KAMARAJ
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3.4.3 Publication

Sl.No	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to website of the Journal	Link to article/paper/abstract of the article	Is it listed in UGC Care list/Scopus/Web of Science/other, mention	Page No
1	A new assessment on mechanical properties of jute fiber mat with egg shell powder/nanoclay-reinforced polyester matrix composites	Ganesan K., Kailasanathan C., Sanjay M.R., Senthamaraikannan P., Saravanakumar S.S.	Department of Mechanical Engineering	Journal of Natural Fibers	2020	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2018.1500340	Scopus	29
2	Preparation of bio-eco based cellulose nanomaterials from used disposal paper cups through citric acid hydrolysis	Nagarajan K.J., Balaji A.N., Kasi Rajan S.T., Ramanujam N.R.	Department of Mechanical Engineering	Carbohydrate Polymers	2020	1448617	https://www.sciencedirect.com/journal/carbohydrate-polymers	https://www.sciencedirect.com/science/article/abs/pii/S0144861720301715	Scopus	30
3	Stability analysis of TiO2–Ag nanocomposite particles dispersed paraffin wax as energy storage material for solar thermal systems	Prabhu B., ValanArasu A.	Department of Mechanical Engineering	Renewable Energy	2020	9601481	https://www.sciencedirect.com/journal/renewable-energy	https://www.sciencedirect.com/science/article/abs/pii/S0960148120300483	Scopus	31
4	Microstructure and Corrosion Behavior of ZnO-Mg Coating on AISI 4140 Steel Fabricated by Spray Coating	Ramkumar T., Selvakumar M., Mohanraj M., Chandramohan P., Narayanasamy P.	Department of Mechanical Engineering	Journal of Materials Engineering and Performance	2020	10599495	https://www.springer.com/journal/11665	https://link.springer.com/article/10.1007%2Fs11665-020-05099-9	Scopus	32

5	Effect of processing parameters on tensile properties of recycled polypropylene based composites reinforced with jute fabrics	Rokbi M., Khaldoune A., Sanjay M.R., Senthamaraikannan P., Ati A., Siengchin S.	Department of Mechanical Engineering	International Journal of Lightweight Materials and Manufacture	2020	25888404	https://www.sciencedirect.com/journal/international-journal-of-lightweight-materials-and-manufacture	https://www.sciencedirect.com/science/article/pii/S2588840419301076	Scopus	33
6	Experimental investigations of reciprocating wear behavior of metal matrix (Ti/TiB) composites	Selvakumar M., Ramkumar T., Mohanraj M., Chandramohan P., Narayanasamy P.	Department of Mechanical Engineering	Archives of Civil and Mechanical Engineering	2020	16449665	https://www.springer.com/journal/43452	https://link.springer.com/article/10.1007/s43452-020-00028-y	Scopus	34
7	Studies on Ramie cellulose microfibrils reinforced cassava starch composite: influence of microfibrils loading	Syafri E., Kasim A., Asben A., Senthamaraikannan P., Sanjay M.R.	Department of Mechanical Engineering	Journal of Natural Fibers	2020	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2018.1470057	Scopus	35
8	Investigation and characterization of Copper-Fly ash-Tungsten hybrid composites synthesized through P/M process	Thanga Kasi Rajan S., Balaji A.N., Raghav G.R., Nagarajan K.J., Vettivel S.C.	Department of Mechanical Engineering	Materials Research Express	2020	20531591	https://iopscience.iop.org/journal/2053-1591	https://iopscience.iop.org/article/10.1088/2053-1591/ab8030	Scopus	36
9	Colloidal release in high temperature porous media with oversaturated fines during supercritical CO2 transport	Kanimozhi B., Mahalingam S., Pranesh V., Kesavakumar R., Senthil S., Ravikumar S., Pradeep S., Senthil S., Murugan R.	Department of Mechanical Engineering	Journal of Petroleum Science and Engineering	2020	9204105	https://www.sciencedirect.com/journal/journal-of-petroleum-science-and-engineering	https://www.sciencedirect.com/science/article/abs/pii/S0920410520304216	Scopus	37
10	Effect of Various Chemical Treatments of Prosopis juliflora Fibers as Composite Reinforcement: Physicochemical, Thermal, Mechanical, and Morphological Properties	Madhu P., Sanjay M.R., Senthamaraikannan P., Pradeep S., Siengchin S., Jawaid M., Kathiresan M.	Department of Mechanical Engineering	Journal of Natural Fibers	2020	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2018.1534191	Scopus	38

11	Characterization of natural cellulosic fibers from Nendran Banana Peduncle plants	Manimaran P., Pillai G.P., Vignesh V., Prithiviraj M.	Department of Mechanical Engineering	International Journal of Biological Macromolecules	2020	1418130	https://www.sciencedirect.com/journal/international-journal-of-biological-macromolecules	https://www.sciencedirect.com/science/article/abs/pii/S0141813020342021	Scopus	39
12	A new study on characterization of Pithecellobium dulce fiber as composite reinforcement for light-weight applications	Manimaran P., Sanjay M.R., Senthamaraikannan P., Yogesha B., Barile C., Siengchin S.	Department of Mechanical Engineering	Journal of Natural Fibers	2020	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2018.1492491	Scopus	40
13	Suitability Evaluation of Sida mysorensis Plant Fiber as Reinforcement in Polymer Composite	Maran M., Kumar R., Senthamaraikannan P., Saravanakumar S.S., Nagarajan S., Sanjay M.R., Siengchin S.	Department of Mechanical Engineering	Journal of Natural Fibers	2020	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2020.1787920	Scopus	41
14	Characterization of a new cellulosic natural fiber extracted from the root of Ficus religiosa tree	Moshi A.A.M., Ravindran D., Bharathi S.R.S., Indran S., Saravanakumar S.S., Liu Y.	Department of Mechanical Engineering	International Journal of Biological Macromolecules	2020	1418130	https://www.sciencedirect.com/journal/international-journal-of-biological-macromolecules	https://www.sciencedirect.com/science/article/abs/pii/S014181301933702X	Scopus	42
15	A Comprehensive Physical, Chemical and Morphological Characterization of Novel Cellulosic Fiber Extracted from the Stem of Elettaria Cardamomum Plant	Ahmed J., Balaji M.A., Saravanakumar S.S., Senthamaraikannan P.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2019.1691121	Scopus	43
16	Structural and Thermal Properties of Chemically Modified Luffa Cylindrica Fibers	Premalatha N., Saravanakumar S.S., Sanjay M.R., Siengchin S., Khan A.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2019.1678546	Scopus	44

17	Effect of deposition thickness on microstructure and thermal behaviour of ZnO-Mg coated AISI 4140 for automotive applications	Ramkumar T., Selvakumar M., Mohanraj M., Senthilkumar A.P., Narayanasamy P.	Department of Mechanical Engineering	Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering	2021	9544089	https://journals.sagepub.com/description/pie	https://journals.sagepub.com/doi/abs/10.1177/0954408920985737	Scopus	45
18	Development and Analysis of Silver Nano Particle Influenced PVA/Natural Particulate Hybrid Composites with Thermo-Mechanical Properties	Rathinavel S., Saravanakumar S.S.	Department of Mechanical Engineering	Journal of Polymers and the Environment	2021	15662543	https://www.springer.com/journal/10924	https://link.springer.com/article/10.1007/s10924-020-01999-y	Scopus	46
19	Development and Analysis of Poly Vinyl Alcohol/Orange peel powder biocomposite films	Rathinavel S., Saravanakumar S.S.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2019.1711285	Scopus	47
20	Studies on adhesion strength and corrosion behavior of ZnO-Mg coated on AISI 4140	Thulasiram R., Mani S., Murugesan M., Pandiyaraj N., Pandiyaraj B.	Department of Mechanical Engineering	Surfaces and Interfaces	2021	24680230	https://www.sciencedirect.com/journal/surfaces-and-interfaces	https://www.sciencedirect.com/science/article/abs/pii/S2468023021000638	Scopus	48
21	Characterization of Ecofriendly Poly (Vinyl Alcohol) and Green Banana Peel Filler (GBPF) Reinforced Bio-Films	Balavairavan B., Saravanakumar S.S.	Department of Mechanical Engineering	Journal of Polymers and the Environment	2021	15662543	https://www.springer.com/journal/10924	https://link.springer.com/article/10.1007/s10924-021-02056-y#:~:text=The%20incorporation%20of%20both%20components,proved%20that%20they%20are%20biodegradable.	Scopus	49

22	Effect of Graphene Powder on Banyan Aerial Root Fibers Reinforced Epoxy Composites	Ganapathy T., Sathiskumar R., Sanjay M.R., Senthamaraikannan P., Saravanakumar S.S., Parameswaranpillai J., Siengchin S.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2019.1675219	Scopus	50
23	Evaluation of tanker vehicle selection using a novel hybrid fuzzy MCDM technique	Görçün O.F., Senthil S., Küçükönder H.	Department of Mechanical Engineering	Decision Making: Applications in Management and Engineering	2021	25606018	https://dmame.rabek.org/index.php/dmame/index	https://dmame.rabek.org/index.php/dmame/article/view/208	Scopus	51
24	Enhancing the Free Vibration Characteristics of Epoxy Polymers Using Sustainable Phoenix Sp. Fibers and Nano-Clay for Machine Tool Applications	Kumar G.R., Hariharan V., Saravanakumar S.S.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2019.1636740	Scopus	52
25	Physico-Chemical Properties of Fiber Extracted from the Flower of Celosia Argentea Plant	Manimaran P., Sanjay M.R., Senthamaraikannan P., Saravanakumar S.S., Siengchin S., Pitchayyapillai G., Khan A.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2019.1629149	Scopus	53
26	Investigation of Physico Chemical Properties and Characterization of New Natural Cellulosic Fibers from the Bark of Ficus Racemosa	Manimaran P., Saravanan S.P., Prithiviraj M.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2019.1621233	Scopus	54
27	Investigation of Physico Chemical, Mechanical and Thermal Properties of the Albizia Lebbeck Bark Fibers	Manimaran P., Solai Senthil Kumar K., Prithiviraj M.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2019.1687068	Scopus	55

28	Characterization of mechanical, electrical and thermal properties of Ag nanoparticle-reinforced Al6061 alloy	Narayanasamy P., Selvakumar M., Ramkumar T., Mohanraj M., Pillai G.P.	Department of Mechanical Engineering	Journal of Thermal Analysis and Calorimetry	2021	13886150	https://www.springer.com/journal/10973	https://link.springer.com/article/10.1007/s10973-020-09834-1#:~:text=It%20is%20confirmed%20that%20the,thermal%20properties%20and%20electrical%20conductivity	Scopus	56
29	Characterization of Musa paradisiaca L. Cellulosic Natural Fibers from Agro-discarded Blossom Petal Waste	Prithivirajan R., Narayanasamy P., Al-Dhabi N.A., Balasundar P., Shyam Kumar R., Ponmurugan K., Ramkumar T., Senthil S.	Department of Mechanical Engineering	Journal of Natural Fibers	2020	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2019.1588826	Scopus	57
30	Characterization of a novel natural cellulosic fiber from Calotropis gigantea fruit bunch for ecofriendly polymer composites	Narayanasamy P., Balasundar P., Senthil S., Sanjay M.R., Siengchin S., Khan A., Asiri A.M.	Department of Mechanical Engineering	International Journal of Biological Macromolecules	2020	1418130	https://www.sciencedirect.com/journal/international-journal-of-biological-macromolecules	https://www.sciencedirect.com/science/article/abs/pii/S0141813019395844	Scopus	58
31	Physicochemical and Structural Properties of Green Biofilms from Poly (Vinyl alcohol)/Nano Coconut Shell Filler	Balavairavan B., Saravanakumar S.S., Manikandan K.M.	Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2020.1723778	Scopus	59
32	Advances in upstream and downstream strategies of pectinase bioprocessing: A review	John J., Kaimal K.K.S., Smith M.L., Rahman P.K.S.M., Chellam P.V.	Department of Biotechnology	International Journal of Biological Macromolecules	2020	1418130	https://www.sciencedirect.com/journal/international-journal-of-biological-macromolecules	https://www.sciencedirect.com/science/article/abs/pii/S014181302033676X	Scopus	60

33	Decolorization of Textile Dye by Halophilic Exiguobacterium sp.VK1: Biomass and Exopolysaccharide (EPS) Enhancement for Bioremediation of Malachite Green	Kalpana R., Maheshwaran M., Vimali E., Soosai M.R., Shivamathi C.S., Moorthy I.G., Ashokkumar B., Varalakshmi P.	Department of Biotechnology	ChemistrySelect	2020	23656549	https://chemistry-europe.onlinelibrary.wiley.com/journal/23656549	https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/slct.202001648	Scopus	61
34	Spectroscopic (FT-IR, FT-Raman, NBO) investigation and molecular docking study of a herbicide compound Bifenox	Karpagakalyaani G., Magdaline J.D., Chithambarathanu T., Aruldhas D., Anuf A.R.	Department of Biotechnology	Chemical Data Collections	2020	24058300	https://www.sciencedirect.com/journal/chemical-data-collections	https://www.sciencedirect.com/science/article/abs/pii/S240583002030104X	Scopus	62
35	Protein Network Studies on PCOS Biomarkers With S100A8, Druggability Assessment, and RNA Aptamer Designing to Control Its Cyst Migration Effect	Manibalan S., Shobana A., Kiruthika M., Achary A., Swathi M., Venkatalakshmi R., Thirukumaran K., Suhasini K., Roopathy S.	Department of Biotechnology	Frontiers in Bioengineering and Biotechnology	2020	22964185	https://www.frontiersin.org/journals/bioengineering-and-biotechnology	https://www.frontiersin.org/articles/10.3389/fbioe.2020.00328/full	Scopus	63
36	Report on biopharmaceutical profile of recent biotherapeutics and insilco docking studies on target bindings of known aptamer biotherapeutics	Manibalan S., Thirukumaran K., Varshni M., Shobana A., Achary A.	Department of Biotechnology	Biotechnology and Genetic Engineering Reviews	2020	2648725	https://www.tandfonline.com/journals/tbgr20	https://www.tandfonline.com/doi/full/10.1080/02648725.2020.1858395	Scopus	64
37	Process development for the degradation of textile azo dyes (mono-, di-, poly-) by advanced oxidation process - Ozonation: Experimental & partial derivative modelling approach	Muniyasamy A., Sivaporul G., Gopinath A., Lakshmanan R., Altaee A., Achary A., Velayudhaperumal Chellam P.	Department of Biotechnology	Journal of Environmental Management	2020	3014797	https://www.sciencedirect.com/journal/journal-of-environmental-management	https://www.sciencedirect.com/science/article/pii/S0301479720303327	Scopus	65
38	Evaluation of anti rheumatic activity of Piper betle L. (Betelvine) extract using in silico, in vitro and in vivo approaches	Murugesan S., Ravichandran D., Lakshmanan D.K., Ravichandran G., Arumugam V., Raju K., Geetha K., Thilagar S.	Department of Biotechnology	Bioorganic Chemistry	2020	452068	https://www.sciencedirect.com/journal/bioorganic-chemistry	https://www.sciencedirect.com/science/article/abs/pii/S0045206820315248	Scopus	66

39	Green synthesis and characterization of zinc oxide nanoparticles with antibacterial and antifungal activity	Pillai A.M., Sivasankarapillai V.S., Rahdar A., Joseph J., Sadeghfar F., Anuf A R., Rajesh K., Kyzas G.Z.	Department of Biotechnology	Journal of Molecular Structure	2020	222860	https://www.sciencedirect.com/journal/journal-of-molecular-structure	https://www.sciencedirect.com/science/article/abs/pii/S0022286020304324	Scopus	67
40	Fabrication of stimuli gated nanoformulation for site-specific delivery of thymoquinone for colon cancer treatment – Insight into thymoquinone's improved physicochemical properties	Pushpa Sweety J., Sowparani S., Mahalakshmi P., Selvasudha N., Yamini D., Geetha K., Ruckmani K.	Department of Biotechnology	Journal of Drug Delivery Science and Technology	2020	17732247	https://www.sciencedirect.com/journal/journal-of-drug-delivery-science-and-technology	https://www.sciencedirect.com/science/article/abs/pii/S1773224719310834	Scopus	68
41	Extraction and purification of an antimicrobial bioactive element from lichen associated Streptomyces olivaceus LEP7 against wound inhabiting microbial pathogens	Rajaram S.K., Ahmad P., Sujani Sathya Keerthana S., Jeya Cressida P., Ganesh Moorthy I., Suresh R.S.S.	Department of Biotechnology	Journal of King Saud University - Science	2020	10183647	https://www.sciencedirect.com/journal/journal-of-king-saud-university-science	https://www.sciencedirect.com/science/article/pii/S1018364720300410	Scopus	69
42	Digital image-based quantification of chlorpyrifos in water samples using a lipase embedded paper based device	Sankar K., Lenisha D., Janaki G., Juliana J., Kumar R.S., Selvi M.C., Srinivasan G.	Department of Biotechnology	Talanta	2020	399140	https://www.sciencedirect.com/journal/talanta	https://www.sciencedirect.com/science/article/abs/pii/S0039914019310410	Scopus	70
43	Surface modification of nanocellulose using polypyrrole for the adsorptive removal of Congo red dye and chromium in binary mixture	Shahnaz T., S. M.M.F., V.C. P., Narayanasamy S.	Department of Biotechnology	International Journal of Biological Macromolecules	2020	1418130	https://www.sciencedirect.com/journal/international-journal-of-biological-macromolecules	https://www.sciencedirect.com/science/article/abs/pii/S0141813020304682	Scopus	71
44	Spectroscopic, quantum chemical, QTAIM analysis, molecular dynamics simulation, docking studies and solvent effect of pyridin-2-yl oxyacetic acid herbicide and its derivatives	Suma N., Aruldhas D., Joe I.H., Anuf A.R., Arun Sasi B.S.	Department of Biotechnology	Journal of Molecular Structure	2020	222860	https://www.sciencedirect.com/journal/journal-of-molecular-structure	https://www.sciencedirect.com/science/article/abs/pii/S0022286019317867	Scopus	72

45	Spectroscopic and molecular structure investigation of Propachlor herbicide: A combined experimental and theoretical study	Suma N., Aruldhas D., Joe I.H., Sasi B.S.A., Anuf A.R., Mol G.P.S., Balachandran S., George J.	Department of Biotechnology	Journal of Molecular Structure	2020	222860	https://www.sciencedirect.com/journal/journal-of-molecular-structure	https://www.sciencedirect.com/science/article/abs/pii/S0022286020311911	Scopus	73
46	Optimization of glutamic acid production by Corynebacterium glutamicum using response surface methodology	Alharbi N.S., Kadaikunnan S., Khaled J.M., Almanaa T.N., Innasimuthu G.M., Rajoo B., Alanzi K.F., Rajaram S.K.	Department of Biotechnology	Journal of King Saud University - Science	2020	10183647	https://www.sciencedirect.com/journal/journal-of-king-saud-university-science	https://www.sciencedirect.com/science/article/pii/S1018364719318440	Scopus	74
47	Organic fouling in forward osmosis: A comprehensive review	Yadav S., Ibrar I., Bakly S., Khanafer D., Altaee A., Padmanaban V.C., Samal A.K., Hawari A.H.	Department of Biotechnology	Water (Switzerland)	2020	20734441	https://www.mdpi.com/journal/water	https://www.mdpi.com/2073-4441/12/5/1505	Scopus	75
48	Dendrimer with Interior Cavity as Catalytic Pockets for Substrate Molecules: Synthesis of Bisimidazoles and Molecular Docking Study	Baby Sherlymole P., Ronaldo Anuf A., Anjali Krishna G., Sreekumar K.	Department of Biotechnology	ChemistrySelect	2020	23656549	https://chemistry-europe.onlinelibrary.wiley.com/journal/23656549	https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/slct.202000770	Scopus	76
49	Immunomodulating Properties of Carrageenan from Tichocarpus crinitus	Cicinskas E., Kalitnik A.A., Karetin Y.A., Mohan Ram M.S.G., Achary A., Kravchenko A.O.	Department of Biotechnology	Inflammation	2020	3603997	https://www.springer.com/journal/10753	https://link.springer.com/article/10.1007%2Fs10753-020-01216-x	Scopus	77
50	Characterization and antifungal activity of the yellow pigment produced by a Bacillus sp. DBS4 isolated from the lichen Dirinaria agealita	Dawoud T.M., Alharbi N.S., Theruvinthalakal A.M., Thekkangil A., Kadaikunnan S., Khaled J.M., Almanaa T.N., Sankar K., Innasimuthu G.M., Alanzi K.F., Rajaram S.K.	Department of Biotechnology	Saudi Journal of Biological Sciences	2020	1319562X	https://www.sciencedirect.com/journal/saudi-journal-of-biological-sciences	https://www.sciencedirect.com/science/article/pii/S1319562X19302657	Scopus	78

51	Influence of number of azo bonds and mass transport limitations towards the elimination capacity of continuous electrochemical process for the removal of textile industrial dyes	Alagesan J., Jaisankar M., Muthuramalingam S., Mousset E., Chellam P.V.	Department of Biotechnology	Chemosphere	2021	456535	https://www.sciencedirect.com/journal/chemosphere	https://www.sciencedirect.com/science/article/abs/pii/S0045653520325765	Scopus	79
52	Lichens of the sirumalai hills, eastern ghats with one genus and six species new to India	Nayaka S., Joseph S., Rajaram S.K., Natesan S., Sankar K., David M.L.R., Upreti D.K.	Department of Biotechnology	Studies in Fungi	2021	24654973	http://www.maxapress.com/sif	http://www.maxapress.com/article/id/61600009ce60b94db5af3ca8	Scopus	80
53	Biochar and activated carbon derivatives of lignocellulosic fibers towards adsorptive removal of pollutants from aqueous systems: Critical study and future insight	Othmani A., John J., Rajendran H., Mansouri A., Sillanpää M., Velayudhaperumal Chellam P.	Department of Biotechnology	Separation and Purification Technology	2021	13835866	https://www.sciencedirect.com/journal/separation-and-purification-technology	https://www.sciencedirect.com/science/article/abs/pii/S1383586621007723#!	Scopus	81
54	Insights about sustainable biodiesel production from microalgae biomass: A review	Rahul S M., Sundaramahalingam M.A., Shivamthi C.S., Shyam Kumar R., Varalakshmi P., Karthikumar S., Kanimozhi J., Vinoth Kumar R., Sabarathinam S., Ganesh Moorthy I., Pugazhendhi A.	Department of Biotechnology	International Journal of Energy Research	2021	0363907X	https://onlinelibrary.wiley.com/journal/1099114x	https://onlinelibrary.wiley.com/doi/abs/10.1002/er.6138	Scopus	82
55	Electrocatalytic removal of fluroquinolones from simulated pharmaceutical effluent: Chemometric analysis, chemical blueprint of electrodes and generated sludge	Rajendran H.K., Deen Fakrudeen M.A., Chandrasekar R., van Hullebusch E.D., Velayudhaperumal Chellam P.	Department of Biotechnology	Environmental Research	2021	139351	https://www.sciencedirect.com/journal/environmental-research	https://www.sciencedirect.com/science/article/abs/pii/S0013935121001389	Scopus	83

56	Environment friendly, renewable and sustainable poly lactic acid (PLA) based natural fiber reinforced composites – A comprehensive review	Rajeshkumar G., Arvindh Seshadri S., Devnani G.L., Sanjay M.R., Siengchin S., Prakash Maran J., Al-Dhabi N.A., Karuppiah P., Mariadhas V.A., Sivarajasekar N., Ronaldo Anuf A.	Department of Biotechnology	Journal of Cleaner Production	2021	9596526	https://www.sciencedirect.com/journal/journal-of-cleaner-production	https://www.sciencedirect.com/science/article/abs/pii/S0959652621017029#!	Scopus	84
57	Kinetic and isotherm studies on adsorptive removal of sulfates by cotton shell derived biochar: Recovery of sulfates from marcasite soil	Rumjit N.P., Samsudin N.A., Low F.W., Thomas P., Lai C.W., Velayudhaperumal Chellam P., Bin Johan M.R., Lim Y.-C., Amin N., Tiong S.K.	Department of Biotechnology	Sustainable Chemistry and Pharmacy	2021	23525541	https://www.sciencedirect.com/journal/sustainable-chemistry-and-pharmacy	https://www.sciencedirect.com/science/article/abs/pii/S2352554120306008	Scopus	85
58	Production and characterization of exopolysaccharide from the sponge-associated Bacillus suDepartment of Biotechnologyilis MKU SERB2 and its in-vitro biological properties	Sathishkumar R., Kannan R., Jinendiran S., Sivakumar N., Selvakumar G., Shyamkumar R.	Department of Biotechnology	International Journal of Biological Macromolecules	2021	1418130	https://www.sciencedirect.com/journal/international-journal-of-biological-macromolecules	https://www.sciencedirect.com/science/article/abs/pii/S0141813020349515	Scopus	86
59	Biodegradation of reactive red 120 in microbial fuel cell by Staphylococcus equoruma RAP2: Statistical modelling and process optimization	Shahi A., Chellam P.V., Singh R.S., Verma A.	Department of Biotechnology	Journal of Water Process Engineering	2021	22147144	https://www.sciencedirect.com/journal/journal-of-water-process-engineering	https://www.sciencedirect.com/science/article/abs/pii/S221471442030790X	Scopus	87
60	In-silico strategies for identification of potent inhibitor for MMP-1 to prevent metastasis of breast cancer	Shunmuga Priya V., Pradiba D., Aarthy M., Singh S.K., Achary A., Vasanthi M.	Department of Biotechnology	Journal of Biomolecular Structure and Dynamics	2021	7391102	https://www.tandfonline.com/journals/tbsd20	https://www.tandfonline.com/doi/abs/10.1080/07391102.2020.1810776	Scopus	88

61	Versatile image processing technique for fuel science: A review	Soosai M.R., Joshya Y.C., Kumar R.S., Moorthy I.G., Karthikumar S., Chi N.T.L., Pugazhendhi A.	Department of Biotechnology	Science of the Total Environment	2021	489697	https://www.sciencedirect.com/journal/science-of-the-total-environment	https://www.sciencedirect.com/science/article/abs/pii/S0048969721015370#!	Scopus	89
62	Chemometric approach towards optimization on the radiolytic removal of micropollutants: Equation based modelling with canonical and ridge analysis	Balamurugan N., Annamalai K., Gandhi Sethuraman M.I., Vasudevan V.N., Achary A., Chellam P.V.	Department of Biotechnology	Chemometrics and Intelligent Laboratory Systems	2021	1697439	https://www.sciencedirect.com/journal/chemometrics-and-intelligent-laboratory-systems	https://www.sciencedirect.com/science/article/abs/pii/S0169743920306572	Scopus	90
63	An intensified approach for transesterification of biodiesel from Annona squamosa seed oil using ultrasound-assisted homogeneous catalysis reaction and its process optimization	Sundaramahalingam M.A., Karthikumar S., Shyam Kumar R., Samuel K.J., Shajahan S., Sivasubramanian V., Sivashanmugam P., Varalakshmi P., Syed A., Marraiki N., Elgorban A.M., Vinoth Kumar R., Ganesh Moorthy I.	Department of Biotechnology	Fuel	2021	162361	https://www.sciencedirect.com/journal/fuel	https://www.sciencedirect.com/science/article/abs/pii/S0016236121000715	Scopus	91
64	Bio-refinery approaches based concomitant microalgal biofuel production and wastewater treatment	Thangam K.R., Santhiya A., Sri S.R.A., MubarakAli D., Karthikumar S., Kumar R.S., Thajuddin N., Soosai M.R., Varalakshmi P., Moorthy I.G., Pugazhendhi A.	Department of Biotechnology	Science of the Total Environment	2021	489697	https://www.journals.elsevier.com/science-of-the-total-environment	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85105356941&doi=10.1016%2fj.scitotenv.2021.147267&partnerID=40&md5=25e0437b88a26d85e352a2eaf649a336	Scopus	92

65	Biodegradation of Used Motor Oil and Biofuel Production by Microalgae Coelastrella sp. M60 and Scenedesmus sp. VJ1	Vimali E., Jayaram M., Vignesh N.S., Ashokkumar B., Ganeshmoorthy I., Sivasubramanian V., Varalakshmi P.	Department of Biotechnology	Chemical Engineering and Technology	2021	9307516	https://onlinelibrary.wiley.com/journal/15214125	https://onlinelibrary.wiley.com/doi/10.1002/ceat.202000494?af=R	Scopus	93
66	Improvement of fuel properties of used palm oil derived biodiesel with butyl ferulate as an additive	Jemima Romola C.V., Karl J Samuel P.K., Megana Harshini M., Ganesh Moorthy I., Shyam Kumar R., Chinnathambi A., Salmen S.H., Alharbi S.A., Karthikumar S.	Department of Biotechnology	Renewable Energy	2021	9601481	https://www.sciencedirect.com/journal/renewable-energy	https://www.sciencedirect.com/science/article/abs/pii/S0960148121007412#	Scopus	94
67	A comprehensive review of the selection of natural and synthetic antioxidants to enhance the oxidative stability of biodiesel	Jemima Romola C.V., Meganaharshini M., Rigby S.P., Ganesh Moorthy I., Shyam Kumar R., Karthikumar S.	Department of Biotechnology	Renewable and Sustainable Energy Reviews	2021	13640321	https://www.sciencedirect.com/journal/renewable-and-sustainable-energy-reviews	https://www.sciencedirect.com/science/article/abs/pii/S136403212100397X	Scopus	95
68	Theoretical investigation of structure, anticancer activity and molecular docking of thiourea derivatives	Kirishnamaline G., Magdaline J.D., Chithambarathanu T., Aruldhas D., Anuf A.R.	Department of Biotechnology	Journal of Molecular Structure	2021	222860	https://www.sciencedirect.com/journal/journal-of-molecular-structure	https://www.sciencedirect.com/science/article/abs/pii/S002228602031440X	Scopus	96
69	Screening of Atherosclerotic Druggable Targets from the Proteome Network of Differentially Expressed Genes	Manibalan S., Harison Raj A.B., Achary A.	Department of Biotechnology	Assay and Drug Development Technologies	2021	1540658X	https://home.liebertpub.com/publications/assay-and-drug-development-technologies/118	https://www.liebertpub.com/doi/10.1089/adt.2021.021	Scopus	97

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71	Extraction of Polymeric Bioflocculant from Enterobacter sp. and Adsorptive Kinetic Studies on Industrial Dye Removal Applications	Muthulakshmi L., Mathangi J.B., Suryasankar R.P., Padmanaban V.C., Helen Kalavathy M., Sanjay M.R., Siengchin S.	Department of Biotechnology	Journal of Polymers and the Environment	2021	15662543	https://www.springer.com/journal/10924	https://link.springer.com/article/10.1007/s10924-020-01871-z	Scopus	99
72	Can human overcome viral hijack-? Comprehensive review on COVID-19 in the view of diagnosis and mitigation across countries	Nagendran M., John J., Annamalai K., Gandhi Sethuraman M.I., Balamurugan N., Rajendran H.K., Deen Fakrudeen M.A., Chandrasekar R., Ranjan S., Padmanaban V.C.	Department of Biotechnology	Journal of Drug Delivery Science and Technology	2021	17732247	https://www.sciencedirect.com/journal/journal-of-drug-delivery-science-and-technology	https://www.sciencedirect.com/science/article/pii/S17732247031409X	Scopus	100
73	Antimicrobial activity of green synthesized biodegradable alginate–silver (Alg-Ag) nanocomposite films against selected foodborne pathogens	Kanagaraj S.S.P., Rajaram S.K., Ahamed M., Subedhar S., Sankar K., Innasimuthu G.M., Karuppiah P.	Department of Biotechnology	Applied Nanoscience (Switzerland)	2021	21905509	https://www.springer.com/journal/13204	https://link.springer.com/article/10.1007/s13204-021-01882-9	Scopus	101
74	In silico approach for enhancing innate lipid content of Yarrowia lipolytica, by blocking the acyl-CoA oxidase-1 enzyme, using various analogous compounds of lipids	Sundaramahalingam M.A., Amrutha C., Rajeshbanu J., Thirukumaran K., Manibalan S., Ashokkumar M., Sivashanmugam P.	Department of Biotechnology	Journal of Biomolecular Structure and Dynamics	2021	7391102	https://www.tandfonline.com/journals/tbsd20	https://www.tandfonline.com/doi/abs/10.1080/07391102.2021.2008498	Scopus	102
75	A New Natural Cellulosic Pigeon Pea (Cajanus cajan) Pod Fiber Characterization for Bio-degradable Polymeric Composites	Shyam Kumar R., Balasundar P., Al-Dhabi N.A., Prithivirajan R., Ramkumar T., Bhat K.S., Senthil S., Narayanasamy P.	Department of Biotechnology ; Department of Mechatronics Engineering; Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2019.1689887	Scopus	103

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77	Design and development of Truncated Angle Variant (TAV) controller for multi-source-fed BLDC motor drive	Rajesh Kanna G.R., Sasiraja R.M., Prince Winston D.	Department of Electrical and Electronics Engineering	Electrical Engineering	2020	9487921	https://www.springer.com/journal/202	https://link.springer.com/article/10.1007/s00202-020-01004-8	Scopus	105
78	Experimental studies on passive inclined solar panel absorber solar still	Sasikumar C., Manokar A.M., Vimala M., Prince Winston D., Kabeel A.E., Sathyamurthy R., Chamkha A.J.	Department of Electrical and Electronics Engineering	Journal of Thermal Analysis and Calorimetry	2020	13886150	https://www.springer.com/journal/10973	https://link.springer.com/article/10.1007%2Fs10973-019-08770-z	Scopus	106
79	Design of sustainable PV module for efficient power generation during faults	Winston D.P.	Department of Electrical and Electronics Engineering	IEEE Transactions on Components, Packaging and Manufacturing Technology	2020	21563950	https://ieeexplore.ieee.org/Xplore/home.jsp	https://ieeexplore.ieee.org/document/8990126	Scopus	107
80	Enhancement of PV/T-integrated single slope solar desalination still productivity using water film cooling and hybrid composite insulation	Balachandran G.B., David P.W., Vijayakumar A.B.P., Kabeel A.E., Athikesavan M.M., Sathyamurthy R.	Department of Electrical and Electronics Engineering	Environmental Science and Pollution Research	2020	9441344	https://www.springer.com/journal/11356	https://link.springer.com/article/10.1007/s11356-019-06131-9	Scopus	108
81	A comprehensive review on electric vehicles	Karthikeyan A., Vijayarajan S.	Department of Electrical and Electronics Engineering	International Journal of Scientific and Technology Research	2020	22778616	http://www.ijstr.org/	http://www.ijstr.org/final-print/feb2020/A-Comprehensive-Review-On-Electric-Vehicles.pdf	Scopus	109
82	Evaluation of faults in a dc grid-connected	Karthikeyan G., Winston	Department of Electrical and	Marine Technology	2020	253324	https://www.	https://www.ing	Scopus	110
83	Enhancement of potable water production from an inclined photovoltaic panel absorber solar still by integrating with flat-plate collector	Manokar A.M., Vimala M., Sathyamurthy R., Kabeel A.E., Winston D.P., Chamkha A.J.	Department of Electrical and Electronics Engineering	Environment, Development and Sustainability	2020	1387585X	https://www.springer.com/journal/10668	https://link.springer.com/article/10.1007/s10668-019-00376-7	Scopus	111

84	Effect of water depth and insulation on the productivity of an acrylic pyramid solar still – An experimental study	Muthu Manokar A., Taamneh Y., Kabeel A.E., Prince Winston D., Vijayabalan P., Balaji D., Sathyamurthy R., Padmanaba Sundar S., Mageshbabu D.	Department of Electrical and Electronics Engineering	Groundwater for Sustainable Development	2020	2352801X	https://www.sciencedirect.com/journal/groundwater-for-sustainable-development	https://www.sciencedirect.com/science/article/abs/pii/S2352801X1930390X	Scopus	112
85	A comparative study of 3E (energy, exergy, and economy) analysis of various solar stills	Muthu Manokar A., Vimala M., Prince Winston D., Rajendran D.R., Sathyamurthy R., Kabeel A.E.	Department of Electrical and Electronics Engineering	Heat Transfer	2020	26884534	https://onlinelibrary.wiley.com/journal/26884542	https://onlinelibrary.wiley.com/doi/abs/10.1002/htj.21832	Scopus	113
86	Performance improvement of solar PV array topologies during various partial shading conditions	Prince Winston D., Kumaravel S., Praveen Kumar B., Devakirubakaran S.	Department of Electrical and Electronics Engineering	Solar Energy	2020	0038092X	https://www.sciencedirect.com/journal/solar-energy	https://www.sciencedirect.com/science/article/abs/pii/S0038092X19312228	Scopus	114
87	Cost effective energy consumption in a residential building by implementing demand side management in the presence of different classes of power loads	Hemanth G.R., Charles Raja S., Jeslin Drusila Nesamalar J., Senthil Kumar J.	Department of Electrical and Electronics Engineering	Advances in Building Energy Research	2020	17512549	https://www.tandfonline.com/journals/taer20	https://www.tandfonline.com/doi/abs/10.1080/17512549.2020.1752799	Scopus	115
88	Experimental investigation on output power enhancement of partial shaded solar photovoltaic system	Prince Winston D., Ganesan K., Praveen Kumar B., Samithas D., Baladhanautham C.B.	Department of Electrical and Electronics Engineering	Energy Sources, Part A: Recovery, Utilization and Environmental Effects	2020	15567036	https://www.tandfonline.com/journals/ueso20	https://www.tandfonline.com/doi/abs/10.1080/15567036.2020.1779872	Scopus	116
89	Investigation on the performance enhancement of single-slope solar still using green fibre insulation derived from Artocarpus heterophyllus rags reinforced with Azadirachta indica gum	Balachandran G.B., David P.W., Radhakrishnan V., Ali M.N.A., Baskaran V.K., Virumandi D., Athikesavan M.M., Sathyamurthy R.	Department of Electrical and Electronics Engineering	Environmental Science and Pollution Research	2021	9441344	https://www.springer.com/journal/11356	https://link.springer.com/article/10.1007%2Fs11356-021-13062-x	Scopus	117
90	Fuzzy decision analysis for regional contextualization of global educational frameworks	Saranya V., Kalyani S., Ramachandran V.	Department of Electrical and Electronics Engineering	Sadhana - Academy Proceedings in Engineering Sciences	2021	2562499	https://www.springer.com/journal/12046	https://link.springer.com/article/10.1007/s12046-021-01616-1	Scopus	118

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92	L-Shape Propagated Array Configuration with Dynamic Reconfiguration Algorithm for Enhancing Energy Conversion Rate of Partial Shaded Photovoltaic Systems	Srinivasan A., Devakirubakaran S., Sundaram B.M., Balachandran P.K., Cherukuri S.K., Winston D.P., Babu T.S., Alhelou H.H.	Department of Electrical and Electronics Engineering	IEEE Access	2021	21693536	https://ieeexplore.ieee.org/Xplore/home.jsp	https://ieeexplore.ieee.org/document/9474476	Scopus	120
93	A novel on-time partial shading detection technique for electrical reconfiguration in solar PV system	Sugumar S., Prince Winston D., Pravin M.	Department of Electrical and Electronics Engineering	Solar Energy	2021	0038092X	https://www.sciencedirect.com/journal/solar-energy	https://www.sciencedirect.com/science/article/abs/pii/S0038092X21006447#!	Scopus	121
94	Reinforced demand side management for educational institution with incorporation of user's comfort	Tamilarasu K., Sathiasamuel C.R., Joseph J.D.N., Elavarasan R.M., Mihet-Popa L.	Department of Electrical and Electronics Engineering	Energies	2021	19961073	https://www.mdpi.com/journal/energies	https://www.mdpi.com/1996-1073/14/10/2855	Scopus	122
95	Solar PV's Micro Crack and Hotspots Detection Technique Using NN and SVM	Winston D.P., Murugan M.S., Elavarasan R.M., Pugazhendhi R., Singh O.J., Murugesan P., Gurudhachanamoorthy M., Hossain E.	Department of Electrical and Electronics Engineering	IEEE Access	2021	21693536	https://ieeexplore.ieee.org/Xplore/home.jsp	https://ieeexplore.ieee.org/abstract/document/9535505	Scopus	123
96	Investigation of performance enhancement of solar still incorporated with Gallus gallus domesticus cascara as sensible heat storage material	Balachandran G.B., David P.W., Rajendran G., Ali M.N.A., Radhakrishnan V., Balamurugan R., Athikesavan M.M., Sathyamurthy R.	Department of Electrical and Electronics Engineering	Environmental Science and Pollution Research	2021	9441344	https://www.springer.com/journal/11356	https://link.springer.com/article/10.1007/s11356-020-10470-3	Scopus	124

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98	Intelligent starting current-based fault identification of an induction motor operating under various power quality issues	Ganesan S., David P.W., Balachandran P.K., Samithas D.	Department of Electrical and Electronics Engineering	Energies	2021	19961073	https://www.mdpi.com/journal/energies	https://www.mdpi.com/1996-1073/14/2/304	Scopus	126
99	Design of IoT based smart compact energy meter for monitoring and controlling the usage of energy and power quality issues with demand side management for a commercial building	Karthick T., Charles Raja S., Jeslin Drusila Nesamalar J., Chandrasekaran K.	Department of Electrical and Electronics Engineering	Sustainable Energy, Grids and Networks	2021	23524677	https://www.sciencedirect.com/journal/sustainable-energy-grids-and-networks	https://www.sciencedirect.com/science/article/abs/pii/S2352467721000254	Scopus	127
100	Development of smart controller for demand side management in smart grid using reactive power optimization	Muthukumaran E., Kalyani S.	Department of Electrical and Electronics Engineering	Soft Computing	2021	14327643	https://www.springer.com/journal/500	https://link.springer.com/article/10.1007/s00500-020-05246-3	Scopus	128
101	Techno-economic analysis of both on-grid and off-grid hybrid energy system with sensitivity analysis for an educational institution	Nesamalar J.J.D., Suruthi S., Raja S.C., Tamilarasu K.	Department of Electrical and Electronics Engineering	Energy Conversion and Management	2021	1968904	https://www.sciencedirect.com/journal/energy-conversion-and-management	https://www.sciencedirect.com/science/article/abs/pii/S0196890421003642#!	Scopus	129
102	A New Ken-Ken Puzzle Pattern Based Reconfiguration Technique for Maximum Power Extraction in Partial Shaded Solar PV Array	Palpandian M., Winston D.P., Kumar B.P., Kumar C.S., Babu T.S., Alhelou H.H.	Department of Electrical and Electronics Engineering	IEEE Access	2021	21693536	https://ieeexplore.ieee.org/Xplore/home.jsp	https://ieeexplore.ieee.org/document/9419048	Scopus	130
103	Parallel power extraction technique for maximizing the output of solar PV array	Prince Winston D., Karthikeyan G., Pravin M., JebaSingh O., Akash A.G., Nithish S., Kabilan S.	Department of Electrical and Electronics Engineering	Solar Energy	2021	0038092X	https://www.sciencedirect.com/journal/solar-energy	https://www.sciencedirect.com/science/article/abs/pii/S0038092X20311567	Scopus	131

104	Effective Power Congestion Management Technique Using Hybrid Nelder–Mead–Grey Wolf Optimizer (HNMGWO) in Deregulated Power System	Charles Raja S., Prakash S., Jeslin Drusila Nesamalar J.	Department of Electrical and Electronics Engineering	IETE Journal of Research	2021	3772063	https://www.tandfonline.com/journals/tijr20	https://www.tandfonline.com/doi/abs/10.1080/03772063.2021.1963858	Scopus	132
105	Internet of things-based smart residential building energy management system for a grid-connected solar photovoltaic-powered DC residential building	Chinnathambi N.D., Nagappan K., Samuel C.R., Tamilarasu K.	Department of Electrical and Electronics Engineering	International Journal of Energy Research	2021	0363907X	https://onlinelibrary.wiley.com/journal/1099114x	https://onlinelibrary.wiley.com/doi/abs/10.1002/er.7264	Scopus	133
106	Analysis of voltage/current mismatch in solar photovoltaic power plants during fault panel replacement	Murugan M.S., David P.W., Murugesan P.	Department of Electrical and Electronics Engineering	Energy Sources, Part A: Recovery, Utilization and Environmental Effects	2021	15567036	https://www.tandfonline.com/journals/ueso20	https://www.tandfonline.com/doi/abs/10.1080/15567036.2021.1909676	Scopus	134
107	Rehash of cooked oil for the palatable water production using single slope solar still	Balachandran G.B., David P.W., Chellam P.V., Ali M.N.A., Radhakrishnan V., Balamurugan R., Manokar A.M.	Department of Electrical and Electronics Engineering; Department of Bio Technology	Fuel	2020	162361	https://www.sciencedirect.com/journal/fuel	https://www.sciencedirect.com/science/article/abs/pii/S0016236120306086	Scopus	135
108	A relative study on energy and exergy analysis between conventional single slope and novel stepped absorbable plate solar stills	Balachandran G.B., David P.W., Alexander A.B., Athikesavan M.M., Chellam P.V., Kumar K.K.S., Palanichamy V., Kabeel A.E., Sathyamurthy R., Marquez F.P.G.	Department of Electrical and Electronics Engineering; Department of Bio Technology	Environmental Science and Pollution Research	2021	9441344	https://www.springer.com/journal/11356	https://link.springer.com/article/10.1007%2Fs11356-021-14640-9	Scopus	136
109	Optimization Studies on Improving the Dielectric Properties of Alkali Treated Fibers from Phaseolus Vulgaris Reinforced Polyester Composites by Central Composite Design	Gurukarthik Babu B., Princewinston D., Padmanaban V.C., Lathief Sherief G., Kiruba Sankar M., Aravind Bhaskar P.V.	Department of Electrical and Electronics Engineering; Department of Bio Technology	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2019.1697985	Scopus	137

110	Investigation on the Physicochemical and Mechanical Properties of Novel Alkali-treated Phaseolus vulgaris Fibers	Babu B.G., Princewinston D., Saravanakumar S.S., Khan A., Aravind Bhaskar P.V., Indran S., Divya D.	Department of Electrical and Electronics Engineering; Department of Mechanical Engineering	Journal of Natural Fibers	2020	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/full/10.1080/15440478.2020.1761930	Scopus	138
111	Saccharum barberi grass bagasse ash-based silicone rubber composites for electrical insulator applications	Balachandran G.B., David P.W., Alexander A.B., Mariappan R.K., Balasundar P., Parrthipan B.K., Saravanakumar S.S., Kannan P.S.	Department of Electrical and Electronics Engineering;Department of Mechatronics Engineering;Department of Mechanical Engineering	Iranian Polymer Journal (English Edition)	2021	10261265	https://www.springer.com/journal/13726	https://link.springer.com/article/10.1007/s13726-021-00975-0	Scopus	139
112	Exploration of Electrical, Thermal, and Mechanical Properties of Phaseolus vulgaris Fiber/Unsaturated Polyester Resin Composite Filled with Nano–SiO2	Gurukarthik Babu B., Prince Winston D., Aravind Bhaskar P.V., Baskaran R., Narayanasamy P.	Department of Electrical and ElectronicsEngineering;Department of Polymer Technology;Department of Mechanical Engineering	Journal of Natural Fibers	2021	15440478	https://www.tandfonline.com/journals/wjnf20	https://www.tandfonline.com/doi/abs/10.1080/15440478.2020.1724231	Scopus	140
113	Dielectric Characterization of Epoxy resin Filled with Micro and Nano fillers of SiO2 and Al2O3 for Encapsulations of Electronic Devices	J. Ganesan, S. Jeyadevi, D. Prince Winston, S. Devakirubakaran, B.Gurukarthik Babu	Department of Electrical and Electronics Engineering	Solid State Technology	2021	0038-111X	http://solidstatetechnology.us/index.php/JSST	https://solidstatetechnology.us/index.php/JSST/article/view/9574	Scopus	141
114	GUI Based Online Monitoring of Performance Parameters of Solar Panel	J.Uma Maheswari , Dr.S.Jeyadevi	Department of Electrical and Electronics Engineering	Tierärztliche Praxis	2020	0303-6286	https://tierarztliche.com/	https://tierarztliche.com/gallery/v40.120.pdf	UGC-CARE	142
115	Thermal, mechanical, and electrical properties of difunctional and trifunctional epoxy blends with nanoporous materials	Ganesan J, Jeyadevi S, Siva Kaylasa Sundari S, Arunjunai Raj M, Pitchaimari G and Vijayakumar CT	Department of Electrical and Electronics Engineering	Journal of Elastomers & Plastics	2021	1530-8006	https://journals.sagepub.com/metrics/JEP	https://journals.sagepub.com/doi/abs/10.1177/00952443211060400	Scopus	143
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A new assessment on mechanical properties of jute fiber mat with egg shell powder/nanoclay-reinforced polyester matrix composites

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ABSTRACT

Natural fiber polymer matrix composites occupy the major percentage in applications due to its ecofriendly and low-cost nature. This study investigates the mechanical properties of a polyester matrix nanocomposite reinforced by the NaOH-treated jute fabric mat (NJM) and untreated jute fabric mat (UJM). In addition, the effects of egg shell powder (ESP) and nanoclay (NC) to the above has also been studied. The matrices were prepared with different combinations of presence and absence of the ESP, NC, and both as well as different weight percentage using compression molding process. The mechanical and morphological properties of the composites were determined. The tensile strength, flexural strength, and impact strength of NJM with NC 1.5%wt and ESP 1.5%wt were found to be 29.28 MPa, 39.51 MPa and impact strength 3.03 J, respectively. This composition is superior to the other compositions. Morphological analysis of tensile fractured surface showed interfacial adhesion between UJM and NJM composites. NJM composites contained smaller amount of pullouts and the splits compared with the UJM composites, which hold up the better performance.

摘要

天然纤维聚合物基复合材料因其生态友好、成本低廉的特点，在应用中占有很大的比重。研究了经NaOH处理的黄麻织物毡（NJM）和未处理黄麻织物毡（UJM）增强的聚酯基纳米复合材料的力学性能。此外，还研究了蛋壳粉（ESP）和纳米粘土（NC）对上述效果的影响。用不同的ESP、NC和两者的组合和不同的重量百分比使用压缩模制工艺制备基质。确定了复合材料的力学性能和形态性能。NC 1.5% WT和ESP 1.5% WT的NJM的抗拉强度、抗弯强度和冲击强度分别为29.28MPa、39.51MPa和冲击强度3.03J。该组合物优于其它组合物。拉伸断口形貌分析表明，UJM与NJM复合材料之间存在界面粘结。NJM复合材料与UJM复合材料相比，具有更小的拉量和劈裂，具有较好的性能。

KEYWORDS

Hybrid filler composite; jute; egg shell; nanoclay; compression moulding

关键词

杂化填料复合材料; 黄麻; 蛋壳; 纳米粘土; 压缩成型

Introduction

Composite materials are employed to produce drastically different chemical, physical, and mechanical property materials for varities of applications with desired properties which are utilized to generate materials embedded with high strength and light weight. (Islam et al. 2011; Rajan et al. 2018) . Polymer-

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Preparation of bio-eco based cellulose nanomaterials from used disposal paper cups through citric acid hydrolysis

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ABSTRACT

The Used Disposal Paper Cups (UDPCs) have become a concern to the solid waste management sector as scientists triggered the problems in recent years, to proceed forward in developing the process for this issue. Based on this concern, the present study emphasizes on the isolation of a novel bio-eco based Cellulose NanoCrystals (CNCs) from UDPCs through citric acid hydrolysis. The effect of acid concentration on microstructure and yield of CNCs are highlighted. The optimized yield (55 wt.%) has an appearance of rod-like structure with a width of 13.7 ± 0.6 nm which results due to 76 wt.% of acid hydrolyzed CNCs. The colloidal stability, crystallinity index, presence of functional groups and elemental composition in CNCs (76 wt.%) were identified by employing zeta potential, XRD, conductometric test and FTIR techniques. Finally, the thermal stability of CNCs (76 wt.%) was investigated by thermo-gravimetric analysis.

1. Introduction

In the latest trend, the entire universe is facing a severe problem by unbalancing the natural processes and waste disposal. This is due to the lack of efficiency in handling the solid waste management techniques which results in continuous deposition of toxic and non-biodegradable materials to the nature (Kumar, Pathak, & Bhardwaj, 2020). The problem in handling the solid waste disposal and ineffective remediation systems is drawing attention to the researchers towards harmless and easily biodegradable materials as well as to reduce the dependence of fossil fuel utilization. In this respect, Cellulose is the most abundant renewable, eco-friendly and sustainable biopolymer, which is available in the universe. It is a fundamental building block of a plant cell wall, in which α-D glucose is formed by condensation reaction linked through 1–4 glycosidic bond (Klemm et al., 2009; Mokhena & John, 2019; Moon, Martini, Nairn, Simonsen, & Youngblood, 2011; Thomas et al., 2018). Besides eco-friendly and renewability, cellulose research is receiving more importance in developing novel materials based on the application of knowledge in nanotechnology due to their promising properties such as high tensile modulus, interfacial area, and low density, etc. (De Mesquita, Donnici, & Pereira, 2010; Guo, Guo, Wang, & Yin, 2016; Klemm et al., 2009; Yano & Nakahara, 2004).

The 'nanocellulose' is a term referring cellulosic materials with at least one dimension in nanometer (nm). This can be produced by enzymatic, chemical hydrolysis and mechanical methods from various bio-mass cellulosic resources. The nano-cellulose can be classified into two main sub-categories such as Cellulose NanoCrystals (CNCs) and Cellulose NanoFibrils (CNFs) based on their preparation methods, chemical composition morphology and dimensions etc. The CNCs and CNFs are similar in chemical characteristics but differ in physical characteristics. The CNFs contain both α-cellulose and amorphous phases, and they exhibit a larger surface area with a network or web-like structure. On the other hand, CNCs contain 100 % α-cellulose content due to the absence of non cellulosic materials such as aromatic (lignin) and amorphous (hemi cellulose) regions, and they exhibit elongated crystalline rod-like shapes (Brinchi, Cotana, Fortunati, & Kenny, 2013; Brito, Pereira, Putaux, & Jean, 2012; Du et al., 2019; Saba et al., 2017).

The CNCs are isolated through a classical (sulfuric) acid hydrolysis process from the forest and agricultural sector's bio cellulosic discarded wastes. These wastes include pistachio shells, usher seed, coffee seed and its husk, kelp waste, sago seed shells, cassava peelings, rice husk, metro solid waste (tetra pack and waste paper etc) and so on (Nagarajan, Balaji, Thanga Kasi Rajan, & Sathick Basha, 2019). Based on their mechanical and morphological characteristics, CNCs are utilized as effective alternative for manmade reinforcing materials, which find applications in the field of food packing, electronic printed circuit board, pharmaceuticals and paperboard industry (Nagarajan, Balaji, &

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Stability analysis of TiO_2–Ag nanocomposite particles dispersed paraffin wax as energy storage material for solar thermal systems

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ABSTRACT

Thermal energy storage using phase change material (PCM) gains momentum as it improves the efficiency of the solar energy thermal systems. The low thermal conductivity of PCMs can be enhanced by dispersing nanocomposite particles in PCM to enhance the performance of energy storage systems. This paper discusses the effect of ball milling on the synthesized TiO_2–Ag nanocomposite particles and analyses the stability of the paraffinwax embedded with TiO_2–Ag nanocomposite particles with various mass concentrations of nanocomposite particles and surfactant. The characterization studies showed that ball milling affects the physical bond between TiO_2–Ag nanocomposites. Next, nanocomposite particles dispersed paraffinwax with and without surfactants SDBS, SDS and SSL were prepared. The suitable surfactant SDS and its proper mass concentration ratio of nanocomposite as 1:0.25 were identified by physical settlement study. Accelerated thermal cycling process was carried out on TiO_2–Ag nanocomposite particles dispersed paraffinwax with and without SDS. Uniform dispersion of nanocomposite particles in paraffin wax was observed for the cycled samples with SDS using SEM. The improved stability, uniform dispersion of TiO_2–Ag nanocomposite particles in paraffinwax and improved thermal properties have proved that this novel PCM could be used as a promising energy storage material in solar energy storage applications.

1. Introduction

In recent times, storing the thermal energy is persistently encouraged all over the world as it would adjust the mismatch between the energy demand and supply. In this juncture, TES systems are primarily intended for enhancing the performance of energy conversion systems. LHESS is a TES system which stores and releases heat energy in the form of latent heat depending on the requirements of thermal load, having high storage density, operating at isothermal conditions, reliable and adoptable with various operating conditions [1]. PCMs are considered as latent heat energy storage system medium. Paraffins were selected as a noble candidate of LHESS because of its appropriate latent heat, better stability at the specific temperature range and low cost [2]. Poor thermal conductivity of the paraffins was one of the demerits of them and reduced their performance of LHESS for heat transfer practical applications. To overcome the effect, many research works have been carried out to enhance its thermal conductivity [3,4]. Thermal conductivity can be improved by using the metal inserts, the porous matrix and the fibrous materials [5–8]. These methods are not desirable due to increase in weight and volume of the LHESS. Dispersing fine particles like metal or a metal oxide nanoparticle with high thermal conductivity in the PCM is a convenient method to increase its thermal conductivity [9]. Tun-Ping Teng et al. [10] studied on thermal storage properties of the paraffin wax with different metal oxide nano particles like TiO_2, Al_2O_3, SiO_2 and ZnO. Their results showed that TiO_2 has more effect on the heat conduction performance and the thermal storage characteristics of the paraffin. Wang et al. [11] examined the influences of dispersing of TiO_2 on the thermal properties of TiO_2/paraffin composites without surfactant. They reported that TiO_2/Paraffin wax composites have enhanced the thermal conductivity compared to the paraffin wax and the thermal conductivity increased with the increase of TiO_2 nanoparticles loading, but decreased with increasing temperature. Sustainability of their synthesized samples after the thermal cycles had not been reported. Motahar et al. [12] investigated the thermal conductivity of n-octadecane/TiO_2 nanoparticles in different mass fractions of 0.5, 1, 2, 3, 4 and 5 wt % over a temperature range of

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Microstructure and Corrosion Behavior of ZnO-Mg Coating on AISI 4140 Steel Fabricated by Spray Coating

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(Submitted April 13, 2020; in revised form July 12, 2020)

This paper aims to investigate the corrosion behavior of ZnO-Mg coatings on AISI 4140 steel using spray coating technology. Three different coating thicknesses of approximately ≈ 30, 60 and 90 µm are considered in this study. The structural and morphological properties of the coated samples are characterized using optical microscope, scanning electron microscope (SEM), x-ray diffraction analysis, atomic force microscope and energy-dispersive spectroscopy analysis. The corrosion behavior is evaluated in a chloride environment by Tafel and electrochemical impedance spectroscopy (EIS) techniques as a function of coating thickness. The acquired results exhibit that the introduction of ZnO-Mg coating improves corrosion resistance of AISI 4140. ZnO-Mg coating acts as a stabilizer in the electrolyte and maintains electrochemical stability. After prolonged polarization, the coating exhibits higher impedance in the subsequent EIS results compared to that of the substrate. The corroded surfaces of AISI 4140 are analyzed using SEM for surface morphological changes.

Keywords AISI-ZnO-Mg, AFM, electrochemical impedance, Tafel

1. Introduction

Mild steel and its derivatives have been used since ages in various applications due to distinct structural characteristics and coat. Automobile applications are significant because of easy availability, ease of fabrication, low cost and good tensile strength among others (Ref 1-4). Specifically, multilayered thin film coatings find excellent engineering applications owing to admirable mechanical properties. ZnO coatings enhance mechanical properties, if coated over steel. Substantial emphasis has been placed on evolving replacements for ZnO-based coatings for the above reason. ZnO-Mg coatings have the potential to act as protective coatings for steel, since they have excellent corrosion resistance. Many coating approaches are applied commercially to offer protection from corrosive environments and for properties enrichment and thus to increase the life span of mild steel base infrastructure. Mg is anodic to mild steel; it protects the base material even when it is deposited in porous condition. However, Mg has limited application as structural material because of its high chemical reactivity and shrinkage on solidification. In order to extend the applications, a substantial care has been paid to ZnO-Mg coatings which have the potential to be expansively used in the destructive atmospheres.

M Mora et al. (Ref 5) have reported tribo-electrochemical characterization of hafnium multilayer systems deposited on nitride/vanadium nitride AISI 4140 steel and the results directs that increase in the polarization resistance, a decrease in the corrosion rate and a low coefficient of friction in comparison with the substrate, due to an increase on the number of bilayers. Yasar Totik (Ref 6) studied the corrosion behavior of AISI 4140 steel subjected to different heat treatments. They found that the corrosion potential of quenched specimens was higher than that of the tempered specimens. Moreover, the highest corrosion potential was observed for water-quenched (WQ) specimens. F. G. Mittelstädt et al. (Ref 7) studied the corrosion resistance behavior of AISI 4140 steel using plasma surface treatment and the results illustrate that potential for pitting initiation and propagation as well as for pitting protection has been determined in a chloride environment. However, they also suggested the control of standard parameters for electrochemical technique. The cited literature confirmed that many research investigations have been made on corrosion behavior of AISI 4140 steel. However, no specific work has been reported on corrosion behavior of ZnO-Mg coatings on AISI 4140 steel. Hence, the current research endeavored to investigate the corrosion behavior of ZnO-Mg coatings on AISI 4140 steel by controlling the deposition thickness. The coated samples were characterized using SEM, XRD, EDS and AFM. The corrosion behavior of the ZnO-Mg coatings on AISI 4140 steel was investigated by Tafel and electrochemical impedance analysis. Further, the surface morphology of the corroded samples was characterized using SEM.

2. Experimental Details

2.1 Materials and Methods

This study is an attempt to fabricate coated samples comprising ZnO-Mg coated over AISI 4140 steel specimen

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Original Article

Effect of processing parameters on tensile properties of recycled polypropylene based composites reinforced with jute fabrics

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ABSTRACT

This work examines the effects of processing parameters such as pressure and temperature on the tensile properties of plain woven jute fabric reinforced recycled polypropylene composite. The main objective of this study is to the utilization of recycled polypropylene in a better way. By recycling of this polypropylene will reduce the environmental impacts and preparation of composites by this recyclable plastic can be used for various applications. In this study, eight different composite laminates under varying pressure (1, 2, 3, 4 MPa) and temperature (190, 210, 230, 250 °C) were produced and they were found to have similar fiber weight fractions up to 62%. Tensile tests were carried out on these composites to optimize the processing parameters. From the static tensile, the various test specimens exposed that the variation in temperature and pressure levels during the performance have a significant effect on the tensile properties of the bio-composites.

1. Introduction

Today's improvement in ecological awareness has created interest to utilize the natural fibers as substitute reinforcing agents in polymer-matrix composites due to being less environmental pollution, less cost, easy processing and comparatively good thermal, mechanical properties [1–3]. All these advantages are now being used in various sectors such as automobile, aerospace, electrical, construction, military, packaging, naval, and household appliances, etc [4–6]. Various researches acknowledged the utilization of plant based bio-fibers such as jute, coir, banana, pineapple, sisal, bagasse and hemp. Out of these fibers, jute fibers are one of the most commonly used types of lignocellulosic fibers for producing polymer composites with good mechanical properties [7–10]. Bledzki et al. [11] used abaca fibers as reinforced agents and PP as matrix. Authors compared their results with those obtained on flax and jute PP composites. They found that jute fibers reinforced polypropylene (PP) composites gave better flexural modulus and tensile properties than flax/PP and abaca/PP composites. The properties of green composites are based on the several parameters such as type (thermoplastic or thermosetting plastic) and condition (virgin or recycled) of matrix, type of fiber (leaf fiber, bast fiber, root fiber, etc.) forms (fibers, yarns, fabrics, etc.), fiber orientation (randomly orientated, unidirectional mat, bi-directional mat etc.), technique utilized to manufacture (hand layup, compression moulding, auto clay moulding, injection moulding, etc.) and process parameters (temperature, pressure, etc.). Tri et al. [12], in their article on the development of composites based on recycled PP reinforced with natural fibers (bamboo fibers), suggested that thermoplastic matrices such as polyethylene (PE), polypropylene (PP), polystyrene (PS) are often used because of their excellent processing temperature. By elsewhere, the temperature of

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ORIGINAL ARTICLE

Experimental investigations of reciprocating wear behavior of metal matrix (Ti/TiB) composites

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Abstract
In this paper, the reciprocating wear behavior of titanium–titanium boride composites with 20 and 40 (by vol. %) titanium boride (TiB) particles IS investigated in dry sliding conditions against Al_2O_3 ceramic balls. The trials have been observed at three loading conditions such as 5, 10 and 15 N load. The composites were processed by three powder metallurgical techniques such as spark plasma sintering (SPS), vacuum sintering (VS) and hot isostatic pressing (HIP). The electron probe microanalysis (EPMA) was used to analyze the homogeneity of Ti and boride phases in the composites. The hardness and indentation fracture resistance were evaluated using nano-indentation technique. The load–depth curves of indents for Ti–TiB shows the deviations of the modulus of elasticity within the spark plasma sintering (SPS), vacuum sintering (VS) and hot isostatic pressing (HIP).The wear resistance of the fabricated samples was analyzed using reciprocating wear tester. The SPS composite (Ti–38.5% TiB) showed lower coefficient of friction (0.07), lower wear volume (0.4368 mm^3) and wear rate (0.000276 mm^3/m) when compared to HIP and VS, which is attributed to the presence of fine titanium boride needles of high hardness, contributing to improving wear resistance. The surface morphology reveals that the composites processed through spark plasma sintering (SPS) and hot isostatic pressing (HIP) are subjected to minor plastic deformation. The outcome of this work is more beneficial to automotive brake pad, precision manufacturing and locomotives to avoid critical wear failures.

Keywords Titanium–titanium boride composites · Reciprocating wear · Nano-indentation

1 Introduction

In automobile applications, the braking system is a vital component which requires accurate friction and wear's behavior. Commercial automotive braking systems containing a disc and brake-lining pads ought to fulfill necessities like wear [1–4]. In past few decades, the researchers investigated the wear behavior of the braking system, even though these are relatively unpredictable owing to the contact variations that exist in the specific and complicated systems [2, 3].

The ability of using conventional processing techniques such as extrusion, forging and rolling makes DRAs notable candidate for a wide range of applications in the automobile, aerospace and electrical industries [4–7]. On other hand, the disc brakes represents a complex tribosystem, with the brake rotors forced into contact with brake pads that are usually composite materials with improved thermal characteristics. Wear is the strategy used for devastation and expulsion of materials from the outside of solids, because of the connection of the scouring parts. Titanium composites have high specific strength-to-weight ratio and high corrosion resistance. Regardless of their tempting mechanical and physical properties, Ti and its amalgams ordinarily show poor tribological properties [8]. With the incorporation of ceramic particles like TiB, TiC and TiN into Ti, Titanium composites

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Studies on Ramie cellulose microfibrils reinforced cassava starch composite: influence of microfibrils loading

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ABSTRACT

Composites were fabricated from Ramie cellulose microfibrils (RCMF) with cassava starch as matrix and glycerol as a plasticizer. Different composites were fabricated with microfibrils loadings of 0, 2, 4, 8, and 10 wt%. The Particle Size Analyzer results show the average size of RCMF as 1.573 µm. The addition of RCMF considerably influenced the physical, crystalline, thermal, and tensile properties of composites. The addition of RCMF enhanced the crystallinity index (CI) from 32% to 36.67%. Thermogravimetric analysis and tensile test results showed improvement in thermal stability and tensile strength of composite up to 6 wt% microfibrils addition.

摘要

以Ramie纤维素微纤维（RCMF）为原料，以木薯淀粉为基质，甘油为增塑剂，制备了复合材料。用微纤维负载量分别为0、2、4、8和10WT%制备不同的复合材料。粒度分析结果表明，Ramie纤维素微纤维的平均粒径为1.573µm。苎麻纤维素微纤维的加入显著影响了复合材料的物理、结晶、热、拉伸性能。苎麻纤维素微纤维的加入使结晶度指数（CI）从32%提高到36.67%。热重分析和拉伸试验结果表明，复合材料的热稳定性和拉伸强度提高到6重量%的微纤维。

KEYWORDS

Cassava starch; Ramie cellulose microfibrils; thermal stability; tensile strength

关键词

木薯淀粉; 纤维素微纤维; 热稳定性; 抗拉强度

Introduction

The inventions of biodegradable materials are necessary for overcoming today's environmental pollution. Thus, many of the researchers are focusing on natural-fiber-reinforced polymer composites instead of synthetic-fiber-reinforced composites (Senthamaraikannan et al. 2015; Rajesh Jesudoss Hyness et al. 2018). Moving toward natural fibers, most of the researchers are still using matrix material as synthetic resins. So, the resultant composites are partially biodegradable material. To make completely bio degradable material, we have to move toward the biodegradable matrix. Cassava (*Manihotesculenta*) starch is one of the commercially available biodegradable matrices throughout the world (Tongdeesoontorn et al. 2011). However, the cassava starch is brittle in nature which results in poor mechanical properties; to overcome this difficulty, plasticizers are added to the starch which may decrease the brittleness of the material and enhance the process ability. On the other hand, it may reduce the degradation temperature of starch (Chang et al. 2006). In addition to these, starch has higher water absorption nature. Reinforcement of natural fiber is one of the efficient

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/wjnf.

Materials Research Express

PAPER

Investigation and characterization of Copper-Fly ash-Tungsten hybrid composites synthesized through P/M process

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Abstract

This research paper describes the enhancement of mechanical, wear and corrosion behaviour of the Copper (Cu) matrix composite by reinforcing Fly ash (FA) and Tungsten (W). The main objective of this study was to reduce the weight and cost of the hybrid composites. The weight percentage of low density material (FA) was kept constant at 6% and samples were prepared by the addition of W in weight percentages of 3, 6 and 9 in the Cu matrix. The characterization of the hybrid composites was studied using a Scanning Electron Microscope (SEM) and Energy-dispersive spectroscopy (EDS). The micrographs revealed the uniform distribution of W and FA in the Cu matrix. From the mechanical characterization, it was identified that there is an increase in microhardness and compressive strength with the addition of W particles. It can be understood that the W particles occupy substitutional type reinforcement and FA particles occupy interstitial type reinforcement in the Cu matrix. The Wear behavior and its mechanism were studied using worn surface SEM micrographs. It was observed that the lowest specific wear rate was recorded for the hybrid composition of Cu-6FA-6W. Electrochemical polarization test and Electrochemical Impedance Spectroscopy (EIS) study revealed that Cu-6FA-9W shows higher corrosion resistance in both 1 N HCl ($256.593 \times 10^{-4}\,\Omega\,cm^2$) and seawater media ($219.855 \times 10^{-4}\,\Omega\,cm^2$) than pure Cu.

1. Introduction

The composite material is made of a mixture of two or more distinctly different insoluble materials. [1]. The main objective of adding reinforcement was to improve the desired properties of the base material based on suitable applications. Copper (Cu), magnesium, titanium and aluminum-based composites are commercially and widely used composite materials. Among which, Cu is considered to be one of the most dominant nonferrous material that find extensive applications in cooling system applications, electrical contacts, heat sink applications, antifriction, antiwear and semiconductor devices [2]. The addition of single reinforcement especially Cu-W composite materials finds application in welding electrodes, high voltage electric contacts, and microelectronic materials [3–6]. Similar kinds of other popular reinforcing materials such as B_4C, Ti & TiO_2, WC, TiC, [7–11] etc, promised to increase the thermal conductivity, electrical conductivity, hardness, and wear resistance.

At present, industry demands to reduce the weight and cost of the material without sacrificing its mechanical, electrical, tribological and thermal properties. The demand even extends up to finding the machining characteristic of the composite material and cost of fabrication etc, [12]. One factor which reduces the cost of fabrication is to reinforce the low cost material. Some of the low density reinforcement materials which are widely used in copper are MoS_2, SiC, Al_2O_3, graphite, and Fly Ash (FA) [13–18].

The addition of low density material has certain advantages and disadvantages. For example, MoS_2 is one of the solid lubricants mainly added with Cu to improve the machinability of the material but it undergoes reaction with the base material and also acts like a poor lubricant [19]. Similarly, the addition of Al_2O_3 increases the

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Colloidal release in high temperature porous media with oversaturated fines during supercritical CO2 transport

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ABSTRACT

This paper presents the impacts of supercritical CO_2 transport in high temperature porous media with oversaturated fines. The latter phenomenon (indicates oversaturated fines) is in which the lift force of the fine particle over pore surface is greater than the gravitational and electrostatic forces combined, where the fines are released from the pore surfaces and transport along with the permeating fluid as colloidal-suspension flow. During transport, the fines are captured in the pore-throats and thereby deteriorating the permeability and decreasing fluid recovery as well. Therefore, three sets of coreflood tests have been conducted to examine the fines mobilization in porous media during supercritical CO_2 transport and the results have been compared with the results obtained from the subcritical CO_2 flow. Produced suspension-colloids have been sent for microstructural analysis and its outcomes, supported the experimental results. Statistical modelling and literature data were employed and compared for model validation, which revealed high agreement.

Credit author statement

B. Kanimozhi: Experimental Setup and Work, Model Prediction, Calculation, S.Mahalingam: Experimental Setup and Work, and Supervision, Venkat Pranesh: Experimental Design and Work, Data Analysis, Wrote the Manuscript, R. Kesavakumar: Statistical Modelling and Supervision, S. Senthil: Experimental Setup and Work, SEM Interpretation, S. Ravikumar: Sandstone Rock Core and Clay Minerals Characterization, Shanthi Pradeep: SEM Interpretation and Sample Physical Properties Examination, Sandhya Senthil: Data Evaluation, Calculation and Analysis, Raji Murugan: Data Evaluation, Calculation and Analysis

1. Introduction

The phenomenon of colloidal-suspension flows and fines migration in porous materials is a common and frequent event in the petroleum, chemical, geothermal, agricultural, metallurgical, and water resource industries. Specifically, during the process of oil and gas recovery, water production from aquifers, thermal energy extraction and storage, waste management, microfiltration, crop irrigation, mineral processing etc., (Malgaresi et al., 2020, 2019; Zhang et al., 2019; Shahverdi et al., 2018; You et al., 2014; Ramaswamy and Raghavan, 2011; Sen and Khilar, 2006; Orts et al., 2000). But, this paper emphasizes on the applications to oil and gas recovery and aquifers during CO_2 injection. Because, for the past 3 decades the CO_2 the most notorious greenhouse gas has been employed in the oil and gas fields to mobilize the subsurface reservoir fluids and recovery as well (Pranesh, 2016). Additionally, solid fine particles are naturally present in the porous media. Mostly, these fines are clay and crystalline minerals, such as kaolinite, illite, montmorillonite, smectite, quartz, etc. Even solid fines may occur in the porous rocks due to the erosion of rock matrix and also, there is a bacterial growth in the reservoir rocks (Kanimozhi et al., 2019a; Wennberg et al., 1996). Actually, fines in the porous medium under supercritical CO_2 flow detaches from the pore surface and transport along with the permeating fluid, which is reported both in laboratory and field case studies (Pearce et al., 2019; Xie et al., 2017). Fig. 1 presents the schematic diagram of fines behaviour and colloidal release during supercritical CO_2 flow in the porous media. Usually, fines attached on the rock

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Effect of Various Chemical Treatments of *Prosopis juliflora* Fibers as Composite Reinforcement: Physicochemical, Thermal, Mechanical, and Morphological Properties

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ABSTRACT

The present environmental regulations enforced by the government authorities have made the investigators around the globe to make use of more and more green materials particularly in composite systems. In this context, natural fibers play an important role and proven to be excellent reinforcements in polymer matrices. However, these natural fibers have got one major limitation: their incompatible hydrophilic behavior which affects their bonding with hydrophobic matrixes. Researchers over the years have come up with several fiber surface modification processes to overcome this defect. So, in this present study, the effect of various chemical treatments like alkaline, benzoyl peroxide, potassium permanganate, and stearic acid on *Prosopis juliflora* fibers has been discussed. These various chemical treatments on the fiber surfaces impacted on their structure, composition, and properties which were discovered through chemical analysis, Fourier transform-infrared, X-ray diffraction, thermogravimetric analysis, differential scanning calorimetry, scanning electron microscopy, and tensile testing.

摘要

政府当局实施的现行环境法规已经使世界各地的调查人员越来越多地使用绿色材料，特别是在复合系统中。在这种情况下，天然纤维起着重要的作用，并证明是优异的增强聚合物基质。然而，这些天然纤维有一个主要的局限性：它们不相容的亲水性影响了它们与疏水性基质的结合。多年来，研究人员已经提出了几种纤维表面改性方法来克服这一缺陷。因此，本研究探讨了碱、过氧化苯甲酰、高锰酸钾和硬脂酸等化学处理对Paopopijululula纤维（PJFS）纤维的影响。通过化学分析、FTIR、XRD、TGA、DSC、SEM和拉伸试验发现，纤维表面的各种化学处理对纤维的结构、组成和性能均有影响。

KEYWORDS

Chemical properties and density analysis; FTIR; XRD; TGA and DSC; SEM

关键词

化学性质和密度分析

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Characterization of natural cellulosic fibers from Nendran Banana Peduncle plants

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ABSTRACT

The objective of this work is to explore the natural cellulosic fibers extracted from Nendran Banana Peduncle plants. This is the first time, the tests are carried out in the Nendran Banana Peduncle Fiber (NBPF) to measure the properties of the chemical, physical, mechanical, thermal (TGA/DTG), X-ray Diffraction (XRD) analysis, Fourier-transform Infrared spectroscopy(FT-IR), Nuclear Magnetic Resonance (NMR) analysis and Atomic Force Microscopy (AFM) furnished in this work. The Weibull distribution analysis was adopted for the analysis of diameter, tensile strength and Young's modulus of the fiber. The XRD analysis for the NBPF shows that the crystallinity index of 53.3%and crystallinity size of 4.72 nm. Thermogravimetric analysis depicted that NBPF can withstand thermally up to 356 °C. FT-IR results proved the existence of different chemical compositions and their corresponding functional groups. AFM analysis revealed the surface of the fiber found as rough. From the results, it is concluded that NBPF utilized as a polymer matrix composite for manufacturing light load automotive components and construction equipment.

1. Introduction

Natural fibers have considered as a polymeric composite materials in recent times. Natural fibers have potential to serve as a replacement to synthetic fibers owing to their significant properties like biodegradability, abundant availability, low density, recyclability, sustainability, non-toxicity, non-corrosive, eco-friendly and low carbon emissions [1–4]. In order to protect the environmental damages due to the usage of petroleum based fiber reinforced composites, many researchers have identified the green composites are prepared from natural cellulosic fibers. Then the proper utilization of new natural cellulosic fibers emerges the significant role in preparing the polymeric composite materials [5–7]. Due to the environmental consciousness, various researchers have to identify the natural new cellulosic fibers for the replacement of the synthetic fibers to save the environment. The natural fibers were introduced from plenty of renewable resources make use of reinforcements in polymer matrix for fabricating the various end components. These natural fiber reinforced composites in the form of degradability and utilization of natural products to protect the environment [8]. Many researchers have been analyzed the fibers, prepared from various parts of the plant such as stem, leaf, bark, roots, fruits and seeds and examined the different plant fibers like banana, hemp, sisal, coir, bamboo for reinforcement to prepare the polymer composites. Recently some researchers examined the appropriateness of natural fibers such as *Sansevieria cylindrica*, Sansevieria ehrenbergii, *Prosopis juliflora*, Indian mallow, Saharan *Aloe vera*, *Furcraea foetida*, *Thespesia populnea*, aerial roots of banyan tree, Red banana Peduncle, *Calotropis gigantea*, Leucas Aspera [9–19]. The final properties of polymer composites are depending on the nature of resin, fiber alignment, and the bonding between the fiber and matrix [20].

Many researchers have extracted the fibers from the stem of Banana only. Usually the Banana Peduncle is disposed as a waste material. In order to beneficially utilize the waste into useful product, our study focused on the fiber extracted from banana Peduncle. Generally there are many varieties of bananas like red banana, nendran banana, rasthaly banana, morris banana and Poovan banana etc. For the first time, the novel natural fibers from Nendran Banana Peduncle (NBP) were prepared and its basic essential properties like density, chemical composition, crystallinity index (CI), crystalline size (CS), Fourier Transform-Infrared (FT-IR) Analysis, X-ray diffraction (XRD) analysis, Single fiber tensile test and Weibull distribution analysis, Thermogravimetric analysis (TGA/DTG), Nuclear Magnetic Resonance (NMR) and Atomic Force Microscopy (AFM) analysis was executed and compared with other fibers.

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A new study on characterization of *Pithecellobium dulce* fiber as composite reinforcement for light-weight applications

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ABSTRACT

A bio-fiber, *Pithecellobium dulce* is abundantly available in all over the world. It has a higher cellulose content (75.15 ± 0.26 wt.%) and low density (865 ± 26 kg/m^3). To acquire fundamental knowledge about *Pithecellobium dulce* Fibers (PDFs), its physicochemical, crystalline, tensile, and morphological properties were examined and compared with other plant fibers. The chemical functional groups and crystallinity index (49.2 ± 2.45%) of the PDFs were obtained via Fourier transform-infrared analysis and X-ray diffraction, respectively. The Thermogravimetric analysis results of PDFs exhibit thermal stability up to 170°C. The surface morphology of PDF was analyzed by scanning electron microscopy. The attained results conclude that PDFs are appropriate fibers for acting as reinforcement in manufacturing of green composite product.

摘要

生物纤维，*PithecellobiumDulce*在世界各地都可获得。纤维素含量较高(75.15±0.26重量%), 低密度 (865±26kg/m3)。为了获得关于PieleloLubul-dulCE纤维（PDFs）的基本知识，对其物理化学、结晶、拉伸和形态性质进行了研究，并与其它植物纤维进行了比较。分别用VIAFAFTIR和XRD对PDF的化学官能团和结晶度指数(49.2±2.45%) 进行了分析。PDF的热重分析结果表明，热稳定性可达170℃，用扫描电子显微镜（SEM）对PDF的表面形貌进行了分析。结果表明，PDFS是制造绿色复合材料的增强纤维。

KEYWORDS

Pithecellobium dulce fibers; crystallinity index; chemical functional groups; tensile strength; surface morphology

关键词

黄花菜; 结晶度指数; 化学官能团; 抗拉强度; 表面形貌

Introduction

In recent days, there is an increasing awareness in using natural fibers as alternative reinforcement for synthetic fibers in polymer matrix composites, especially due to the environmental impact of synthetic fibers (Sanjay et al. 2018a; Sanjay. et al. 2018b). The other disadvantages connected with the synthetic fibers are high costs, higher power spending for fibers production, creating skin annoyance to processing labors, and higher abrasion of processing equipment. The natural fibers can overcome this troubles by its renewable origin, low density, high specific strength, high toughness, biodegradability, noncorrosiveness, reduced wear, low cost, easy availability, good thermal, and insulating properties along with less power consumption during processing (Jawaid and Abdul Khalil 2011; Rajesh Jesudoss et al. 2017). Due to these advantages, natural fiber reinforced composites are used in many fields, such as

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Suitability Evaluation of *Sida mysorensis* Plant Fiber as Reinforcement in Polymer Composite

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ABSTRACT

The physicochemical, thermal, and surface morphological properties of the *Sida mysorensis fiber* (SMF) were investigated first time in this article. From the chemical compositional analysis, higher cellulose (53.36 wt. %) and lower hemicelluloses (15.23 wt. %), lignin (9.46 wt. %), wax (0.86 wt), and ash content of (3.33 wt. %) SMF were acknowledged. The different functional groups of SMF were determined through the Fourier transform infrared spectrometer. The Crystallinity index (41.17%) and crystalline size (13.06 nm) of SMF were evidenced through the X-ray diffraction analysis. Atomic force microscopy investigation was used to study the surface morphology of SMF. Thermal stability (220°C) and kinetic activation energy (65.486 KJ/mol) of the SMF were determined through the thermogravimetric analysis. All the above findings ensured that SMF can be used as reinforcement in polymer composite.

摘要

本文首次研究了Sida mysorensis纤维（SMF）的理化、热学和表面形态特性. 化学成分分析表明，SMF的纤维素含量较高（53.36%），半纤维素含量较低（15.23%），木质素（9.46%），蜡（0.86 wt.）和灰分（3.33 wt.%）. 利用傅立叶变换红外光谱法测定了不同官能团的表面活性剂. 通过X射线衍射分析，确定了SMF的结晶度指数（41.17%）和晶粒度（13.06nm）. 采用原子力显微镜对表面形貌进行了研究. 通过热重分析测定了SMF的热稳定性（220oC）和活化能（65.486kJ/mol）. 以上研究结果表明，SMF可以作为聚合物复合材料的增强体.

KEYWORDS

Sida mysorensis; chemical analysis; thermogravimetric Analysis; Fourier transform-infrared spectroscopy; x-ray diffraction and Atomic Force Microscopy

关键词

化学分析; 热重分析; 傅立叶变换红外光谱; X射线衍射和原子力显微镜

Introduction

Recently, environmental alertness and regulations in the globe have driven the materials investigators toward the plant fiber-reinforced polymer composite because of its availability, lightweight, low cost, and biodegradable nature (Manimaran et al. 2018b). Chemical composition in the fiber is subjected to the various parameters such as maturity of the plant, soil condition, and extraction method (water retting, chemical retting, mechanical extraction, ect.) (Madhu et al. 2018). Properties of the plant fibers majorly depend on the chemical composition such as cellulose, hemicellulose, lignin, wax, and moisture. A higher amount of cellulose content leads to higher tensile strength and increased thermal stability. Today, automotive industries are majorly using the commonly used natural fibers such as jute, hemp, sisal, coir,

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Characterization of a new cellulosic natural fiber extracted from the root of *Ficus religiosa* tree

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ABSTRACT

Physical, chemical, thermal and crystalline properties of new natural fiber extracted from the root of *Ficus Religiosa* tree(FRRF) are reported in this study. The chemical analysis and X-ray diffraction (XRD) analysis results ensured the presence of higher quantity of cellulose content (55.58 wt%) in the FRRF. Nuclear Magnetic Resonance (NMR) spectroscopy analysis is transported away to support the chemical groups present in the considered fibre. Thermal stability (325 °C), maximum degradation temperature (400 °C) and kinetic activation energy (68.02 kJ/mol.) of the FRRF areestablished by the thermo gravimetric analysis. The diameter (25.62 μm) and density (1246 kg/m^3) of the FRRF have been found by the physical analysis. Scanning electron microscope analysis (SEM) and Atomic force microscope analysis (AFM) outcomes revealed that FRRF has the relatively smoothest surface. Altogether the above outcomes proved that novel FRRF is the desirable reinforcement to fabricate the fiber reinforced composite materials.

1. Introduction

Baskaran et al. Characterized a new natural fibre extracted from the bark of *Dichrostachys Cinerea*(DCF). They reported that the proposed DCF has significant thermal stability up to 226 °C temperature; in turn DCF can be used as a better reinforcement for high temperature polymer matrix applications [1]. Belouadah et al. studied thefibre extracted from the stemof *the Lygeum Spartum plant* (LSF). The results disclosed that the LSF had significant rough surface which is the desirable property to achieve good interfacial bonding between the fiber and matrix [2]. Gopinath et al. characterized the fiber extracted from the stem of the *Sida Rhombifolia* plant (SRF). SRF had higher value of crystallinity index as 56.6%, which indicated the fiber had rich cellulose contents, in turn high crystalline nature [3]. Rajesh Jesudoss Hyness et al. verified the fundamental properties of the plant fiber obtained from the tip of the *Heteropogon Contortus* plant (HCF). The HCF would have a lesser density (602 kg/m^3) and greater tensile strength (476 ± 11.6 MPa) [4]. Indran et al. extracted the bio- fiber from the stem of *Cissus Quadranglaris* plant (CQF); and detailed that the fiber has lower density (1.22 g/cm^3) in comparison with that of synthetic fibers such as glass and carbon fibers. CQF has the better tensile strength and thermal stability (270 °C) [5]. Jayaramudu et al. investigated the fibers obtained from the bark of *Grewia Tilifolia* tree (GTF). The morphological study showed that the GTF has uni-axially aligned constituents with rough surface. After carrying out the entire characterization process, the authors said that the GTF could be proposed for producing the high strength composite structures [6].

Mabrouk Maache et al. worked with the *Juncus Effusus* fiber (JEF) obtained from the stem of the plant. It was noted from the thermogravimetric analysis results that the JEF has the thermal stability upto 220 °C, in turn the fiber is preferable for high temperature applications [7]. Maepa et al. reported from the characterization resultsof fiber obtained from the top stem of raped *Maize Tassel* plant (MTF) that the MTF yield great mechanical properties since they are composed of the highest percentage of cellulose contents (41%) and comparable lower amount of hemicelluloses (29%) and lignin (18%) constituents [8]. Maheshwaran et al. analyzed the *Epipremnum Aureum* fibers (EAF) for checking out the possibility of using them for reinforcement material for composite materials. From the thermal

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A Comprehensive Physical, Chemical and Morphological Characterization of Novel Cellulosic Fiber Extracted from the Stem of *Elettaria Cardamomum* Plant

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ABSTRACT

To overcome the environmental regulations adopted across the globe in polymer composites, a natural fiber extracted from the waste stem of *Elettaria cardamomum* plant (ECF) was investigated for its suitability in polymer composites. Fundamental properties such as chemical, physical, thermal and surface morphology of ECF were evaluated using chemical composition analysis, optical microscope test, X-ray diffraction, Thermo-gravimetric and scanning electron microscope analysis. The chemical analysis outcomes revealed that ECF has a comparatively higher amount of cellulose (63.12 wt. %), lignin (16.5 wt. %) and lower hemicelluloses (13.7 wt. %), wax (1.5 wt. %) which is expected property of a reinforcement. Thermal analysis results demonstrated that ECF has thermal stability (up to 230°C). Surface morphological analysis showed that non-cellulosic materials and impurities existed on the surface of the ECF. So, mild surface treatment was recommended. Higher tensile strength (294 ± 1.62 MPa) and lower density (1470 Kg/m^3) of ECF defined this as an appropriate fiber for reinforced composites.

摘要

为了克服目前世界各国对聚合物复合材料的环保要求，从豆蔻植物（ECF）的废茎中提取天然纤维，研究其在聚合物复合材料中的适用性. 采用化学成分分析、光学显微镜测试、X射线衍射、热重分析和扫描电镜分析等方法，对ECF的化学、物理、热和表面形貌等基本性能进行了评价. 化学分析结果表明，ECF具有较高的纤维素含量（63.12 wt.%）、木质素含量（16.5 wt.%）和较低的半纤维素含量（13.7 wt.%）、蜡含量（1.5 wt.%）等预期的增强性能。热分析结果表明，ECF具有热稳定性（高达230°C）. 表面形态分析表明，非纤维素材料和杂质存在于ECF表面. 因此，建议进行温和的表面处理. 较高的拉伸强度（294±1.62mpa）和较低的ECF密度（1470kg/m3）将其定义为增强复合材料的合适纤维.

KEYWORDS

Elettaria cardamomum fiber (ECF); chemical analysis; thermal analysis; crystalline properties; surface morphology and Single fiber tensile strength

关键词

小豆蔻纤维（ECF）; 化学分析; 热分析; 结晶性能; 表面形貌和单纤维拉伸强度

Introduction

Today, the execution of new environmental policies around the globe is emphasizing the engineering industries to replace the non-biodegradable materials by the biodegradable plant fiber reinforced plastics (Halimatul, Sapuan, and Jawaid 2019). Usually, plant fibers are extracted from the various portions of the trees such as flower, fruit, root, barks, etc. Chemical compositions of the fibers are principally influenced by the properties of the plant fibers such as crystalline index, thermal stability and

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Structural and Thermal Properties of Chemically Modified *Luffa Cylindrica* Fibers

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ABSTRACT

This present investigation is aimed at understanding the impact of various chemical treatments on the physicochemical properties of *Luffa cylindrica* fibers (LCFs). One of the major disadvantages of natural fiber as reinforcement materials in polymer composites is the incompatibility of hydrophilic nature of natural fiber and hydrophobic nature of polymers. So in this investigation, LCFs were pre-treated using optimal alkali solution followed by individual treatments with potassium permanganate, benzoyl peroxide and stearic acid to reduce the hydrophobic nature of LCF to use as reinforcement materials in composites which can be used for semi-structural applications such as household products, construction and building materials, car-interior components, etc. Further, the physicochemical properties of chemically modified LCFs were studied using thermogravimetric analysis (TGA) and X-ray diffraction (XRD). It was noticed that all modified LCFs improved crystallinity and thermal stability. Moreover, the stearic acid treatment promoted the superior thermal stability of LCFs.

摘要

本研究旨在了解不同化学处理对丝瓜纤维理化性质的影响. 天然纤维作为聚合物复合材料增强材料的一个主要缺点是天然纤维的亲水性与聚合物的疏水性不相容. 因此，在本研究中，LCFs用最佳碱液预处理，然后用高锰酸钾、过氧化苯甲酰和硬脂酸单独处理，以降低LCF的疏水性，用作复合材料中的增强材料，可用于半结构应用，如家用产品，利用热重分析（TGA）和x射线衍射（XRD）对化学改性lcfs的物化性能进行了研究. 结果表明，所有改性LCFS均提高了液晶的结晶度和热稳定性。硬脂酸处理提高了LCFS的热稳定性.

KEYWORDS
Chemical treatment; crystallinity index; thermogravimetric analysis; *Luffa cylindrica* fibers

关键词
化学处理; 结晶度指数; 热重分析; 丝瓜纤维

Introduction

Bio-fibers have been exploited for centuries and potential new applications for these ever-present renewable resources are still being sought mainly in response to environmental concerns (Sun et al. 2004; Singha, Shama, and Thakur 2008; Sanjay et al. 2018). Keeping in view the eco-friendly advantages of green materials, a large number of industries are initiating the design and engineering of these products. In spite of a number of advantages, natural fibers also have few disadvantages. One of the

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Case Study

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Effect of deposition thickness on microstructure and thermal behaviour of ZnO-Mg coated AISI 4140 for automotive applications

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Abstract

In this research article, the detailed morphology characterization and thermal behaviour of AISI 4140 steel coated with ZnO-Mg were studied. Coating thickness of approximately ≈ 30, 60 and 90 μm were taken. The surface morphology of the coated samples was studied using Optical Microscope (OM) and Scanning Electron Microscope (SEM). Phases present in the coated samples were confirmed using X-Ray Diffraction Technique (XRD) and Raman Spectroscopy. Thermal properties of the coated samples such as thermal conductivity and thermal diffusivity were determined. In addition, specific heat of the coated samples was also identified. The samples with coating thickness of 30 μm exhibit enhanced thermal properties compared to other coated samples. The results reveal that ZnO-Mg coating can significantly improve the thermal properties of AISI 4140 steel, which can be a fair candidate material for automotive applications.

Keywords

AISI 4140/ZnO-Mg, X-ray diffraction, Raman spectroscopy, thermal conductivity

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Introduction

The coated AISI 4140 steels are widely used for gears, blades, and so forth in many industrial applications due to abrasion and impact resistance, high strength and toughness.[1,2] AISI 4140 steel is exposed to high temperature and corrosion; it undergoes severe failures such as micro pitting, scuffing, etc., which are detrimental to the service life of the critical components. Many coating techniques are there namely Physical Vapour Deposition (PVD), Chemical Vapour Deposition (CVD), spray coating and spin coating. Among all the coating techniques, spray coating is most efficient and cost effective. In recent times, spray coating techniques are used since uniform structures are formed with desirable properties of engineering importance.[3,4] Specifically, multilayered thin film coatings offer more advantages in engineering applications due to its admirable mechanical properties. ZnO-Mg coatings improve the mechanical and corrosion properties, if coated over steel.[5] But desired values of thermal properties are not yet achieved using these coatings over steel. In a heat exchanger and fast reactors applications, the principle materials are ferritic steels (AISI 4140) 2.25Cr-lMo, Niobium stabilised 2.25Cr-lMo, 9Cr-1Mo and modified 9Cr-lMo (Grade 91), austenitic stainless steel (AISI4140). Now days, compared with single element coatings, multi elements coatings have been widely studied for their stronger performance sections (for example tube sheets of heat exchangers). Erich sigolo et al.[6] AISI 4140 steel was coated with Plasma Transferred Arc (PTA) method. The coating

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ORIGINAL PAPER

Development and Analysis of Silver Nano Particle Influenced PVA/Natural Particulate Hybrid Composites with Thermo-Mechanical Properties

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Accepted: 26 November 2020

Abstract
Owing to develop the utilization of biowaste materials and minimize the usage of plastic materials, Orange peel Powder (OPP) biowaste is chosen as filler material along with Polyvinyl Alcohol (PVA) as a matrix to form biocomposite films. To stretch its applications to antibacterial applications the metal nanoparticles were incorporated by the in-situ generation of Ag by reducing the various concentration of the aqueous solution of $AgNO_3$ to fabricate novel PVA/OPP/(1 mM to 5 mM) AgNPs hybrid biocomposite films. The fabricated biofilms were undergone the antibacterial test, mechanical test, and characterized by FESEM, FTIR, XRD & thermal analysis. The FESEM images clarify the homogenous distribution of filler materials in the PVA matrix and binding between the filler materials & matrices. FT-IR spectrum illustrates, there is no functional group change in the films by the inclusion of AgNPs as compare to the PVA/OPP films and indicates the strong adhesion and well dispersion of filler materials. XRD patterns confirm the presence of Ag and accentuated the crystallite size of generated AgNPs in the films as 23.44 nm, 25.59 nm, 26.25 nm, 28.17 nm, and 28.42 nm. Thermal analysis of the films shows improved thermal stability as well as glass transition temperature of the composite films included with AgNPs, also the considerable increase in the tensile strength and tensile modulus of the PVA/OPP/AgNPs films as compared to the neat PVA, PVA/OPP films. As compare to neat PVA and PVA/OPP films, with the increase of concentration of $AgNO_3$ source solution antibacterial activity of the PVA/OPP/AgNPs films increases against gram-negative and gram-positive bacteria. With the above-improved results by the inclusion of Ag nanoparticles, this hybrid biocomposite films can be utilized in food processing industries

Keywords Orange peel powder · Biopolymeric film · Silver nanoparticles · Tensile properties · Hybrid composite · Thermal analysis

Introduction

One particular production of artificial material by mankind is plastics because of cheap and abundant availability of Phenol–formaldehyde and Petro chemical-based materials [1]. In this large production, most part of them are single-use disposal plastics which contribute mainly to packaging applications [2]. Post consuming plastic packaging waste materials shares 30–50% of the municipal solid waste in India. The disposal of these packaging wastes involves landfill or incineration [3]. Because of the non-bio degradable property of plastics, both of these methods of disposal result in liberation of greenhouse gases and create environmental issues [4]. To overcome such issues, researchers are looking forward to an alternative to the habitual non-bio degradable packaging materials particularly their recycling is troublesome and not an economical process. Natural bio waste materials are the perfect alternatives because of their abundant availability and biodegradable property [5]. Biodegradable packaging materials can be formed as films, sheets, pouches, and coatings [6].

Biopolymer matrices like polysaccharides, polylactic acid, Polypropylene carbonate, and polybutylene

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Development and Analysis of Poly Vinyl Alcohol/Orange peel powder biocomposite films

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ABSTRACT

Environmental concerns are raised due to municipal solid wastes especially due to non-biodegradable packaging waste materials. To overcome such issues, researchers gained attention in biodegradable natural waste materials as an alternative to existing non-biodegradable packaging materials. In this work, Orange Peel Powder (OPP) chosen as a filler at varying proportion (5% to 20% of wt.) and polyvinyl alcohol (PVA) used a matrix to prepare biocomposite films by solution casting method. The films were analyzed with FT-IR, XRD, TGA, DSC, and tensile tests. The results of FT-IR and XRD show smooth dispersion of PVA and OPP, whereas samples are thermally stable up to 350°C & tensile properties of the prepared biofilms increased with inclusion of OPP from 6.20 MPa to 7.80 MPa and are better than the conventional-packaging materials which can be used as eco-friendly packaging materials.

摘要

城市固体废物，特别是非生物降解包装废物，引起了环境问题. 为了克服这些问题，研究人员在生物降解天然废物材料中引起了关注，作为现有非生物降解包装材料的替代方案. 在这项工作中，橙皮粉（OPP）选择作为填充物以不同的比例（5%至20%的wt.）和聚乙烯醇（PVA）使用基质制备生物复合膜的溶液铸造方法. 对薄膜进行了FT-IR、XRD、TGA、DSC和拉伸试验. FT-IR 和 XRD 的结果显示 PVA 和 OPP 平滑分散，而样品的热稳定性高达 3500C – 制备的生物膜的拉伸性能随 OPP 的加入而增加，从 6.20 MPa 增加到 7.80 MPa，并且优于传统封装 可用作环保包装材料的材料.

KEYWORDS

Orange peel powder (OPP); Crystallinity index; Bio film; thermal stability; tensile properties

关键词

橙皮粉（OPP）; 晶体指数; 生物膜; 热稳定性; 拉伸特性

Introduction

The increasing utilization of plastics grew more and more rapidly worldwide because of the low cost and high availability of Phenol-Formaldehyde which is the raw material for the Plastic materials (Gupta et al. 1998). The main purpose of the utilization of these plastics or polymers is for Packaging application accounts 42% of the total consumption of Plastics/non-biodegradable Polymers (Davis and Song 2006). This wide range of consumption causes a serious environmental issue and disposal of such wastes is a problem to Municipal solid waste Management to all over the world. To reduce these white pollution problems, researchers are looking forward for a proper balance between mechanical properties of Packaging materials and biodegradability (Mutha, Patel, and Premnath 2006). So they are moving toward Natural waste materials because of its availability in abundance. These natural biopolymers should settle on them a decision material to be utilized as a packaging material for various kinds of applications like wrapping and films. The formation of such biofilm requires at least one Bio polymer as a matrix. Some commonly available Biodegradable polymer matrices are polylactides which are

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Studies on adhesion strength and corrosion behavior of ZnO-Mg coated on AISI 4140

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ABSTRACT

The electrolytic ZnO based alloy coating with admixed interfacial blend of Mg have been successfully coated on medium carbon steel (AISI 4140) substrate by spray coating technique over a range of applied current density and dwell time. The structural and morphological properties of the coated samples are characterized using Optical Microscope (OM), Scanning Electron Microscope (SEM), X-ray Diffraction Analysis (XRD) and Energy Dispersive Spectroscopy (EDS) analysis. The adhesion test was carried out using scratch testing. The corrosion behavior is evaluated in a chloride environment (NaCl) by Tafel exploration as a function of coating thickness. The results revealed that the introduction of ZnO-Mg particles increases the adhesion strength of the AISI 4140. During scratching, cracks parallel with the scratch channel, external transverse cracks, adhesive spalling, and complete breaking of the coating within the scratch channel were observed. The acquired results exhibit that the introduction of ZnO - Mg coating improves corrosion resistance of AISI 4140 in NaCl solution. Equally, deposition thickness significantly affected the adhesion and corrosion properties. Increasing the coating thickness from 30 μm to 90 μm leads to decreasing the adhesion and corrosion properties.

1. Introduction

Mild steel and its derivatives have been used in the past in various applications due to distinct structural characteristics and cost. Automobile applications are significant because of easy availability, ease of fabrication, low cost and good tensile strength among others [1–3]. Specifically, multilayered thin film coatings find excellent engineering applications owing to mechanical properties. If ZnO is coated over AISI 4140 steel, it enhances the adhesion and thermal properties such as thermal conductivity and thermal diffusivity. Substantial emphasis has been placed on evolving replacements for ZnO based coatings for the above reason. ZnO-Mg coatings have the potential to act as protective coatings for steel, since they have excellent corrosion resistance [4]. Many coating approaches are used commercially to offer protection from corrosive environments and for adhesion strength enrichment and thus to increase the life span of mild steel base infrastructure. Mg is anodic to mild steel; it protects the base material even when it is deposited in porous condition [5]. However, Mg has limited application as structural material because of its high chemical reactivity and shrinkage on solidification [5]. In order to extend the applications, a substantial care has been paid to ZnO-Mg coatings which have the potential to be used in the destructive atmospheres. There are many coating techniques such as electro plating deposition, spray coating, physical and chemical deposition. Of these, spray coating is an easily available and most cost effective technique.

M. Mora et al. [6] have reported that tribo-electrochemical characterization of hafnium multilayer systems deposited on nitride/vanadium nitride AISI 4140 steel. The results indicate increase in the polarization resistance, a decrease in the corrosion rate and a low coefficient of friction in comparison with the substrate, due to an increase on the number of bilayers. F. G. Mittelstädt et al. [7] studied the corrosion resistance behavior of AISI 4140 steel using plasma surface treatment. The results illustrate that there is potential for pitting initiation, propagation as well as pitting protection in a chloride environment. Filiz

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ORIGINAL PAPER

Characterization of Ecofriendly Poly (Vinyl Alcohol) and Green Banana Peel Filler (GBPF) Reinforced Bio-Films

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Abstract

With an intention to replace the synthetic non-biodegradable films in packaging applications, the polyvinyl alcohol (PVA) blended with green banana peel filler (GBPF), the biodegradable films were prepared by solution casting method with varying the concentrations of GBPF (5–25 wt%) in PVA matrix. The bio films were characterized by Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), thermo gravimetric analysis, transmissibility, FESEM, tensile test, film solubility and water absorption, water vapour transmission (WVT), soil burial test. Based on results obtained, the changes evidenced in the FTIR spectrum of this PVA/GBPF biofilms suggest that strong hydrogen bonding is taking place due to interfacial exchanges of GBPF in PVA matrix. The XRD results showed that crystallinity of bio films are greater than PVA. Thermo gravimetric analyses predicted that PVA/GBPF bio films are thermally stable up to 300 °C. The light is 45% for transmittance in the visible light region for the PVA/GBPF (25 wt%) bio film. The FESEM micrographs of biofilms palpable that formation of good physical interaction and compatibility between polymer matrix and GBPF up to 20 wt% of GBPF in PVA Matrix. FESEM results also confirmed that higher loading of GBPF (25 wt%) in PVA matrix, observed voids and agglomerations in film surface. The PVA/GBPF bio films with 20% of GBPF gave the highest tensile strength and young's modulus 44.5 MPa and 66.7 GPA respectively compared to other samples. The elongation at break decreases with increases the GBPF in PVA Matrix up to 20 wt%.The slight decrease in mechanical properties perceived due to higher loading of GBPF (25 wt%) with PVA matrix. The solubility, water absorption and WVT of the PVA/GBPF bio films increased upon increasing the GBPF content. The biodegradation test results discovered that he highest weight loss at 42.3% (25 wt% of GBPF) probably due to the hydrophilic nature of GBPF in PVA matrix. On the whole, the present investigation confirmed that the PVA/GBPF bio films potential for possible utilization in active packaging applications attributable to its better mechanical, thermal, optical, water absorption and biodegradation properties.

Keywords Green banana peel filler · Water absorption · WVP · Surface morphology: biodegradability

Introduction

Petrochemical-based plastics are being replaced by bio based materials because of being widely eco-friendly. The plastics produced from sources (e.g., polyesters and polyolefin) have been commonly used in the packaging industry due to their potential features. Plastic is used as packing material on daily life. They are obtainable in large quantities and at low cost, displaying advantageous properties (i.e., good tensile strength, enriched barrier properties, and heat sealing) and applicability in the industry [1]. Even though plastic has those advantages, a high dependence on plastic could make bad effect not only on human health but also for the environment. However, these plastics are totally non-biodegradable and expose a serious ecological problem due to hydrophobic properties and very low water vapor transmission rate [2]. Due to that reason, there is an urgent need to find a new alternative packing material which is save for our body and environmentally friendly to replace plastics [3].

The growing public interest on the environment is induced the considerable research to develop biofilms from biopolymers. The harmful effect of conventional

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Effect of Graphene Powder on Banyan Aerial Root Fibers Reinforced Epoxy Composites

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ABSTRACT

In this work, graphene was used as a filler for banyan aerial root fibers reinforced epoxy composites at various compositions. The synergetic effect of graphene and banyan fibers, on the physical and mechanical characteristics of the epoxy thermoset, was studied. The mechanical tests, hardness, water absorption behavior and morphology of the composites were studied. Significant improvement in tensile strength, flexural strength, shore D hardness and substantial reduction in the percentage of water absorption was observed. This paper also discusses the ideal proportion of banyan fibers with graphene powder for the development of the improved epoxy composites. The optimum concentration of the composites was observed at 4% of graphene powder in the 40% banyan fiber-reinforced hybrid epoxy composites. From the results, it is proved that graphene combined with 40% banyan fiber-reinforced epoxy hybrid composites will efficiently improve the strength of the composites.

摘要

本文以石墨烯为填料，制备了不同组成的榕树气生根纤维增强环氧树脂复合材料．研究了石墨烯与榕树纤维对环氧热固性树脂物理力学性能的协同作用．研究了复合材料的力学性能、硬度、吸水性能和形貌．观察到拉伸强度、抗弯强度、肖氏硬度和吸水率显著降低的显著改善．本文还讨论了榕树纤维与石墨烯粉的理想配比，以期开发出性能优良的环氧树脂基复合材料．在40%榕纤维增强混杂环氧树脂复合材料中，石墨烯粉体的最佳浓度为4%．结果表明，石墨烯与40%榕树纤维增强环氧混杂复合材料复合，能有效地提高复合材料的强度．

KEYWORDS

Graphene; Banyan aerial root fibers; mechanical properties; water absorption properties; morphology analysis

关键词

石墨烯; 榕树气生根纤维; 机械性能; 吸水性能; 形态分析

Introduction

Natural fibers have high strength, biodegradability, low cost, and lightweight is an alternative for synthetic fibers. Natural fibers are suitable as reinforcement materials for making polymer composites that could be employed for different lightweight applications such as automotive parts, aeroplane seats, and racing sailboat, etc. (Binoj et al. 2016; Faruk et al. 2012; Pickering, Aruan Efendy, and Le 2016; Rangappa and Siengchin 2018; Sanjay et al. 2016, 2018, 2018).

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EVALUATION OF TANKER VEHICLE SELECTION USING A NOVEL HYBRID FUZZY MCDM TECHNIQUE

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Abstract: *Petroleum products transportation considered as one of the crucial parts of dangerous material transportation is a risky logistics activity. The selection of the appropriate tanker vehicles may be a suitable solution to reduce the risks and increase the efficiency and performance of the fuel transportation companies. However, the selection of a suitable road tanker vehicle is not an easy task for decision-makers as there are many conflicting criteria and many decision alternatives. In addition, decision-makers may have to decide with insufficient information since collecting crisp values may not be possible at all times. Hence, many ambiguities affecting the evaluation results exist in an assessment process performed to select the best tanker vehicle option. This paper suggests a novel integrated fuzzy approach to solve these decision-making problems. Sensitivity analysis is conducted to test the validation of the proposed integrated fuzzy approach and its results was performed by forming 130 scenarios. The results of sensitivity analysis prove that the proposed model can be applied to solve these kinds of decision-making problems.*

Key *words*: *Road tanker vehicle, Fuzzy SWARA, Fuzzy CODAS, dangerous goods transportation, MCDM.*

1. Introduction

In recent years, the flammable liquid transportation industry is an important part of the dangerous goods logistics industry has grown quickly depending on the increase of energy needs of both industries and individuals. The number of car

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ARTICLE

Enhancing the Free Vibration Characteristics of Epoxy Polymers Using Sustainable *Phoenix Sp*. Fibers and Nano-Clay for Machine Tool Applications

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ABSTRACT

This study focuses on enhancing the free vibration characteristics of epoxy polymers by reinforcing it with *Phoenix sp*. fibers and nano-clay for the first time. The composites were prepared by varying the fiber length, fiber volume fraction, concentration of NaOH treatment, and weight percentage of nano-clay and subjected to modal analysis. The optimum fiber length and fiber volume fraction for better vibration characteristics is found to be 30 mm and 40%, respectively. Moreover, the results revealed that the chemical treatment and nano-clay addition show the largest effect on vibration behavior of the composites. Based on the experimental data, it is concluded that the natural frequency of epoxy polymer could be enhanced up to 242% by using aforesaid reinforcements.

摘要

本研究首次采用凤凰纤维和纳米黏土对环氧聚合物进行增强，以增强其自振特性.通过改变纤维长度、纤维体积分数、NaOH处理浓度和纳米粘土的重量百分比制备复合材料，并进行模态分析.最佳纤维长度和纤维体积分数分别为30mm和40%.结果表明，化学处理和纳米粘土的加入对复合材料的振动性能影响最大.根据实验数据，得出了采用上述增强剂可使环氧树脂自振频率提高242%的结论.

KEYWORDS

Phoenix sp.; epoxy composites; free vibration; natural frequency; chemical treatment

关键词

凤凰社; 环氧复合材料; 自由振动; 固有频率; 化学处理

Introduction

Increasing environmental awareness and stringent policies around the world against the usage of synthetic materials make the researchers to focus on energy efficient green materials for various industrial applications in the recent days. To this aim, the researchers start using natural fibers as reinforcement material for enhancing the properties of the polymers to suit for various industrial requirements. Such resulting composites have several advantages like renewability, availability, biodegradability, nontoxicity, low cost, and good mechanical properties (Fiore et al. 2015; Mohammed et al. 2015; Saba et al. 2016; Saravanakumar et al. 2014; Scarponi and Messano 2015; Ramakrishnan et al. 2018). In general, the composite materials used for machine tool applications are subject to vibration because of dynamic loads acting on various parts of the machine. Hence, a sound understanding of vibration behavior of composite materials is very much essential to use them for such applications.

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Physico-Chemical Properties of Fiber Extracted from the Flower of *Celosia Argentea* Plant

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ABSTRACT

This study was aimed at understanding the characteristics of *Celosia argentea* fiber (CAF) and its physicochemical properties. The physicochemical properties of CAF were analyzed by FT-IR, XRD, TGA, SEM, and AFM analysis. Cellulose content (64.34wt.%), density (843 kg/m^3) and crystallinity index (52.54%) properties were identified in the CAF while the thermal studies performed by TG and DTG technique revealed that the maximum degradation temperature is 324°C with a kinetic activation energy of 61.393 kJ/mol. From the results, it is evident that the CAF could be one of the future reinforcement materials for green composites applications.

摘要

本研究旨在了解紫藤纤维的特性及其理化性质. 采用FT-IR、XRD、TGA、SEM、AFM等分析方法对(CAF)的理化性质进行了分析. 通过热重分析和差热分析确定了CAF的纤维素含量（64.34wt.%）、密度（843kg/m3）和结晶度指数（52.54%）等性能，热重分析和差热分析表明，最大降解温度为324°C，动力学活化能为61.393kJ/mol，结果表明，CAF是一种较好的降解剂. 用于绿色复合材料应用的未来增强材料.

KEYWORDS

Celosia argentea flower fiber; FTIR; XRD; TGA; AFM; SEM

关键词

紫藤花纤维

Introduction

With the increase of environmental consciousness, the use of natural fiber based materials has proved to be an effective solution to reduce the production of synthetic fiber based plastic composites (Jawaid and Abdul Khalil 2011; Sanjay et al. 2018). At present, many researchers are focusing their concentration on good fiber-yielding plants which are cost-effective without compromising mechanical properties. The attractive properties of natural fiber based composite materials are; they are renewable, carbon neutral, biodegradable, lower density, high specific strength with stiffness (Madhu et al. 2018) . In addition to the above, there is a thrust for innovation of new natural fibers because of their cost effectiveness, less weight, non-abrasiveness to process equipment, abundant availability and the growing demand for eco-friendly products by the consumers. Hence natural fibers are widely used in various sectors such as aerospace, automotive, construction and packaging industries. Natural fibers can be extracted easily from different

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Investigation of Physico Chemical Properties and Characterization of New Natural Cellulosic Fibers from the Bark of *Ficus Racemosa*

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ABSTRACT

The objective of this examination is to characterize the fibers from the bark of *Ficus racemosa* fibers (FRF). FRF is composed of cellulose (72.36 wt. %), hemicellulose (11.21wt. %), lignin (10.45 wt. %), and has a density of 895 Kg/m^3. The Differential thermogravimetry (DTG) shows that the maximum degradation peak temperature was attained at 310.56°C. The presence of a chemical group in the fibers was revealed through Fourier transform (FT-IR) analysis. The crystalline structure was characterized by X-ray diffraction (XRD). For surface morphology, Scanning electron microscopy (SEM) and Atomic force microscopy (AFM) were used. The obtained results indicated that FRFs are suitable fibers for polymer composite as reinforcement.

摘要

本试验的目的是对无花果树皮纤维进行定性分析. FRF由纤维素（72.36 wt. %）、半纤维素（11.21 wt.%）、木质素（10.45 wt.%）组成，密度为895 kg/m3. 差热重分析（DTG）表明，在310.56℃时，降解峰温度达到最大值. 傅立叶变换（FT-IR）分析表明纤维中存在化学基团. 用X射线衍射（XRD）对晶体结构进行了表征. 表面形貌采用扫描电子显微镜（SEM）和原子力显微镜（AFM）. 结果表明，FRF是一种适用于高分子复合材料增强的纤维.

KEYWORDS

Ficus racemosa Fibers; Chemical composition; TGA/DTG; FT-IR; XRD; SEM; AFM

关键词

无花果纤维; 化学成分

Introduction

The growth of ecological alertness induces the use of biocomposites which is majorly constructed with the help of natural fibers that have played as effective alternatives, since they reduce the making synthetic fibers composites (Thakur, Thakur, and Gupta 2014). Natural fiber has significant properties like availability in abundance, low cost, high specific strength and stiffness, toughness, flexibility, ease in processing, non-toxicity, non-abrasion during processing. It is also biodegradable and renewable (Manimaran et al. 2016; Uma Maheswari et al. 2013). Natural fiber-based polymer composites have found its place in several sectors like furniture, consumer goods, Packaging, Building industry, Automobile industry, Aeronautical and Naval application (Anbukarasi and Kalaiselvam 2015; Malkapuram, Kumar, and Yuvraj 2009; Satyanarayana et al. 1990). The properties of the natural fibers will vary depending on part of extraction such as plant stem, bark, seeds, fruits, leaves, etc and also differ with the age of the plant, locations, and extraction techniques adapted to the fiber. Many researchers have investigated on several natural fibers such as *Prosopis juliflora, Azadirachta indica, Thespesia lampas, Calotropis gigantea, Sansevieria ehrenbergii, Maize Tassel, Cissus quadrangularis, Cyperus Pangorei* and *Dichrostachys Cinerea* (Saravanakumar et al. 2014, Manimaran et al. 2018a; Obi Reddy et al. 2014; Ganeshan et al. 2018; Sathishkumar et al. 2013;

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Investigation of Physico Chemical, Mechanical and Thermal Properties of the Albizia Lebbeck Bark Fibers

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ABSTRACT

The production of materials using synthetic fibers is a strong contributor to carbon emissions and waste. Because of growing environmental consciousness, natural fibers act as a substitute for synthetic fibers due to their renewable, eco-friendly and bio-degradable nature. Natural cellulose fibers are newly identified from the sources of *Albizia Lebbeck* fibers (ALF). This study is intended to understand the characteristics of ALF extracted from the bark of the *Albizia Lebbeck* and its physicochemical properties. The structure of the fibers was analyzed by FT-IR and X-ray diffraction. Cellulose content (72.59 wt.%), density (905 kg/m^3), and crystallinity index (52.99%) properties were identified in the AL fibers, and thermal studies using Thermo Gravimetric Analysis and Derivative Thermo Gravimetric analysis revealed that the maximum degradation temperature is 353.37°C with kinetic activation energy of 89 kJ/mol. From the results, it is concluded that the properties of ALFs guaranteed that it could be an alternative material as new reinforcement as green composites in the manufacturing and automobile industries.

KEYWORDS

Albizia Lebbeck fiber; FT-IR analysis; XRD; TG and DTG analysis; NMR; AFM; SEM

摘要

使用合成纤维生产材料是碳排放和废物的主要来源. 由于环保意识的增强，天然纤维以其可再生、环保、可生物降解的特性，成为合成纤维的替代品. 天然纤维素纤维是从白合欢纤维（ALF）的来源中新鉴定出来的. 本研究旨在了解白合欢树皮中提取的ALF的特性及其理化性质. 用红外光谱和X射线衍射分析了纤维的结构. 在铝纤维中测定了纤维素含量（72.59重量%）、密度（905公斤/立方米）和结晶度指数（52.99%），热重分析和导数热重分析表明，最大降解温度为353.37℃，活化能为89 mol / mol. 结果表明，ALFS的性能保证了其作为新型增强材料在制造业和汽车工业中的应用.

关键词

白合欢纤维; 分析; 和; 分析

Introduction

In recent years, natural fibers have drawn significant attention as an alternative material to synthetic fibers such as glass, carbon, and aramid in composite materials (John and Thomas 2012; Joshi et al. 2004; Wambua, Ivens, and Verpoest 2003). The significant properties of natural fibers are renewable, biodegradable, low density, high specific strength, stiffness, and less damage when compared to synthetic fibers (Huda et al. 2007). In addition to the above, there is a thrust for innovation of new natural fibers due to factors' cost-effectiveness, less weight, non-abrasiveness to process equipment, abundant availability and growing demand for eco-friendly products by the end users (Boumediri et al. 2019). The applications of natural fiber composites are gaining increasing significance in many

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Characterization of mechanical, electrical and thermal properties of Ag nanoparticle-reinforced Al6061 alloy

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Abstract
In this paper, the detailed characterization of mechanical, electrical and thermal properties of Ag nanoparticle-reinforced Al6061 alloy was studied. Four composites with Al6061 alloys and different mass percentages (3%, 6%, 9% and 12%) of Ag nanoparticles were processed by stir casting method. The chemical analysis was used to confirm the elemental composition. The microstructural examination was carried out using optical microscopy. The phase analysis of the samples was studied using X-ray diffraction technique. The density and hardness were measured as per ASTM standards. Four-point probe tester and differential scanning calorimetry were used to measure the electrical conductivity and specific heat. In addition, the thermal conductivity and thermal diffusivity were measured using laser flash method. The results reveal the presence of Ag nanoparticles can significantly enhance the mechanical, electrical and thermal properties.

Keywords Al6061 · Ag nanoparticles · Electrical · Thermal · Characterization

Introduction

Nanocomposites are considered as a key and eco-friendly material. The potential applications of nanocomposites are wide. Nowadays due to the demand of mass reduction for improved product performance and fuel economy, aluminum and magnesium composites are being used in critical structural applications in electronic, automotive and aerospace industries [1]. The field of aluminum casting is of particular interest as the application of this technology to produce vehicle components can offer the combination of mass savings and strength due to the low density [2]. Stir casting process has numeral advantages over other conventional production routes such as reduced porosity, increased die life, and improved mechanical as well as tribological properties [3]. Al–Si alloys have low coefficient of thermal expansion, low density and good wear resistance with high strength at elevated temperatures [4].The influences of alloying elements (Si, Cu, Mg, Ni, Sn, Ti, B, Sr, Be, Mn, Yb, Cr, Zr, Fe, Zn, Ce) on microstructures and mechanical properties of aluminum alloys are reported by many researchers [5–7].

Fang et al. [8] have reported that the addition of Yb particles to the 7A60 aluminum alloy significantly increases its mechanical properties. It was reported that Zr and Sc addition could effectively increase the mechanical and thermal properties of aluminum [9]. Ebrahimi et al. [10] studied the effects of Zr addition on the mechanical properties of cast aluminum alloy. They also found that there is considerable decrease in the grain size of an Al–Zn–Mg–Cu alloy by the addition of Zr. However, the addition of reinforcement has significantly reduced the electrical and thermal conductivity of the aluminum matrix. Moreover, such elements made these alloys hard to machine and therefore limit their industrial applications. Therefore, reinforcement addition has a substantial influence on the wide-ranging performance of the matrix.

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Characterization of *Musa paradisiaca* L. Cellulosic Natural Fibers from Agro-discarded Blossom Petal Waste

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ABSTRACT

Musa paradisiaca L. blossom petal (MPBP) fibers are extracted from banana plant agro-based domestic waste. The properties of MPBP fibers were reported for the first time in this communication. X-ray diffraction analysis showed the crystallinity index and size of 56.71% and 16.38 nm, respectively. The thermogravimetric analysis indicates that the MPBP fibers are thermally stable up to 220°C. Differential Scanning Calorimetry analysis gives two thermal degradation temperatures of 368.1 and 476.8°C with kinetic activation energy of 62.43 kJ. Tensile strength, Young's modulus, and strain at failure were determined from the single fiber tensile test as 108 MPa, 1.05 GPa, and 11.15%, respectively.

摘要

从香蕉植物农业生活垃圾中提取了*Musaparadisiaca*L.花瓣（MPBP）纤维.本文首次报道了MPBP纤维的性能.XRD分析表明，结晶度指数为56.71%，粒径为16.38nm.热重分析表明，MPBP纤维的热稳定性高达220°C.两个热降解温度分别为368.1和476.8℃，动能为62.43 kJ.拉伸强度、杨氏模量和断裂应变分别为108MPa、1.05Gpa和11.15%。

KEYWORDS

Discarded agro waste; *Musa paradisiaca* L. blossom petal fiber; structural properties; mechanical and thermal properties

关键词

丢弃的农业废物; 花瓣纤维; 结构性能; 机械和热性能

Introduction

The natural fibers extracted from various parts of plant sources provide healthy and sustainable environment (Sanjay et al. 2018). Natural fibers are extracted from several plants and when reinforced in polymer matrix will yield promising properties (Kumar et al. 2018). Many investigations are going on in identifying potential natural fibers as the agricultural by-products and discarded waste fibers (Akpan et al. 2016; Binoj et al. 2016). By-product and waste generated from commodity crops are abundant, easily available, relatively cheap, and renewable resources that are suitable for fiber production (Hassan et al. 2010). Making use of these sources for natural cellulose fibers is becoming progressively necessary due to concerns on both the future price and availability of the natural fibers in current use for the potential lingo-cellulosic fiber reinforcement (Ramasamy, Obi Reddy, and Varada Rajulu 2018).

Musa paradisiaca L. commonly known as banana belongs to the Musaceae family and has great economic interest due to its worldwide consumption. The native belongs to the tropical region of

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Characterization of a novel natural cellulosic fiber from *Calotropis gigantea* fruit bunch for ecofriendly polymer composites

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ABSTRACT

In this current research, the change in properties of alkali treatment on the physicochemical, structural, thermal and surface morphological properties of *Calotropis gigantea* fruit bunch (CGFB) fibers are investigated. The alkali-treatment was discovered to reduce the amorphous contents and removed the non-cellulosic components which were inveterate by the FTIR analysis. The X-ray diffraction pattern showed that the crystallinity index of the alkali-treated CGFB fibers was fairly higher than raw fibers. Thermal degradability and stability of alkali-treated *Calotropis gigantea* fruit bunch fibers were more than that of the untreated fiber. Scanning electron microscopy and Atomic force microscopy images showed the partially roughened surface of the fiber due to the removal of non-cellulosic elements and surface impurities during alkali treatment.

1. Introduction

Now a day's renewable resource utilization is an important consideration due to environmental awareness and economic concerns. Natural lingo-cellulosic fibers are available in large quantities, are cheap, biodegradable, environmentally friendly and also more suitable for reinforcements in polymer composites instead of synthetic fiber. The cellulosic fibers were extracted from different plants and its parts such as leaf [1], stem [2], bark [3], root [4], pod [5], blossom pedal [6], fruit [7], fruit bunch [8], straw [9] and nutshell [10]. They can be used as a natural reinforcement or filler materials in polymer composites to produce components used for automotive, packaging and also building material sectors [11].

In general, lignocellulose fibers having a hydrophilic nature, exhibited high moisture absorption property, poor reactivity and compatibility with polymeric matrices. That can be overwhelmed by chemical treatment such as seawater, silane, alkalization, acetylation, treatment, etc., [12]. Treatments may activate the hydroxyl groups in the natural cellulosic fiber and remove the non-cellulosic elements and impurities from the fiber surface [4]. Among all treatments, alkali treatment is the cost-effective and effectual method to reduce amorphous substances such as hemicelluloses and lignin which results in the enhancement in chemical composition, surface topography, crystallinity index, mechanical properties and thermal stability of the fibers [3,13].

The alkaline treatment has improved the interfacial bonding among the fiber reinforcements and polymer matrices also enhanced the physical, mechanical, and thermal properties of the polymer composites [9,14]. From the previous literature, it is concluded that the treatment of cellulosic fibers with 5% NaOH having optimistic changes in the fiber properties [1,15].

Calotropis gigantea (crown flower) is a species of Calotropis native to Asia and Tropical Africa. It is a fast-growing and well-known flowering plant that grows in a harsh environment and be able to pinpoint by its thick oblong leaves and odorless purplish flowers [16]. *Calotropis gigantea* plant was identified as a valued medicinal plant and used as a folk medicine in India for many years [17]. *Calotropis gigantea* plants are harvested to obtain the fibers from their stems for a wide range of applications. Also, fibers from CG plant crops are durable which can be useful for ropes, carpets, fishing nets, and sewing thread. The fibers extracted from the *Calotropis gigantea* (CG) plant stems were characterized and reported [18,19]. Cellulosic fibers from CG plant bark were successfully extracted by the usual water retting method followed by alkali treatment [20]. *Calotropis gigantea* plant fiber reveals good adequate buoyancy, hydrophobic–oleophilic properties, high oil absorption

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Physicochemical and Structural Properties of Green Biofilms from Poly (Vinyl alcohol)/Nano Coconut Shell Filler

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ABSTRACT

There is growing interest in recent times to develop biodegradable films with improved properties. They are potential substitutes for existing petroleum-based synthetic polymers. Eco-friendly biofilms based on Poly (vinyl alcohol)/Nano coconut shell filler (PVA/NCSF) were primed by a solution casting method. The biofilms were characterized by Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), thermogravimetric analysis, Tensile test, FESEM, Transparency Water absorption, biodegradability test, and tensile testing. FTIR and XRD results revealed the structural characterization and crystallinity index of prepared PVA/NCSP biofilms. FTIR suggested that strong hydrogen bonding due to interfacial exchanges of PVA/NCSF. Thermogravimetric analyses revealed thermal degradation temperatures of biofilms that were observed between 259.79°C and 350°C. The tensile strength and elastic modulus were enhanced by 25.5% and 97.25%, respectively, when NCSF was added at 25 wt% level. It is intriguing that % of elongation linearly decreased with the incorporation of filler. The FESEM results evident that good compatibility between PVA and NCSF. The water absorption of PVA/NCSF biofilms slightly increases with increase in the NCSF content. Soil burial test results evident that 34% weight loss of biofilms (25 wt% of NCSF) due to NCSF loading in PVA Matrix. Taken together, the present study confirmed that PVA/NCSF biofilms can be a potential for packaging applications.

KEYWORDS

Biodegradable; biofilms; thermal stability; mechanical properties; crystallinity; packaging

摘要

近年来，人们对开发性能更好的可生物降解薄膜越来越感兴趣. 它们是现有石油基合成聚合物的潜在替代物. 以聚乙烯醇/纳米椰壳填料（PVA/NCSF）为基料，采用溶液浇铸法制备了环保型生物膜. 通过FTIR、XRD、TGA、拉伸试验、FESEM、透明吸水率、生物降解性试验和拉伸试验对生物膜进行了表征. FTIR和XRD分析结果表明，制备的PVA/NCSP生物膜具有良好的结构表征和结晶性能. FTIR分析表明，PVA/NCSF的界面交换导致了较强的氢键作用. 热重分析显示生物膜的热降解温度在259.79℃到350℃之间. 当NCSF质量分数为25%时，拉伸强度和弹性模量分别提高了25.5%和97.25%. 有趣的是，随着填料的加入，延伸率呈线性下降。FESEM结果表明PVA与NCSF具有良好的相容性. 随着NCSF含量的增加，PVA/NCSF生物膜的吸水率略有增加. 土壤埋藏试验结果表明，在PVA基质中加入NCSF后，生物膜的失重率为34%（25%NCSF）. 综上所述，本研究证实了PVA/NCSF生物膜在包装领域的应用潜力.

关键词

可生物降解; 生物的电影; 热稳定性; 机械性能; 结晶度; 包装

Introduction

With the growing concerns on the environmental problems and resource limitation induced by the wide usage of petroleum-based synthetic polymers, the development of biodegradable materials for

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Advances in upstream and downstream strategies of pectinase bioprocessing: A review

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Biological Chemistry & Chemical Biology

Decolorization of Textile Dye by Halophilic *Exiguobacterium* sp.VK1: Biomass and Exopolysaccharide (EPS) Enhancement for Bioremediation of Malachite Green

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The salt pan soil screened for the exopolysaccharides (EPS) producing organisms for the decolourization textile dyes. The isolate was characterized and confirmed as *Exiguobacterium* sp. VK1 by 16S rRNA analysis. The enhanced production of EPS was obtained with the minimal medium which was supplemented with various carbon sources, and cassava peel which has shown a 5.9 fold increase in the EPS (7704.71 mg/L) production. *Exiguobacterium* sp. VK1 removed Malachite Green (MG) dye (684.38 mg/g) with the maximum biosorption capacity of 79.1% at pH 6 and 40°C. With the increased EPS production, by supplementing the cassava peel, the MG dye adsorption also increased up to 97.61%, when decolorized within 30 min by *Exiguobacterium* sp. VK1. It was found that Pseudo Second-order kinetics and Freundlich isotherm is the best fit for the equilibrium adsorption process of MG dye by *Exiguobacterium* sp. VK1. The thermodynamic properties such as activation energy (12.993 kJ/mol), change in enthalpy (10.501 kJ/mol), change in entropy -254.07 J/(mol K) and change in Gibbs energy (84.945-90.026 kJ/mol) were investigated by Arrhenius and Eyring equation using Pseudo-second-order kinetic model. The result revealed that the adsorption process was thermodynamically feasible.

Introduction

Dyeing industry is one of the most critical sources of water contamination which releases the untreated wastewater into nearby water bodies. Most of the industrial wastes consist of different reactive dyes and are recalcitrant by its chemical composition. MG cation is commonly used as a dyeing agent in many like textile, leather, cosmetic, paper, printing, plastic, pharmaceutical, and food processing industries.

Among all foresaid industries, two-third of the dye effluents are released from the textile industries, in which nearly 10-15% of MG is used as coloring agent and it directly influences the chemical and biological oxygen demand of the water bodies.[1] The effluents are not only polluting the water system but also cause a deleterious effect on flora and fauna of the aquatic environment. As MG is known to have harmful carcinogenic and teratogenic effects, it is a prominent environmental contaminant.[2] According to the United States, the Food and Drug Administration (FDA) department has banned the use of MG since it affects the mammalian cells by disturbing the reproductive system, and the immune system.[3] On the other hand, the anti-fungal property of the MG is mainly used in commercial fisheries to avoid fungal infection.[4] Physical and chemical methods such as flocculation, electroflotation, electro-kinetic coagulation, precipitation, exchange of ions filtration of membranes irradiations, ozonisation, adsorption, oxidation, precipitation, bleaching, and photodegradation are used to treat the dye effluents.[5] However, the significant disadvantages in both the methods are dye disposal and generation of intermediate toxic products.[6] These can be possibly overcome by biodegradation.[7] It was already noted that the dye molecules are effectively degraded by microorganisms especially by the fungi, for instance, *Aspergillus flavus* and *Alternaria solani, Candida albicans*[8] and bacteria like *Proteus vulgaris, Staphylococcus aureus* and *Klebsiella pneumoniae*.[9] Novel isolate of *Pseudomonas* sp. could degrade nearly 1000 mg/L of Malachite Green in 12 h.[10] *Citrobacter sedlakii* Rl11 recorded higher dose of tolerance and decoloration up to 1000 mg/L of MG dye.[11] *Bacillus thuringiensis* degrade 40 mg/L[12] and *Klebsiella terrigenaptcc* degrades 100 mg/L of MG.[13] It is noteworthy to mention that MG was effectively decolorized and degraded by the enzymatic activity of *Exiguobacterium* sp. MG2.[14] Hence, this investigation was intended to study the MG decolorization efficiency of the aforesaid new isolate under various conditions.

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Spectroscopic (FT-IR, FT-Raman, NBO) investigation and molecular docking study of a herbicide compound Bifenox

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ABSTRACT

The FT-IR and FT-Raman spectra of Bifenox, Methyl 5-(2, 4-Dichlorophenoxy)-2-Nitrobenzoate have been recorded in the range 4000-450 cm^{-1} and 4000-50 cm^{-1}, respectively. The optimized molecular geometry calculated using density functional theory with B3LYP method was compared with available experimental data. The distributions of the vibrational bands are carried out with the help of Normal Coordinate Analysis (NCA) and are assigned with the help of potential energy distribution method. Stability of the molecule arising from hyperconjugative interactions and charge delocalization are analyzed using Natural Bond Orbital (NBO) analysis. Molecular Electrostatic Potential (MESP) and HOMO-LUMO analysis are also performed. Docking simulations are done to identify the herbicidal active site of the title compound.

Specifications Table:

Subject area	Spectroscopy.
Compounds	Bifenox, Methyl 5-(2,4-Dichlorophenoxy)-2-Nitrobenzoate
Data category	Spectral analysis and computational simulations
Data acquisition format	FT-IR and FT-Raman spectra
Data type	Theoretically simulated and analyzed both experimentally and theoretically
Procedure	Spectral analysis of Bifenox have been carried out both experimentally and theoretically with the aid of quantum chemical computations and molecular structure was analyzed to identify the structural relationship with herbicidal activity
Data accessibility	With this article

1. Rationale

Bifenox, Methyl 5-(2, 4-Dichlorophenoxy)-2-Nitrobenzoate, is an herbicide of the diphenyl ether class. Diphenyl ether herbicides (DPE) are peculiar in that they kill plants only in the light. They induce peroxidative degradation of cellular

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Protein Network Studies on PCOS Biomarkers With S100A8, Druggability Assessment, and RNA Aptamer Designing to Control Its Cyst Migration Effect

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The prevalence of polycystic ovary syndrome (PCOS) has been gradually increasing among adult females worldwide. Laparoscopy drilling on ovary is the only available temporary solution with a high incidence of reoccurrence. S100A8 with S100A9 complex is believed to facilitate the cyst migration in PCOS condition. The high evident protein interaction network studies between PCOS biomarkers, cancer invasion markers, and the interactors of S100A8 confirm that this protein has strong interaction with other selective PCOS biomarkers, which may be associative in the immature cyst invasion process. Through the network studies, intensive structural and pathway analysis, S100A8 is identified as a targetable protein. In this research, the non-SELEX *in silico* method is adapted to construct RNA Library based on the consensus DNA sequence of Glucocorticoid Response Element (GRE) and screened the best nucleotide fragments which are bound within the active sites of the target protein. Selected sequences are joined as a single strand and screened the one which competitively binds with minimal energy. *In vitro* follow-up of this computational research, the designed RNA aptamer was used to infect the MCF7 cell line through Lipofectamine 2000 mediated delivery to study the anti-cell migration effect. Wound Scratch assay confirms that the synthesized 18-mer oligo has significant inhibition activity toward tumor cell migration at the cellular level.

Keywords: network analysis, druggability, RNA aptamer, lim method, pcos targets, protein network

INTRODUCTION

Nucleotide aptamers are successfully explored as better therapeutics to treat diseases and disorders. Time-consuming low-throughput procedures have been in practice to design the aptamers *in vitro* (Ghavami et al., 2009). Therefore, *in silico* non-SELEX approach is the better choice to perform the selection of aptamers, which involves the construction of an oligonucleotide library without amplification and binding them with suitable target protein unlike SELEX (Berezovski et al., 2006; Tseng et al., 2011). Designing the RNA aptamer for the validated biomarker helps us to normalize the disease state at the genetic level. Hence, delivering a well-designed aptamer against response elements (REs) can control the strange translation of the target gene. REs are the critical

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ARTICLE

Report on biopharmaceutical profile of recent biotherapeutics and insilco docking studies on target bindings of known aptamer biotherapeutics

Subramaniyan Manibalan, Kandasamy Thirukumaran, Mathimaran Varshni, Ayyasamy Shobana and Anant Achary

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ABSTRACT

Accumulated Toxicity, disease recurrence and drug resistivity problems have been observed due to the synthetic and semi-synthetic therapeutic practices, which alternatively led to focus on Bio-therapeutics production than xenobiotics. Quick plasma clearance and high potency are the reasons for trending research with huge pharma market of numerous Bio-therapeutics than ever before. Researchers proved that most of the nano and micro Bio-therapeutics have multiple beneficial therapeutic effects. We have analyzed the past, and present scenario of some notable clinically approved Bio-therapeutics to identify the future formulation needs with advanced techniques. Protein-related drugs are the foremost Bio-therapeutics such as antibodies, enzymes, and short, fragmented polypeptides show aggregation properties during storage, naked peptide moieties are resisted by the polar cell membrane, and also the antidrug antibodies were reported. Even though Nucleic acid nano-bodies are excellent target binders than proteins, they had only a few minutes of half-life. Maintaining homogeneousness upon storage of Bio-therapeutics is still a significant challenge in industrial-scale formulation. Notably, plant systems are identified as most useful cost-effective hosts to produce human enzymes than animal systems without any possible viral loads. Irrespective of numerous advancements in routes of administration and additives, subcutaneous is still a golden one to achieve better dynamics. Additionally, the interactions and effective bonds made by each class of well-known aptamer biotherapeutics which are considered as future drugs were studied.

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KEYWORDS
Biotherpeutics; aptamers; formulations; molecular docking

Introduction

Bio-therapeutic, are the recent class of drugs, consisting of biomolecule as Active Pharmaceutical Ingredients (API) such as Nucleic acids, Proteins, Hormones, Microbes (Probiotics, vaccines and whole cells). ViperaTAb™, Atgam®,

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Research article

Process development for the degradation of textile azo dyes (mono-, di-, poly-) by advanced oxidation process - Ozonation: Experimental & partial derivative modelling approach

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ARTICLE INFO

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ABSTRACT

The present study focuses on modelling the removal of reactive azo dyes (Reactive Orange 16, Reactive Red 120 and Direct Red 80) by ozonolytic degradation. The process was optimised using One Variable at a Time (OVAT) approach followed by Response Surface Methodology (RSM). The operational parameters influencing the process of degradation, i.e. initial dye concentration (mg/L), pH and ozone exposure time were modelled using Central Composite Design (CCD). Under the optimal condition (Initial dye concentration = 2000 mg/L, pH = 11.0, Ozone exposure time = 10 min), the highest desirable response (i.e. Concentration of the degraded dye) for the degradation of RO 16, RR 120 and DR 80 are 1289.35 mg/L, 1224.98 mg/L and 1039.87 mg/L, respectively. The high correlation coefficients, 0.9814 (RO 16), 0.9815 (RR 120) and 0.9685 (DR 80) indicates the closeness of the results predicted by RSM with the experimental results. The rate of degradation for all the three dyes at the optimal condition followed pseudo-first order kinetics with the rate of reaction as 141 mg/L.min, 197.2 mg/L. min and 216.6 mg/Lmin. The predicted model was also evaluated by partial derivative-based equation modelling and experimental approach. The reliability and applicability of the developed process were confirmed by degrading the synthetic mixed dye effluent.

1. Introduction

Industries play a major role in gearing up the economy of a nation and hence they are recognized as the "***engine of economic growth***". Textile industries belong to the subsector of the manufacturing industry that has a major contribution to the economy of many countries such as China, Bangladesh, India, Vietnam, Turkey and Nigeria 6z. India accounts 63% of the market share of textiles and garments. The Textile and Apparel (TA) industry in India, contributes to 14% of total industrial production, 4% of gross domestic product and 15% of total export earnings (2016–17) (Textile Ministry, Make in India, TechSci Research). Despite being the major contributor to the global economy, textile industries impose a strong negative environmental impact associated with water pollution (Celekli et al., 2009). The textile processing units consume large quantity of water for various operations such as washing, dyeing, rinsing and finishing (Tizaoui and Grima, 2011). Everyday around 3.7 million litres of wastewater is produced worldwide by the textile industries (Buthiyappan et al., 2016). An estimation shows that 7 $\times$ 10^5 metric tonnes of synthetic dyes are produced annually, in which the global consumption by the textile industrial sector is more than 10, 000 tonnes/year (Yagub et al., 2014). Azo dyes represent 60% of the commercially available synthetic dyes and they are extensively used in the textile industries (Ulson et al., 2010). Azo dyes are of different classes, based on their charge, they are classified as cationic (all basic dyes), anionic (direct, acid, and reactive dyes), and non-ionic (dispersed dyes) (Yagub et al., 2014). Owing to the demand for fabric with bright colours, usage of reactive dyes containing azo based chromophores with reactive groups such as chlorotriazine, vinyl sulfone, trichloro-pyrimidine, and dichloro-fluoropyrimidine has increased (Sudarjanto et al., 2006; Tehrani-Bagha and Amini, 2010). The fixation

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Evaluation of anti rheumatic activity of *Piper betle* L. (Betelvine) extract using *in silico, in vitro* and *in vivo* approaches

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ABSTRACT

Rheumatoid Arthritis is a chronic, inflammatory, and systemic autoimmune disease, it affects elders worldwide. Herbal medicines have been used for the treatment of various ailments from ancient times. Betelvine (*Piper betle* L.) leaves have long been used in Asian countries as a medicine to relieve pain and some metabolic diseases. The present study of methanolic extract of phytochemical analysis confirms the presence of alkaloids, tannins, terpenoids, saponins, steroids, total flavonoids and total phenols. GC–MS analysis of MeOH extract of *Piper betle* (PBME) revealed the presence of 40 bioactive compounds. *In vitro* antioxidant and anti-inflammatory assays showed greater inhibitory effect. The anti-arthritic effects of PBME at 250 and 500 mg/kg concentration showed recovery from joint damage in *in vivo* rat model. Among the 40 GC–MS derived bioactives, 4-Allyl-1,2-Diacetoxybenzene exhibited the higher interactions with minimized binding energy to the RA targets of MMP 1 (-6.4 kcal/mol), TGF-β (-6.9 kcal/mol), IL-1β (-5.9 kcal/mol). Further, the effect of PBME extract against RA molecular disease targets (IL-1β, MMP1 and TGF- β) were studied using Real-time PCR. These results substantiate that *P. betle* leaves could be a source of therapeutics for the treatment of rheumatoid arthritis.

1. Introduction

Rheumatoid Arthritis (RA) is a chronic and systemic autoimmune disease leads to bone and joint destruction [1]. The primary symptoms of RA include pain, swelling, and destruction of cartilage. When the disease gets severe, it causes permanent disability of bones by means of progressive destruction of cartilage and bone. According to WHO, 0.3–1% of the world population is affected from RA and among them women are three times more prone to the disease when compared to men [2]. Clinical analysis of RA allows therapeutic monitoring, which remains the standard method for evaluating the progress of the disease. The loss of articular cartilage leads to diminished joint space differentiation, which may be brought about through a variety of pathological mechanisms [3]. There are some common risk factors include aging, genetic factors, environmental factors, lifestyle which are believed to be involved in RA development. Till now, there is no permanent cure for RA, but some treatments are available to manage symptoms [4].

Abbreviations: GC–MS, Gas Chromatography-Mass spectrometry; PBME, *Piper betle* Methanol extract; RA, Rheumatoid Arthritis; WHO, World Health Organization; TGF-β, Transforming growth factor beta; MMPs, Matrix metalloproteinases; M−CSFR, Macrophage Colony-Stimulating Factor Receptor; COX-2, Cyclooxygenase-2; PGE2, Prostaglandin E2; IL17, Interleukin 17; IL34, Interleukin 34; Th1, T helper type 1; Th17, T helper type 17; RANKL, Receptor activator of nuclear factor kappa-B ligand; CFA, Complete Freund's Adjuvant; TPC, Total Phenolic Content; TFC, Total Flavonoid Content; DPPH, 2,2-diphenyl-1-picrylhydrazyl; ABTS, 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid); GAE, Gallic acid equivalent; RE, Rutin equivalent; BSA, Bovine Serum Albumin; Anti-CCP, Anti–citrullinated protein antibody; RF, Rheumatoid Factor; CRP, C-Reactive Protein; VEGF, Vascular endothelial growth factor; NFκB, Nuclear factor kappa B; IFN-γ, Interferon gamma; Mmff94, Merck molecular force field 94; ADMET, Absorption, Distribution, Metabolism, Excretion and Toxicity; ECM, Extra Cellular Matrix; PCR, Polymerase Chain Reaction; IgG, Immunoglobulin G; WBC, White Blood Cells; RBC, Red Blood Cells; Hb, Hemoglobin; PCV, Packed Cell Volume; NSAIDs, Nonsteroidal Anti-Inflammatory Drugs; HBD, Hydrogen Bond Donor; HBA, Hydrogen Bond Acceptor; TPSA, Higher Polar Surface Area; AMR, Atomic Molecular Refractivity; BBB, Blood Brain Barrier; HIA, Human Intestinal Absorption; HOB, Human Oral Bioavailability; Zn, Zinc

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Green synthesis and characterization of zinc oxide nanoparticles with antibacterial and antifungal activity

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ABSTRACT

The present study involves synthesis of zinc oxide nanoparticles (ZnO-NPs) through a rapid, cost effective and eco-friendly method using four different plant extracts. The plants used in this study were *Beta vulgaris, Cinnamomum tamala, Cinnamomum verum, Brassica oleracea* var. *Italica.* Characterizations of ZnO-NPs were done using X-Ray Diffraction (XRD), Fourier Transform Infrared spectroscopy (FTIR), and Scanning Electron Microscopy (SEM). Moreover, the antibacterial activities of ZnO-NPs were demonstrated using both gram negative and gram positive bacteria such as *Escherichia coli* and *Staphylococcus aureus*, respectively. All samples of ZnO-NPs presented antibacterial activity against both gram negative and positive bacteria, while ZnO-NPs prepared using *Beta vulgaris* was found to be inactive towards *S. aureus*. The antifungal activity of ZnO-NPs was also demonstrated using *Candida albicans* and *Aspergillus niger* fungal stains. It was found that ZnO-NPs prepared using *Beta vulgaris* were active against *A. niger*, while those prepared from *Cinnamomum tamala* were active against *C. Albicans.* Also, ZnO-NPs prepared from the extract of *Brassica oleracea* var. *italica* have shown activity against both the fungal stains. Overall, a rapid, cost-effective, environmentally-friendly method for ZnO-NPs synthesis was demonstrated, which can be used as a potential antimicrobial agent against different microbial species.

1. Introduction

Nanotechnology is a fast evolving field which deals with manufacturing new materials on nanoscale level. In other words, nanotechnology aims to synthesize, characterize, and manipulate matter in size of 1–100 nm. In the 21st century, nanotechnology has evolved as an interdisciplinary field. An indicative example is the biosynthesis of metal nanoparticles. Biosynthetic nanotechnology has immense applications in the areas of food and feed, health care, biomedical science, cosmetics, chemical industries, drug and gene delivery, energy science, electronics, mechanics, and space industries. The reduction of materials size results in achieving a wide range of novel physicochemical properties and a big spectrum of potential applications such as material science and biomedical applications [1].

Zinc oxide nanoparticles (ZnO-NPs) attracted exciting research interest due to their vast horizon of applications such as smart UV sensors [2], targeted drug delivery [3], antioxidant activity [4], biosensors [5], environmental remediation [6] and even as agent enhancing drought tolerance and nutrient source of crops [7]. One of the unique features of nanoparticles biosynthesis is the selectivity of different morphology of the formed nanoparticles according to the biological source used with enhanced stability. Classic chemical and physical methods used for nanosynthesis can be generally classified in (i) top-down and (ii) bottom-up approach. The "top-down synthetic approach" of nanomaterials employs mechanical energy, high energy lasers, thermal, and lithographic

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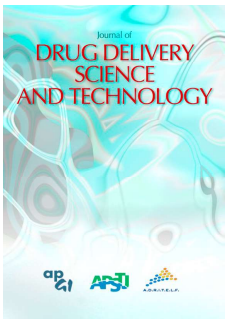

Fabrication of stimuli gated nanoformulation for site-specific delivery of TQ for colon cancer treatment – Insight into thymoquinone's improved physicochemical properties

Joseph PushpaSweety, Surendran Sowparani, Padmanaban Mahalakshmi, Nandakumar Selvasudha, Dhayandamoorthy Yamini, Karuppasamy Geetha, Kandasamy Ruckmani

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Original article

Extraction and purification of an antimicrobial bioactive element from lichen associated *Streptomyces olivaceus* LEP7 against wound inhabiting microbial pathogens

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ABSTRACT

The ever increasing spectrum of microbial disease and emergence of life threatening antibiotic resistant pathogen necessitates more intensive search for microbial antagonistic agents from diverse symbionts and habitats. Lichens from various niches and its associated cohabitates promise derivation of such antimicrobial compounds. In the present study conventionally and genetically identified *Streptomyces olivaceus* LEP7, one among 36 isolates from tree bark inhabiting lichen *Leptogium* sp., was assessed for its synthesis of antimicrobial bioactive compounds. Screening of antimicrobial activity was performed as per standard procedures. *In vitro* production by shake flask culture, solvent based extraction, TLC and GC–MS based separation, purification and identification revealed the presence of cyclopentene, an effective antimicrobial compound against wound inhabiting pathogens.

E. coli, *P. aeroginosa*, *S. aureus*, *Klebsiella* sp., *Acinetobacter* sp., and *Candida* sp. MIC value of partially purified compound was 7.81 μg/ml against *E. coli* and *P. aeroginosa*. In addition, TLC profile of the active extract displayed four different spot with Rf values of 0.64, 0.78, 0.93 and 1.00. This initial lead will add to antimicrobial arsenal on further research.

1. Introduction

Actinomycetes are Gram-positive filamentous bacteria with substrate and aerial mycelia. They are rich source of bio-active secondary metabolites like antibiotics, enzymes, enzyme inhibitors, antioxidants, and others having restorative importance (Barka et al., 2016). Fifty percent of approximately 22,000 microbial biologically potent secondary metabolites and 40% of 160 microbes originated antibiotics are from actinomycetes (Berdy, 2012). However, with often originating new uncharacterized etiological agent and reemergence of old agents with more threatening multiple drug resistance, there is an immediate need for discovery and development of new drugs. In order to combat this challenge, exploration of new strategies or a revisit of earlier methods is required. Search of special ecological niches along with new methods of isolation of novel species of actinobacteria may lead to the identification of new products (Xu et al., 2010). Marine habitats (Wagner et al., 2014), animal gut (Li et al., 2014), insects (Kim et al., 2014) and plants (Janso and Carter, 2010) are continuously assessed for novel actinomycetes members which produce equally novel bioactive compounds. Of utmost importance is the exploration of often neglected and poorly studied habitats for the derivation of novel bioactive producing taxa (Okoro et al., 2009; Hong et al., 2009). One such ignored niche is lichens which hold a prime place from ecological and biological point of view. Lichens do have valuable bioactive elements and such elements from lichen associated actinomycetes should provide novelty for the benefit of human kind.

Lichens inhabit around 8% surface of the earth (Ahmadjian, 1995) with nearly 18,450 species (Boustie and Grube, 2005; Feuerer and Hawksworth, 2007). Though ubiquitous, lichens are

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Digital image-based quantification of chlorpyrifos in water samples using a lipase embedded paper based device

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Smartphone

ABSTRACT

A paper-based device (PBD) for the detection of chlorpyrifos pesticide at field application was fabricated based on the principles of enzyme inhibition and image processing. *Rhizopus niveus* lipase, p-nitrophenol palmitate and Whatman No.1 paper were used as an enzyme, substrate and support matrix, respectively. The performance of functionalized PBD was tested for lateral flow assay reaction in pure water (negative control), artificial pesticide water (positive control) and selected fruits and vegetables wash water (test). The digital image of the PBD after the test was captured using an android smartphone and analyzed in MATLAB software. Different colour space models such as, grey, RGB, HSV and YCbCr were studied and the Cb coordinate was chosen for its higher linearity ($R^2 = 0.988$) with pesticide concentration. Experimental variations such as paper length, relative concentration ratio of the substrate and enzyme were investigated to minimize the product cost and analysis time. The developed PBD showed a significant response over wide range of sample solution's pH and operational temperature. Further, a long-term storage stability was measured for developed PBD. The LOD and LOQ were found to be 0.065 mgL^{-1} and 0.198 mgL^{-1}. The results obtained from newly developed image processing method showed 92.8% accuracy with microtiter plate assay. Higher MRL was determined in the wash water of cauliflower, grapes, coriander leaves, brinjal and bitter guard. Overall, the developed paper biosensor was precise, cost effective and most suitable for field applications.

1. Introduction

Pesticides are widely used in agricultural fields around the globe to increase the crop yield, improve the quality and to protect the food from pest infestation. These pesticide residues enter into the food chain through air, water and soil which cause adverse impacts on human health and environment. It is therefore important to monitor the persistence of these pesticide residues in water and food grown for human consumption. Among many types of pesticides used all over the world, organophosphates (OPs) are synthetic organic pesticides manufactured from carbon chemicals and contain phosphorus integrated by esters of phosphoric, phosphonic, phorothionic or related acids. Many parts of the India are heavily polluted with organophosphate pesticides. More than 80% of the pesticide related hospitalization cases are due to organophosphate pesticide [1]. Chlorpyrifos is one of the OP group of pesticides, which is most commonly used due to its cost-competitive and broad spectrum of activity [2]. In humans, chlorpyrifos poisoning involves competitive inhibition of carboxylic ester hydrolases which results neuronal disorders. It also causes oxidative stress and endocrine disruption [3,4]. Hence, proper monitoring the pesticide residues in human food consumption will prevent the health risk. The conventional analytical methods such as GC-MS and LC-MS techniques are well established for wide range of pesticide detection. However, they are very expensive, laborious and need of trained expertise to execute. Further, these facilities are limited and are not affordable to general public. Owing to health concern, Food Safety and Environmental Protection regulatory authorities demand the researchers to develop rapid, sensitive, user friendly methods to monitor the presence of food, environmental contaminants and toxic substances.

Rising to the challenge, biosensing techniques attract food and environmental analysts in recent years. Many researchers have developed biosensor for the detection of variety of pollutants and hazardous compounds present in the environment [5–7]. Among various biosensing strategies, amperometric biosensors have proven its effectiveness in the qualitative and quantitative analysis of pesticide [8,9]. Recently, Stepenkova [10] and Justino [7] has compiled and presented a detailed

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Surface modification of nanocellulose using polypyrrole for the adsorptive removal of Congo red dye and chromium in binary mixture

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ABSTRACT

In this study, nanocellulose was synthesised by acid hydrolysis of cellulose and was coupled with polypyrrole supporting matrix. The synthesised nanocellulose polypyrrole composite (NCPPY) was characterised by FESEM, XRD, FTIR, BET, TGA/DSC and NMR. These analysis showed the conversion of cellulose to nano sized crystalline structure with excellent thermal stability and higher surface area. The effect of different parameters like pH, temperature, contact time, adsorbent dosage and initial concentration of Chromium (Cr(VI)) and Congo Red (CR) were optimised in batch mode. Response Surface Methodology (RSM) has been employed as an optimization tool for the efficient removal of Cr(VI) and CR and the maximum removal efficiency was found to be 80% and 85% respectively. The Langmuir and Freundlich isotherm well fitted the equilibrium data for CR and Cr(VI) respectively. Thermodynamic data showed that the biosorption of Cr(VI) and CR on NCPPY is an endothermic, spontaneous, and entropy-driven process. The adsorption kinetic followed pseudo-second-order for Cr(VI) and intraparticle diffusion for CR. Effect of co-existing ions were checked using several common salts and heavy metals. Results indicated that NCPPY has great potential to remove Cr(VI) and CR binary mixture under simulated conditions.

1. Introduction

Water is one of the most important resource for the survival of living organisms. These water bodies are polluted by various micropollutants like dyes, heavy metals released from the industries [1]. The presence of very low concentration of these micropollutants (<1 ppm) can seriously affect the quality and oxygen solubility of the water [2,3]. The organic dyes and heavy metals are used in various industries like paper, fertiliser, metal plating, leather tanneries, mining textile, photography, cosmetics and pharmaceutical industries [4]. For the treatment of textile dyes, various water treatment approaches such as adsorption [5–9], photo degradation [10–17], chemical oxidation, advanced oxidation process [8], biological treatment have been reported and methods such as chemical precipitation [18], ion exchange [19], electrochemical oxidation and membrane based processes have been employed for metal removal [20,21]. Among these methods, adsorption can be employed industrially, to recover back the metal ions for further reuse and also it is cost and time effective. Though various approaches on adsorption has been studied for the development of biological adsorbents with high selectivity and binding capacity, less attention has been given for the simultaneous removal of heavy metal and dyes in an industrial simulated condition. In recent decades, cellulosic polymers are used as a promising adsorbent for the removal of heavy metals and dyes. In addition to this, these polymers have special features like biodegradability, hydrophilicity, recyclable and non-toxic [19,20]. The structural aspect of cellulosic polymers are well studied which paves the way for easy chemical modification with high chemical stability. The conversion of cellulose to nano size further significantly enhances the specific surface area and minimises the intraparticle diffusion distance. Despite their ability to adsorb various pollutants, the challenge in scaling up of the process lies in agglomeration and disintegration of cellulosic material in the aqueous media. In the past decade, various studies have been reported to overcome these difficulties by using polymer matrices as a support which provide high mechanical strength and stability under different environmental conditions to improve the adsorption efficiency of the cellulosic base material [22,23]. The polymers like polyaniline, polypyrrole, polyvinyl are commonly used for this purpose [24,25]. Pyrrole is one of the key components in natural molecules such as haemoglobin, chlorophyll and Vitamin B_{12}. Pyrrole has been employed as a preservative, catalysts, corrosion inhibitor in the metallurgical process, adsorption of heavy metals [26,27] and in various fields like luminescence chemistry and spectrochemical analysis [28]. Polypyrrole (PPY) is the organic polymer formed by the polymerisation of pyrrole rings (C_4H_5N). Extensive studies on this polymer justifies its stability,

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Spectroscopic, quantum chemical, QTAIM analysis, molecular dynamics simulation, docking studies and solvent effect of pyridin-2-yl oxyacetic acid herbicide and its derivatives

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ABSTRACT

The density functional theory calculations and spectroscopic characterization (FTIR, FT- Raman, ^{1}H, ^{13}C NMR and ultraviolet–visible) of the herbicide compound Triclopyr (TCP) on monomeric and dimeric model is carried out. Its computational results are correlated with two pyridine derivative compounds FPA and FOP. The specific solvent effect of monomer with water complexes (TCPW, FPAW and FOPW) formed by hydrogen bonding interactions are investigated at the B3LYP 6-311G (d,p) level. Potential energy surface (PES) scanning of above compounds has been performed to discover the most stable conformer. The distribution of the vibrational bands are carried out with the help of normal coordinate analysis (NCA) and the resulting harmonic wavenumbers are scaled by using Wavenumber–Linear Scaling (WLS) method. The nature of inter and intramolecular hydrogen bonds are analyzed using NBO, QTAIM and Hirshfeld surface analysis. Furthermore herbicidal activity is confirmed on the compounds with molecular docking studies and molecular dynamic simulations (MDS).

1. Introduction

Triclopyr [((3,5,6 trichloro-2-pyridinyl)oxy) acetic acid] is a pyridine herbicide that is used to control a wide variety of woody plants as a foliar spray or as a basal spray when applied to cut surfaces [1]. The molecular formula of triclopyr (TCP) is $C_7H_4Cl_3NO_3$. The mode of action of triclopyr is an auxin mimic or synthetic auxin [2]. It is one of the most commonly used herbicide against woody species in natural areas which has less toxic. Triclopyr acid has an intermediate soil adsorption capacity [3,4]. Bojidarka et al.,2015 [5] has explained the solid state UV-MALDI mass spectrometric quantization of fluroxypyr and triclopyr in soil. Microbial Toxicity of triclopyr and related herbicides are observed by William H. Baarschers et al.,1988 [6]. D. Aruldhas et al.,2013 [7] explains the vibrational spectral studies of phenoxy acetic acid herbicide molecule. N. Karthikeyan et al.,2013 [8] has reported vibrational spectral studies on 2, 4, 5-Trichlorophenoxy acetic acid.

The literature review reveals that there is no detailed study on experimental and computational techniques on triclopyr and its related compounds with monomeric and dimeric model have been performed. This motivates to do the structural analysis, vibrational spectroscopic analysis and herbicidal activity of the molecule with density functional theory. In this present study, pyridine-2-yl oxy acetic acid herbicide compound such as triclopyr (TCP), fluoro pyridin-2-yl oxy acetic acid (FPA) and fluroxypyr (FOP) in the monomer form and it's dimeric structures have been selected for the comparative structure activity and herbicidal activity study. In addition to this, two water molecules are added to TCP, FPA and FOP which are represented as TCPW, FPAW and FOPW also used for structural analysis. In this study, a complete vibrational spectroscopic investigation gives a detailed assignment of the fundamental bands in FT-IR and FT-Raman spectra on the basis of normal coordinate analysis (NCA). The Wavenumber-Linear Scaling (WLS) method has been used for vibrational study. The ^{1}H and ^{13}C NMR spectra are recorded. The maximum absorption peak of triclopyr

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Spectroscopic and molecular structure investigation of Propachlor herbicide: A combined experimental and theoretical study

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ABSTRACT

The Fourier Transform Infrared (FT-IR) and FT- Raman spectra of propachlor(PCRM) herbicide are recorded in the region 400–4000cm^{-1}and 50–3500cm^{-1} respectively. Vibrational spectrum is performed with NCA and the wavenumber's are scaled by using wavenumber linear scaling (WLS) method to discover the herbicidal active region. The optimized molecular structure, vibrational frequencies corresponding vibrational assignments of PCRM have been investigated experimentally and theoretically using Gaussian 09 software package. The solvent effect of monomer with water complexes (PCRW) has been investigated at the B3LYP/6-311G (d,p) level to identify the hydrogen bonding interactions. The two methodologies used in recent years to partition the molecular space are the AIM theory and the ELF function, which are used to provide new insights into chemical bonding of potential propachlor herbicide. Potential energy surface (PES) scanning with six dihedral angles is performed to identify the stable conformer. The structure activity descriptors are measured from UV, HOMO-LUMO analysis, molecular electrostatic potential etc. The stability of the molecule arising from hyperconjugative interaction and charge delocalization has been analysed using NBO analysis. Hirshfeld surface analysis is performed to explain intermolecular interactions. Furthermore, the herbicidal activity is confirmed with molecular docking studies and molecular dynamic simulations (MDS).

1. Introduction

The amide moiety is an important constituent of many biologically significant compounds [1]. Acetamide-N-phenyl compounds are very important materials for medicinal, dyes and stabilizers [2,3]. Further, many acetanilide exhibits fungicidal, herbicidal and pharmacological activities [4]. Propachlor has first registered as a pesticide in the U.S. in 1964 [5]. Propachlor (2–chloro-N-isopropyl-N-phenylacetamide) is a pre emergent herbicide applied on corn, onion, cabbage, rose bushes and ornamental plants to control broadleaf and annual weeds [6]. The molecular formula of Propachlor is $C_{11}H_{14}ClNO$ and its molecular weight is 211.68 g/mol [7]. Oxyacetamides and chloroacetanilides have the same site of herbicidal action [8]. The crystal structure had been reported by Mao-Sen Yuan et.al [7]. Villareal et al. [9] has proposed a pathway of propachlor degradation yielding 2–chloro-N-isopropylacetamide as an intermediate. Co-metabolism of propachlor, alachlor, and cycloate has been studied by Novick et al. [10]. Additionally, Troitifjo et al. [11] reported the IR and Raman spectra of α-chloroacetamide together with those of other α—haloacetamides. Vibrational spectra of α-chloroacetamide and three deuterated analogues in the crystalline state are studied by Yoshiyuki mido et al. [12].

The literature review reveals that there is no detailed study on monomer, solvent effect and other bioactive studies for the herbicidal compound propachlor have not been investigated yet. In the present work, the title compound has been optimized with DFT/B3LYP level using 6-311G (d,p) basis set. In addition to this the PCRM-H_2O complexes has been taken into account to analyze various types of H-bond. IR and Raman spectra of propachlor

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Original article

Optimization of glutamic acid production by *Corynebacterium glutamicum* using response surface methodology

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water

MDPI

Review

Organic Fouling in Forward Osmosis: A Comprehensive Review

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Abstract: Organic fouling in the forward osmosis process is complex and influenced by different parameters in the forward osmosis such as type of feed and draw solution, operating conditions, and type of membrane. In this article, we reviewed organic fouling in the forward osmosis by focusing on wastewater treatment applications. Model organic foulants used in the forward osmosis literature were highlighted, which were followed by the characteristics of organic foulants when real wastewater was used as feed solution. The various physical and chemical cleaning protocols for the organic fouled membrane are also discussed. The study also highlighted the effective pre-treatment strategies that are effective in reducing the impact of organic fouling on the forward osmosis (FO) membrane. The efficiency of cleaning methods for the removal of organic fouling in the FO process was investigated, including recommendations on future cleaning technologies such as Ultraviolet and Ultrasound. Generally, a combination of physical and chemical cleaning is the best for restoring the water flux in the FO process.

Keywords: forward osmosis; membranes; organic fouling; FO membrane cleaning; wastewater treatment

1. Introduction

Water scarcity due to climate change and industrialization has urged researchers to focus on developing sustainable technology for desalination and wastewater purification [1,2]. Additionally, uncontrollable anthropogenic activities and an increase in population resulted in a huge rise of emerging pollutants in groundwater [2,3]. In general, wastewater contains a massive amount of pollutants including heavy metal ions, radioactive metals, pesticides, pharmaceutical waste, and many others [4]. A traditional pressure-driven membrane, such as microfiltration, ultrafiltration, nanofiltration, and reverse osmosis processes are applied to concentrate or purify a contaminated solution [5,6]. The pore size and pore distribution of the membrane in these processes decrease in the order of microfiltration < ultrafiltration < nanofiltration < reverse osmosis [7]. With a decrease in pore size, the resistance of the membrane will increase for the mass transfer, which requires higher pressure to obtain the same flux [6,8]. The pollutants present in wastewater remain dissolved in water

Catalysis

Dendrimer with Interior Cavity as Catalytic Pockets for Substrate Molecules: Synthesis of Bisimidazoles and Molecular Docking Study

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Dendritic nanostructure with the catalytic moiety covalently attached within the core domain and protected from the environment by a polymeric shell was synthesized successfully. This prospective will focus on the exclusive features observed for such a catalytic system with reactive sites present both at the core and the periphery and highlight its potential as enzyme mimics, by synthesizing different bisimidazoles following the MCR method, at room temperature. An unprecedented reaction rate and high yield of products were obtained within a short time, which is supposed to be its ability to form reverse micelle in the core, where the substrates are adequately concentrated. This is the first reported synthesis of bisimidazoles, using the homogeneous PAMAM dendrimer as a basic organocatalyst. The newly synthesized bisimidazoles obtained from bis(3-aminopropyl)amine were subjected to molecular docking studies against anticancer protein receptor using AutoDock Vina software, to evaluate their activity against breast cancer cell line (3HB5).

1. Introduction

During the last few years, great attention has been directed to develop novel polymeric nanostructures as scaffolds for catalysis.[1] Polymers with core-shell in the nanometer range can be used as catalytic nanoreactors, where the catalytic site is present in the core, in the shell or in periphery of the molecule.[2] The polymer architectures with the required size range to function as nanoreactors for organic reactions can be synthesized by controlled polymerization techniques.[3] Surfactant-type polymer micelles and amphiliphlic dendrimers can form reaction pockets in aqueous medium/ polar solvents, where the substrate molecules get bind/encapsulated.[4] The trapped molecules within a nanoreactor feel a well-confined nanoenvironment, may control the reaction in terms of selectivity, reactivity, reaction pathway, kinetics, mechanism, extent of conversion, etc. These characteristics of nanoreactors are similar to the hydrophobic pockets present in enzymes of biological systems, where molecular recognition and selective encapsulation of substrate molecules occur, and selectively reduce the energy of the transition states of the expected reaction intermediates. Moreover, high local concentration of substrates in the hydrophobic core, accelerate reaction rates many times compared to the reaction in the bulk.[5] For the formation of micelles, critical micelle concentration (CMC) of amphiphilic molecules, critical micellization temperature (CMT) and nature of solvent are important parameters. But the micellization process is opposed by repulsive interactions between the head groups of the molecules and the interaction due to residual alkyl chain-water/polar solvent molecule contacts at the micelle surface.[6] Again, micelles formed by conventional surfactant monomers are dynamic in nature because the monomers constituting the micelle and free monomers in the intermicellar solution are mutually exchanging always. But there is no dynamic exchange of monomers between free solution and the micellar pseudo-phase in polymeric micelles which leads to rigidity and stability of polymeric micelles.[7] Polymeric micelles have low CMC and in a dilute solution, where the concentration becomes less than CMC, the micellar system dissociates and the monomers are free. This disadvantage can be overcome by cross-linking of micelles formed by linear polymers, which can form unimolecular polymeric nanoreactors in the inner core,[8] intermediate corona[9] or outer shell.[10]

In contrast to conventional micelles, formed by thermodynamic association of amphiphilic molecules, dendrimers and hyperbranched polymers can form unimolecular micelles where the hydrophilic and hydrophobic segments are connected covalently and do not show any CMC. Thus the micellar structure formed is static rather than dynamic, which is retained at all concentrations and in a variety of solvents.[11] Their tendency is to exist as spherical appearance with core-shell type structures having hydrophilic and hydrophobic domains.[12] The core-shell system help the molecules to behave as a 'container' in solution. The inherent stability of the

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ORIGINAL ARTICLE

Immunomodulating Properties of Carrageenan from *Tichocarpus crinitus*

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Abstract— Several *in vivo* immunotropic effects of κ/β-carrageenan isolated from the red algae *Tichocarpus crinitus* were studied, by orally administering it at 100 mg/kg/day to mice for 7 days. Serum levels of IFN-γ, IL-12, IL-1β, and IL-4 were measured. Carrageenan's ability to influence development of LPS-induced inflammation was also assessed. Oral administration of κ/β-carrageenan increased serum levels of all the studied cytokines at least twice in comparison to the intact mice, while intraperitoneal LPS injection at 1 mg/kg increased concentration of only the pro-inflammatory cytokines: IFN-γ, IL-12, and IL-1β. Furthermore, κ/β-carrageenan demonstrated a higher efficacy at inducing IFN-γ production than LPS. Previous 7-day-long oral carrageenan administration impaired development of LPS-induced inflammation: level of IL-1β dropped below that found in intact mice, while IFN-γ and IL-12 concentrations were at least 40% lower than in mice with LPS-induced inflammation. Murine peritoneal macrophages were also affected by the oral administration of the κ/β-carrageenan: their motility was increased, and morphology altered. In sum, we have demonstrated that κ/β-carrageenan, when administered orally, is not only not immunologically inert, but at the dose of 100 mg/kg possesses pharmacologically exploitable effects.

KEY WORDS: κ/β-carrageenan; *Tichocarpus crinitus*; cytokines; immune cells; *in vivo*.

BACKGROUND

Carrageenans are a family of naturally occurring water-soluble linear sulfated galactans, composing cell wall of numerous species of red algae. Carrageenans consist of regularly alternating β-1,3- and α-1,4-linked D-galactosyl residues (G- and D-units), which are classified in accordance with the basic structure of disaccharide repeating unit (carrabiose), presence of 3,6-anhydrogalactose (DA-unit) as 4-linked residue, and numbers of sulfate groups per one disaccharide unit [1]. Thus, the most industrially exploited types of carrageenans – κ-, ι- and λ-carrageenans,

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Original article

Characterization and antifungal activity of the yellow pigment produced by a *Bacillus* sp. DBS4 isolated from the lichen *Dirinaria agealita*

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ABSTRACT

This study emphasis the production of yellow pigment from endolichenic *Bacillus* sp. isolated from the lichen *Dirinaria aegialita* (Afzel. ex Ach.) B.J. Moore. Yellow pigment-producing twenty different strains were investigated. The hyperactive pigment-producing bacterial strain was identified as *Bacillus gibsonii* based on 99 % sequence similarity. Maximum bacterial pigment production appeared in Luria Bertani medium. Methanol extraction of the pigment and its partial purification using TLC was carried out. Furthermore, isolated pigments were characterized using UV-visible spectroscopy, FTIR spectroscopy, and GC-MS results related to the possibility of the carotenoid occurrence. The pigment also exhibited efficient antifungal activity against selected fungal pathogens of economic importance. Likewise, the pigment extract evaluated for the total antioxidant potential using Phosphomolybdenum and Ferric reducing antioxidant power assay and the results represented in Ascorbic Acid Equivalent (AAE)- 21.45 ± 1.212 mg/mL. The SC_{50} of the pigment extract found to be 75.125 ± 0.18 μg/ml determined by the ABTS assay.

1. Introduction

Recently, human well-being and environmental conservation have gained importance, leading to concerns regarding food safety issues, such as those arising due to indiscriminate use of food colors. Color additives are the main ingredients of many products that make it look attractive and tasty. FDA is responsible for ensuring that all foods containing color additives are safe for consumption. Various synthetic pigments applied in food materials, cosmetics and pharmaceutical industries have different harmful side effects (Venil and Lakshmanaperumalsamy, 2009).

To counteract these ill impacts of synthetic colorants, there is a global attention in making pigments from natural sources. Basically, natural pigments (NP) are colored, water-insoluble, and organic solid powders. They are available in a wide range of colors and are not have any side effects with the substrate in which they are added. The demand for utilization of NP in the aforementioned industries is increasing currently (Unagul et al., 2005). Sources of these NP can be either plants or microbes. The approved NP mined from plants have frequent negatives: instability, low-water solubility, and limited availability during the year. Thus, recent research focuses on pigment production from microorganisms. The reasons for high interest in using microbes as pigment sources are as follows: fast and easy growth rate of microbes using low-cost culture medium, independent in the conditions of weather, and wide range of available color(s). So, production of the pigments using microbes is one of the major emerging research field having demonstrated its latent for several industrial applicants (Parekh et al., 2000).

Pigments such as Quinones, Carotenoids, Violacein, Indigo and Melanins are produced from microbes (Dufossé, 2006). Carotenoids are among the most diverse natural products. Because of antioxidant properties, microbial carotenoids are known for their

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Influence of number of azo bonds and mass transport limitations towards the elimination capacity of continuous electrochemical process for the removal of textile industrial dyes

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Article

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Lichens of the Sirumalai hills, Eastern Ghats with one genus and six species new to India

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Abstract

Lichens of Sirumalai hills are reported here for the first time. Lichen biota comprised of 95 species. The genus *Japewiella* is reported for the first time in India and is represented by *J. tavaresiana* (H. Magn.) Printzen. Furthermore, the following six taxa including one variety are new to India viz. *Arthonia atra* (Pers.) A. Schneid., *Graphis brevicarpa* M. Nakan., Kashiw. & K.H. Moon, *Micarea erratica* (Körb.) Hertel, Rambold & Pietschm., *Pertusaria cicatricosa* var. *deficiens* A.W. Archer, Elix & Streimam, *Porina subargillacea* Müll Arg., and *Pyxine schmidtii* Vain. Brief accounts for all the new records to India are provided to facilitate their identification. *Arthonia redingeri* Grube and *Lepraria caesiella* R.C. Harris are reported for the first time from south India. Besides all above, 29 species are recorded for the first time from the state of Tamil Nadu. The lichen biota of the area is primarily corticolous in habitats and dominated by crustose form.

Keywords – lichenized fungi – new records – south India – Tamil Nadu – tropical lichens

Introduction

India supports high lichen biodiversity, with 2714 recorded species. As new areas have been explored as well as revisionary studies in the recent years have resulted in a steep rise in novel species being discovered. During the years 2010 to 2017, a total of 411 species were added to the recorded Indian lichen biota (Sinha et al. 2018). However, many natural habitats of scientific interest remain to be explored. Although, the Eastern Ghats contribute significantly to the species richness and number of endemic lichen species, it has received less attention for conservation than the Western Ghats (Muthumperumal & Parthasarathy 2010). Nayaka et al. (2013) emphasized the current extent of lichen research in the Eastern Ghats. The lichen survey in Horsley and Tirumala Hills in Andhra Pradesh and Shevaroy Hills in Tamil Nadu resulted in several new additions to the recorded species of the Eastern Ghats (Nayaka et al. 2013). In our ongoing effort to explore new and under explored areas of the country, an attempt to examine the lichen diversity of Sirumalai hills in south India was carried out as a part of the "Workshop on lichen biology and bioprospecting (LBB2017)".

The Sirumalai hills are situated in the southern part of Eastern Ghats in Dindigul district of Tamil Nadu (10°.07´-10°.18´N and 77°.55´-78°.12´ E) (Fig. 1). The months March to July are the

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Biochar and activated carbon derivatives of lignocellulosic fibers towards adsorptive removal of pollutants from aqueous systems: Critical study and future insight

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ABSTRACT

The enormous growth of industries and the increased release of untreated effluents containing emerging pollutants are major problems that contaminate the water resources. Current efforts are oriented towards developing cost-effective, eco-friendly alternatives to remove a wide range of water pollutants. This paper provides critical insight on various lignocellulosic fibers used for colored and wastewater decontamination. The potential of various agricultural waste materials and their adsorptive capacity of pollutants compared to activated carbon was discussed. Furthermore, an outline of the mathematical modeling describing the kinetics, isotherms, the type of adsorption, and the significant factors influencing the adsorption process were reported. Also, a discussion of the new trends proposed for valorizing vegetable materials in wastewaters decontamination was pointed out. The proposed mechanism for the surface-based adsorption of pollutants onto the lignocellulosic fiber surface was discussed. The challenges and future scope of research on the surface-based removal of pollutants were also discussed.

1. Introduction

The environmental problems of developing countries became an integral part of a severe economic crisis due to a lack of advanced treatment methods to handle emerging contaminants. Thus in recent decades, researchers have focused their interest on developing cost-effective methods in resolving environmental issues caused by untreated industrial waters [1]. The existence of various types of pollutants including, carcinogenic heavy metals, organic dyes, phenols, nitrates, and other salts, has caused severe damage to aquatic and human life [2]. The removal of such toxic compounds demands a major necessity for environmental safety [3]. Over the last ten years, researchers have reported a lot of efficient methods like chemical oxidation [4], electrocoagulation [5], membrane separation [6], reverse osmosis [7], anodic oxidation [8] coupling anodic oxidation with biosorption [9]. However, the efficiency of the process cannot depend only on its capacity to remove contaminants from the treated water; in parallel, it must comply with some important aspects like low cost and ease of application [10]. The adsorption has a significant pollutant removal capacity from wastewater [11,12] by which the volume of effluent can be significantly reduced. For many decades, commercial activated carbon has been the dominant adsorbent used in water treatment [13]. Indeed, adsorption on activated carbon has many advantages: it allows the elimination of a wide range of pollutants, including different types of dyes, but also other organic and inorganic pollutants, such as phenols, ions, metals, pesticides, detergents, as well as the compounds responsible for taste and odor [14]. Activated carbons are massively used for pollutant removal due to their highly porous materials and well-developed textural

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SPECIAL ISSUE REVIEW PAPER

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Insights about sustainable biodiesel production from microalgae biomass: A review

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Summary

Production of biodiesel from microalgae can be categorized as a symbiotic engineering solution focusing on energy and environmental problems. This review presents a collection of recent methods adopted for the production of biodiesel from microalgae. Microalgae are tiny cell factories which yield a large quantity of biomass by employing different methods of cultivation and using different types of harvesting techniques. Different strategies like nutrient starvation and micronutrient supplementation for hyper lipid accumulation to produce biodiesel for competing with the high market demand for fossil fuel are discussed. The use of different cultivation techniques for increasing the algal biomass in the recent scenario is focused. Also, improvement in the design strategies of bioreactors like the open pond, photobioreactors, and hybrid systems is included in the review. Further, diverse technologies for lipid improvement, including manipulating the bioprocess parameters and genetic engineering, are addressed. Also, microalgae for biorefinery approaches solve pollution problems, and its biomass can be used for biodiesel production which is elaborated in detail. The possibility of production of biodiesel from microalgae at a larger scale by overcoming the main bottlenecks in different steps of algal growth like high biomass cultivation, investment factor, and implementation of biorefinery approaches to address the current energy demand is also proposed.

KEYWORDS

algal cultivation, biodiesel, biomass, bioreactors, biorefinery, microalgae

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Electrocatalytic removal of fluroquinolones from simulated pharmaceutical effluent: Chemometric analysis, chemical blueprint of electrodes and generated sludge

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ABSTRACT

Electrocatalytic removal of fluroquinolones from simulated pharmaceutical effluent is studied in this work. The effects of parameters like NaCl concentration, pH and initial concentration of Ofloxacin were studied. The synergistic effect of H_2O_2 on the degradation of Ofloxacin paves the way to move towards radical based chemistry. The process was modelled and statistically evaluated through Central Composite Design approach towards the maximum concentration of Ofloxacin degraded (for 0.8 mM) as 0.46 mM at pH-3.0 and the concentration of H_2O_2 at 0.2 mM. The model was analyzed mathematically and observed as saddle response based on canonical and ridge analysis. The process follows pseudo first order kinetics with k = 0.047 min^{-1} and reaction rate of 13.6 $mg.L^{-1}.min^{-1}$. The mineralization efficiency of the process was studied using Total Organic Carbon analysis and 76.5% removal efficiency was obtained on the simulated pharmaceutical effluent containing Ofloxacin, Ciprofloxacin and Norfloxacin. The crystal structure of the green and red colour sludge was determined by XRD to be lepidocrocite (a = 3.87 Å, b = 12.4 Å, c = 3.06 Å) and gupeiite (a = 5.6620 Å), respectively. The elemental composition of sludge and electrodes were found using SEM-EDX. Morphological change in electrode surface was determined using roughness plot.

1. Introduction

Antibiotics are chemicals that are used to treat bacterial infections. Despite the inarguable and applauded use in the field of medicine, antibiotics have turned out to be an emerging threat in terms of the generation of Multi Drug-Resistant organisms (MDR). This resistance occurs when the bacteria undergoes the natural defense mechanism against the prevalent antibiotics. The World Health Organization (WHO) has also cautioned towards the generation of antibiotic-resistant microbes as a global threat in the UN assembly in 2016. The WHO has published a list of twelve priority antibiotic resistant pathogens in three different categories: Critical (*Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Enterobacteriaceae*), High (*Enterococcus faecium, Staphylococcus aureus, Helicobacter pylori, Campylobacter* spp, *Salmonella* spp., *Neisseria gonorrhoeae*) and Medium (*Streptococcus pneumoniae, Haemophilus influenzae, Shigella* spp.) (Tacconelli, E., N. Magrini and Singh, 2017). Out of these microorganisms, four organisms (*Campylobacter* spp, *Salmonella* spp., *Neisseria gonorrhoeae, Shigella* spp.) are resistant against fluoroquinolone antibiotics. The WHO is currently promoting the activity of finding new generation antibiotics to treat humankind (Tacconelli et al., 2018). The probable reason for the increase in the concentration of this emerging micropollutant is due to improper handling in terms of usage, disposal in human - animal health sector and release of effluents from the antibiotic producing pharmaceutical industries (Gothwal and Shashidhar, 2015). The occurrence of antibiotics has been reported in various water resources like sea, lakes, rivers, and under groundwater tables (Fick et al., 2009). The presence of antibiotics in environment have been reported in India and China from Asian continent (Peng et al., 2011; Wu et al., 2018), Spain in European continent (Valcárcel et al., 2011) and in American continent (Mohapatra et al., 2016). A study has revealed that the concentration of antibiotics in Indian rivers were at higher concentration when compared to the antibiotic accumulation in groundwater

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Review

Environment friendly, renewable and sustainable poly lactic acid (PLA) based natural fiber reinforced composites – A comprehensive review

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ABSTRACT

The Environmental concern and awareness around the globe have led to the development of sustainable bio composites which are derived from renewable resources. Biodegradable polymers and natural fibers derived from different renewable resources have played a vital role in the manufacture of bio composites. Poly lactic acid or polylactide (PLA) is one of the versatile aliphatic linear thermoplastic biodegradable polymers obtained from fully renewable sources such as wheat, corn, rice and sweet potato, and it has unique characteristics like renewable, sustainable, biocompatible and compostable. PLA has distinct advantages like low energy consumption and emission of low greenhouse gas during production and suitable for 3D printing applications. It also has some demerits such as low gas and water barrier properties, poor toughness, low glass transition temperature and is hydrophilic in nature, which limit its use in commercial applications. To overcome this, PLA is blended with various natural fibers in order to improve the thermal, water barrier, crystallization, mechanical, antimicrobial and degradability properties. Moreover, inclusion of natural fibers not only decreases the cost of PLA products but also helps in producing good competitive commercial products which are used in different industries. Hence, this review focuses on the synthesis and degradation of PLA, its applications in various sectors and manufacturing methods involved in PLA composites. Moreover, this review discusses about the different types of natural fibers and their influence on the unique properties of PLA based natural fiber reinforced composites. The overall aim of this paper is to provide a holistic idea about PLA based bio composites to academicians, industry personnel and researchers.

1. Introduction

The continuous advancements in science and technology have resulted in the increase in demand for natural resources all over the world (Rangappa et al., 2020). This development has led to concerns such as scarcity of materials and conservation of environment (Thyavihalli Girijappa et al., 2019). In addition, the rapid depletion of oil reserves, greenhouse emissions due to the extensive usage of petroleum-based products and their non-biodegradability, have triggered researchers to explore novel materials that are biodegradable, renewable and recyclable (Scaffaro et al., 2018a). Biodegradable composites are one such material that can be employed to address these issues and simultaneously ensure a sustainable environment. These composites contain matrix materials that are derived from agricultural and forestry feedstock and they are reinforced with cellulose fibers (Campilho, 2015). End-of-life disposal is not an issue when bio

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Kinetic and isotherm studies on adsorptive removal of sulfates by cotton shell derived biochar: Recovery of sulfates from marcasite soil

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ABSTRACT

This work illustrates the potential applications of the raw cotton shell (RCS) and cotton shell biochar (CSB) in the remediation of sulfate contaminants from aqueous solvents. Comprehensively, optimal batch and adsorption kinetics of sulfate by RCS and CSB were intensively analyzed and determined by varying the adsorption parameters. For RCS, the optimal series of parameters were at (pH-7, sulfate conc-150 mgL^{-1}, adsorbent dose- 0.5 g and time-150 min). While for CSB optimum conditions were at (pH-9.8, sulfate conc-100 mgL^{-1}, dosage- 0.1 g and time-90 min). The maximum adsorption efficiency for both RCS and CSB was achieved at 86.47% and 90.77%, respectively. Sulfate adsorption by RCS and CSB was examined by isotherm models and kinetic studies. The data are best suited to the Langmuir isotherm model with the highest RCS and CSB sulfate adsorption capability of 61.35 and 153.85 mg g^{-1} and followed pseudo-second-order kinetics. Box-Behnken design (BBD) based response surface methodology (RSM) model-based analysis of variance test has demonstrated optimum conditions and sulfate adsorption by both RCS and CSB. The recovery studies on sulfates from marcasite soil were evaluated at different doses of RCS and CSB. This study provides insights into the usage of the developed process towards the circular economy of the sulfates.

1. Introduction

The removal of sulfate minerals is a difficult task for the mining industry, particularly for drinking water (Ayangbenro et al., 2018). The highly acidic nature of acidic drainage affects the soil properties and vegetation, which results in groundwater problems and generates toxic contaminants to nearby water bodies, disturbing human and aquatic life. Sulfate salt is one of the primary poisonous pollutants present in natural waters after mixing with related acids and is mainly derived from industrial effluents (Runtti et al., 2016). Undeniable, sulfate is one of the essential salt ingredients for human physiology and health, especially dietary reference intake (Ljung et al., 2009). Excessive sulfate, however, may cause imbalances in the natural sulfur cycle and corrosion and may exert adverse effects on human health (Fernando et al., 2018). The most proven and established methods for sulfate removal from effluents include biological treatment (Kijjanapanich et al., 2014), adsorption (Hu et al., 2010), and chemical precipitation (Dou et al., 2017). However, it is problematic because it is challenging to maintain the environmental conditions necessary for microbial growth. Generally, carbon-based materials meet the requirements for the industrial remediation of contaminants due to their high mechanical strength, high adsorption capacity with corrosive resistance, low toxicity as well as small production

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Production and characterization of exopolysaccharide from the sponge-associated Bacillus subtilis MKU SERB2 and its in-vitro biological properties

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Affiliations + expand

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Abstract

In this study, the sponge-associated a potential endosymbiotic bacterium, Bacillus subtilis MKU SERB2 was identified and optimized the production of exopolysaccharide (EPS) by using response surface methodology (RSM). The central composite rotatable design (CCRD) exhibited the highest yield of EPS (617.81 µg/mL) obtained from the optimized medium containing 11.5 g/L of sucrose, 3.5 g/L of yeast extract, 3.0 g/L of peptone, and 2.5 g/L of calcium chloride. Fourier transform infrared (FTIR) spectrum of purified EPS indicated that the presence of carboxyl, hydroxyl, and amide as functional groups, and their structural composition was confirmed by ^{1}H and ^{13}C nuclear magnetic resonance (NMR) analysis. Moreover, the fibrous, porous and semi-crystalline nature of EPS was confirmed by SEM and X-ray powder diffraction (XRD) analysis and the EDX inferred demonstrated the presence of C, Na, O, N, S,

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Biodegradation of reactive red 120 in microbial fuel cell by *Staphylococcus equoruma RAP2*: Statistical modelling and process optimization

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ARTICLE INFO

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ABSTRACT

A laboratory-scale Microbial Fuel Cell (MFC) is used for the degradation of reactive red 120 (RR120) using bacterial strain *Staphylococcus equorum* RAP2 (Accession number MW36539) isolated from wastewater treatment plants capable of degrading 100 % of dye (100 ppm) in 72 h at pH 7 efficiently. The effect of pH, concentration, and time on dye degradation and electricity generation were studied using Center Composite Design (CCD) combined with Response Surface Methodology (RSM). Predicted values (R^2 0.9920) for dye degradation and (R^2 0.9428) current density was found to be high with P-value <0.05. A quadratic model was best fitted with the experiment. The optimized solutions obtained through RSM were also validated with experiments (±0.5 % error). Analytical techniques such as Fourier-transform infrared spectroscopy (FTIR), Liquid chromatography, and mass spectroscopy analysis (LCMS) were used for establishing the phenomena of biodegradation. Metabolite toxicity was also assessed by phytotoxicity.

1. Introduction

Rapid industrialization has created a lot of positive and negative impacts on the environment. The dye using industries such as textile, leather, plastic, paint liquor and pulp and paper continuously discharge their effluent to the environment which is toxic to the human being as well as to the plant and animal kingdom [1–3]. The complex structure of these dyes making them difficult in their removal process also they are not aesthetically acceptable [4,5]. They possess a tremendous threat to the environment because they are carcinogen, toxic, mutagenic, and stable towards light and heat [6,7]. Different types of synthetic dye are used in day to day life such as azo, anthroquinone, nitro, thio, nitroso, indigo, etc. but 80 % of the market is occupied by azo dyes [8–10]. Azo dyes are characterized by their —N=N— bond and upon degradation sometimes they form toxic compounds such as amine which are a secondary pollutant. Removal techniques should be selected in such a way that the secondary toxic pollutants should also be removed along with azo dyes [11–13]. There are many techniques such as adsorption, ion-exchange, filtration, advanced oxidation process for dye removal from these discharges but they have the disadvantage of the generation of secondary pollutants and high cost [14–18]. MFC is an emerging green and clean technology that can be used for the removal of dyes due to its several advantages such as no production of secondary waste due to the anaerobic nature of degradation. MFCs technologies are better than standalone aerobic and anaerobic bioremediation as it produces electricity along with a higher rate of degradation [19]. The biological method of removal of dyes has a disadvantage in that they can only remove the low concentration of dyes as these dyes at high concentrations become toxic to the microorganism. Although MFC technology is costly, it can be used instead of a biological method because of its dual benefit in terms of faster degradation process and energy production [20]. Fang et al. [21] have reported the degradation of reactive brilliant red X-3B up to a concentration of 271 ppm using MFC coupled with a constructed wetland. Fernando et al. [12] have successfully removed Acid Orange-7 up to 90 % at a loading of 210 g m^{-3} day^{-1} in an integrated microbial fuel cell with an aerobic two-stage bioreactor system. A lot of dye degradation such as reactive red 2, acid orange 7, reactive black 5, methyl orange using MFC have been reported by many researchers [2,22–24]. Recently Aiyer et al. [25] have assessed microbial electron transfer activity of MFC based on methylene blue dye reduction activity. Mishra et al. [1] have successfully removed a mixture of dyes reactive red 21 and reactive orange 16 at an initial concentration of 50

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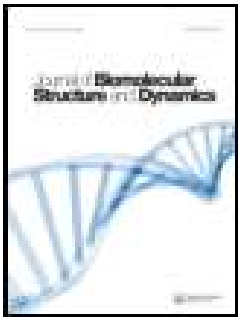

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In-silico strategies for identification of potent inhibitor for MMP-1 to prevent metastasis of breast cancer

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Review

Versatile image processing technique for fuel science: A review

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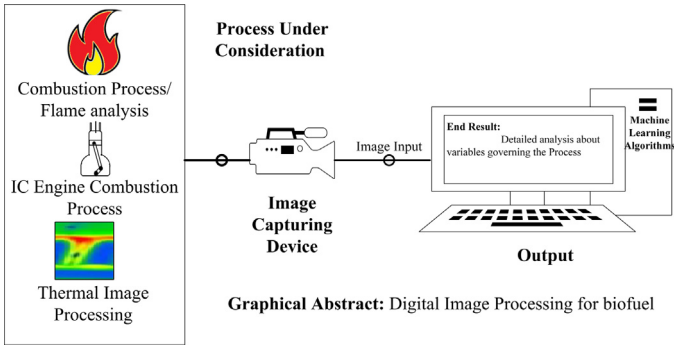
HIGHLIGHTS

- A discussion about the various techniques in digital image processing is presented.
- Digital image processing use in biomass grading, biodiesel testing is also reviewed.
- The use of digital image processing in adulteration of fuel is presented.
- Flame and combustion analysis using digital image processing is discussed.

GRAPHICAL ABSTRACT



Graphical Abstract: Digital Image Processing for biofuel

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ABSTRACT

The evolution of computer vision and image processing system paved the way that any technologists can extract quantitative data sets from the visual results of an image. Digital image processing (DIP) technique precisely measures and quantifies the image and eliminates the subjectivity of manual interpretation. DIP is a non-destructive, inexpensive and rapid method that has been used by many researchers in various applications of biofuel. In fuel science, DIP and artificial intelligence (AI) techniques have been successfully applied for the classification of biodiesel, selection of biomass for biofuel production. DIP can be used in the combustion process and its control parameters, gas leakage, monitoring fuel reactant conversion reactions, impurities present and adulteration of fuel, also automation process of a fuel injection system. This review gives an overview of the applications of image processing in fuel science.

Contents

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Chemometric approach towards optimization on the radiolytic removal of micropollutants: Equation based modelling with canonical and ridge analysis

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ABSTRACT

In accordance with optimization, Response Surface Methodology act as indispensable tool which helps in the aspects of process development and understanding the effects of various parameters on a particular process. Though this tool provides valuable insights about a process, Eigen structural analysis of response surfaces aid in detailed understanding of a model. In this study, statistical model for gamma radiolytic degradation of RO-16 dye was developed using Central Composite design with alpha value as 1. The interactive effects of parameters such as pH, Dose of γ ray (kGy), initial concentration of dye (mg/L) were studied. The Canonical analysis was also carried out for degradation RO-16 dye along with other pollutants such as RR-120, DR-80 and Ofloxacin. The developed model showed 55.97% of degradation at pH: 6.0, Dose of gamma ray: 4 kGy, and initial concentration of dye: 500 mg/L. Canonical analysis revealed that the responses for degradation of three azo dyes were maximum and that of Ofloxacin was minimax. The optimal value for all the processes was determined theoretically by Ridge analysis. Thus canonical and ridge analysis could be used to understand the insights of Response Surface Methodology effectively.

1. Introduction

Industrialization and urbanization have resulted in release of significant amount of micropollutants into water system which affects the mankind as well as flora and fauna in various ways. In order to treat these pollutants several physical, chemical and biological methods have been adopted. Current researches focuses on Advanced Oxidation Processes (AOP), the reliable processes for the degradation of micropollutants in wastewater. Among them gamma radiolysis is highly efficient method for the treatment of dyes and pharmaceutical effluents [1–3]. The radiolysis of water produces both oxidants($HO^{\cdot}$, $O_2H^{\cdot}$) and reductants(e^{-}_{aq}, H_2). These radicals further reacts to form secondary radicals which involves in the degradation of recalcitrant molecules [2–6]. The hydroxyl radical ($HO^{\cdot}$) is a strongest oxidant which has the oxidation potential of 2.8 V majorly contributes in the degradation process [6–8]. The gamma radiolysis does not produce toxic intermediates or byproducts, it can be operated in low cost when compared to other AOPs and it is a sludge-free process [3,4,9]. Transformation of a technology from bench scale to pilot scale or industrial scale, depends greatly on the parameters involved which could be carefully analysed and optimised. In analytical chemistry the term optimization refers to discovering the conditions which on applying to a procedure produces the best response [10]. Among the various methods of optimization traditional method includes the One Variable at a time (OVAT) which generates experimental data by changing one factor and keeping the other factors a constant. However this method became less efficient because of its several disadvantages such as high time consuming, expensive, more consumption of materials which results in extensive process and also the interactions between parameters that cannot be studied [11]. The Design of Experiments (DOE) a systematic procedure based on the process response which are evaluated and justified through statistical analysis took advantage over the traditional approaches because of its efficiency as it not only studies the linear, quadratic and the interactive effects but also helps in markable model prediction for the responses at the range of variables used in the study and thereby achieving the highest performance [12]. The main purpose of DOE is the generation of maximum information that can be

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Full Length Article

An intensified approach for transesterification of biodiesel from *Annona squamosa* seed oil using ultrasound-assisted homogeneous catalysis reaction and its process optimization

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ABSTRACT

In this work, *Annona squamosa* seed oil (ASSO) was extracted using ultrasound-assisted extraction (UAE) and converted into fatty acid methyl esters (FAME) by ultrasound-assisted transesterification (UAT) using methanol and KOH. The multivariable process of UAE and UAT was optimized using a response surface methodology (RSM). The experimental data were analyzed by Pareto analysis of variance (ANOVA) and quadratic polynomial models developed using non-linear regression analysis. A maximum ASSO yield of 31.91% was achieved by the model with the optimum conditions for UAE: liquid-to-solid ratio, 8.8 mL g^{-1}; extraction temperature, 45 °C; sonication time, 19.5 min; and sonication amplitude, 88%. The maximum conversion of ASSO into biodiesel (97.6%) was achieved with the optimum condition of the model: oil-to-methanol ratio, 5.04; catalyst concentration, 1.12%; temperature, 57 °C; and sonication time, 113 min. These models were found to be significant at the 95% confidence level. The transesterified ASSO FAME was characterized using Fourier-transform infrared (FT-IR) spectroscopy, thermogravimetric analysis (TGA), gas chromatography mass spectrometry (GC–MS), ^{1}H-nuclear magnetic resonance (^{1}H NMR), and fluorescence spectroscopy methods. Various physicochemical properties of ASSO and ASSO FAME were characterized according to ASTM standards. The ultrasound-assisted extraction and transesterification process was found to be rapid and simple without any change in the product quality. Importantly, ASSO was found to be a possible new source for potential biodiesel production.

1. Introduction

For the past several decades, the energy crisis and continuous hike in fuel prices have encouraged intensive research on renewable energy sources [1]. Thus, biofuels derived from renewable sources are being developed worldwide to overcome the shortcomings of petroleum products such as cost, availability, and pollution. The energy produced from biological sources is considered an alternative and possible solution for the energy crisis [2]. Consequently, the importance of biodiesel in transportation fuels has increased drastically. Biodiesel from vegetable oil and/or animal fat sources has been shown to have a high cetane number (required value of 45–55) with low sulfur content (maximum acceptable limit, 15 ppm), in addition to being biodegradable, non-toxic, and less emissive for carbon dioxide, carbon monoxide, and some greenhouse gases [3–5]. Moreover, it is used in several countries as the main substitute for diesel. Brazil, USA, and some countries in the European Union are utilizing food crops as sources of bioethanol and biodiesel, which augments the conflict of food security versus bioenergy [6]. Hence, fuel produced from non-consumable crops has evolved as the second-generation biofuel. Non-consumable human

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Bio-refinery approaches based concomitant microalgal biofuel production and wastewater treatment

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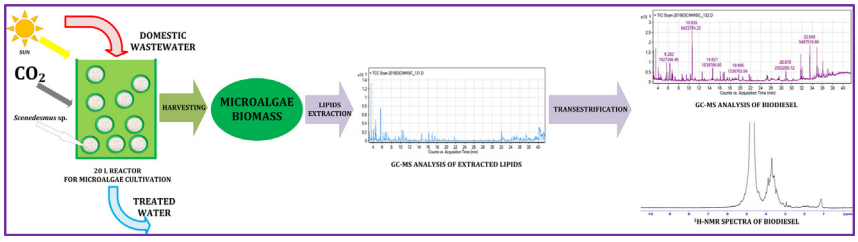
HIGHLIGHTS

- Biofuel production is reported during treatment of wastewater by *Scenedesmus* sp.
- Enhanced biomass and lipid productivity (19 mg/L/day) obtained in phycoremediation.
- Characterization of FAME by FT-IR, GC–MS and ^{1}H NMR is reported.

GRAPHICAL ABSTRACT



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ABSTRACT

Adopting the biorefinery approaches on the coupled process of phycoremediation and biofuel production using freshwater microalgae. A green microalga, *Scenedesmus* sp., cultivated in various concentrations of domestic wastewater (0, 20, 40, 60, 80, 100%*v*/v). Maximum biomass productivity was obtained 62 mg/L/day cultivated in 100%v/v wastewater. During the stationary phase, the biomass was harvested adopting the flocculation technique. Interestingly, *Scenedesmus* sp., preferentially utilized 71.2% nitrate, 89.6% phosphorus, 23.5% calcium, 2% magnesium, 97.7% sulphate, 30% ammonia, 10.9% chloride, and 15.2% alkalinity in the wastewater which contribute to the wastewater treatment. Lipid productivity was found to be 19 mg/L/day. The fatty acid profile of transesterified lipids was characterized by adopting FT-IR, GC–MS, and ^{1}H NMR. The extracted biomass was utilized for the feedstock for bioethanol production. The amount of reducing sugar was found to be 11.2% (*w*/*v*). Acid hydrolyzed reducing sugars subjected to fermentation using *Saccharomyces cerevisiae* NCIM3288. Bioethanol was found to be 10.4 g/L after distillation.

1. Introduction

The wastewater can be categorized into different types for the cultivation of microalgae such as livestock wastewater, domestic wastewater, foodstuff wastewater, and industrial effluent water. Domestic wastewater consists of essential macronutrients for microalgae growth. The recent microalgae work like "All-gas" (European Union) project and OMEGA (NASA) project, reported that the project working cost was decreased by 330 USD/galloon by use of biofuels as compared to that of fossil fuel usage for the same (Batan et al., 2010). The combined work of wastewater treatment and microalgae cultivation is a beneficial strategy for biofuel production and pollution control. Microalgae are adaptable hence they can be cultivated in wastewater for higher biomass production by utilizing

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Biodegradation of Used Motor Oil and Biofuel Production by Microalgae *Coelastrella* sp. M60 and *Scenedesmus* sp. VJ1

Microalgae are valuable biological resources for application in the fields of food, feed, fuel, and therapeutics. Recently, their usage was extended for their efficacy in bioremediation of pollutants. In this context, the degradation of used motor oil (UMO) and biodiesel production was performed with the freshwater microalgae *Coelastrella* sp. M60 and *Scenedesmus* sp. VJ1. Both microalgae were inoculated into a blue-green 11 medium with different concentrations of UMO as carbon source. The obtained results indicated that microalgae grown in 5 % UMO yielded the maximum lipid content compared to the control and other treatments. TiO_2 was selected as heterogeneous catalyst to examine the fatty acid methyl ester profile of the obtained lipid. The biodegradation of UMO by two different microalgae was also evaluated using GC-MS analysis.

Keywords: Biodegradation, Biodiesel production, Heterogeneous catalyst, Microalgae, Used motor oil

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Supporting Information available online

1 Introduction

In the last five decennia, the researchers addressed the issue to remediate the toxic pollutants which are released from various industries into the soil [1, 2]. The yearly discharge of used engine oil is estimated at 25–28 million tons. Especially, the motor oil expelled out from different automobiles and machines into the environment causes several consequences by releasing hydrocarbons which impose serious threats to the ecosystem [3]. On the other hand, the used motor oil (UMO) discharged into soil creates an insufficient oxygen supply by blocking the pores that could affect the nitrogen cycle of aerobic microorganisms [4], reduces the soil pH, and arrests the transfer of the nutrients that may further end up with forming infertile farmlands [5]. Furthermore, the UMO contains dangerous/toxic contaminants like carcinogenic hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and toxic heavy metals such as Cu, Cr, Pb, Ni, and Cd [4].

So far, several outlooks on remediating toxic pollutants with chemical and physical methods have been reported but still there is an immense need for restoring the contaminated soils and other environments with cost-effective, efficient, and reliable methods [2]. Thus, research interest in remediating this massive crude oil pollution mostly found in the marine environment has gained wide attention, but exclusive research on this direction is scarce. Thus, this foresaid issue can be rectified by demonstrating various kinds of methods or technologies and employing diverse microbes including microalgae.

Generally, the versatile microalgae have the potential to grow in various adverse environments. Many isolates of microalgae can undergo heterotrophic growth by utilizing organic carbon sources [6] which is the major reason for their potential to deteriorate organic pollutants. Furthermore, it has been dexterously discussed that both micro- and macroalgae proved to be effective in heavy metal adsorption and degradation of xenobiotics [7]. Interestingly, the marine red alga *Portieria hornemannii* has the potential to eradicate trinitrotoluene (TNT) present in seawater [8, 9]. In another study, *Chlamydomonas reinhardtii,* a green microalga, can absorb and remove the herbicide prometryne up to 66 % in the aquatic system [10]. *Prototheca zopfi* was reported for its capability to utilize crude oil and different hydrocarbons as an additional substrate for growth. Further, it exhibited an efficient degradation of both *n*-alkanes, isoalkanes, and aromatic hydrocarbons [11].

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Improvement of fuel properties of used palm oil derived biodiesel with butyl ferulate as an additive

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ABSTRACT

The present study addresses the significant utility of Used Palm oil Methyl Ester (UPOME) and enhancing the capabilities by adding butyl ferulate. This phenolic antioxidant ester was synthesized using *Rhizopus nevius* lipase immobilised onto cuttlebone. The butyl ferulate synthesis was monitored in RP-HPLC and confirmed via GC-MS. Concurrently, UPOME was prepared using KOH as the catalyst from the used palm oil. The UPOME was fortified with ferulic acid and butyl ferulate, separately at various concentrations and subjected to thermal oxidation at 110 °C. Biodiesel prepared were estimated for oxidative stability by pattern variations deciphered from the excitation-emission matrix profile. Similarly, the induction period (IP) of the prepared biodiesels was analysed in Rancimate. The addition of the butyl ferulate at 600 ppm in UPOME was able to reduce 80% of the hydroperoxide formation whereas the free ferulic acid showed Stokes shift at the same condition and concentration. Comparatively, 3.5 fold escalation in IP was observed in UPOME with 1000 ppm butyl ferulate than the free ferulic acid. Emission characteristics depicted a significant reduction in NO_x (4.7%), CO (27.8%), CO_2 (8.3%) and Unburned Hydrocarbons (5.7%) when fuelled B20 with 1000 ppm BF in Compression Ignition engine.

1. Introduction

Energy depletion and the high rise of prices for fossil fuels emancipate the dire need for alternative renewable energy resources. Biofuel research has witnessed ultimate momentum globally in discovery and application perspectives from a variety of resources. Several advancements in biodiesel production have been undertaken by Researchers worldwide for sustainable development in the field of biofuel production. Nevertheless, the utilization of available fossil fuels contributes to enormous amounts of Air pollution, accumulation of Green House Gases (GHG's) and necessitates Environmental Impact Assessment (EIA) on a large scale [1]. Combustion of fossil fuels results in the primary culmination of obnoxious discharge of nitrogen oxides (NOx), carbon monoxide (CO), Volatile Organic Oxides (VOCs) [2], methane (CH_4) emissions and sulphur dioxide (SO_2) emissions due to coal combustion [3]. Kyoto protocol also emphasizes large scale applications of biofuel in addressing environmental menace due to fossil fuel usage [4]. The above-said limitations can be curbed by biodiesel because, plethora of advantages comprising renewability, excellent lubrication capabilities and reduced emissions of carbon monoxide (CO), hydrocarbons (HC) and other particulate matter (PM) in comparison with conventional fossil fuels [5]. However, biodiesel combustion increases NO_x emission into the atmosphere. Fuel composition, injection timing, ignition delay, adiabatic flame temperature and radiative heat loss are the factors that affect NO_x emission. At high temperatures inside the combustion chamber, N and O react by Zeldovich mechanism to form NO_x. In some cases, if the fuel contains nitrogen from detergents or dispersants in high concentrations, it may react to form NO_x [6]. Although several flaws have been proposed in biodiesel, factors hampering the practical applications are rectified by several means.

Sources employed for Biodiesel production have been accomplished through a variety of organisms. One of the successful

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A comprehensive review of the selection of natural and synthetic antioxidants to enhance the oxidative stability of biodiesel

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Antioxidants
Auto oxidation
Rancimat method
Principle compound analysis (PCA)

ABSTRACT

Achievement of sustainable development goals emphasizes alternative fuel strategies posing biodiesel production from plant and animal matter stressing long-chain fatty acid esters. Biodiesel production from renewable energy sources are largely preferred owing to its environment friendly and cost effective economic benefits. Nevertheless several limitations hurdle the efficiency of harnessing the maximal usage render the complexities to be rectified for advancing efficacy of biodiesel. Major issue posing severe hazard can be attributed to the ageing process namely oxidation that positively influence the engine performance and negatively alters storage capabilities. Chemical reactions after iterative chain modifications result in free radicals accumulation ameliorating ease of use in biodiesel. Hence, oxidative stability remains the prominent mechanism for enhancing the compatibility of biodiesel employing suitable antioxidants either natural or synthetic for optimally arresting the chain reactions thereby abating culmination of free radicals. The aim of this review was to analyze and compare the crucial role of natural and synthetic antioxidants in preventing the ageing process of biodiesel. Comparative analysis of the antioxidants that significantly escalates oxidative stability of biodiesel over the last two decades are assessed along with the strategic methodology are scrutinized for apprehending biodiesel stability subsequently based on oxidative stability.

1. Introduction

The advent of the ever-increasing population poses renewable energy sources like biodiesel than fossil fuels owing to enhanced lubrication and reduction of Green House Gases (GHG's) [1]. Energy security and economic advantage are the major benefits of biodiesel's potential benefits [2]. Furthermore, reduced emissions of carbon monoxide, hydrocarbons and particulate matter into the atmosphere render biodiesel the best alternative to conventional fossil fuels [3]. The optimal advantages of using biodiesel can be attributed to the non-toxic nature and ease of production employing simple chemical processes from a plethora of sources like edible oil, non-edible oil, waste cooking oil, animal fat oil, microbial oil and algal oil. Biodiesel production depends on local lipid feedstock availability, regional climate, and geographic location.

A wide variety of comprehensive methodologies have been advocated for biodiesel production. Among these significant protocols include the supercritical fluid method, emulsification, pyrolysis, and *trans*-esterification. Transesterification remains the superior method as evident from its simplicity and efficiency [4]. Principally, Homogeneous, base catalysts, like NaOH or KOH, are utilized for catalysis of the transesterification process [5]. Subsequently, as a result of the transesterification process, glycerol is generated along with biodiesel as a by-product [6].

A plethora of optimal assets is confined to biodiesel as evident from copious research perspectives globally. Nevertheless, commercialization faces applicability drawbacks. Precisely maintenance of fuel compatibility or storage capacity at specific standards necessitates dire attention to combat the issue of oxidation stability. Rancidity of biodiesel occurs

Abbreviations: Antioxidant, AO; Bond Dissociation Energy, BDE; Butylatedhydroxyanisole, BHA; Butylatedhydroxytoluene, BHT; Differential Thermal Analysis, DTA; Ditert-butylhydroquinone, DBHQ; Excitation Emission Matrix, EEM; Free Fatty Acid, FFA; Induction period, IP; N,N0- diphenyl-p-phenylenediamine, DPD; Nitrogen oxides, NOx; Principal component analysis, PCA; Propyl Gallate, PG; Pyrogallol, PY; Tert-butylhydroquinone, TBHQ; Thermo Gravimetric Analysis, TGA; Topological polar surface area, TPSA; Tert-butylated phenol derivative, TBP; Octylatedbutylated diphenylamine, OBPA.

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Theoretical investigation of structure, anticancer activity and molecular docking of thiourea derivatives

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ABSTRACT

Quantum chemical computations and *in silico* biological evaluation of three substituted thiourea derivatives namely (4-nitrophenyl)thiourea (NPT), (3,5-dimethylphenyl) thiourea (DMPT) and 1,3-di-o-tolylthiourea (DTTU) are described in this study. Spectroscopic properties and vibrational analysis of these derivatives have been characterized experimentally through Fourier transform infrared (FT-IR) and Fourier transform Raman (FT-Raman) spectral techniques and theoretically using density functional theory (DFT) method employing B3LYP functional implemented with the 6-311++G(d,p) basis set. Electronic properties such as molecular electrostatic potential (MEP) and HOMO–LUMO analysis were executed to identify the most reactive site and also to identify the charge transfer takes place within the molecules. Besides, the natural bond orbital (NBO) analysis was carried out to explain the delocalization of charge takes place within the molecule due to intramolecular interactions. Molecular docking and molecular dynamics simulation studies verified the inhibitory nature of the title compounds against BRAF (V600E) protein kinase. Assessment of ADMET properties along with the drug-likeness parameter has exposed good drug-like behaviour of the title compounds. Furthermore, through *in silico* approaches, the thiourea derivatives under study were evaluated for their antineoplastic activity and were shown to possess potential anticancer activity.

1. Introduction

Cancer is one of the more serious diseases, which leads to a large percent death in the world. In the last decade, a wide range of novel agents have been emerged as potential anti-cancer agents. Thiourea plays a vital role among them. Thiourea derivatives have considerable applications in agriculture, gold leaching process, analytical chemistry and medicine [1–3]. Compounds having thiourea scaffold hold a wide spectrum of biological activities such as anticancer, anti-thyroid, antimalarial, antifungal, antiviral, antimicrobial, antioxidant, anti-allergic, anti-inflammatory, anti-epileptic, anti-leishmanial and anti-hypertensive activities [3–5]. The thiourea pharmacophore acquires specific binding sites such as hydrogen binding area (NH), complementary area (S) and auxiliary binding area (1,3-substituents) [4]. The introduction of thiourea linker adds flexibility between the ring systems thereby promote the anticancer activity of the drug against a series of cancer cell lines including breast, head-neck, lung, renal, colon and ovarian cancers [6–10]. Moreover, thiourea could strongly enhance blocking since sulfur is a weak hydrogen bond acceptor, and simultaneously it could improve hydrogen-bonding because of the bidentate binding mode of the thiourea protons [11]. The recent evolution of the anticancer activity of thiourea derivatives has influenced many pharmacologists to design and synthesize new thiourea derivatives.

Thiourea derivatives comprising sulfur and nitrogen atoms play a prominent role in drug research. It could be hypothesized that the thiourea scaffold holding N and S electron donors could exhibit potent aromatase inhibitory activity. The aromatase enzyme activity inhibition is considered to be a selective approach to decrease the amount of estrogen production [12]. Because of this inhibitory activity, it plays a prominent role in healing breast can-

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0022-2860/

ASSAY and Drug Development Technologies, Vol. 19, No. 5 | Original Articles

Screening of Atherosclerotic Druggable Targets from the Proteome Network of Differentially Expressed Genes

Subramaniyan Manibalan, Allan Blessing Harison Raj, and Anant Achary

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Abstract

Differently expressed genes of atherosclerotic sample analysis are helpful to sort the prominent genes that influence the plaque formation and progression. Scientific evidence-based protein–protein interaction network (PPIN) studies were used to find hub proteins in complex disease conditions. Druggable capacity is one of the important parameters to confirm as a successful drug target. Construction of protein interaction network and principal node analysis (PNA) on atherosclerotic data sets lead to screen the hub proteins. Furthermore, druggable property of protein pocket confirms the targetability of susceptible target candidates and for target selection. Differentially expressed genes are identified through GEO2R analyzer on data sets of various atherosclerotic samples. STRING database and Cytoscape are employed to construct PPIN. Targets were identified by PNA such as centrality measures and clustering algorithm. Gene Ontology enrichment also used as one of

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Full Length Article

Transesterification kinetics of waste cooking oil and its diesel engine performance

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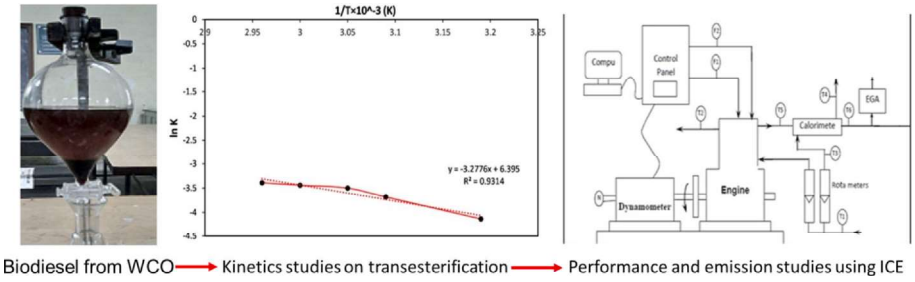
GRAPHICAL ABSTRACT



ARTICLE INFO

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Activation energy
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ABSTRACT

Biodiesel is one of the renewable forms of energy and waste cooking oil (WCO) serves as an effective source to produce biodiesel through the process of transesterification. Kinetic studies on such chemical reactions help in scaling up the process, simulation studies including designing of reactors. In the present study, waste cooking oil was subjected to conventional transesterification process catalyzed by methanol and 1% (w/v) catalyst sodium hydroxide under different temperatures (40–65 °C). Methanol-oil was taken in the ratio 6:1 and maximum yield of biodiesel obtained was found to be 90% at 60 °C. The activation energy E_a of transesterification reaction of WCO to biodiesel was calculated and found to be 27.24 kJ/mol. A linear Arrhenius plot and high value of R^2 confirmed the irreversible pseudo-second order of the reaction. The biodiesel was characterized for various fuel properties such as calorific value, ash content and cetane number. Engine testing using lab scale internal combustion engine (ICE) revealed an increase in power output with lower fuel consumption with reduction of CO, CO_2, NOx, HC emission. Hence this study concluded that the WCO could be a potential feedstock to produce biodiesel.

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ORIGINAL PAPER

Extraction of Polymeric Bioflocculant from *Enterobacter* sp. and Adsorptive Kinetic Studies on Industrial Dye Removal Applications

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Abstract

Microbial polymeric flocculants are used as eco-friendly biosorbent materials in industrial dye removal. This study attempts to evaluate the dye adsorption efficiency of a bioflocculant extracted from a soil bacterium, *Enterobacter* sp. The chemical composition of the bioflocculant is 88% carbohydrate and 11% protein. The flocculation efficiency of the extracted compound against kaolin was found to be 86.2%. Batch adsorption, kinetic, and isotherm studies were performed with the bioflocculant (biosorbent) in the removal of the cationic dye, malachite green. The adsorption efficiency of the bioflocculant was confirmed by SEM/EDX and FTIR studies. From the morphological images, it was inferred that the bioflocculant has a rough surface that is suitable for dye adsorption. The efficiency of adsorption of the dye was evaluated by various isotherms (Langmuir, Freundlich, and Temkin) and the adsorption found to follow the Langmuir isotherm ($R^2 = 0.96$). The adsorption was evaluated using pseudo-first-order and pseudo-second-order ($R^2 = 0.99$) kinetics and the Weber–Morris model. The rate of reaction in terms of maximum adsorption capacity was found to be 384.6 mg g^{-1}. Experimental results confirmed the suitability of the bacterial-secreted bioflocculant for industrial dye removal applications.

Keywords *Enterobacter* sp. · Malachite green · Characterization · Biosorption · Isotherm · Kinetics

Nomenclature

A	Optical density value of control
B	Optical density value of sample
T	Time (min)
C_o	Initial adsorbate concentration (mg L^{-1})
C_t	Adsorbate concentration at time t (mg L^{-1})
C_e	Adsorbate concentration at equilibrium (mg L^{-1})
q_t	Amount of dye adsorbed by biosorbent at time t (mg g^{-1})
q_e	Amount of dye adsorbed by biosorbent at equilibrium (mg g^{-1})
q_m	Maximum adsorption capacity corresponding to complete monolayer adsorption (mg g^{-1})
M	Weight of biosorbent (g)
V	Volume of adsorbate (mL)
K_F	Adsorption equilibrium constant of Freundlich adsorption isotherm (mg g^{-1} (g L^{-1})$^{1/n}$)
1/n	Heterogeneity factor (g L^{-1})
K_L	Adsorption equilibrium constant of Langmuir isotherm (L mg^{-1})
R_L	Separation factor
K_t	Equilibrium binding constant corresponding to maximum binding energy (L mg^{-1})

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Review article

Can human overcome viral hijack-? Comprehensive review on COVID-19 in the view of diagnosis and mitigation across countries

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ABSTRACT

The novel COVID-19, a pandemic disease, is showing an alarming spread and severity throughout the world. Globally, the community transmission of this disease is affecting people in large clusters and so it is necessary to mitigate and control them in order to minimise the social and economic consequences. This review emphasize on the origin of the coronoviral epidemics, discussion on the structural and functional basis of SARS-CoV-2, epidemiology, pathognomonic symptoms, fatality, available rapid diagnostic methods and proposed possible treatment methods for the treatment of COVID-19. The diagnostic markers with respect to genetic material of the virus based on PCR, CRISPR & APTAMER and with respect to proteins based on Antigens were discussed which provides new arena for the development. In control of a pandemic situation the policy adoption and implementation by the governments plays a major role and the policy implementation in different countries are discussed which establishes the effectiveness of the policies framed by the governments. The effectiveness of ethnic traditional medicines of various countries such as India and China in Immunity enhancement, along with their utilisation is also discussed. This review provides an insights towards the COVID-19 which helps in continuous investigation on different dimensions which could help us to understand the mysteries behind the havoc created by this invisible creature.

1. Introduction

A recent viral outbreak, COVID-19 (Coronavirus Disease-2019) is a serious concern in terms of global health as well as global economy. Though there are many drugs which subsides the symptoms of this disease, as of now there is no specific established medicine to treat COVID-19. Generally, viral infections are difficult to treat, as the viruses unlike other pathogens, hijack the host cells and use the host cell machinery to replicate and multiply themselves. Hence, it is difficult to discover a drug that specifically attacks the viruses without harming the host cells. Inspite of the above said risk, many possible methods were also proposed to treat the lethal coronaviral infections. Coronaviruses are a group of viruses that belong to the subfamily Orthocoronavirinae in the family Coronaviridae. They are enveloped viruses with positive sense, RNA genome of size approximately 30 kb. The first human coronaviruses were reported in 1965 by Tyrrell and Bynoe [1]. These viruses are known to cause mild to severe upper and lower tract respiratory diseases in humans and are also known to cause diseases in other mammals and birds. Among the four genera of the Coronaviruses (α, β, γ, δ), β Coronaviruses are known to cause severe respiratory diseases in humans. Two β coronaviruses SARS-CoV and MERS-CoV were already caused epidemics in 2003 and 2012 respectively. The total reported cases in SARS-CoV infection which caused Severe Acute Respiratory Syndrome was about 8096 and 774 associated deaths were reported in

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ORIGINAL ARTICLE

Antimicrobial activity of green synthesized biodegradable alginate–silver (Alg-Ag) nanocomposite films against selected foodborne pathogens

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Abstract
In the recent past, the nanobiotechnology field has grown up tremendously with more applications because the synthesis process will be more practically possible techniques. Since, plant-derived biosynthesis of silver nanoparticles is superior since its eco-friendly, cost-efficient, speedy process in nature. Alginate-based eco-friendly, biodegradable nanocomposite films were prepared with *Celosia cristata* leaf extracts silver nanoparticles (CC-AgNPs) and sodium alginate by simple casting techniques. The synthesized alginate–silver (Alg-Ag) nanocomposite films were characterized and confirmed by UV/Vis spectroscopy, Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), thermogravimetric analysis (TGA) and atomic force microscopy (AFM). The various characterization process was further confirmed synthesized CC-AgNPs and Alg-Ag nanocomposite films. In addition, TEM and SEM monogram also showed uniformity and smooth surface of Alg-Ag nanocomposite films. The nanocomposite films displayed effective antimicrobial proficiency against selected foodborne pathogens i.e., *Staphylococcus aureus*, *Salmonella typhimurium* and *Clostridium perfringens*. Further, the Alg-Ag nanocomposite films resolve and eliminate the microbial intruders and enhance food stuff's quality and storage stability.

Keywords Green synthesis · Alg-Ag nanocomposite · Antimicrobial activity · Foodborne pathogens · Nanoparticles

Introduction

For the past few years, biopolymer-based nanocomposites have more attention in the food packaging field for their physical, mechanical, biodegradable properties. The nanocomposite films act as a dynamic food packing material because of their antimicrobial properties. These nanocomposite films resolve and eliminate the microbial intruders and enhance the quality and storage stability of foodstuffs (Gutt and Amariei 2020). In recent times, consumer needs for fresh foods have encouraged the scientist to establish the new techniques for improving the food quality through packaging systems.

Maintaining the quality of food is a major concern in food processing industries (Devlieghere et al. 2004). This antimicrobial system is possessed by the incorporation of nanoparticles. Among many metallic nanoparticles, silver has the most favorable antimicrobial function than other nanoparticles. Amongst several approaches for silver nanoparticles synthesis, the environment-friendly biosynthesis method was found to be "cost-effective, environment friendly and it can be simply scaled up for large scale synthesis" (Roy et al. 2019; Erdogan et al. 2019). Moreover, natural living materials such as plants (Masum et al. 2019; Pannerselvam et al. 2020; Govindappa et al. 2021), bacteria

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Research Article

In silico approach for enhancing innate lipid content of *Yarrowia lipolytica*, by blocking the acyl-CoA oxidase-1 enzyme, using various analogous compounds of lipids

M.A. Sundaramahalingam, C. Amrutha, J. Rajeshbanu, K. Thirukumaran, S. Manibalan, Muthupandian Ashokkumar & P. Sivashanmugam ✉

...show less

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Abstract

Yarrowia lipolytica is used as a model in this study to screen the potential candidates for inflating the innate lipid content of the cell. This study focuses on reducing the lipid degradation that occurs by the β-oxidation process and discursively increasing the innate lipid content. Acyl-CoA oxidase-1, the primary and initial enzyme involved in the lipid degradation pathway, was selected as a target and blocked using various lipid

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A New Natural Cellulosic Pigeon Pea (*Cajanus cajan*) Pod Fiber Characterization for Bio-degradable Polymeric Composites

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ABSTRACT

High performance natural cellulosic fiber can contribute to fiber-reinforced polymer composites or as organic fillers through replacement of the synthetic or man-made fibers. The natural fibers extracted from various parts of plant sources provides healthy and sustainable environment. Hence, the present work aimed to identify agro-residues of *Cajanus cajan* pod could be converted as organic filler through its intrinsic characters. The physico-chemical, morphology and anatomy, structural and thermal properties of *C. cajan* pod fibers are characterized by chemical analysis, scanning electron microscopy, X-ray diffraction, Fourier transform infrared spectroscopy and thermogravimetric analysis. The physico-chemical properties of the pod fiber were determined as 59.15% of cellulose, 10.43% of hemi cellulose, 21.59% of lignin, 0.49% of wax, 3.05% of ash, and 5.29% of moisture content. The boundary of single fiber showed about 100 µm diameter. The thermal resistance of the pod fiber showed up to 274°C, will make it better performance. Thus, fiber from *C. cajan* pod would be better alternative for synthetic fibers and preferable reinforcement for bio-degradable polymeric composites.

摘要

高性能天然纤维素纤维可以替代合成纤维或人造纤维，成为纤维增强聚合物复合材料或有机填料从植物来源的不同部位提取的天然纤维提供了健康和可持续的环境因此，本研究旨在通过Cajanus cajan -pod的内在特性将其转化为有机填料采用化学分析、扫描电镜、X射线衍射、傅立叶变换红外光谱和热重分析等方法对Cajanus cajan -pod纤维的物理化学、形态解剖、结构和热性能进行了表征纤维的理化性质为：纤维素59.15%，半纤维素10.43%，木质素21.59%，蜡0.49%，灰分3.05%，水分5.29%单根纤维的边界直径约为100µmpod纤维的耐热性高达274℃，将使其具有更好的性能因此，CCC -pod纤维是合成纤维的较好替代物，是生物降解高分子复合材料的较好增强体.

KEYWORDS

Cellulosic fibers; agro waste; *Cajanus cajan*; SEM; TGA; FTIR

关键词

纤维素纤维; 农业废弃物

Introduction

Contemporary development represents the replacement of synthetic fibers such as glass, Kevlar and aramid fibers are not biocompatible and toxic in nature. Natural fibers extracted from plant sources

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/wjnf.

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Improvising the efficiency of single-sloped solar still using thermally conductive nano-ferric oxide

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Abstract
The world is facing a severe shortage of freshwater, and so we are in urge to fetch new technologies to resolve water scarcity. To desalinate saline water, the single-sloped solar still (SSSS) has proven to be a viable option with much affordability. This research work concentrates on the usage of nanomaterial on the absorbent layer to improve the thermal conductivity of the basin area and thus the distillate produced per hour. The micro-coated and nano-Fe_2O_3 particles were employed and analyzed. The experiment proved that the implementation of this idea had a better productivity rate. The nanoparticles and microparticles were added at weight proportions of 10%. The experiment was conducted on two consecutive days. On the first day, the saline water was maintained at 0.5 cm depth, while on the next day, the saline water level was maintained at 1 cm. The cumulative yield for micro absorbent layer solar still (MALSS) was 3.23 kg/m^2 and nanoabsorbent layer solar still (NALSS) was 4.39 kg/m^2.

Keywords Single-sloped solar still · Nano · Ferric oxide · Desalination · Thermal conductive coating · Absorbent layer

Abbreviations

SSSS	Single-sloped solar still
CSS	Conventional solar still
MALSS	Micro absorbent layer solar still
NALSS	Nanoabsorbent layer solar still
TDS	Total dissolved solids
RPM	Revolutions per minute

Nomenclature

T_a	Ambient temperature (°C)
G	Irradiance (W/m^2)
V_a	Wind speed (m/s)
T_w	Basin water temperature (°C)
T_g	Glass cover temperature (°C)
m_{ew}	Hourly productivity from a solar still (kg/m^2 h)
L_{fg}	Latent heat of vaporization (kJ/kg K)
η_{th}	Thermal efficiency (%)
h	Heat transfer coefficient (W/m^2 K)
I_s (t)	Solar intensity (W/m^2)
g	Glass
s	Sun
A	Area (m^2)

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Introduction

The production of solar still was examined in accordance with the climatic and operating conditions pertaining to the research location. The major climate conditions comprise of wind velocity, incident irradiation of solar, and the ambient temperature. The operating condition comprises of water depth, insulation, and the contrast between the glass cover and thermal insulations (Xiao et al. 2013, Balachandran et al. 2019). A review was presented based on the obtainable results for the survey of heat transfer of nanofluids (Mahian et al. 2017). Based on the important results in the scientific community for conduction, convection, and radiation in

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Electrical Engineering
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ORIGINAL PAPER

Design and development of Truncated Angle Variant (TAV) controller for multi-source-fed BLDC motor drive

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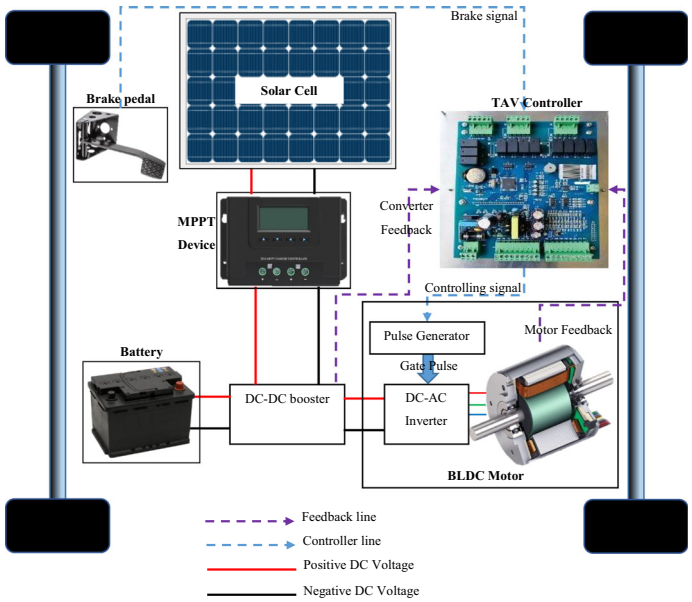
Received: 22 November 2019 / Accepted: 17 April 2020

Abstract

In electric vehicles (EVs), the major role of BLDC motor is controlling the speed of a vehicle and effective breaking. This can be achieved by reducing the torque and managing the current flow in the motor. In recent researches, current-controlling methods in BLDC give the better way in controlling the speed of a motor. This research work focuses on the design of the speed control system. In this, EV is run by the battery connected with the photovoltaic (PV) system. The proposed work optimally controls the switching devices to manage power for BLDC motor. This extracts the properties of PV system with feedback signals of the bidirectional converter and motor terminals to evaluate the energy transfer level to EV. This can also reduce the decaying effect of battery, which is connected parallel to the converter. Since the proposed controller truncates the error signal with varying angle of vector quadrant named as Truncated Angle Variant (TAV) controller, this can also monitor the accelerator frequency that refers to the required speed of the BLDC motor. The experimental result shows the performance of proposed TAV-based controlling technique and the comparison of parameters with state-of-the-art methods is also made.

Graphic abstract



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Experimental studies on passive inclined solar panel absorber solar still

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Abstract
This manuscript aims to analyze the passive inclined solar panel basin (PISPB) still at diversified flow rate of water (m_f). The freshwater collected from the solar still for different m_f at 4.68, 7.56 and 10.08 kg h^{-1} is 3.7, 2.7 and 1.6 kg, respectively. Results showed that at higher flow condition, the still energy and exergy efficiency decreases and it is estimated as 36.06, 25.56 and 16.95% and 2.97, 1.91 and 1.01%, respectively, for flow rates of 4.68, 7.56 and 10.08 kg h^{-1}. Results revealed that electrical, thermal and exergy efficiency of photovoltaic panel increases under higher flow condition and it is found as 8.05, 8.81 and 9.44%, 11.43, 20.8 and 22.17 and 19.38, 20.58 and 21.16% for mass flow rates of (m_f) 4.68, 7.56 and 10.08 kg h^{-1}, respectively. When the m_f increases, there is a decrease in the PISPB still distilled water production rate, thermal and exergy efficiency, and there is an increase in power production, electrical, thermal and exergy efficiency through the photovoltaic panel.

Keywords Passive solar still · Mass flow rates · Enhancement · Electrical efficiency · Thermal efficiency

Abbreviations

CSS	Conventional solar still
CHTC	Convective heat transfer coefficient
EHTC	Evaporative heat transfer coefficient
ISPB	Inclined solar panel basin
PSS	Pyramid solar still
PV	Photovoltaic
SSS	Stepped solar still

List of symbols

A	Area (m^2)
h	Heat transfer coefficient (W m^{-2} K^{-2})
I	Current (A)
$I(t)$	Solar intensity (W m^{-2})
L	Latent heat of vaporization (kJ kg^{-1} K^{-1})
M	Hourly productivity from solar still (kg m^{-2} h^{-1})
P	Partial vapor pressure (N m^{-2})
T	Temperature (°C)
V	Voltage (V)

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Design of Sustainable PV Module for Efficient Power Generation During Faults

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***Abstract*—The design of a sustainable photovoltaic (PV) module with advantages of high power output during faulty and hot-spot conditions is presented. This PV module is designed by incorporating a small modification in the existing PV modules. The cost involved in modification is negligible during the initial fabrication process. In a commercial market, all PV modules have only one junction box that contains terminals from various strings. Bypass diodes and output cables are connected with these terminals in the junction box. In the existing PV module, two substrings are connected in series, and its output terminals are given to the junction box. The proposed PV module has two junction boxes: one at the top and another at the bottom. The top box has top-end terminals of each substring, whereas the bottom box has bottom-end terminals of each substring. By having two junction boxes, the proposed PV module provides an opportunity to remodify the string connections during fault conditions. This research work analyzed the performance of existing and proposed PV modules under faulty and hot-spot conditions. This analysis verifies the sustainable nature of the proposed PV module.**

***Index Terms*—Fault analysis, module design, photovoltaic (PV), power enhancement.**

I. Introduction

SOLAR photovoltaic (PV) is an emerging alternative source of energy. The PV modules are made by interconnecting the strings in series as well as parallel. The different types of PV cell technologies are polycrystalline, monocrystalline, and amorphous solar. In commercial markets, for the panel wattage higher than 200 W, three-string structures are used [1]. The present PV module structure has only one junction box. This junction box has string terminals. The strings are connected in series with a bypass diode across it. The main problem in the present solar PV module is that the fault in any cell of a string can affect the entire power generation of the string [2], [3]. Faults such as crack, hot spot, and partial shading are the most important problems that are frequently occurring in many of the PV modules. These faults can be identified easily by thermal imaging techniques [4], [5]. Some faults can be rectified, and for some other faults, module has to be replaced. The present PV module structure does not produce sustainable power during faulty conditions. The proposed PV module structure can deliver sustainable power under faulty conditions.

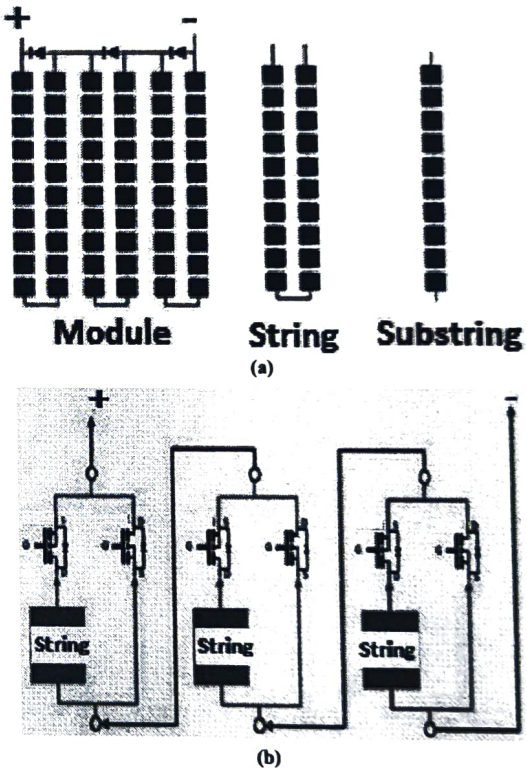

Fig. 1. (a) Structure of strings and substrings in the existing PV module. (b) Hot-spot reduction circuit for the existing PV module [1].

II. Description of Existing PV Module

The existing PV module has three strings that are connected in series. The structure diagram is shown in Fig. 1.

Across every string, a bypass diode is connected to overcome the power limitation caused by faults. During faults, these diodes bypass the current generated from the nonfaulty strings. Fig. 2(a) shows the design structure of the existing PV module, which has one junction box. In that, six leads from all the strings are present. The diodes are connected across the leads of each string. Changing the bypass diodes is the one and only possibility to repair the PV module during faulty conditions.

Fig. 1(b) shows the hot-spot reduction circuit that can be integrated with the PV module to reduce hot spots and enhance

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RESEARCH ARTICLE

Enhancement of PV/T-integrated single slope solar desalination still productivity using water film cooling and hybrid composite insulation

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Abstract
This context is about enhancing the freshwater production of a single slope solar desalination still (SSSDS) using water film cooling over the glass cover and using hybrid natural fibre composite (HNFC) insulation. In contrast to the conventional insulations, we proposed the HNFC insulation; this composite was made of natural fibre *Pharsalus vulgaris* (6 %) and nano-silica (1 %) with unsaturated polyester resin. In this study, conventional SSSDS and proposed SSSDS with enhanced evaporation and condensation have been designed. The same was built with native materials. A conventional and proposed type SSSDS was subjected to the same experimental condition. The experimental result showed that using water film cooling over glass cover and HNFC insulation at 0.5 cm depth caused a 35% increase in the amount of distilled water when compared with the conventional type SSSDS with polystyrene—Styrofoam (thermocol) insulation. Water film cooling over glass cover and HNFC insulation at 1 cm depth caused a 21% increase in the amount of distilled water when compared with the conventional type SSSDS with thermocol insulation. The conventional type solar desalination still with thermocol insulation at 0.5 and 1 cm depth yields are 1.665 and 1.171 l/m^2/day, respectively, and the proposed solar desalination still with water film cooling over glass cover and HNFC insulation at 0.5 and 1 cm depth yields are 2.253 and 1.420 l/m^2/day, respectively.

Keywords Single slope solar desalination still · Hybrid natural fibre composite · Nano-silica · Thermal insulation · PV/T integrated still · Glass cover cooling

Abbreviations

SSSDS	Single slope solar desalination still
SDS	solar desalination still
HNFC	Hybrid natural fibre composite
PV/T	Photovoltaic/thermal
UP	Unsaturated polyester (resin)
PVF	*Pharsalus vulgaris* fibre
SiO_2	Silicon dioxide (nano)
CSDS-0.5 cm	Conventional solar desalination still at 0.5-cm depth
PSDS-0.5 cm	Proposed solar desalination still at 0.5-cm depth
CSDS-1 cm	Conventional solar desalination still at 1-cm depth
PSDS-1 cm	Proposed solar desalination still at 1-cm depth

Nomenclature

T_a	Ambient temperature (°C)
G	Irradiance (W/m^2)
V_a	Wind speed (m/s)
T_w	Water temperature (°C)
T_g	Glass temperature (°C)
L	Latent heat of vaporization (kJ/kg K)

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Published online: 23 August 2019

A Comprehensive Review On Electric Vehicles

A.Karthikeyan, Dr. S. Vijayarajan

Abstract: Electric vehicles (EVs) are winding up progressively prominent in numerous nations of the world. EVs are demonstrating more energy effective and ecological well-disposed than ICEVs. Be that as it may, the absence of charging stations confines the wide appropriation of EVs on the planet. As EV use develops, progressively open spaces are introducing EV charging stations. Then again, if EVs are charged by means of existing utility framework controlled by petroleum derivative based age framework, at that point it influences the dissemination framework and couldn't be earth well disposed. As solar has great potential to generate the electricity from the PV panel, the charging of EVs from PV panels would be a great solution and also a sustainable step toward the environment. This paper presents a comprehensive analysis of solar PV-EV charging systems and deployment in the world. Analytical methods were proposed to obtain information about EV charging behavior, modes of charging station operation, and geolocation of charging station users. The methodology presented here was time- and cost-effective, and very helpful to the researchers and students in this field.

INTRODUCTION

Sustainable power source bolster plans have been broadly created in numerous nations lately in view of the natural concern increment and vitality security dangers [1]. As an outcome, huge quantities of sustainable power source assets are incorporated in power frameworks, which give new difficulties and chances to the activity and the arranging of lattices. These days, sustainable power source assets close by customary generators give various sorts of intensity framework subordinate administrations, e.g., frequency control [2]. Frequency control expects to keep the dynamic power balance between all-out power age and the power request in the power framework so that the framework frequency stays in a worthy range [3]. The Plug-in Electric Vehicle (PEV) innovation is one of the circulated vitality advances that has been progressively sent. Their ability to put away vitality and quick dynamic power controllability make them alluring, particularly for the arrangement of Primary Frequency Control (PFC) in island and network associated frameworks [4]–[6]. A few qualities of PEV armada like the sort of the frequency controller, the infiltration dimension of PEVs in the framework, and the battery charger topology impact the interest of PEVs in the PFC. The impact of these elements on the PFC reaction of PEVs has been assessed in the writing [5]–[11]. Concerning the sort of the frequency controller, the easiest control approach is the abrupt separation of all PEVs from the power framework following a huge unsettling influence in the framework [7]. Be that as it may, this control approach can result in undesired over frequency reactions, when the disengaged intensity of PEVs is more than the power unevenness in the framework. As a substitute, a straightforward consistent hang trademark with dead-band capacity can be decentrally utilized in each PEV to cause it to react to frequency changes inside 10 s to 30 s [8].

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The steady hang control execution has brought about the improvement of the base transient frequency and the frequency recuperation term, which keeps going a few minutes [5], [8]. For a more drawn out timeframe, e.g., a few hours, PEV can consistently take an interest in PFC this may influence the charging calendar of PEVs, and as a result, the vitality of the PEV's battery differs. In this way in [9], a decentralized Vehicle to Grid (V2G) control has been created to at the same time control the PEV's charging plan and the framework frequency. In this control, the hang coefficient is balanced by the vitality of the PEV's battery. Notwithstanding the hanging control [10], a subsidiary controller can be added to PFC of PEVs that imitates the virtual inertial reaction, which has improved further frequency reaction of an island arrange. The PFC support from PEVs increases if their infiltration level in the power framework increments. Inside the power arrangement of Great Britain, huge quantities of PEVs are recreated to take part in PFC constantly of 2020, and thus, the framework frequency is improved in [7]. In an island framework, which is completely entered by PEVs and inexhaustible assets, PEV armada reaction has stifled frequency deviations [8]. Moreover, this can encourage amplifying the breeze ranches mix by smothering frequency deviations in power frameworks [11]. Concerning the battery charger topology, a PEV outfitted with the Bidirectional Battery Charger (BBC) gives more essential hold than a PEV with the Unidirectional Battery Charger (UBC) [7]. Since the topology of the BBC permits that the battery vitality is infused back to the framework.

Electric vehicle configuration

There are commonly two acknowledged essential arrangements for HEVs including arrangement and parallel. A double or multi-mode type is additionally considered as a third kind that consolidates the highlights of both the arrangement and parallel mixtures [12]. The arrangement HEV setup fuses a fuel converter (IC Engine), a generator, battery, and an electric engine as appeared in Figure 1.

PAPER

Evaluation of Faults in a DC Grid-Connected Solar Systems of Ships

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ABSTRACT

Fulfilling the increasing demand for electricity is a huge challenge worldwide. At the same time, dependence on fossil fuels for power generation and its enervation is becoming a severe concern as fossil fuels will be unavailable after 25 years. Hence, research needs to be focused on minimizing the dependence on fossil fuels for power generation especially in the shipping industry. This study aims to implement the solar photovoltaic (PV) system in a ship so as to investigate the possible difficulties related to fault detection and islanding protection methods of a direct current (DC)grid-tied solar PV system in a ship. The simulations have been modeled using an Arduino Uno R3 with IC ATMEGA 328P controller in Proteus PCB Design and Simulation software. In faulty conditions, the impact of the faults on the grid is very critical. Hence, it is essential to identify faults immediately and island the grid.

Keywords: Arduino Uno R3, fault detection, grid-tied solar PV system, islanding, ship

Introduction

The impact of maritime transport on the environment comprises greenhouse gas (GHG) emissions, noise, and oil pollution. The International Maritime Organization (IMO) reported that carbon dioxide (CO_2) emission from ships was approximately 2.2% of manmade emissions worldwide during 2012 (Basile & Hampton, 2014) and is expected to increase by two to three times in 2050, if no restrictive measures are taken (Buhaug et al., 2009). IMO and Marine Environment Protection Committee (MEPC) aim to limit the GHG emission from ships by utilizing renewable energy sources (RES) such as solar energy, wind energy, and so forth (Skjølsvik et al., 2000). The process of implementing expansion of RES in ships is still in its initial stage. Among several types of RES, the solar photovoltaic (PV) system is highly prioritized to be implemented in ships. The implementation of a solar PV system will definitely reduce the GHG emission, but the security and consistency of the system are uncertain. So, a comprehensive study is required on the implementation of the solar PV system and possible faults that may occur in the system. In this study, the DC distribution system has been considered as a replacement for the present alternating current (AC) power distribution system on ships. The proposed work signifies a novel method of distributing power for low-voltage appliances in the ships. It can be utilized by any electrical ship application for up to 20 MW and operates at a nominal voltage of 1,000-V DC.

Islanding is a situation in which the power generation system remains to supply the load through the DC grid when the power is not available due to natural or manmade faults (Mahatt et al., 2011; Yu, 2014). In such conditions, the generation system may provide the power to consumers, which is normally an unwanted mode of operation. The incongruities of the voltage, frequency, or phase from the generation system may damage the electrical equipment and create harmful effects to the electrical line workers (Yu, 2014). Hence, islanding is considered a fault, and it is not allowed in utility practice. So, islanding fault detection has been considered as one of the indispensable technologies in the design of distributed grid-tied generation systems. Islanding is a main issue in many distributed DC grid–tied generation systems, particularly when those generation systems supply both the load and the DC grid.

Islanding modes are classified into two types—intentional (planned) and unintentional (unplanned) islanding (Bower & Ropp, 2002). The aim of intentional islanding is to sectionalize the utility system to make a power "island" when the fault occurs. This is a common situation faced mainly during maintenance. The local load in the formed island will be supplied continually by distributed generation

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Enhancement of potable water production from an inclined photovoltaic panel absorber solar still by integrating with flat-plate collector

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Abstract

This manuscript brings out with an enhancement of the freshwater productivity from the active inclined solar panel basin solar still (AISPBSS). The research was conducted on the AISPBSS by the diversified mass flow rate of water (m_f). The maximum freshwater yield obtained at m_f at 1.8, 3.2 and 4.7 kg/h is 7.5, 6.5 and 5.4 kg, respectively. The daily average thermal and exergy efficiency of the AISPBSS at m_f at 1.8, 3.2 and 4.7 kg/h is 43.71, 38.27 and 29.62% and 8.39, 6.94 and 5.08%, respectively. The daily average PV panel power production of 47.71, 49.84 and 53.83 watts, electrical efficiency of 7.2, 7.6 and 8.1%, thermal efficiency of 17.3, 18.3 and 19.7%, exergy efficiency of 18.32, 20.23 and 22.39%, the overall thermal efficiency of 61.39, 57.44 and 51.37% and the overall exergy efficiency of 26.52, 27.14 and 27.40% are obtained from the system under m_f at 1.8, 3.2 and 4.7 kg/h, respectively. When m_f increases, there are decreases in the AISPBSS distillate yield, thermal, exergy and the overall thermal efficiency and increases in the PV panel power production and electrical, thermal, exergy and the overall exergy efficiency. Further, energy return term and carbon credit attained for the AISPBSS have been calculated. It was found that payback period of 20, 18.7 and 17.5 years and carbon credit earned of 21, 25 and 30 $ are obtained at m_f at 1.8, 3.2 and 4.7 kg/h, respectively.

Keywords Photovoltaic panel-integrated solar still · Mass flow rates · Panel efficiency · PV thermal and exergy analysis · Energy payback period · Carbon credit earned

Abbreviations

CSS	Conventional solar still
EHTC	Evaporative heat transfer coefficient
EPBP	Energy payback period
AISPBSS	Active inclined solar panel basin solar still
ISS	Inclined solar still
IWSS	Inclined wick solar still
PSS	Pyramid solar still

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Effect of water depth and insulation on the productivity of an acrylic pyramid solar still – An experimental study

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Abstract

Evaporation and condensation rate directly depend on the surface area provided in the solar still. Considering that, pyramid solar still provides greater surface area than basin type still for condensation process and gives out high performance. In this research work, the pyramid solar still is researched by varying the water depth from 1 to 3.5 cm with and without insulation conditions. The performance of the pyramid solar still with insulation is greater than the without insulation. Insulation plays an important role to increase the yield by increasing the water temperature. The yield produced from the pyramid solar still was higher at the lowest water depth of 1 cm for both insulation and un-insulated condition. The freshwater production from the pyramid solar still without insulation is 3.27, 2.93, 2.26, and 1.59 kg/m^2 and with insulation is 3.72, 3.40, 2.70, and 2.08 kg/m^2 for the water depth of 1, 2, 3, and 3.5 cm, respectively. At 1 cm water depth, the pyramid solar still with and without insulation produced 19.46% and 8.26% higher yield than the single basin type solar still.The daily efficiency of solar still is improved to about 28.5% with insulation whereas, the daily efficiency for solar still without insulation is found as 26.17%.

Keywords: pyramid solar still; acrylic collector cover; insulation; water depth; condensation

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RESEARCH ARTICLE

HEAT TRANSFER WILEY

A comparative study of 3E (energy, exergy, and economy) analysis of various solar stills

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Abstract

In this paper, an experimental study of the conventional solar still (CSS), the conventional solar still with glass cooling (CSSGC), the conventional solar still with basin heating (CSSBH), and the conventional solar still with glass cooling and basin heating (CSSGCBH) was carried out on the basis of the distilled water production, the energy efficiency (EnE), the exergy efficiency (ExE), and economic analysis. The CSSGC and CSSBH contain Peltier modules for cooling the glass and heating the basin. The evaporative heat transfer coefficient for all the experimental stills was calculated. The values of daily distilled water production from the CSSGCBH, CSSBH, CSSGC, and CSS were 4.56, 3.79, 2.49, and 1.89 kg/m^2, respectively. The daily distilled yield of the CSSBH and CSSGCBH were increased by 58.55% and 50.13%, respectively, as compared with the CSS. Moreover, the daily EnE and ExE of the CSSGCBH were 27.03% and 3.5%, respectively, whereas the EnE and ExE of the CSS were 10.88% and 1.3%, respectively. Furthermore, the cost of distilled water

Abbreviations: CSS, conventional solar still; CSSBH, conventional solar still with basin heating; CSSGC, conventional solar still with glass cooling; CSSGCBH, conventional solar still with glass cooling and basin heating; EHTC, evaporative heat transfer coefficient; EnE, energy efficiency; ExE, exergy efficiency; $T_w - T_g$, temperature difference between the water and glass cover.

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Performance improvement of solar PV array topologies during various partial shading conditions

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ABSTRACT

The output power produced by solar Photovoltaic (PV) array is reduced drastically by partial shading effect. Various array formation and reconfiguration techniques were introduced by many researchers to mitigate partial shading effects in PV array. This paper proposes new PV Array Topologies (PVATs) to improve the performance during partial shading conditions (PSCs). Totally, eight shading patterns are considered in the analysis for seven types of array configurations. Based on the existing array configurations, six novel PVATs are proposed to address the partial shading effect. A 4 × 4, 4 kW solar PV array which consists of sixteen panel of each 250 W rating is considered in this paper. The proposed PVATs are simulated in *MATLAB/Simulink*® to assess the performance. The results obtained from the simulation are compared with the conventional PVATs and suitable topologies which give best performance during various PSCs are identified. The result comparison shows that the modified total cross-tied (TCT) configuration performs well to extract more power in most of the PSCs. For the Short and Wide PSC, the proposed TCT improves the output power of PVAT by 105% compared to the existing TCT topology. The proposed method is also validated experimentally using 2 × 2 TCT PV array topology and the output waveforms are presented in this paper. This research would be helpful for the PV power plant installers to identify a suitable array configuration.

1. Introduction

Electricity generation system based on the conventional energy sources are replaced by solar PV system due to its environmental-friendly feature, reliability, renewing ability, etc. Solar PV systems have global range of applications starting from mite industries in autonomous structures to chock full industries (Vieira et al., 2008). A solar PV power plant consists of PV array; power converters, controllers and interface unit for grid integration (Meenakshi Sundaram et al., 2019)A PV array consists of numbers of PV panels which are connected in series and parallel to meet the power demand. The performance of PV array depends on parameters such as irradiation, aging, cell degradation, operating temperature, partial shading, etc. (Manganiello et al., 2015). Among all these parameters, irradiation and temperature are the predominant factors which affect the performance of PV array. The output power of PV array is reduced due to mismatch loss, which is the difference among the output power of the rows of PV array due to the partial shading conditions (PSCs) (Chamberlin et al., 1995; Picault et al., 2010). To decrease these mismatch losses, semiconductor devices or ideal switches or diodes or the combination of the above three are used in certain existing topologies. In this paper, a current injection method is proposed to reduce the mismatch losses.

A detailed comparison of series (Se) and series-parallel (Se-Pa) PVAT under PSCs is explained in Patel and Agarwal (2008). The reported array topologies emphasize that the scale of maximum power point (MPP) purely relies on PVAT and the corresponding shading pattern. The performance of five different topologies such as Se, Se-Pa, Totally Cross Tied (TCT), Bridge Coupled (BC) and Honey Comb (HC) under PSC were compared in Hsu and Hsu (2011). The technical and economical evaluation on the use of reconfiguration systems and aged panel reconfiguration were reported in Cynthia Christabel et al. (2016). The scrutiny of PVAT is done by arranging the sequential nonlinear mathematical statement using the Newton-Raphson's procedure. A comprehensive MATLAB simulation is used to examine and inquire the consequences of PSCs on PVAT. Solar PV array composition dominated by PSCs is done in Ramaprabha and Mathur (2012). The analysis of

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Cost effective energy consumption in a residential building by implementing demand side management in the presence of different classes of power loads

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ABSTRACT

In the present scenario, in order to meet the growing electricity demand, demand side management (DSM) is one among the various approaches used in smart grid. By applying DSM at the customer side, various benefits such as reduction in electricity cost, reduction in peak demand, and improvement in load factor can be achieved. This paper proposes a new architecture, namely, Intelligent Universal Load Management System (IULMS) to implement DSM based on load shifting approach for a residential building in the presence of different classes of loads. In this work, the objective is to minimize the cost of electricity consumption and there are several constraints imposed by the device types operating in the system and it is solved by Binary Grey Wolf Optimization algorithm. The objective function is non-linear in nature because the price of electricity varies each hour. A real-time system involving residential building users of Agrini Apartment in Madurai, Tamilnadu, India is discussed. Further, the potential of DSM is analyzed. The minimization of electricity consumption cost, peak demand, and Peak to Average Ratio (PAR) are validated for each test case.

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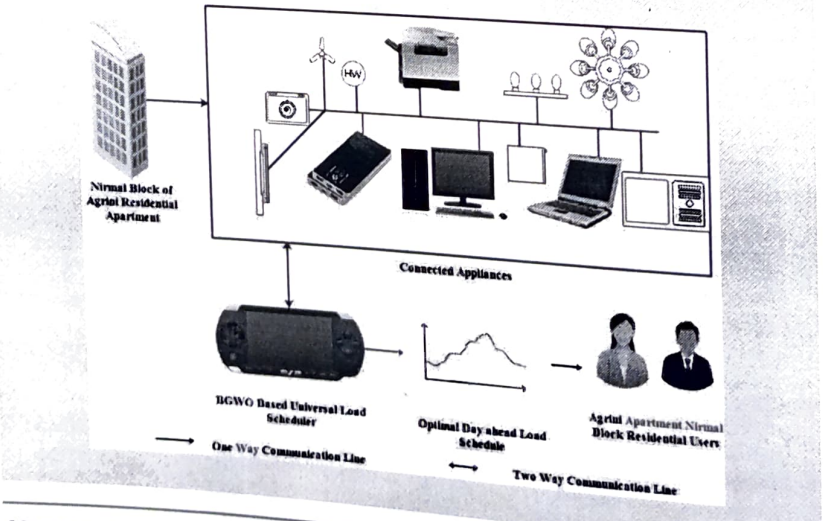
Demand side management architecture; load shifting; Binary Particle Swarm Optimization; Binary Grey Wolf Optimization; smart grid



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Experimental investigation on output power enhancement of partial shaded solar photovoltaic system

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RESEARCH ARTICLE

Investigation on the performance enhancement of single-slope solar still using green fibre insulation derived from *Artocarpus heterophyllus* rags reinforced with *Azadirachta indica* gum

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Abstract

The fruits and vegetable waste has become the highest compared with the production rate. These types of wastes had reached up to 70% by 2019–2020 as estimated by Food and Agriculture Organization (FAO). Improvisation of the performance of still using fibre insulation (*Artocarpus heterophyllus* rags and *Azadirachta indica* gum (AHRAIG)) has been carried out in this study. Potable water demand in arid areas is a vast problem where fresh water is very expensive. The proposed solar still (PSS) retains the basin temperature and raises the rate of evaporation. Rags are latex-like filament extracted from the waste of the jackfruit peels and an adhesive agent from *Azadirachta indica* tree. A comparison is made among still without insulation (SWI), still with polystyrene insulation (SPI) and still with fibre insulation (SFI) in producing the fresh water under same ambient conditions. The experiments result a promising yield of 9.3% rate of rise of potable water produced using AHRAIG insulation related to conventional still. The energy efficiency is premeditated as 26.45%, while the exergy efficiency is 4.07%. The production of the potable water reached 2.58 L/m^2 for still with polystyrene insulation, 3.26 L/m^2 for fibre insulation and 1.93 L/m^2 for still without insulation, respectively.

Keywords Single-slope solar still · *Artocarpus heterophyllus* rags · *Azadirachta indica* gum · Polystyrene · Analysis

Abbreviations

SWI	Still without insulation
SPI	Still with polystyrene insulation
SFI	Still with fibre insulation
AMC	Annual maintenance operational cost
CRF	Capital recovery factor
FAC	Fixed annual cost
CPL	Cost of distilled water per litre
SFF	Sinking fund factor
ASV	Annual salvage value
M	Average annual productivity
AC	Annual cost
P	Principal cost
HNFC	Hybrid natural fibre composite

Nomenclature

$h_{c,w-g}$	Convective heat transfer coefficient from water to glass
$h_{e,w-g}$	Evaporative heat transfer coefficient from water to glass
P_{gi}	Partial vapour pressure at inner glass
P_w	Partial vapour pressure at water temperature
I(t)	Solar intensity
T_{gi}	Inner glass temperature
T_w	Water temperature
h	Convection heat transfer coefficient
α	Permeability of the system

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Fuzzy decision analysis for regional contextualization of global educational frameworks

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Abstract. The main aim of this research work is to identify a suitable educational framework, which can be implemented in the institutions of a specific region, so as to reform their educational system in a contextualized way. It is proposed to investigate the impact of unpredictable events on the instructional methodologies adopted by the globally accepted educational frameworks, by perceiving experts' opinion in linguistic terms, thus formulating a fuzzy decision matrix to derive the fuzzy set of alternatives. Expert opinions are gathered based on the cost, quality of education, and learning outcomes independently with respect to each imprecise event and the methodology to be considered. The educational framework that adopts the instructional methodology which has the highest grade of membership in the derived fuzzy set of alternatives, shall be considered for implementing educational reformation in the institutions of a specific region to match the global competency with respect to desirable graduate attributes. Fuzzy statistical methods have been applied to verify the closeness of the derived fuzzy set of alternatives towards making appropriate decisions. Fuzzy Hurwicz Rule is applied to balance the decision due to optimistic or pessimistic views of the experts about the imprecise events.

Keywords. Educational framework; fuzzy decision analysis; fuzzy Hurwicz rule; fuzzy statistical methods; instructional methodologies.

1. Introduction

The education system to be followed should be adaptable to the context of culture, the industrial revolution and the developmental growth of a specific region, which will be certainly influenced by many unpredictable factors. The system once implemented should withstand over a long period not only to cope with the technological changes but also to meet the global competency requirement. Universities in the USA and European countries have developed contextualized educational frameworks such as CDIO (conceive, design, implement and operate) [1–3, 9], NEET (new engineering education transformation) [10], etc., that are well-defined especially for technical education and have been implemented in their institutions to meet the challenges and requirement to dominate the world in the 21st century. In India, nearly 1.5 million candidates complete their graduation from technical institutions every year and hence it should not miss the opportunity to forecast the unprecedented challenges of the 21st century. In every region of India, there exists diversity of culture and hence adopting an educational framework for reformation of educational system in a specific region to meet the global competency requirement is a challenging task due to uncertainty in predicting the future events over the long term period.

Higher education, especially technical education in India is facing a lot of challenges due to many inadequacies. Efforts have been taken to improve the situation but due to irregularity and inconsistency in making the efforts, there are no significant changes in the current educational scenario. Due to unprecedented growth in technology, lot of diversifications with focus on specialization are required to meet the industrial as well as societal needs. Long since, it has been felt, there is a need for robust educational system to promote the practical skills of the faculty so as to cope with the rapidly changing technological developments. There is a long term inconsistency in understanding the depth and breadth of technological changes especially in higher learning institutions due to inadequate competency of faculty.

The phenomenal growth in technological development is to be monitored continuously and the emerging areas need to be identified from time to time accordingly. The curriculum, instructional strategies and the practical skills of the faculty are to be regularly updated. Over a long term period it emerges as a challenging task to predict the direction of technological developments, the political

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METHODOLOGIES AND APPLICATION

Design and performance analysis of adaptive neuro-fuzzy controller for speed control of permanent magnet synchronous motor drive

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Abstract
This article has been focused on the design of the artificial neural network with fuzzy inference system (ANFIS) for the speed control of permanent magnet synchronous motor (PMSM). PMSM is widely used in industrial applications such as robotic manipulators and machine tools due to the high efficiency, high torque to weight ratio and smaller size. One of the efficient control strategies of PMSM is based on ANFIS. ANFIS is very popular technique to deal with uncertainties. System dynamics in such cases can be compared with combining the proportional–integral–derivative (PID) with the Sliding Mode Controller (SMC). Simulations have been performed in MATLAB to validate the performance of the proposed model, and comparisons are made with ANFIS, SMC–PID and PID controllers compared to other controllers reported in the benchmark of the proposed controller's efficiency. The proposed adaptive neuro-fuzzy-dependent results indicate good transient efficiency. Robustness against the robustness of adaptive neuro-fuzzy-based PID and SMC–PID controllers is satisfactory in terms of easy settling time, zero peaks overflow and zero steady state error. The simulation results have been implemented in MATLAB 2019b, and experimental results are implemented in BD63030.

Keywords Adaptive neuro-fuzzy · PID control · Sliding mode control · Robust control · Switching algorithm

1 Introduction

The permanent magnet synchronous motors (PMSMs) have many excellent performance features such as high torque, power density and high efficiency (Tao et al. 2017). PMSMs are commonly used in electric hybrid vehicles, wind turbine turbines, industrial servo drives, etc. The traditional proportional–integral (PI) controller is still common in the actual PMSM system because of its simplicity and ease of understanding (Yu et al. 2018a). Recent studies, however, show that such a control strategy has encountered some bottlenecks, such as the optimal PI coefficients being difficult to obtain, the inconsistency between stability and efficiency, robustness of model parameter variations and external disturbances (Li and Rogovchenko 2018; Darba et al. 2016). In order to overcome these challenges, different nonlinear control methods have been proposed to improve control efficiency, such as fuzzy logic control (Lang et al. 2016), sliding mode control (Katsuji et al. 2015), predictive control (Yu et al. 2016), neural network control (Petrovic et al. 2001) and adaptive control (Yu et al. 2018a). The SMC is a favored subject for research in the above-mentioned nonlinear control methods because its insensitivity to external disturbances and internal parameter variations can ensure perfect control output (Mynar et al. 2016). The stable switching surface must be designed to allow the sliding mode to occur in order to implement a Sliding Mode Controller. This is the direction of the state vector after the sliding plane converges to the origin. The initial state vector enters the execution stage on the switching surface at this point in time. Once the initial state vector hits the switching surface, the feedback loop configuration is adaptively changed to track the location of the sliding mechanism along the

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L-Shape Propagated Array Configuration With Dynamic Reconfiguration Algorithm for Enhancing Energy Conversion Rate of Partial Shaded Photovoltaic Systems

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ABSTRACT Partial shading is an unavoidable factor that reduces the performance of solar PV systems. The PV system receives uneven irradiation due to partial shading which causes the mismatch loss. The partial shading distracts the irradiation from the PV modules that makes the healthy modules as idle or low performing modules. The mismatch loss can be mitigated by uniformly distributing the partial shading over the PV array. In this work, L-shaped propagated array configuration method with a new dynamic reconfiguration algorithm have proposed for enhancing the energy conversion under the partial shading conditions. A new kind of array configuration is implemented in a 4 × 4 PV array for the better shade dispersion. Further, a dynamic reconfiguration algorithm is employed to disperse the effect of partial shading. The combination of new array configuration and reconfiguration method is simulated in MATLAB/Simulink®and implemented in hardware. The outputs are measured under all possible shading patterns and validated with the outputs of convention methods for observing the enhanced energy conversion rate of the proposed system.

INDEX TERMS Array configuration, futoshiki puzzle pattern, mismatch loss, partial shading, PV array reconfiguration, total cross tied (TCT), sudoku pattern.

I. INTRODUCTION

Photovoltaic (PV) system accelerates its development in the global energy market in recent years because of its eco-friendly characteristics, reliability and renewability [1], [2]. Many countries prefer the solar PV plant for future energy demand. The structure of a PV cell is made with the bonding of n-type and p-type semiconductors with a PN-junction. The energy of photons in the sunlight breaks the bonding electrons in n-type and makes it flow to the load by through the p-type. The amount of free electrons liberated by the photons is the actual amount of current generated by the PV cell [3]. Some environmental factors like partial shading due to clouds, shadows of nearby objects, dust accumulation, dropping of birds, etc., will distract the rate of incident photons, which directly reduces current generation [4], [5]. The partial shading distributes non-uniform irradiation over the PV array which causes the mismatch losses. The power generation by the un-shaded PV cell will not be available at the load because of the shaded PV cells is the effect of

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A novel on-time partial shading detection technique for electrical reconfiguration in solar PV system

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ABSTRACT

Mismatch losses due to partial shading condition (PSC) is not permitted to extract maximum power from the solar PV array. Numerous techniques were proposed to reduce the partial shading effect. But the major problem is in finding out the occurrence and its distribution of the partial shading in the solar PV array. Conventional methods disconnect the load temporally from the PV array and measure the short circuit current (I_{sc}) and use the information to detect the partial shading. Frequent disconnection of the solar PV array from the load makes the conventional method unpractical in a large solar power plant and even a stand-alone PV system. A novel on-time partial detection technique is proposed in this paper and useing difference in row voltage (V_d) instead of the short circuit current (I_{sc}) to estimate the partial shading. Greater the V_d infers the severity of occurrence of the partial shading in the solar PV array. By using a static reconfiguration and then a modified couple matching (MCM) technique the voltage difference (V_d) gets reduced. This will ensure the mitigation of the PSC. As in this proposed technique, the load never be disconnected from the solar PV array, to detect the partial shading, it can be used practically even for a stand-alone PV system. Eight extensive partial shading patterns are simulated using MATLAB Simulink to validate the proposed work and the size of 3 × 4 120 W polycrystalline PV panel array is used for the experimental validation.

1. Introduction

The conventional energy sources are getting depleted day by day and at the same time, the energy requirement is amplified rapidly due to the increase industrial and individual demand (Abdelsalam et al., 2011). Renewable energy sources such as solar, wind, geothermal, tidal etc. are the alternative solution for the growing energy demand. An abundantand at the same time clean, environmentally pleasing solar energy makes a vital place in renewable energy. The recent technology improves the efficiency of the solar cell output and reduces the production cost. Mismatch losses due to partial shading condition (PSC) is the foremost problem in harvesting the solar energy (Dolara et al., 2013). Partial shading happens due to passing clouds, shadows of nearby trees, buildings, birds and dust not only affect the power generation of the shaded module but also disturb the module which receiving good irradiations. Partial shading is not predictable not measurable and unavoidable (Srinivasan et al., 2020). Partial shading also leads to the problem of hot spot (Ahmad et al., 2017; Skomedal et al., 2020). By disconnecting the partially shaded module from the PV array using bypass diode, the extraction of maximum power will be achieved. Introduction of bypass diode across each module, introduce the multiple peaks (Sahu et al., 2016) in P-V curve, which make the conventional MPPT algorithm like P&O and incremental conduction unable to track the global maximum power point (GMPP).

PV modules are connected in series to meet the voltage requirement and connected in parallel to achieve the current requirement. There are several interconnection schemes which are used to connect the module in series and parallel. Among Series-Parallel (SP), Total Cross Tie (TCT), Bridge-Linked (BL) and Honey Comb interconnection scheme TCT is found to be the best configuration for MPPT (Gautam & Kaushika, 2002). (Yadav et al., 2017) introduced some hybrid interconnection schemes like series–parallel - total cross-tied (SP-TCT), bridge link- total cross-tied (BL-TCT), Bridge link- Honey Comb (BL-HC). The only series connection of PV module makes most susceptible to power loss due to mismatch in their electrical characteristics (Agrawal et al., 2020).

Static array reconfiguration or dynamic (Electrical) array reconfiguration is used to minimize the number of peaks in a solar PV array. In

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Article

Reinforced Demand Side Management for Educational Institution with Incorporation of User's Comfort

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Abstract: Soaring energy demand and the establishment of various trends in the energy market have paved the way for developing demand-side management (DSM) from the consumer side. This paper proposes a reinforced DSM (RDSM) approach that uses an enhanced binary gray wolf optimization algorithm (EBGWO) that benefits the consumer premises with load scheduling, and peak demand reduction. To date, DSM research has been carried out for residential, commercial and industrial loads, whereas DSM approaches for educational loads have been less studied. The institution load also consumes much utility energy during peak hours, making institutional consumers pay a high amount of cost for energy consumption during peak hours. The proposed objective is to reduce the total electricity cost and to improve the operating efficiency of the entire load profile at an educational institution. The proposed architecture integrates the solar PV (SPV) generation that supplies the user-comfort loads during peak operating hours. User comfort is determined with a metric termed the user comfort index (UCI). The novelty of the proposed work is highlighted by modeling a separate class of loads for temperature-controlled air conditioners (AC), supplying the user comfort loads from SPV generation and determining user comfort with percentage UCI. The improved transfer function used in the proposed EBGWO algorithm performs faster in optimizing nonlinear objective problems. The electricity price in the peak hours is high compared to the off-peak hours. The proposed EBGWO algorithm shift and schedules the loads from the peak hours to off-peak hours, and incorporating SPV in satisfying the user comfort loads aids in reducing the power consumption from the utility during peak hours. Thus, the proposed EBGWO algorithm greatly helps the consumer side decrease the peak-to-average ratio (PAR), improve user comfort significantly, reduce the peak demand, and save the institution's electricity cost by USD 653.046.

Keywords: smart grid; institutional loads; reinforced demand-side management; load-shifting; user comfort index; enhanced binary gray wolf optimization

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1. Introduction

Demand-side management (DSM) is a very promising approach in a smart grid environment to minimize the energy consumption for the consumer and minimize the energy generation for the utility. The DSM algorithms and schemes include energy conservation programs, energy efficiency programs, and demand response (DR) programs. In the literature, there are different methods in which DSM has been implemented. Different types of the load management system have been implemented, such as a scheduling mechanism for interruptible loads over 16 h [1], a load-shifting based DSM controller for different categories of load in a residential area, commercial area, and industrial area [2],

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Solar PV's Micro Crack and Hotspots Detection Technique Using NN and SVM

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ABSTRACT For lifelong and reliable operation, advanced solar photovoltaic (PV) equipment is designed to minimize the faults. Irrespectively, the panel degradation makes the fault inevitable. Thus, the quick detection and classification of panel degradation is pivotal. Among various problems that promote panel degradation, hot spots and micro-cracks are the prominent reliability problems which affect the PV performance. When these types of faults occur in a solar cell, the panel gets heated up and it reduces the power generation hence its efficiency considerably. In this study, the effect of the hotspot is studied and a comparative fault detection method is proposed to detect different PV modules affected by micro-cracks and hotspots. The classification process is accomplished by utilizing Feed Forward Back Propagation Neural Network technique and Support Vector Machine (SVM) techniques. The investigation of both the techniques permits a complete analysis of choosing an effective technique in terms of accuracy outcome. Six input parameters like percentage of power loss (PPL), Open-circuit voltage (V_{OC}), Short circuit current (I_{SC}), Irradiance (I_{RR}), Panel temperature and Internal impedance (Z) are accounted to detect the faults. Experimental investigation and simulations using MATLAB are carried out to detect five categories of faulty and healthy panels. Both methods exhibited a promising result with an average accuracy of 87% for feed-forward back propagation neural network and 99% SVM technique which exposes the potential of this proposed technique.

INDEX TERMS Binary tree, feed forward back propagation neural network, hot-spotting, micro crack, PV module, support vector machine.

I. INTRODUCTION

In photovoltaic (PV) panels, hot-spotting is a solidity problem. It can be characterized when the adjacent solar cells heat up to a remarkable level and decrease the optimum power generation of the PV panel [1]. Hot spotting arises when a single cell or group of cells operate at reverse bias condition or peculiar inflated temperature levels [2], [3]. Hotspots are predominately caused by following reasons – non-uniform current density, variations in shading, improper soldering, and package failure [4]. Due to the hotspots, PV degradation is enhanced and a high probability for the occurrence of permanent damage to PV panels prevails [5]. Another solidity problem that affects the PV panels is discontinuation [6], Maximum Power Point Tracking (MPPT) faults [7], [8], [29]–[31], micro-cracks [9] and variations in the wind speed and humidity [10]. The above-mentioned problems affect the performance of output power in a PV panel but, the parameters such as temperature coefficient will decrease its annual energy production. Ultimately, these studies only state the effect of hot-spotting in PV panels but do not focus on other issues. For obtaining the maximum output from the PV system over the lifetime, systematic maintenance and perpetual inspection are mandatory [11]. Since manual

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RESEARCH ARTICLE

Investigation of performance enhancement of solar still incorporated with *Gallus gallus domesticus* cascara as sensible heat storage material

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Abstract
In this research work, the conventional single slope still (CSS) with egg shells of breed *Gallus gallus domesticus* cascara as sensible heat storage (SHS) material are studied experimentally to enhance the yield. In this experimental investigation, the proposed single slope still (PSS) with SHS material was made in comparison with the CSS to evaluate the productivity of fresh water under the same ambient conditions. Comparatively, this PSS has higher thermal conductivity than the CSS. The yield obtained from the PSS is 2.46 L/m^2, while the yield from the CSS is 2.07 L/m^2. The average rate at which the rise of output fresh water obtained from the PSS is 18% more than the fresh water output obtained from the CSS. The daily energy efficiency of the PSS is 26.07%, and for the CSS, it is only 22.25%. The daily exergy efficiency of the PSS is 2.36%, and for the CSS, it is only 1.67%. Since using the egg shell will employ as organic waste management and modification in this still is economical, less initial, and maintenance cost.

Keywords Desalination · Calcium carbonate crystal · Chicken egg shell · Sensible heat storage material

Abbreviations

CSS	conventional single slope solar still
PSS	proposed single slope solar still
SHS	sensible heat storage
EHTC	evaporative heat transfer coefficient
CRF	capital recovery factor
FAC	fixed annual cost
SFF	sinking fund factor
ASV	annual salvage value
M	average annual productivity
AC	annual cost
AMC	annual maintenance operational cost
CPL	cost of distilled water per liter
P	principal cost

Nomenclature

q	solar radiation rate (W/m^2)
σ	Stefan Boltzmann constant (W/m^2 K^4)
h	convection heat transfer coefficient (W/m^{2}K)
T_{surf}	glass surface temperature (°C)
T_{air}	air temperature (°C)
k	thermal conductivity (W/m/k)
Nu	Nusselt number
L	characteristics length of the system (m)
R_a	Rayleigh number
v	fluid viscosity (kg/ms)
g	acceleration due to Earth's gravity (m/s^2)
p	perimeter (m)
P_r	Prandtl number
v	kinematic viscosity (m^2/s)
$En_{w,\ in}$	energy input rate of the water (W)
$En_{w,\ out}$	energy output rate of the water (W)

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A New Alternate Method to Reuse Rehashed Edible Oil for the Betterment of Society - Dual Benefit Approach in Photovoltaic Modules

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ABSTRACT The Photovoltaic (PV) cell converts a portion of incident irradiation of visible wavelength into electricity and the remaining into heat, thereby decreasing the electrical efficiency. Hence, it is necessary to transfer the heat generated in the module by a cooling medium, thereby maintaining the operating temperature within the operating limit. This study discusses the feasibility of cooling the monocrystalline and polycrystalline modules by using rehashed edible oil (coconut oil, sesame oil, and peanut oil) with an integrated oil tank attached to the backside of the module. This study has used the environmentally friendly rehashed edible oil as a coolant, which can be used as an alternate to the toxic mineral oil. Hence, this study can prevent the consumption of reused edible oil along with the food, which causes harmful effects on human health. The rehashed edible oil flows from the storage tank through the backside of the module and is collected in another storage tank, which can be reused. Also, the performance of the monocrystalline and polycrystalline modules under different rehashed edible oil shows a significant reduction in module temperature and improvement in the efficiency of the module. The performance of the peanut oil is found to be superior in improving the performance by 14.0 % and 16.8 % on monocrystalline and polycrystalline modules respectively.

INDEX TERMS Module temperature, rehashed edible oil, environmental friendly, cooling, output power, efficiency.

NOMENCLATURE

P_m	Maximum power.
V_{mp}	Voltage at maximum power.
I_{mp}	Current at maximum power.
V_{oc}	Open circuit voltage.
I_{sc}	Short circuit current.

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I. INTRODUCTION

The incident irradiation of visible wavelength ranges from 400 nm to 1200 nm is absorbed by the PV cells and converted into electricity [1]. The incident solar irradiation outside the visible range is converted into heat, thereby increasing the operating temperature of the module. The commercial efficiency of the monocrystalline module is 11-17%, compared to a laboratory efficiency of 24% [2]. Ortega *et al.* [3] have observed that the average efficiency of the monocrystalline

energies

Article

Intelligent Starting Current-Based Fault Identification of an Induction Motor Operating under Various Power Quality Issues

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Abstract: Since most of our industries use induction motors, it is essential to develop condition monitoring systems. Nowadays, industries have power quality issues such as sag, swell, harmonics, and transients. Thus, a condition monitoring system should have the ability to detect various faults, even in the presence of power quality issues. Most of the fault diagnosis and condition monitoring methods proposed earlier misidentified the faults and caused the condition monitoring system to fail because of misclassification due to power quality. The proposed method uses power quality data along with starting current data to identify the broken rotor bar and bearing fault in induction motors. The discrete wavelet transform (DWT) is used to decompose the current waveform, and then different features such as mean, standard deviation, entropy, and norm are calculated. The neural network (NN) classifier is used for classifying the faults and for analyzing the classification accuracy for various cases. The classification accuracy is 96.7% while considering power quality issues, whereas in a typical case, it is 93.3%. The proposed methodology is suitable for hardware implementation, which merges mean, standard deviation, entropy, and norm with the consideration of power quality issues, and the trained NN proves stable in the detection of the rotor and bearing faults.

Keywords: discrete wavelet transform (DWT); power quality issues; induction motor; motor faults

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1. Introduction

The squirrel cage induction motor has a wide range of applications such as pumping, cooling, compressing, etc., in the industrial area because of its simple construction, low cost, and high reliability. The quality and shape of the industrial product mostly depends on motor performance. Generally, the performance of the motor is measured in terms of speed and torque. Different kinds of motors have been constructed with two main parts, namely the rotor (a rotating part) and stator (a stationary part) [1]. These motor parts can be damaged due to unbalanced current regulation and stress. This motor damage, especially in squirrel cage induction motors, can be classified into three major faults, including rotor fault, winding fault, and bearing faults, as well as some minor faults. Among the various kinds of faults, the occurrence of a broken rotor fault is measured as 10%, and the event of a bearing fault is measured as 40–50%, which is shown in Figure 1 [1].

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Design of IoT based smart compact energy meter for monitoring and controlling the usage of energy and power quality issues with demand side management for a commercial building

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ABSTRACT

Internet of Things (IoTs) plays a vital role in energy sector which introduces a smart metering and monitoring system. The smart monitoring focuses on incorporating smart meters and control techniques which requires smart equipment control, bidirectional communication, integration of network and users. In this paper, a new Commercial Building Energy Management System (CBEMS) using IoT based Smart Compact Energy Meter (SCEM) is proposed to monitor and control the energy usage and power quality issues. In addition, Demand Side Management (DSM) for a commercial building in proposed using IoT. Here, low-voltage metering hardware uses Advanced Reduced Instruction Set Computing (RISC) Machines (ARM) cortex and real-time operating system. The choice of ARM microprocessor aims at rendering a wide range of complex operations such as data acquisition, processing, disturbance detection and classification, consumption and data exchange which consequently requires optimization of the embedded software. The IoT based SCEMs with CBEMS is implemented in real time commercial building at M/s Quantanics Techserv Private Limited. Here, the load pattern of M/s Quantanics Techserv Private Limited is dynamically optimized using DSM after successfully integrating CBEMS. The operation of monitoring and controlling commercial appliances are examined and validated remotely using the mobile Blynk application. The proposed SCEMs analyzes the power quality at low cost with high accuracy in detecting and classifying the disturbances. The proposed SCEM output values are compared with standard *Elmeasure iM-8000* meter and the results are tabulated.

1. Introduction

Energy is a fundamental component for a nation's financial improvement and for expanding the ways of life in planet and furthermore for worldwide populace development, worldwide energy request has been expanded extensively [1]. The efficient ways of electrical energy generation, transmission, distribution and utilization implement various levels of automation using wide area monitoring and deployment of smart meters. The accuracy of measurement, fault detection and isolation can also be accurately predicted by measuring the electrical parameters along with universal time stamps in the transmission system. This enhances the reliability of the transmission grid [2]. There is a huge gap with respect to automation in the distribution and utilization parts of the grid. Recent developments in Internet of Things (IoT) plays a major part in automation and control [3].

Home automation is one of the recent trends in the utilization side of power grid, where various types of IoT are deployed for automating the appliances, measuring the electrical, other parameters, identifying and controlling the power quality-based issues [4]. Various types of communication devices are being connected through wired or wireless mode of operation. In [5], a wireless based in-Home Energy Management (iHEM) system is introduced and is compared with an optimization-based residential energy management scheme. The main objective is to minimize the energy consumed by the customers, but the work has not described any real time implementation of iHEM technique. An experimental setup is developed in [6] using ZigBee based wireless home automation system with photovoltaic and wind energy systems monitoring. A systematic theoretical review of various home energy management schemes is delivered in [7]. They attempted various pricing schemes such as Real Time Pricing, Time of Use, Inclining Block Rates and Critical Peak Pricing for coordinating different home appliances. A low-cost smart energy meter is introduced in [8] for billing and energy measurement process. It is based on IoT with Long Range –

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Development of smart controller for demand side management in smart grid using reactive power optimization

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Abstract
Reactive power optimization is one of the major problems of concern in smart grid (SG) environment. Although several techniques have been proposed for reactive power optimization, demand side management (DSM) plays a vital role in smart grid networks. The main idea of this work is to address reactive power optimization by developing a smart controller for DSM by effective monitoring of real power loss in the smart grid network. The proposed smart controller is developed by formulating the DSM as an optimization problem and obtaining its solution by applying elephant herd optimization–firefly (EHO–FF) evolutionary algorithm. Further, the proposed smart controller for DSM aims to meet the power demand and limit the power flow in transmission network by adding distributed generation (DGs) units at optimal locations. The proposed work aims to improve the energy efficiency and voltage profile in the power grid network when operating under different load scenarios. The benchmark IEEE 30 bus system consisting of 6 generating units, 41 transmission lines with total load of 283.4 MW and 126.2 MVAR is used as the test system in this work. The test system is subjected to varying load pattern for 24 h in a typical day. The performance of the proposed smart controller is evaluated on the bench mark IEEE 30 bus system through program code developed in MATLAB environment. The simulation results have proved that the proposed smart controller for DSM minimizes the power loss and improves the voltage profile significantly by incorporating DG units in optimal locations. The effectiveness of the EHO–FF algorithm is analyzed by comparing the results obtained with PSO and bAT algorithm.

Keywords Smart controller · Reactive power control · DSM · EHO–FF algorithm · Smart grid

1 Introduction

There is a great challenge in electricity due to the introduction of smart grid concept. The distributed generation with renewable energy resources integration has become the major part of smart grid. The greatest challenge in the smart grid environment is to reduce the system power loss and improve the bus voltage profile which in turn will help the customers to reduce the total cost incurred. The varying demand is very normal in distribution system, so it is necessary to consider generation system with varying load conditions. The demand side management satisfies the varying demand based on consumer participation in choice of power generation. DSM makes the customer to get cheaper power generation by choosing the power generation and by reducing their demand. The reactive power optimization problem reduces the power loss in power system and improves the voltage profile in the system. Nowadays, the smart grid paradigm is considered an adequate beacon of energy policies to support the modernization of the electricity sector (De Oliveira-De Jesus and Henggeler Antunes 2018). The smart grid is an intelligent power grid to optimize the production, distribution and consumption of electricity. It supports steady delivery and demand on the electric grid (Marah and El Hibaoui 2018). The SG technology is undertaking a transformation from a

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Techno-economic analysis of both on-grid and off-grid hybrid energy system with sensitivity analysis for an educational institution

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ABSTRACT

The Renewable Energy Sources (RES) have marked a new trend in the Indian energy market and sustainable energy development. In countries like India, the consumers are more welcomed to be prosumers by utilizing the primary renewable energy sources such as solar, wind, biogas, geothermal etc. The renewable energy generation is highly dynamic and thus, Hybrid Energy Systems (HES) strengthens its scope in self-dependent energy generation of the consumers. This paper proposes techno-economic analysis of a Hybrid Energy System (HES) design that has been set up at Kamaraj College of Engineering and Technology (KCET), Virudhunagar, Madurai, Tamil Nadu, India. The paper investigates the on-grid and off-grid operation of the proposed HES. The system is designed and optimized by using HOMER (Hybrid Optimization Model for Electric Renewables) software. The feasibility of the HES system is studied under different dispatch strategies such as Cycle Charging (CC) and Load Following (LF) for both on-grid and off-grid operation. Further, the sensitivity analysis is carried out for the proposed HES system with the fuel price and scaled annual solar radiation as sensitivity variables. The Net Present Cost (NPC) and Cost of Energy (COE) of the system under different architectures are determined and it is found that, the on-grid HES with LF dispatch is the optimal system design for the selected location. The performance of the system is studied in both technical and economic perspectives to optimally design the HES components and a minimum NPC of $ 7.66 M has been obtained.

1. Introduction

The soaring energy demand and rapid depletion of conventional resources have raised the concern of the human society for its future energy need. Thus, the population moves toward Renewable Energy Sources (RES) and the Hybrid Energy System (HES). Moreover, the tremendous increase in emission of greenhouse gases like CO_2, NO etc. has been the major reason behind global warming. For the past few decades, the utilization of renewable energy sources (RES) is growing gradually [1]. India has set a goal of installing 175 GW of renewable power by 2022 and increases the country's share of non-fossil-based installation to 40% by 2030. The optimization of RES system depends on different aspects such as component sizing, selection of components and various control strategies. Various forms of renewable energy generation across the globe in 2020 is shown in Fig. 1.

However, RES generation is unpredictable because of the intermittent and stochastic nature of the RES energy sources like the solar radiation, temperature, wind velocity, wind speed, humidity etc. Thus, an alternate method is the energy generation with HES system. The design of HES system requires proper selection and sizing of the components under a feasible energy management strategy. The selection of energy management strategy is critical, as it determines the behaviour of the system by prioritising the components in the system [1,2]. Sharafi et al. [4] solved a multi-objective optimization problem using a simulation-based approach for a hybrid system including PV, WT, DG, battery, fuel cell, electrolyzer and hydrogen tank by MATLAB. Merei et al. [5] designed a WT/PV/diesel system with different energy storage technologies and optimised the HES system. Isa et al. [6] designed PV-fuel cell- battery to provide the electricity for a hospital in Malaysia. He et al. [7] electrified the residential sector with on-grid PV, WT, battery system and concluded that more than 50% of required power has been supplied by renewable resources. Jamian et al. [8] installed the battery bank and optimal location and the size of the storage system was determined. Fathy et al. [9] optimized the HES system deploying a mine blast algorithm and obtained the minimum cost of the proposed system. Ramli et al. [10] investigated the economic and environmental features

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A New Ken-Ken Puzzle Pattern Based Reconfiguration Technique for Maximum Power Extraction in Partial Shaded Solar PV Array

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ABSTRACT Solar Photovoltaic array may often be subjected to partial shading, which may lead to uneven row current and creates local maximum power point on the power-voltage characteristics. One of the effective approaches to dilute the concentration of partial shading is the array reconfiguration technique. This study proposes a ken-ken puzzle-based reconfiguration technique for 4 × 4 total-cross-tied configuration to rearrange the position of modules within the array and to improve the maximum power under partial shading conditions. Further, the performance of the ken-ken puzzle arrangement is compared with the total-cross-tied configuration and existing reconfiguration techniques namely odd-even, Latin Square, and Sudoku reported in the literature. The performance of all these configurations is evaluated in terms of fill factor, mismatch loss, power loss, execution ratio, and performance enhancement ratio. The proposed ken-ken puzzle-based reconfiguration technique mitigates the occurrence of local maximum power point and eliminates the need for a complex algorithm to track the global maximum power point. The simulation result shows that the KK puzzle-based reconfiguration technique has obtained an improved PE of 10.85 % compared to TCT configuration, followed by LS, Sudoku, and OE. Also, the experimental result shows the effectiveness of the ken-ken in diluting the effects of partial shading when the rows of the photovoltaic array are shaded. The ken-ken puzzle-based reconfiguration technique reduces the complexity, maintenance and increases reliability, scalability of the PV array.

INDEX TERMS Shade dispersion, ken-ken puzzle pattern, global maximum power point, local maximum power point, and performance enhancement ratio.

I. INTRODUCTION

The partial shading can occur in a photovoltaic (PV) module due to shading of nearby buildings, clouds, dust, and dirt, etc. The shaded modules consume power from the non-shaded modules and dissipate energy in the form of heat. Therefore, the bypass diodes are connected across the modules [1]–[3]. However, this introduces local maximum power point (LMPP) in power-voltage (P-V) characteristics, which misleads the maximum power point tracking

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Parallel power extraction technique for maximizing the output of solar PV array

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ABSTRACT

Solar energy is one of the clean energy sources which does not causes any pollution to the environment. The photovoltaic system will play a vital role in the world's power production for the energy demand in future. Partial shading is a major concern have to be considered while installing the PV system. The effect of shaded panel will affect the performance of the non-shaded PV modules that leads to the mismatch losses. This work proposes a new technique to overcome the partial shading effect and also to enhance the total power generation from the PV array. The mismatch losses in the PV system is nullified in the proposed technique, by operating each row of the PV array with even current generation by extracting mismatch power from each row. The proposed technique is experimented in the 3 × 3 Total Cross Tied (TCT) PV array with nine numbers of 10 W PV modules. The experimental setup has been validated under the all possible shading patterns which shows that, the proposed technique nullifies the mismatch losses and also the performance has been compared with the other existing methods. The Percentage Power Loss (PLL) is greatly reduced in the proposed technique. The comparative analysis has been presented for eight shading patterns in the result and discussion in terms of Mismatch Loss (ML), Percentage of Power Loss (PPL) and Fill Factor (FF).

1. Introduction

Renewable energy resources are causing a valuable impact on the world's energy demand, and it is the hope for future. Among the renewable energy resources, solar energy is the most reliable source that faces allot of challenges on the energy crisis. Partial shading is the major constrain to the power generation of solar PhotoVoltaic (PV) system. Partial shading is caused due to the dynamic change of irradiation, shadows caused by the trees and nearby building. Due to the partial shading the PV system operated with non-smoothen P-V and I-V characteristic curves with multiple peaks. The consequences of the partial shading is: (i) It limits the current level and (Srinivasa Rao et al., 2014) it reduces the entire efficiency of the whole solar PV array (Indu Rani et al., 2014; Prince Winston, 2019). Different methodologies are proposed in different literature for the extraction of maximum power under partial shading situation. In (Srinivasa Rao et al., 2014), Boost converter is used as the MPPT tracker to track the maximum power in the P-V characteristics. Here, the extraction of maximum power under partial shading condition of the PV array is implemented using single time reconfiguration technique. This technique may subject to higher amount of wiring resistance losses. Moreover, an additive and reverse-based shifting algorithm was proposed to enhance the power production of the solar PV array in (Pillai et al., 2018). This method is efficient under various irradiation conditions and it reduces the mismatch power of the PV array. In addition, Indu Rani et al. (2013) proposed a pattern of solar PV array using Su Do Ku configuration to obtain the maximum power and to reduce the power losses (Sai Krishna et al., 2019). Furthermore, a rearranged square matrix method is highlighted in (Sajwan et al., 2018) to extract the maximum amount of power of a PV array. It is understood that, the physical relocation of the PV panel to disperse the shading effect is the best way to reduce the cost and improve the efficiency.

In (Sahu and Nayak, 2016), the Total-Cross-Tied based configuration was proposed to enhanced the output power from the whole PV array using in PRM-FEC (Physical Relocation of the Modules with a Fixed Electrical Connection) algorithm. The characteristics PRM-FEC is given by when occurs partial shading, equal distribution of row current in PV array. The line current is to be improved. In addition, a Branch and

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Effective Power Congestion Management Technique Using Hybrid Nelder–Mead – Grey Wolf Optimizer (HNMGWO) in Deregulated Power System

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ABSTRACT

The aim of this article is to apply Hybrid Nelder–Mead – Grey Wolf Optimizer (HNMGWO) in congestion management problem with optimal congestion cost by rescheduling generators in the power system. When the transmission power lines are overloaded in the power system, the following strategies are followed: generator rescheduling and installation of FACTS devices on the lines and load curtailment. But, load curtailment is not performed as the deregulated system encourages customer satisfaction. Thus, generator rescheduling is selected for problem solution as it does not involve the creation of any new infrastructure. Grey Wolf Optimizer (GWO) is one of the recent optimization techniques which work based on the leadership hierarchy and the hunting technique of grey wolves. The effective local search is performed by the Nelder–Mead (NM) method and the output is used to initialize the population for GWO, which searches global best value. In this paper, the HNMGWO is attempted based on the positive outcome of both NM and GWO. This proposed algorithm has been applied and results have been discussed related to the tasks of Independent System Operator. The proposed HNMGWO is applied in a standard IEEE 30 bus and IEEE 118 bus systems and thereby results are compared with standard GWO, Particle Swarm Optimization (PSO), fuzzy adaptive PSO, genetic algorithm, and bacterial foraging algorithms. The result shows that the proposed work is more effective by consuming minimum congestion cost in reduced rescheduled power and power loss.

KEYWORDS

Bilateral and multilateral transaction; generator rescheduling; generation cost minimization; Hybrid Nelder–Mead – Grey Wolf Optimizer (HNMGWO); power congestion management

1. INTRODUCTION

Among various tasks in the deregulated environment, transmission congestion is the most powerful task of Independent System Operator (ISO) all over the world. As power system deregulation is practiced extensively, the critical task of congestion management is important in maintaining system security and stability. At the same time, the additional cost in mitigating congestion should be least.

Several mathematical modellings were used for congestion management in the earlier years. Lagrangian decomposition approach is suggested where quadratic regional sub-problems are formed for interregional congestion [1]. To solve the congestion problem, an optimal power flow (OPF)-based method is used [2].

A modified augmented ε-constraint is used by considering congestion management as a multi-objective problem [3]. By clustering buses based on their sensitivity, congestion management has been solved by dividing the congestion areas as zones/cluster and it is solved by using the GAMS solver [4]. The Bender decomposition technique is used to relieve congestion on an iterative basis [5], whereas a modified Bender decomposition technique is used for a two-stage congestion management problem [6]. Based on the relative distance between generator nodes and load nodes, called relative electrical distance, congestion alleviation has been presented [7].

Nature-based optimization techniques are also applied to tackle congestion once these optimization techniques become dominant in various real-time applications. Genetic algorithm is applied to tackle congestion by using deterministic and genetic algorithms [8]. Particle swarm optimization (PSO) is applied to relieve congestion where the generation cost and line overload were taken as two objectives [9]. The minimization of congestion cost is considered as an objective function where the change in generation values is taken as particles and the movement of particle toward the global best is guided by the fitness function [10]. Variants of PSO are applied where the standard PSO with time-varying quantities, such as inertia weight and acceleration coefficients, was analysed along with classical PSO [11]. Congestion is eliminated by generation rescheduling by different

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RESEARCH ARTICLE

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Internet of things-based smart residential building energy management system for a grid-connected solar photovoltaic-powered DC residential building

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Summary

The intermittent nature of photovoltaic (PV), energy conversion losses, appliance compatibility, and load dynamics pose serious challenges to PV-based DC power distribution system in residential buildings. This article proposes a holistic approach to develop a new smart residential building energy management system using internet of things (IoT)-based multifunction compatible relaying system. The proposed system monitors the loads and provides uninterruptible power supply with minimum energy conversion losses. It achieves best operating load configuration, load prioritization in various modes, and demand-side management (DSM). IoT-based multifunction compatible relaying dystem is embedded with Information and Communication Technology-enabled PZEM module, smart relays, and appliance status monitoring devices. The proposed scheme has been implemented in a DC residential building located at Madurai, Tamil Nadu, India, with 1.5 kW PV system. The results are compared in four scenarios. The experimental results prove that the losses are minimized by 18% ensuring uninterrupted power supply. The implementation of DSM further reduces the losses by 5%. The appliances can be monitored through Grafana based in home touch screen.

KEYWORDS

demand-side management, energy conversion losses, internet of things, multifunction compatible relaying system, smart residential building energy management system

1 | INTRODUCTION

In India, residential sector consumes nearly 24.76% of the total energy generated.[1] The increase in number of household users consuming more than 500 units (based on bimonthly tariff structure) is one of the key driving factors for India's residential electricity sector. The demand of the residential sector will continue to grow significantly due to increased use of appliances. To meet this growing demand of residential sector, erecting small-scale rooftop solar photovoltaic (PV) systems in residential sector will prove to be viable solution.[2]

In this era, most of the household appliances are DC in nature, which requires AC to DC conversion.[3] The conventional grid-connected PV systems have AC distribution systems, while most of the household appliances are shifting toward DC. It is high time to shift from the conventional AC distribution to DC distribution system

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Analysis of voltage/current mismatch in solar photovoltaic power plants during fault panel replacement

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ABSTRACT

In few years of installation, hardly any of the PV panels need replacement, rather than the whole PV array. The common damage occurs due to hotspot/aging/partial shading condition. Moreover, during the replacement schedule, customers are not provided with the same type/rated panels after some years. Since manufacturers of PV panels in order to excel in their market, they update their products each and every year which in turn leads to lesser availability of same kind of panels. There comes necessity to go for an alternate option during panels' replacement. In this paper, panels replacement in the damaged position are discussed by classifying an alternate option into five different cases based on its type and ratings as follows: (i) Under rated same type, (ii) Over rated same type, and (iii) under-rated different type (iv) over-rated different type (v) Same rated different type. A 3*3 solar TotalCrossTied (TCT) array of 10 W polycrystalline panels are reviewed here for replacement. This paper also features the performance analysis of PV panels' replacement for without changing position and by changing position. Comparison in all the five cases are carried out based on their maximum power achievement for various values of irradiation. Power losses, maximum power, Fill Factor in all cases are discussed to attain the better replacement. Our paper will be beneficial for the solar PV sector, since we analyzed the performance of solar PV systems when other rated/type of panels are replaced when any of the existing panel becomes faulty.

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PV array; panels replacement; maximum power achievement; voltage/current mismatch

Introduction

In a tropical country like India, the scope for solar energy is abundant since the geographical location of the country stands to its worth. This energy is a utilitarian, if properly planned. Developed the infrastructure for production, transmission, utilization in energy aspect of our need, it will surely replace all the conventional form of energy such as coal, petroleum. The main advantages of this source of energy are unlimited, ubiquitous in nature with respect to India, cost effective and pollution-free (Ma et al. 2017). India is located (between 6̊ and 32̊ latitudes) in the sunny strap of the world. Up to 250–300 days a year clear sunny weather is long served in most parts of India (Sudhakar and Srivastava 2014). Moreover, the conventional forms of power production have many constraints such as quality of the fuel availability, load shedding, transmission loss etc. henceforth solar energy is one of the best alternative energy to earn massive response from consumers. In agriculture sectors also, solar energy works out in a specific way as Photovoltaic water pumping attracts farmers who are suffering from inadequacies in electric power supply (Mantri, Kasibhatla, and Chennapragada 2020). India's dependence on crude oil, fluctuation of price, dollars dominant trade washes away most of the reserves. If the

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Full Length Article

Rehash of cooked oil for the palatable water production using single slope solar still

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Solar still
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ABSTRACT

The present work investigates about the performance of single slope still (with rehash cooked oil) to enhance the palatable water productivity. The tray with basin contains rehash cooked oil represent the external heat source to increase the temperature of basin water. The performance of proposed solar still with the effects of high heat exchanger rehash cooked oil are studied. In this study, the proposed solar still is compared with conventional solar still for the purpose of evaluating the palatable water productivity under the presence of same ambient condition. The experimental result is obtained during the period from March to May 2019 under the Indian conditions. The production of palatable water reached 3.77 L\m^2 for the proposed still, while it is only 3.02 L/m^2 for the conventional still. The rate of rise of yield obtained from the single slope solar still with used cooked oil is 57.02% more than the yield obtained from the conventional still in an average. For the proposed still, the energy efficiency is 24.35% and the exergy efficiency is 0.69%.

1. Introduction

Plummeting groundwater, encroachment of sea water, withered reservoirs are the most important factors for water scarcity. In the 21st century, world is moving towards the use of renewable energy to reduce pollution and to have an eco-friendly environment. Fresh water and oil are the most essential resource in the world, but the actual threat is that both of them are not available in sufficient quantity. In past two decades, many researchers are working to recycle and reuse the available resources. Making the use of solar energy for the generation of palatable water is the best solution for water scarcity as this process is eco-friendly to the environment. The experimental analysis of single slope with two basins in solar still was studied by Modi et al. [1]. They used wick materials such as jute and cloth made of cotton and black in color is used to increase the productivity. The enhancement in yield of 18.03% and 21.46% at various depths was obtained from their experimental results. Pal et al. [2] made modifications in basin type with two slopes and used wick materials to enhance the amount of yield obtained. The yield obtained is 3.5–4.8 L/m^2 day. Hansen et al. [3] made an experimental analysis of solar still with one slope, three absorbing plates and three different wick materials. The experiment shows the use of wick material such as water coral fleece with stepped weir mesh as an absorber plate produces the maximum yield of about 4.28 L/day. Enhancing the basin type still by using rotating wick in vertical manner was experimentally done by Haddad et al. [4]. The output obtained as a result of this experimental setup shows the increase in output by 14.2% in hot season and 51.1% in cold season. Shalaby et al. [5] used 'v' corrugated absorber plate and used phase changing material to increase the productivity. Paraffin wax was used as phase changing material and hole is made at an equal distance in the copper tube is made in the solar still. Modification in stepped solar still by adding mirror as internal reflectorsis was reported by Omara et al. [6]. The percentage efficiency of this experimental setup is double than the conventional still efficiency. Suneesh et al. [7] designed a new type of solar still which looks like English alphabet 'v' in shape. They used cotton gauze over the glass to distribute the heat uniformly. They

Abbreviations: mL, Milliliter; PH, Potential of Hydrogen; HPP, High Precision Pyranometer; CRF, capital recovery factor; FAC, fixed annual cost; SFF, Sinking fund factor; ASV, Annual salvage value; M, Average annual capacity; AC, Annual cost; AMC, Annual maintenance operational cost; CPL, Cost of distilled water per liter; EHTC, Evaporative heat transfer coefficient

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RESEARCH ARTICLE

A relative study on energy and exergy analysis between conventional single slope and novel stepped absorbable plate solar stills

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Abstract

The innovation of novel absorbing materials using composite materials and nanotechnology is of new trends for many researches. Here, the present study is concerning to enhance the distilled water productivity of a proposed solar still (PSS) using novel absorbing materials. The absorbing material is composed of chitosan (obtained from waste shrimp shells), ethylene diamine tetraacetic acid (EDTA), and *Chrysopogon zizaniodes* (Vetiver). The combination of these materials is coined as CHEDZ, and it acts as a super absorbent polymer that is coated on the stepped solar still. Evaporation rate increases due to this absorbent, which further increases the yield of the still. In this present study, the PSS is compared with the conventional solar still (CSS) for the use of assessing the yield of freshwater in the same atmospheric circumstance. The experimental setup was performed through the period from December to February 2020 in the Indian climatic condition. The freshwater productivity was improved to 3.05 L/day while the yield of the CSS is 2.47 L/day. The increase in efficiency obtained from a PSS is 39.71% more than the productivity attained from the CSS. The energy efficiency of the PSS is 18.34% and the exergy efficiency is 0.45%.

Keywords Stepped absorbable plate · CHEDZ · Super absorbent · Renewable energy

Highlights of this study:

- The present study is concerning to enhance the distilled water productivity of a proposed solar still (PSS) using novel absorbing materials.
- The absorbing material is composed of chitosan (obtained from waste shrimp shells), ethylene diamine tetraacetic acid (EDTA), and *Chrysopogon zizaniodes* (Vetiver). The combination of these materials is coined as CHEDZ, and it acts as a super absorbent polymer that is coated on the stepped solar still.
- The increase in efficiency obtained from a PSS is 39.71% more than the productivity attained from the CSS. The energy efficiency of the PSS is 18.34% and the exergy efficiency is 0.45%.

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Optimization Studies on Improving the Dielectric Properties of Alkali Treated Fibers from *Phaseolus Vulgaris* Reinforced Polyester Composites by Central Composite Design

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ABSTRACT

This study investigates the dielectric efficiency of a composite prepared using a fiber extracted from *Phaseolus vulgaris*. The extraction of fiber was statistically modeled using face-centered central composite design. The concentration of NaOH and extraction time was taken as the process variables and dielectric strength was taken as the response. The numerically optimized model for the extraction of fiber from *Phaseolus vulgaris* of alkali treatment showed 14.325 kV/cm as dielectric strength of initial NaOH concentration of 3% and time period of 51 min. The model was significant with $R^2 = 0.9323$ and adjusted $R^2 = 0.884$. The linear, quadratic & interactive relationship between the response (dielectric strength) and variables (NaOH & time) was also established. This study explains the importance of NaOH and time period in establishing the fiber extraction by the alkali treatment process.

摘要

本研究研究使用从西多卢斯提取的纤维制备的复合材料的电介质效率. 纤维的提取采用以面为中心的中央复合设计进行统计建模. 以NaOH的浓度和提取时间作为过程变量和介电强度作为响应. 碱处理的Phaseolus纯化纤维提取数值优化模型显示，初始NaOH浓度为3%，周期为51分钟，介电强度为14.325千伏/厘米. 该模型在 R2 = 0.9323 和调整后的 R2 = 0.884 时显著. 建立了响应（电强度）和变量（NaOH + time）之间的线性、二次和交互关系. 本研究阐述了NaOH和时间段在碱处理工艺建立纤维提取过程中的重要性.

KEYWORDS

Response surface methodology; face centered central composite design; dielectric strength; Fibers; alkali treatment

关键词

响应面方法; 面为中心的中央复合设计; 电介质强度; 纤维; 碱处理

Introduction

An electrical insulator is a material which resists the flow of electric charges. Insulator differs from other materials like semiconductors and conductors based on the principle of resistivity. Insulators acquire higher resistivity than semiconductors and conductors. A class of insulators which can store charges are dielectrics. Rubber, paper, porcelain, and plastics are widely used commercial insulators. The insulator has a point at which a high voltage will cause an arc, breaking down its internal structure and forcing it to conduct the flow of electrons. Dielectric strength refers to the voltage breakdown rating of a material. The better insulator has the high dielectric strength (Omah et al. 2018). In the electrical applications, a variety of solid, liquid and gaseous insulators are used. The primary electrical systems use insulators as wooden poles in telegraph lines which gives very poor results during damp weather. Glass insulator with untreated pinhole is also used in

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Investigation on the Physicochemical and Mechanical Properties of Novel Alkali-treated *Phaseolus vulgaris* Fibers

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ORIGINAL RESEARCH

Saccharum barberi grass bagasse ash-based silicone rubber composites for electrical insulator applications

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Abstract

Induction motors, acting as work house of industries, are affected by winding temperature due to poor insulation. In producing a sustainable polymer composite electrical insulator, this article gets into the investigative study of tensile strength, hydrophobicity, hardness and the electrical breakdown properties of silicone rubber (SR) reinforced with sugarcane bagasse ash (SCBA). In order to identify optimal proportion, various filler proportions are studied for mechanical, physical, tensile and electrical properties. For 7% optimal filler composition, the tensile and hardness tests on SR/SCBA composite manifested a maximum value of 78.48×10^{-3} MPa and 0.91496 MPa, respectively. The electrical breakdown was recorded with the maximum value of 108.65 kV/cm with 7% filler. For hydrophobicity, the 7% filler specimens had the lowest rate of rise in weight after the water absorption test. Scanning electron microscopy (SEM) analysis and particle size analysis were carried out to evaluate the molecular interaction and particle dispersion. SEM analysis confirmed the presence of fiber-adhesion in matrix composites. Finally, the superiority of the context is also compared with earlier works. This context investigates the properties of bio-resin composite derived from sugarcane ash and creating its properties with artificial polymers to come out with a reliable electrical insulator application.

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Exploration of Electrical, Thermal, and Mechanical Properties of *Phaseolus vulgaris* Fiber/Unsaturated Polyester Resin Composite Filled with Nano–SiO2

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ABSTRACT

In this study, the electrical, thermal, and mechanical properties of hybrid natural fiber composite are taken under consideration. Fly ash waste is used as the filler material. Unsaturated polyester resin is used as the matrix material to bind the composite. Alkali-treated *Phaseolus vulgaris* fiber (PVF) (5% NaOH for 45 min) is taken as the primary filler. Nanosilica synthesized is added to the composite samples at a constant percentage (1%). Samples of various weight percentages are prepared (2%, 4%, 6%, 8%, and 10% of PVF) and studied. Dielectric strength test for electrical property, thermal conductivity test for the thermal property, mechanical tests like tensile strength, Brinell hardness, Izod impact tests, and water absorption test are also taken under consideration. The composite showed a regular increasing trend in mechanical and electrical properties with varying weight percentages until 6% PVF; afterward, a decreasing trend in the mechanical and electrical properties of the composite was found with greater weight percentages. Whereas for thermal conductivity and water absorption tests, the results showed a regular decreasing trend until 6% PVF; afterward an increasing trend was found. It is found that the composite of 6% PVF and 1% SiO_2 shows better electrical, thermal, and mechanical properties.

摘要

本研究考虑天然纤维混杂复合材料之电、热及力学性质. 粉煤灰废料用作填料. 以不饱和聚酯树脂为基体材料对复合材料进行了粘结. 以碱处理的菜豆纤维（PVF）（5%NaOH，45min）为主要填料. 合成的纳米二氧化硅以1%的比例加入到复合材料中. 制备了不同重量百分比的样品（PVF的2、4、6、8和10%），并对其进行了研究. 还考虑了电气性能的介电强度试验、热性能的导热性试验、拉伸强度、布氏硬度、Izod冲击试验和吸水性试验等机械试验. 复合材料的力学性能和电学性能随重量百分比的变化呈规律性的增加趋势，直到6%PVF后，随着重量百分比的增加，复合材料的力学性能和电学性能下降. 而对于热导率和吸水率，则表现出规律性的下降，直到6%PVF后才开始上升. 结果表明，6%PVF和1%SiO2的复合材料具有较好的电学、热学和力学性能.

KEYWORDS

Phaseolus vulgaris fibe electrical properties; t properties; mechanical properties; hybrid composite; Nanosilica

关键词

菜豆纤维; 电性能; 力学性能; 混杂复合 纳米二氧化硅

Introduction

In recent days, maintaining green balance among the globe plays a vital role, and awareness saving the green became popular. Now researchers fetching an alternative for polymer compo

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Dielectric Characterization of Epoxy resin Filled with Micro and Nano fillers of SiO_2 and Al_2O_3 for Encapsulations of Electronic Devices

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***Abstract*—** In recent years Epoxy resin plays important role in Information Technology and Electronics sector because of its wide range of applications. It is used in the manufacturing of major electronic components such as transistors, printed circuit boards, Solar panels, and many other devices. In this paper, the normal epoxy resin has been integrated with the Micro and Nanofillers to enhance its dielectric strength and dielectric loss. The performance enhancement of the composited epoxy resin has been measured and compared with the normal epoxy resin. The proposed epoxy resin has been tested in both AC and DC circuits with various composition levels. In AC circuits, the 3:1 composition of Micro silica and alumina has the less power loss sampled at 100 Hz and 100^{o} C and it has the more power loss sampled at 5 MHz and 100^{o} C with the composition of 1:3. In DC circuits, the 3:1 composition of Micro silica and alumina has the less power loss sampled at 50 Hz and 150^{o} C and it has the more power loss sampled at 5 MHz and 150^{o} C with the composition of 1:3.. The semiconducting devices are operating with the high temperature stress, where the resin coating has employed for reducing the heat dissipation. The experimental validation of the composite epoxy resin at various composition levels, various sample rates has given and compared with the normal epoxy resin. The efficiency of the epoxy resin is measured by coated it on the semiconducting devices.

Keywords- *Dielectrics, Dielectric strength, Epoxy Resin, Fillers, Dielectric Strength, Dielectric Loss, Semiconductor*

I. INTRODUCTION

The Evolution of power electronics devises brings many advantages to electrical systems by reducing the size of equipment, increasing the quality, etc., [1]. Dielectrics are an important part of power electronic systems for various applications such as converters, power stabilization, communication, etc., [2]. Epoxy resins are discovered invented in the year 1909 which is defined as low molecular weight pre-polymers contained with more than one epoxide group [3]. It has a wide range of applications in various fields like fiber optics, high-performance coating, general-purpose adhesives, encapsulating materials, etc., because of its good mechanical properties, chemical and heat resistance, adhesiveness. Epoxy resins have different properties which are depending on the composite materials with them [4-8]. A tiny inorganic particle added with the polymer insulating materials to avoid tracking was called as Nano fillers. Nano fillers were also used to improve the appearance and mechanical properties of polymer insulating materials. Polyamides or polyimide were group of thermo set polymers with the highest heat resistance of all polymers as per IEC 60317-13. They were often used to make composite parts in the aerospace industry. In the past decade, the

GUI Based Online Monitoring of Performance Parameters of Solar Panel

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Abstract

This paper focuses on monitoring and assessment of the characteristics and the performance parameters involved with the solar panel are implemented using GUI. The characteristics curve and performance parameters are documented on the webpage and accessed online through the internet using the browser. The proposed method is verified with a 5KW solar panel which is used by an educational institution located in Madurai. The current-voltage (I-V), power-voltage (P-V) characteristics and the performance factors related to the solar panel are monitored and analyzed. The results show that there is a good agreement between the measured and simulation results values at the acceptable working condition of the panel. GUI is the Graphical User Interface that uses graphical icons for performing functionalities and visual indicators for interacting with users through input and output. Laboratory Virtual Instrument Engineering Workbench (LabVIEW) environment is used as GUI. LabVIEW is a graphical programming language used to acquire, present and analyze the electrical parameters. This application software integrates measuring instruments into a single system that able to display data from the solar panel on the webpage. This is used as potential pedagogical tool in teaching and learning process. The comparative results of the power generated from the solar panels in winter and summer are analyzed.

Keywords: *Browser, GUI, LabVIEW, Online, Web page*

1. Introduction

The electricity tariff for power consumption rises abruptly as the power utilization increases. For commercial industries, the tariff is varying based on the slab of power usage. To reduce the cost of the electricity bill, the industries generate electrical energy of their own by using renewable sources. The educational institute running at day time generates power with the help of renewable sources and cut down the EB bill. Moreover, renewable energy is clean, green and free energy. India receives more than 7 hours of direct sunlight each day throughout the year. The sunlight is converted to electrical energy with the help of the solar cell [1-5]. However, the performance solar panel plays a major role in power generation. A real-time monitoring system is needed to evaluate important parameters such as irradiance, output voltage, current, power, panel temperature and ambient temperature for appropriate utilization of solar panel. LabVIEW package is used to display, analyze and store the collected data. In this paper, all necessary data from the solar panel is acquired, parameters involved with the PV modules is calculated and evaluated, and webpage is created for online monitoring of data and the behavior of the dynamic system in real time at a remote location is studied and also it is used as pedagogy

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Thermal, mechanical, and electrical properties of difunctional and trifunctional epoxy blends with nanoporous materials

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Abstract

In the present study, the aim is to synthesize the particulate nanocomposites with difunctional and trifunctional epoxy blend as matrix and synthesized nanoporous materials as fillers. Organic/inorganic hybrid networks were prepared by the novel solvent free method. Viscoelastic, thermal, and electrical properties of di- and trifunctional epoxy and the effect of different nanoparticles in the particulate nanocomposites have been studied by dynamic mechanical analyzer, thermogravimetry (TGA), and dielectric strength. Epoxy mixed with different compositions of TGPAP and particulate nanocomposites by the addition of different types of nanomaterials shows higher storage modulus than the pure epoxy. The addition of TGPAP and nanofillers decreases the thermal stability of epoxy matrix. The evolved gas analysis (TG-FTIR) was also done in order to study the products formed during degradation. An increase in dielectric strength and impact strength (4%) was also observed in the particulate nanocomposites.

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NEW FIXED POINT THEOREMS FOR SET VALUED MAP ON *G*-METRIC SPACES

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ABSTRACT. By this article, we get a common fixed point for the pair of set-valued maps on a G-complete G-metric spaces in new way. Further, we extend this technique and proved the existence of the coincidence points for a pair of set-valued and single-valued maps on such spaces.

1. INTRODUCTION AND PRELIMINARIES

In [1], Banach newly proved the existence of fixed point of self maps satisfying contraction principle on metric space. Afterwards, in [3] Nadler was focused his interest to study and established fixed point on multi-valued mappings and his effort, he proved such in Banach contraction principle version and subsequently many author were contributed their important to develop and extend the concept of Banach contraction principle in many ways.

In 2006, Z.Mustafa and B.Sims [2] introduced the new notion called $G-$metric space which is generalization of metric space. In this direction, several research articles related to fixed point theory on $G-$metric space have appeared.

In this article, we proved the existence of fixed point of a set-valued map defined on $G-$complete $G-$metric space satisfying some simple fractional condition only. Further we extend this concept to prove the existence of common fixed point for a pair of set-valued maps.

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Key words and phrases. Fixed point, Coincidence point, G - metric spaces, Set-valued map.

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A DOUBLE-SEQUENCE HYBRID S-ITERATION SCHEME FOR FIXED POINT OF LIPSCHITZ PSEUDOCONTRACTIONS IN BANACH SPACE

S. Gopinath, J. Gnanaraj and S. Lalithambigai

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Keywords and phrases: Lipschitz pseudocontraction, Double sequence Hybrid S- Iteration, Banach space, Nonexpansive, Strong convergence.

Abstract. For any closed convex non-empty subset C of a real Banach space E, we proved that a double sequence Hybrid S-Iteration scheme converges to a fixed point of Lipschitz pseudocontractive map T which maps C into C.

1 Introduction

In this article, we only consider a real Banach space. For a Banach space E, the normalized duality map from E to 2^{E^*} is denoted by J and is defined by

$$J(x) = \{f^* \in E^* : \langle x, f^* \rangle = || x ||^2, \ || f^* || = || x ||\}, \quad for\ all \ \ x \in E,$$

where E^* denotes the dual space of E and $\langle . , . \rangle$ denotes the generalized duality pairing. We will denote single-valued duality map by j.

The following definitions have been studied widely and deeply by many authors; see, e.g., [1-12] for more details.

Definition 1.1. Let C be non-empty closed convex subset of a Banach space E and let $T : C \to C$ be a mapping. Then

(i) The mapping T is said to be nonexpansive if

$$|| Tx - Ty || \leq || x - y ||, \quad for\ all \ \ x, y \in C$$

(ii) The mapping T is said to be Lipschitzian if there exists a constant L >1 such that

$$|| Tx - Ty || \leq \ L || x - y ||, \quad for\ all \ \ x, y \in C$$

Now let us recall pseudocontractive and strongly pseudocontractive mapping.

Definition 1.2. The mapping $T : C \to C$ is said to be pseudocontractive if there exists $j(x-y) \in J(x-y)$ such that

$$\langle Tx - Ty \ , \ j(x-y) \rangle \ \leq || x - y ||^2 \quad for\ all\ x, y \in C.$$

Definition 1.3. The mapping T is said to be strongly pseudocontractive if there exists $0 < k < 1$ such that

$$\langle Tx - Ty \ , \ j(x-y) \rangle \ \leq \ k || x - y ||^2 \quad for\ all\ x, y \in C.$$

In [11], C. Moore introduced the concept of double sequence iteration process in fixed point theory. Let $\mathcal{N}$ denote the set of all the non-negative integers and let E be a normed linear space. By a double sequence in E is meant a function $f : \mathcal{N} \times \mathcal{N} \to E$ defined by $f(n, m) = x_{n,m}$ which is in E.

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On group vertex magic graphs

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Abstract

Let $G = (V(G), E(G))$ be a simple undirected graph and let $\mathcal{A}$ be an additive abelian group with identity 0. A mapping $l : V(G) \to \mathcal{A} \setminus \{0\}$ is said to be a $\mathcal{A}$-vertex magic labeling of G if there exists an element μ of $\mathcal{A}$ such that $w(v) = \sum_{u \in N(v)} l(u) = \mu$ for any vertex v of G, where $N(v)$ is the open neighborhood of v. A graph G that admits such a labeling is called an $\mathcal{A}$-vertex magic graph. If G is $\mathcal{A}$-vertex magic graph for any nontrivial abelian group $\mathcal{A}$, then G is called a group vertex magic graph. In this paper, we obtain a few necessary conditions for a graph to be group vertex magic. Further, when $\mathcal{A} \cong \mathbb{Z}_2 \oplus \mathbb{Z}_2$, we give a characterization of trees with diameter at most 4 which are $\mathcal{A}$-vertex magic.

Keywords: $\mathcal{A}$-vertex magic; Group vertex magic graph; Weight of a vertex; Tree

1. Introduction

By a graph $G = (V, E)$ we mean a finite undirected graph with neither loops nor multiple edges. The order $|V|$ and the size $|E|$ are denoted by n and m respectively. For graph-theoretic terminology, we refer to Bondy and Murthy [1]. For concepts in group theory, we refer to Herstein [2].

Throughout this paper $\mathcal{A}$ stands for an abelian group with identity element 0. The group $\mathbb{Z}_2 \oplus \mathbb{Z}_2 = \{(0, 0), (1, 0), (0, 1), (1, 1)\}$ under component-wise addition modulo 2 is the Klein's-4 group and is denoted by V_4.

Lee et al. [3] introduced the following concept of group-magic graphs.

Definition 1.1. For any abelian group $\mathcal{A}$, a graph $G = (V, E)$ is said to be $\mathcal{A}$-magic if there exists a labeling $l : E(G) \to A \setminus \{0\}$ such that the induced vertex labeling $l^+ : V(G) \to A$ defined by,

$$l^+(v) = \sum_{uv \in E(G)} l(uv)$$

is a constant map.

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An improved particle swarm optimization algorithm to solve hybrid flowshop scheduling problems with the effect of human factors – A case study

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ABSTRACT

This paper addresses the multi-stage hybrid flowshop scheduling problem with identical parallel machines at each stage by considering the effect of human factors. The various levels of labours and the effects of their learning and forgetting are studied. The minimization of the weighted sum of the makespan and total flow time is the objective function. Since the problem is NP-hard, an improved version of the particle swarm optimization (PSO) algorithm is presented to solve the problem. A dispatching rule and a constructive heuristic are incorporated to improve the initial solutions of the PSO algorithm. The variable neighbourhood search (VNS) algorithm is also hybridized with the PSO algorithm to attain the optimal solutions consuming less computational time. An industrial scheduling problem of an automobile manufacturing unit is discussed. Moreover, several instances of the random benchmark problem are used to validate the performance of the proposed algorithm. Computational experiments have been performed and the results prove the effectiveness of the proposed approach.

1. Introductions

Production scheduling is vital in any manufacturing industry to maintain a competitive position in the fast-changing global market. For this, effective and efficient advanced scheduling technologies and approaches are to be developed. Hybrid flowshop (HFS) scheduling problems appear in a variety of manufacturing systems, such as textile, furniture, iron and steel, and so on. HFS is an extended version of flowshop scheduling which permits a job to be processed by any one machine from a given set of machines during a given stage. It finds equal importance in both the fields of production management and combinatorial optimization. Due to the strong non-deterministic polynomial-time hard (NP-hard) nature of this problem (Gupta, 1988; Hoogeveen et al., 1996), exact methods cannot be used to solve even small-sized problems. Therefore, researchers have addressed many heuristics and meta-heuristics to solve these problems. It is quite common in the scheduling literature to assume processing time to be a constant. However, in real industrial scenarios, processing time is not fixed. In fact, it varies due to a number of reasons, such as differing levels of labourers, their learning and forgetting skills, and so on.

Human factors such as boredom and fatigue also disturb the performance of labourers on the shop floor (Aravindkrishna et al., 2009). To improve the performance of labourers, the idea of job rotation was presented, and the genetic algorithm (GA) and imperialist competitive algorithm (ICA) were suggested to solve these job rotation scheduling problems (Ayough et al., 2012). A multi-objective mixed integer programming model was established for workforce scheduling. The relationships between workers' skills, fatigue, attitudes and strengths, and their performance while performing a job were considered by the researchers (Othman et al., 2014). Boenzi et al. (2015) addressed the effects of skill and age of the workers and recommended a job rotation model to increase system performance. Calzavara et al. (2019) also considered the problems of ageing of labourers. The researchers presented a comprehensive literature review on the management of an ageing workforce in manufacturing industries. They highlighted that more work should be done on the impact of the aging of workers on production systems. The investigators stated that the consideration of human factors would improve production efficiency (Gong et al., 2018). However, it would be difficult to compute the human factors such as boredom, fatigue levels, attitudes and strengths (Bidanda et al. 2005). Moreover, the objective of the

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Optimal inventory system for pharmaceutical products incorporating quality degradation with expiration date: A game theory approach

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ABSTRACT

Healthcare supply chain systems around the world face an immediate pressure to transform in the face of unprecedented demand and high Customer Service Level (CSL). And the expiration date of a pharmaceutical product is also a widespread issue in a customer's purchase decision. In view of this, studies are essential to understand operations in healthcare systems and to offer decision support tools that improve public health, patient safety and strategic decision-making in the healthcare systems. This paper proposes a game theory approach for addressing inventory strategies for managing the flow of a pharmaceutical raw-material incorporating different quality characteristics in a two echelon hospital and pharmaceutical company supply chain. This research also considers a more realistic situation where the deteriorating rate of a finished product gradually increases as the expiration date approaches. We design a procedure for deciding an optimal strategy to achieve the target CSL of the hospital with the help of game theory payoff matrix. Numerical example is presented to illustrate the solution procedure and the sensitivity analysis of some key parameters is provided to demonstrate the proposed model.

1. Introduction

Healthcare Supply Chain (HSC) is series of processes, workforce involved across different teams and movement of medicines, surgical equipment, and other products as needed by healthcare professionals to do their job [1]. HSC normally consists of pharmaceutical wholesalers, pharmaceutical companies, hospitals, medical surgical distributors, medical shops, etc [2]. In many industries, the cost of goods sold is high relative to price, so gross margins are relatively low. So companies tend to focus on controlling supply chain costs by minimizing inventory levels and improving efficiency. Missing a few sales can be less important than managing inventory levels overall. In the healthcare industry, it is different: People's lives and health depend on an uninterrupted supply of medicine. Disrupting patients' lives by missing a sale is simply unacceptable. In addition, pharmaceutical products can be expensive to purchase and distribute. Thus an effective inventory management of pharmaceutical is required to ensure the 100% product availability at the right time, at the right cost, in good condition to right customers. In view of this, the aim of all pharmaceutical industries is to provide high customer service with minimum supply chain cost.

Numerous researchers recently developed papers in the field of healthcare supply chain and inventory management in various environments. Norris [3] investigated cost reductions for hospitals by considering the total delivered cost of a product rather than just the unit cost. Dellaert and Van de Poel [4] developed a simple inventory rule for joint ordering in a university hospital, but they ignored capacity constraints. Lapierre and Ruiz [5] designed a strategy for improving hospital logistics by focusing on scheduling decisions and a supply chain approach rather than the more common multi-echelon inventory management. Kelle et al. [6] provided decision support tools that improve operational and strategic decision-making in HSC management under periodic review inventory policy. Sharon and Dmitry [7] suggested an operational research approach to minimize the program costs while maintaining a required standard of public benefits using supply chain concepts and techniques. The inventory models mentioned above are single-echelon models that consider a constant lead time, which is not a controllable factor under a periodic inventory review environment.

All steps from the supply of raw materials to the finished products can be covered in a supply chain connecting raw material suppliers, manufacturers, retailers and the customer/hospital. Multi-echelon inventory management is the management of inventory and coordination of the distribution process at more than one level of a supply chain network. Kim [8] presented

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Optimal inventory strategies for two-echelon supply chain system involving carbon emissions and fuzzy deterioration

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Abstract: The industry sector is an vital direct and indirect source of carbon emissions. Today industries are looking for solutions to reduce carbon emissions associated with their operations. Operational adjustments, such as modifications in batch sizes or order quantities, have proven to be an effective way to decrease emissions. This paper provides a new mathematical model which integrate cost and emissions in transportation and storage to execute optimal operational adjustments for deteriorating products under the framework of two-echelon inventory system. The deterioration rate is treated as the triangular fuzzy number, and we use the extension principle to find the membership function of the fuzzy total cost and defuzzify by the centroid to find the estimate of the total cost in the fuzzy sense. Numerical example is performed to show the effectiveness of the proposed model, and several managerial insights are observed from sensitive analyses which may help both the government and the industry to adopt appropriate carbon reduction regulations.

Keywords: deteriorating product; fuzzy number; centroid method; carbon emission.

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ARTICLE

Mechanical and Acoustic properties of Bagasse – Coconut Coir based Hybrid Reinforced Composites

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ABSTRACT

In this paper, a hybrid composite is developed from natural fibers of bagasse and coconut coir. The mechanical and acoustic properties of the hybrid composites are investigated. While preparing the hybrid composites, the polyester resin is used as a matrix. Treated and untreated specimens were prepared by varying the weight percentage of bagasse and coconut coir fibers and resin. Various mechanical tests including tensile test, hardness test, flexural test, impact test and impedance tests were carried out as per ASTM standards. Experimental results on comparison reveal that the developed hybrid composite has a better sound absorption coefficient values and mechanical properties. Hence, the proposed hybrid composite could be used in Industries.

摘要

本文以甘蔗渣和椰子壳聚糖为原料, 研制了一种混杂复合材料. 研究了混杂复合材料的力学性能和声学性能. 在制备杂化复合材料时, 以聚酯树脂为基体. 通过改变蔗渣和椰子椰壳纤维和树脂的重量百分比来制备处理和未处理的样品. 根据ASTM标准进行了拉伸试验、硬度试验、弯曲试验、冲击试验和阻抗试验. 对比实验结果表明, 所研制的杂化复合材料具有较好的吸声系数和力学性能. 因此, 所提出的杂化复合材料可用于工业领域.

KEYWORDS

Composites; natural fibers; bagasse; coir; tensile strength; impedance test

关键词

复合材料; 天然纤维; 蔗渣; 椰子壳; 抗拉强度; 阻抗测试

Introduction

Sound will be a significant disturbance in various industries, residential places, home appliances as well as in automobiles (Arenas and Crocker 2010). Effective noise control is required in industries as it affects the laborers psychologically and hence the production (Zhu et al. 2014). Though several synthetic materials are used for sound absorption such as rock wool, glass wool, and mineral wool, the use of these materials would cause a severe threat to the health of the workers. Hence, researchers developed several natural fiber-based composites to replace the existing synthetic materials. The fiber-based composites have many advantages including high sound absorption coefficient, environmentally friendly, bio degradable, availability, low cost, and ease of manufacturing (Gokulkumar et al. 2019). Renewable and biodegradable nonwovens were produced using banana, bamboo, and jute fibers to reduce noise in the automotive interiors (Thilagavathi et al. 2010). Fouladi et al. (2013) used the coir, corn, sugar cane, and grass fibers for sound absorption. They prepared samples and measured their porosities and sound absorption coefficient. They proved that the increase the thickness would reduce the porosity and improve the absorption coefficient.

Putra et al. (2013) suggested sugarcane-wasted fibers as a sustainable acoustic absorber. They concluded that the sugarcane wasted fibers have an average absorption coefficient of 0.65. Xiang et al. (2013) investigated the sound absorption properties of kapok fibers. Doost-hoseini, Taghiyari,

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Article

Sustainable Decision-Making Approach for Dual-Channel Manufacturing Systems under Space Constraints

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Abstract: In response to the digital revolution, nowadays, many companies operate online and offline businesses in parallel to ensure their future competitiveness. This research examines the inventory strategy for multi-product vendor-buyer supply chain systems, considering space constraints and carbon emissions, in order to improve competence in managing online and offline integrated orders. We amalgamate costs and emissions in transport and storage. Here, we divide the warehouse of the buyer into two stages: one for satisfying online orders and the other for satisfying offline orders. We also assume that additional crashing costs reduce the lead times for receiving products in the buyer's warehouse. This study demonstrates a mathematical model in the form of a constrained non-linear programme (NLP) and derives a Lagrangian multiplier method to solve it. An iterative solution procedure is designed in order to attain sustainable manufacturing decisions, which are illustrated numerically.

Keywords: dual-channel; space constraint; carbon emission; Lagrangian multiplier

1. Introduction

The modest business environment may amplify the need for industrial storage in order to grasp a higher assortment of products and serve a broader topographical zone of consumers. We should think about stretching out our warehousing abilities to satisfy our commerce and clientele needs more readily throughout this development and extension. The frequent warehouse configurations are either centralized or decentralized. Centralization involves a primary site that supplies all the ordered products to the various sites, such as suppliers, buyers, etc. Decentralization is a method of controlling the batches of various warehouses that send out the products to multiple locations to better aid different markets or store various products. The well-known merit of centralized warehousing is the reduction in operating costs. A significant drawback to centralization is the increased shipping costs. The merits of decentralizing are the reduction in the delay of material handling and an increased ability to store products. The biggest problem with decentralization is the increased operating costs.

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ORIGINAL ARTICLE

A memetic algorithm to solve uncertain energy-efficient flow shop scheduling problems

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Abstract
This paper addresses energy-efficient flow shop scheduling problems with uncertainties such as cancelled and new orders to minimize the total energy cost (TEC). The absenteeism of workers is also considered. As this problem is NP-hard (non-deterministic polynomial-time hard) in nature, an improved memetic algorithm (IMA) is proposed to tackle this problem. A constructive heuristic is built-in with the memetic algorithm (MA) for the improvement of the solution quality. Additionally, likelihood-based selection, crossover, and mutation operators are utilized in the IMA. A variable neighborhood search (VNS) algorithm is also hybridized as a local exploration heuristics. Broad computational experimentations are presented. The results of IMA are compared with a set of algorithms addressed in the literature. It is shown that the IMA overtakes other algorithms in terms of solution quality.

Keywords Scheduling · Flow shop · NP-hard · Memetic algorithm · Total energy cost

1 Introduction

Due to global competitive market, industries ought to supply their products at low cost and at right time. But industries are struggled due to several problems such as cancelled and new orders from the customers. Some customers may cancel their order before the commencement of production while certain customers may cancel their job order after the production has begun. The first scenario is relatively easier to tackle than the second one. However, in both the cases, the scheduling would become a complex problem. Moreover, rules and regulations related with environmental impacts should be satisfied by the industries as well as service sectors. Hence, energy-efficient scheduling plays vital role in most of the industries [1]. Though a wide variety of scheduling problems are addressed in the scheduling literature, flow shop scheduling problems play vital role due to their practical and theoretical importance since it was proposed by Johnson [2]. A flow shop is defined as a shop that consists of two or more machines. The jobs are processed by the machines in the same order. The flow shop scheduling problems are NP-hard in nature. The layout of a flow shop with n jobs and m machines is shown in Fig. 1 [3]. The flow shop scheduling problems were addressed by a lot of researchers for the past several decades. They considered different objective functions such as minimization of makespan, flow time, and number of tardy/early jobs. Very few researchers only tackled the scheduling problems with total energy cost objective that is significant for better environmental sustainability [4]. Hence, energy-efficient flow shop scheduling problems are considered in this paper. The workers' absenteeism would be another big challenge to be considered by the industries while preparing effective schedule. Therefore, the objective of the present work is to minimize the total energy cost of an energy-efficient flow shop scheduling problem by considering the cancelled and new orders and the absenteeism of workers. The rest of the paper is organized as follows: The detailed literature of scheduling problems is presented in "Section 2." "Section 3" illustrates the problem considered in the present work. The proposed improved memetic algorithm will be described in detail in "Section 4." Computational experiments are addressed in "Section 5."

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Solving industrial multiprocessor task scheduling problems using an improved monkey search algorithm

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Abstract: This paper addresses multiprocessor task scheduling in a multistage hybrid flowshop environment which has been proved to be strongly NP-hard. An improved monkey search algorithm (IMSA) is proposed to solve this problem. The objective is to minimise the makespan which is the completion time of all the tasks in the last stage. The proposed algorithm is tested with three types of problems. A real industrial data is first used. Then, random problem instances are generated and finally, the benchmark problems addressed in literature are also considered. In all the three cases, the results are compared with earlier reported algorithms in the literature and the computational results reveal that the proposed algorithm is competent.

Keywords: scheduling; hybrid flowshop; HFS; multiprocessor tasks scheduling; NP-hard; monkey search algorithm; MSA; makespan.

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RESEARCH ARTICLE

Polymer COMPOSITES WILEY

A novel palm sheath and sugarcane bagasse fiber based hybrid composites for automotive applications: An experimental approach

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Abstract

A novel hybrid composite was developed from natural fibers and the mechanical properties were investigated in this work. The palm sheath and sugarcane bagasse fibres were the natural fibers used and epoxy resin was the matrix. By using compression-molding machine, various samples were prepared by varying the weight proportions of fibers. The performance of fibers was investigated under untreated and NaOH treated conditions. The tensile properties, flexural properties, hardness, and impact properties were evaluated using ASTM standards. The best sample was determined based on the experimental results. The best sample had the tensile strength of 19.80 ± 0.78 MPa, Young's Modulus of 0.953 ± 0.076 GPa, flexural strength of 28.79 MPa, impact strength of 2 kJ/m^2, and the hardness value of 38.02 HD. The best sample was used to develop an automobile dashboard to justify its application.

KEYWORDS

epoxy resin, mechanical characterization, micro-structural analysis, palm sheath fiber, sugarcane bagasse fiber

1 | INTRODUCTION

As the natural fibers have several benefits such as easy availability, biodegradability, lightweight, low cost and the ease of manufacturing, the natural fiber-based biocomposites have replaced the synthetic plastics in wide variety of fields [1]. Several researchers have proposed many natural fiber based composites for various engineering applications [2]. Because of their lightweight nature, biocomposites used by the automobile industries enhance their fuel economy [3]. Researchers have also investigated hybrid biocomposites that are made by adding two or more variety of natural fibers in a standard matrix to increase the mechanical properties [4]. Moreover, from the literature [5–8], it is confirmed that there is no reported study on the hybrid biocomposite based on palm sheath and sugarcane bagasse natural fibers. Therefore, in the present study, a hybrid biocomposite based on palm sheath and sugarcane Bagasse is developed for the automobile sector. The matrix material has considerable impact on the mechanical properties of the biocomposites. Hence, authors have used epoxy resin as the

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Research Articl

Application Of Neutrosophic Soft Set In Medical Diagnosis

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Abstract: Fuzzy theory and neutrosophic theory are almost trending in all the fields. This paper exhibit techniques of neutrosophic soft set by demonstrating a case study of the patients. Analyse the medical report of the patients; the result obtained in the current work is compared with the existing earlier result to carry out the conclusion.

Keywords: fuzzysoftset, $\mathcal{N}_{SS}$,$\mathcal{N}_{SSM}$, defuzzification.

1. Introduction

The present situation of every person's life is unpredictable. Since the day to day life style of people are changing new problems in health also occurs. The most commonly found health problem all around the world is Diabetes which has become usual to all generations at present. Diabetes is incurable, but to lead a healthy life with diabetes we should keep the sugar level under control by food habits, exercises, taking regularly the prescribed medicine and regular checkup. At times when the sugar level is uncontrolled it becomes complicated and it may lead to other co-related diseases. To investigate the health problem at earlier stage, even with the insufficient or indistinct information we can find out the state of disease in earlier by neutrosophic soft set ($\mathcal{N}_{SS}$). Fuzzy mathematics as an approach of describing uncertainty was put forward in 1965 by Lotfi.A.Zadeh [11].Molodtsov [5] brings out the inherent difficulties in fuzzy concept using soft set theory. Soft set theory has many potential applications. Extensive research has been done and new methods of medical diagnosis have been proposed with Sanchez's approach. Florentine Smarandache [1] introduced a novel concept called Neutrosophic set for handling data with imprecise, indeterminacy and inconsistent. Later Maji [6] presented a new topic named Neutrosophic soft set. In this paper we are going to use neutrosophic soft set and the well-known Sanchez's medical approach, for diagnosing a diabetes patient having certain symptoms of medical issues. The Neutrosophic soft set along with the Sanchez's approach would help to get treated at primary stage. This paper contributes a small step to prevent the disease and live a long.

2. PRELIMINARIES

DEFINITION[3]:The**defuzzificationof triangular fuzzy number** $\square_b$=(*a*, b, c) is given by$C^{\square}_b$= $\frac{a+b+c}{3}$

D**EFINITION** [1]: The **neutrosophic set** A on the universe of discourse X is defined asA ={< x, $T_A(x)$, $I_A(x)$, $F_A(x)$ > : x∈X}, where T_A, I_A, F_A : X→ (0, 1) and $^{-}0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3^{+}$; T_A , I_A , F_A are called ***neutrosophic components***.

DEFINITION [6]: If U is an initial universe set and E said to be a set of parameters. Let $A \subset E$, P (U) denotes the set of all neutrosophic sets of U. Then the collection (F, A) is termed to be the **neutrosophic soft set** ($\mathcal{N}_{SS}$) over U, and F is a mapping given by F:A→P(U).

DEFINITION [8]: If x_{ij} = ($T_A(u_i, e_j)$,$I_A(u_i, e_j)$, $F_A(u_i, e_j)$), then **neutrosophic soft set matrix($\mathcal{N}_{SSM}$) of order m x n** is given by $(\overset{\vee}{x_{ij}})_{m\,x\,n}$=$(x_{ij})_{m\,x\,n}$

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Development of hybrid composite materials for machine tool structures

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ABSTRACT

Several types of machine tools are used in industries to produce a variety of components. As the speed of these machine tools is increased, is developed. The vibrations developed by these machines should be controlled as it would affect the quality of the parts produced and the life of the machine tools. Hence, in this paper a hybrid composite material is proposed to manufacture a gear hobbing machine column with the aim of improving the dynamic characteristics of the machine. Cast iron is made as outer casing and glass fibre reinforced epoxy is made as inner core. A finite element model of the gear hobbing machine column is developed to carry out the investigations. The proposed model is validated by conducting experiments. The results show an improvement in natural frequency of the hybrid column by 40%.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Design, Materials and Manufacturing.

1. Introduction

Machine tools play an important role in manufacturing industries. High static stiffness for bending and torsion, good dynamic characteristics, good dimensional stability, low coefficient of expansion, low cost and low material requirements are the some of the properties required for a machine tool to perform well [1]. During the machining process, vibration is the most important problem which affects machining performance, surface finish and tool life. To overcome the above problems, the machine tool structures should have high stiffness and damping capacity. The requirement of high specific stiffness with high damping for high speed machine tool structures could be attained by employing fiber reinforced polymer composite materials [2]. Therefore, these materials are used in automobile structures and machine tool structures due to their high specific strength, high stiffness and damping. Generally, the structural components are made of cast iron (CI) due to its higher damping capacity. However, casting process requires open box structures with small wall thickness, which implies low natural frequencies that limit the machining conditions. Several research works were carried out to find a suitable replacement to cast iron [3]. Chang et al. [4] proposed a column made of adhesively bonded glass fiber reinforced epoxy composite and the damping capacity was calculated with respect to the fiber orientation and thickness of the composite laminate plate and compared to the measured damping capacity. It was found that the damping capacity of the hybrid column was 35% more than that of the CI column. Chen et al. [5] investigated the structure performance of the artificial granite material for machine tool structure. They proved that the artificial granite has superior dynamic stiffness than the CI. Rangasamy et al. [6] developed a mini lathe bed with laminated hybrid composites, carbon, and glass/epoxy and attained superior dynamic properties with less weight. Murugan and Thyla [7] presented a detailed review on the mechanical and dynamic properties of alternate materials proposed for machine tool structures. They reported that there is a scope for the development of new materials for machine tool structural applications. Dunaj et al. [8] developed a composite steel–polymer concrete frame and hence increased the stability of a lathe machine. Yin et al. [9] investigated the effect of particle type and its surface characteristics on the mechanical properties of particle filled polymer composite for precision machine tools.

In this work, an attempt is made to improve the dynamic behaviour of a gear hobbing machine with the help of polymer composites. The design modification proposed in this work is to replace the conventional CI column of the machine with a hybrid structure. In this work, cast iron is used as outer case of the column and glass fiber reinforced epoxy stacking are used as inner core. The glass

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Investigation on mechanical properties of automobile strut made by GFRP composites

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ABSTRACT

The strut bar is one of the most crucial mechanical parts used in the moving parts of automobiles where high hardness is required. In this work, the numerical and experimental analyses of a strut bar which is made of a Glass Fiber Reinforced Polymer (GFRP) composite are performed. The GFRP composite strut bar is fabricated and the experimental results are taken by performing various tests such as tensile, compression, and impact, flexural according to ASTM standards. Then, the numerical analysis is also carried out for the conventional and the fabricated struts using the finite element analysis software. The GFRP composite strut model shows improvement in specific strength and specific modulus.

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1. Introduction

Safety, quality and least cost are the important requirements of automobile sector today to compete in the global market. Replacement of any automobile component is expensive and hence it is essential to develop low-cost materials. Most of the automobile components fail suddenly due to fatigue. Therefore, it is necessary to analyse the fatigue conditions of each component of an automobile. From the fatigue analysis, the fatigue strength and the life of the component can be easily estimated. In general, the strut bars are made of stainless steel due to better structural rigidity. Besides, stainless steel would prevent the crack behaviour. But stainless steel is a more expensive material. To overcome this difficulty, polymer composite materials are developed by the researchers [1]. The composite materials have several advantages such as lightweight, chemical stability and better corrosion resistance and hence widely used in several automobile components. Lee et al. improved the dynamic and thermal stability of a machine tool spindle using graphite epoxy composite [2]. The graphite epoxy composite provided better vibrational and thermal characteristics than the conventional metals. A mathematical model was developed to analyse the dynamic performance of the spindle.

Jeong et al. experimentally investigated the dynamic characteristics of high strength carbon fiber epoxy composite thin beams and predicted the natural frequency and the damping coefficient [3]. It was concluded that the hybrid structure would have 3–5 times better damping capacity than the conventional steel beams. Kim et al. developed an ultra-precision computer numerical control (CNC) grinding machine bed using the epoxy resin concrete [4]. They obtained better mechanical properties by varying the compaction ratio. Chang et al. fabricated a hybrid column made of adhesive bonded glass fiber reinforced epoxy composite and cast iron [5]. Experiments were conducted to find the damping capacity and it was found that the damping capacity of the hybrid column was 35% higher than that of the cast iron column. Lee et al. fabricated a hybrid structure made of welded steel with polymer concrete for a high-speed gantry type milling machine [6]. The dynamic characteristics of the hybrid structure were determined by the impulse dynamic test. The results concluded that the hybrid machine tool structure could provide better performance than steel or cast iron structure under higher frequency ranges. The damping ratio was also improved significantly. Panigraphy et al. manufactured a column made of adhesive bonded glass fiber reinforced epoxy composite to replace a cast iron column [1]. The damping capacity was calculated for various fiber orientation and thickness of the composite laminate plates. The damping capacity of the hybrid column was 35% higher than that of the cast iron column. Kim et al. designed a column for a micro-electrical discharge

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Synthesis and characterization of cerium oxide nanoparticles using different solvents for electrochemical applications

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Abstract
Cerium oxide nanoparticles were synthesized through sol–gel method using different solvents which include water, acetone, ethanol and ethylene glycol. Cerium (III) nitrate hexahydrate and ammonium hydroxide were used as the precursors. The influence of the solvent on the structural, optical and electrochemical properties was investigated using powder X-ray diffraction, transmission electron microscope imaging, selected area electron diffraction (SAED), Fourier transform infrared spectroscopy (FTIR), UV–visible absorption spectroscopy, photoluminescence (PL) spectroscopy, cyclic voltammetry (CV) measurement and galvanostatic charge–discharge analysis. A significant change in the properties of the samples was observed in all the characterization techniques, and it was well discussed with the already reported data. Especially with the help of electrochemical studies, it was found that ethylene glycol used as a solvent can easily activate the surface defects in the crystal structure rather than other solvents. This may be due to the fact that the nanocrystalline cerium oxide contains interchangeable oxidation states (Ce^{4+} and Ce^{3+}) resulting from the oxygen vacancy. The atmospheric molecular oxygen can easily react with these surface oxygen vacancies and forms highly active atomic oxygen over the surface of the material which enhances the electrochemical property of the material. The results of the present study provide a promising platform for developing a cathode material for electrochemical applications.

1 Introduction

Metal oxide nanoparticles are an important class of semiconductors which can be used in a variety of applications like storage media, electronics, solar power, catalysis, etc. [1]. They have attracted considerable attention by the researchers for the synthesis, structure and properties of their applications. Among the rare earth oxides, cerium oxide (CeO_2) has been extensively studied and considered as a promising material because of its high refractive index, good transmission in the visible light region, excellent UV absorption and high stability [2–4]. The cerium oxide nanoparticles are highly interested in the field of electrochemistry as they can act as electrode materials in power storage devices like super-capacitors, because it provides a large energy density as well as better cycling stability. Environment-friendly power generation devices like solid oxide fuel cells (SOFCs) require the good cathode material like cerium oxide nanomaterial for electrochemical reduction of oxygen in the temperature range of 500–700 °C.

Generally, cerium can exist in two oxidation states, namely Ce^{3+} and Ce^{4+}. Hence, in the bulk scale, ceria can exist in two different oxide forms, CeO_2 (in Ce^{4+} state) and Ce_2O_3 (in Ce^{3+} state). In nanoscale, the cerium oxide lattice has a cubic fluorite structure and both Ce^{3+} and Ce^{4+} can coexist on its surface [5]. The reason for choosing cerium oxide nanoparticle in the present study is the presence of these two interchangeable oxidation states (Ce^{3+} and Ce^{4+}) which is favourable for a redox material in an electrochemical reaction. The surface nature of the cerium (IV) oxide nanoparticles has been studied by many researchers, and it was found that oxygen vacancy can be present over the surface of the ceria, which in turn can change the surface charge distribution [5]. Creation and annihilation of oxygen vacancies and alterations in cerium valence impart exceptional redox activity to cerium oxide nanoparticles, which is further enhanced by the increased surface area and quantum lattice alterations that occur at the nanoscale [6]. It is

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Effect of different dosage of gamma irradiation on quasi-solid-state conducting polymer electrolyte and its application as high performance dye-sensitized solar cells

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ABSTRACT

The nanocomposite polymer electrolyte [x (85 PVA: 10 PPy: 5 KI: I_2:15 EC: 15MPII: 10 TiO_2) for $x = 5$, 10, 15 Gy γ-ray irradiation] is prepared using the solution casting technique. Exposure of γ-ray irradiation enhanced the amorphous nature of the polymer electrolyte, is confirmed by XRD. The 15Gy γ-ray-irradiated nanocomposite polymer electrolyte has higher electrical conductivity and minimum activation energy (0.664 kJ mol^{-1}). The EIS measurement reveals that the 15Gy γ-ray-irradiated nanocomposite polymer electrolyte incorporated DSSC shows lower R_{ct1} and R_{ct2} values at the counter electrode/electrolyte and photoanode/electrolyte interface, respectively. An outstanding performance is observed in the fabricated DSSCs using 15 Gy γ-ray-irradiated nanocomposite polymer electrolyte with a short circuit current density of 12.602 mA cm^{-2}, an open-circuit voltage of 0.711 V, a fill factor of 0.535, and a photovoltaic conversion efficiency of 4.79% under the light intensity of 100 mW cm^{-2}.

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KEYWORDS
Gamma irradiation; dye-sensitized solar cell (DSSC); conducting polymer electrolyte; crystallinity; band gap; electrical conductivity

1. Introduction

Worldwide, the renewable energy market expansion is done predominantly due to the increasing aggressiveness of solar photovoltaics which increases the interest for electricity in developing countries. The sun's radiation is a plentiful source of freely available energy and the total amount of solar energy reaching the surface of the earth is 120,000 TW. The developing countries are giving more importance to the production of electricity by installing solar photovoltaics (*1*). An energy-generating device produces electric power by harvesting energy from resources, such as sunlight and indoor light. The dye-sensitized solar cell (DSSC) is a photo-electrochemical cell which offers large potential as an alternative renewable energy provider (*2,3*). A DSSC consists of a photo-anode, containing a Ruthenium dye-sensitized nano-TiO_2 layer coated on an FTO glass, electrolyte and a Platinum-coated counter electrode. The advantages of DSSC devices are low-cost production and the fabrication process is easy (*4,5*). Disadvantages are the long-term stability of the electrolyte under various weather conditions, flammability, easy evaporation and leakage (*6*). At lower

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Investigation of Indium Trihydride Molecule and Its Clusters Using Density Functional Theory for Semiconductor Application

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It is widely known that few metal hydrides are potential candidates as atom sources for organo-metallic vapor phase epitaxial growth of III–V semiconductor layers. For such an application, it is important to know the structure, bond lengths, bond angles and other molecular properties of metal hydrides such as BH_n, AlH_n, GaH_n, AsH_n, InH_n and SbH_n. In this view of semiconductor application, indium trihydride clusters $(InH_3)_{n=1-3}$ have been chosen in the present study and clusters of InH_3 molecules, i.e., InH_3, In_2H_6 and In_3H_9, have been investigated using density functional theory in conjunction with the B3LYP-LANL2dZ basis set which is the most popular effective core potential for the computations on metal containing systems. Various parameters including zero point vibrational energy, thermal energy, specific heat, entropy, heat of formation, vibrational frequencies and their intensities, etc., were derived. The infrared spectral features of indane (InH_3), diindane (In_2H_6) and triindane (In_3H_9) were compared with the already reported set of data. It was predicted based on the results obtained in the present study that the stability of the In_3H_9 molecule was possible, since no imaginary frequencies in the IR spectra and favourable heats of formation were obtained. The results obtained in the present study gave a new perspective of the $(InH_3)_{n=1,2,3}$ material.

topics: indium trihydride, DFT analysis, geometry, IR spectra

1. Introduction

Interest in metal hydrides arises from the fact that they are sources of the corresponding elements to generate layers of group III–V semiconductors. For this reason, hydrides such as BH, AlH, GaH, AsH, InH, SbH, RbH, CsH, etc., have been studied by many authors [1–6]. For semiconductor applications, the choice of metal hydride films for the use in semiconductor devices plays a crucial role and the criterions like band gap and hydrogen desorption temperature have to be accounted for the further consideration of the material [7]. Also, the methods of deposition of films should be compatible with those used for the fabrication of optoelectronic devices [8].

Among various metal hydrides, indane (InH_3) has more significance in nature, for instance, it is the only experimentally observed molecule and hence it can be used to gauge the quality of theoretical calculations, too. Aluminium, gallium and indium trihydrides in solid argon were successfully synthesized using different synthesis techniques and a prediction of vibrational frequencies was done using density functional theory (DFT) and CCD methods [9]. The stability of the group 13 hydrides in the oxidation state +III of the metal was analyzed using the *ab initio* Moller–Plesset (MP2) calculations [10]. An extensive study of InH and its complexes was performed to verify the assignments of the vibrational bands based on the *ab initio* calculations using DFT by adopting the Perdew–Wang correlation and the exchange function [11].

A systematic investigation of the stability, structure and properties of indium trihydride complexes was performed and a detailed comparison of InH_3 with other lighter group 13 metal trihydrides complexes was also done [12]. The structural, electronic and thermochemical properties of various indium compounds including InH_3 were studied by *ab initio* and statistical thermodynamic methods [13]. A laser ablation matrix isolation infrared spectroscopy experiment was carried out to understand the reactions of laser-ablated In atoms with pure hydrogen and pure deuterium. The emission and infrared spectra were also recorded for $(InH_3)_n$ and $(InD_3)_n$ compounds [14]. In view of the fact that the controlled decomposition of these halides has led to an array of clusters and related

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ORIGINAL PAPER

The effect of γ-ray-irradiated conducting polymer electrolyte and its application of dye-sensitized solar cells to building window glass system

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Abstract

In the present study, γ-ray-irradiated and un-irradiated PVA/PPy/KI/I_2 conducting polymer electrolytes have been prepared for dye-sensitized solar cell (DSSC). The conducting polymer electrolyte was prepared by solution cast technique. The degree of crystallinity of both the γ-ray-irradiated and un-irradiated samples has been studied using X-ray diffraction (XRD), and the studies show that γ-ray irradiation increases the amorphous nature. The band gap energy, Urbach's energy, and no. of carbon in a cluster were determined from the UV–visible spectra. An electrical conductivity of all the samples has been analyzed by four-probe method, and it shows an increase in the electrical conductivity of γ-ray-irradiated samples. The EIS measurement revealed that the γ-ray-irradiated electrolyte possessed excellent electro-catalytic activity and low R_{ct1} at the CE/electrolyte interface. A significant improvement in the photo-conversion efficiency of γ-ray-irradiated polymer electrolyte in DSSC by 4.53% was also observed. This proves to be better and efficient DSSCs for building window glass system. Moreover, the stability tests indicated that ~ 80% of the initial efficiency was persistent after the long-term stability of 450 h.

Keywords Crystallinity · γ-Ray irradiation · Conductivity · Band gap energy · Urbach's energy · Conducting polymer electrolyte · Surface roughness

Introduction

Nowadays, the electric power from renewable energy meets out ~ 30% of power demand. In the future, it is projected that > 70% of worldwide electricity production will be led by renewable energy sources, such as solar photo-voltaic (PV), wind, hydropower, and bio-energy [1]. Dye-sensitized solar cells (DSSCs) hold promise as the most valuable renewable energy source in the prospect due to their non-complicated manufacturing process, semi-transparency [2, 3], cost-effectiveness, improved efficiency in diffused light conditions [4], multicolor choice, lightweight, and mechanical flexibility [5].

Dedicated to the memory of Ivo Alexandre Hümmelgen

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Article

The Effect of Plasticizers on the Polypyrrole-Poly(vinyl alcohol)-Based Conducting Polymer Electrolyte and Its Application in Semi-Transparent Dye-Sensitized Solar Cells

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Abstract: In this work, the quasi-solid-state polymer electrolyte containing poly(vinyl alcohol)-polypyrrole as a polymer host, potassium iodide (KI), iodine (I_2), and different plasticizers (EC, PC, GBL, and DBP) was successfully prepared via the solution casting technique. Fourier transform infrared spectroscopy (FTIR) was used to analyze the interaction between the polymer and the plasticizer. X-ray diffraction confirmed the reduction of crystallinity in the polymer electrolyte by plasticizer doping. The ethylene carbonate-based polymer electrolyte showed maximum electrical conductivity of 0.496 S cm^{-1}. The lowest activation energy of 0.863 kJ mol^{-1} was obtained for the EC-doped polymer electrolyte. The lowest charge transfer resistance R_{ct1} was due to a faster charge transfer at the counter electrode/electrolyte interface. The polymer electrolyte containing the EC plasticizer exhibited an average roughness of 23.918 nm. A photo-conversion efficiency of 4.19% was recorded in the DSSC with the EC-doped polymer electrolyte under the illumination of 100 mWcm^{-2}.

Keywords: plasticizer; dye-sensitized solar cells (DSSC); conducting polymer electrolyte; crystallinity; polypyrrole

1. Introduction

Nowadays, electricity is essential in the society because of the fast-growing industrialization and for domestic applications. Solar radiation is one of the most promising future renewable energy resources for a wide range of applications due to its abundance and easy accessibility and the fact that it does not cause pollution. The solar photovoltaic (PV) technology contributes to generating electricity. Solar cells are applied in charging portable devices, outdoor lightings, electronic signboards on the road, fountain pumps, electric vehicles, agricultural machines, remote communication for the military, etc. Dye-sensitized solar cells (DSSCs) have been developed due to their low cost, semi-transparency, various colors, flexible nature, and simple fabrication process compared to silicon solar cells [1–3]. A DSSC comprises a photoanode, a redox electrolyte, and a counter electrode. The use of plasticizers in polymer electrolytes enhance the performance, flexibility, and long-term stability of various electrochemical devices such as dye-sensitized solar cells, fuel cells, batteries, biosensors, chemical sensors, and super-capacitors [4,5].

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Particulate nanocomposites based on bismaleimide–graphene oxide: Thermal studies

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ABSTRACT

The structurally different bismaleimides (BMIs) such as 4,4'-bismaleimidodiphenyl ether (BMIE), 4,4'-bismaleimidodiphenyl sulphone (BMIS) and 4,4'-bismaleimidodiphenyl methane (BMIM) were synthesized. The materials graphite (G), graphene oxide (GO) and washed graphene oxide (WGO) particles are separately blended (3% w/w) with BMIs and thermally polymerized under appropriate conditions. The effects of the presence of the nanoparticles in BMIs were investigated using Differential Scanning Calorimetry (DSC). The DSC results show that the blended nanoparticles alter both the cure exotherm and the enthalpy of curing of the BMIs. Thermogravimetric analysis (TGA) was employed to understand the thermal stability of the cured pure BMIs and their blends with nanoparticles. The presence of the nanoparticles in the crosslinked BMIE matrix shifts the onset of the thermal degradation temperature to higher temperature region (around 15 °C). Among all the materials investigated, the nanoparticles incorporated BMIS increases the char residue. This is due to the efficiency of the physical dispersion and the possible chemical interactions shown by nanoparticles in the cured bismaleimides. The SEM results reveal that the debris of GO are removed by the base washing of GO and the incorporated nanoparticles are well dispersed in the cured BMIM.

1. Introduction

Bismaleimide (BMI) is one of the most important high performance thermosetting polymers, and has been used in a wide range of applications especially in aerospace industries [1]. The application of bismaleimides in fibre reinforced composites is one of the fields of intensive commercial development [2]. The invention of nanomaterials with excellent mechanical and thermal properties provides an amiable reinforcement material to use with polymer matrices. Based on the above inference various research on the application of nanomaterials in bismaleimide, is being explored. This provides a possibility of improving the toughness of bismaleimide resin.

Over the decades the development of polymeric nanocomposites becomes prominent where the dimensions of the filler material is of the order of a nanometre. The final product is not mandatory to be in the order of nanoscale [3]. When the size of the fillers was switched from micro to nano level it leads to dramatic changes in physical parameters. Surface area of nanomaterials will be larger in the specified volume [4]. Generally physical and chemical properties of nanostructured materials are highly influenced by surface and surface properties.

Graphite and graphene related compounds have some novel properties. These properties have made graphite and graphene related compounds are proposed field in the research world [5–7]. The evaluation of graphene which imbibe excellent physical properties has the ability of greater degree of dispersion in various polymeric materials results in a new class of polymer nanocomposites. The outstanding thermal behaviour of graphene under demanding conditions influence the researchers to investigate this nanomaterial. One of the most promising applications of this material is in polymer nanocomposites, polymer matrix composites which incorporate nanoscale filler materials [8,9].

On account of this, usage of graphene oxide (GO) to prepare graphene-based materials for composites and other applications has emerged recently [10–12]. The graphene-based polymer composites shows edge in mechanical and electrical properties in comparison to that of clay or other carbon filler based polymer composites [13,14]. In recent, Graphene/Polymer Composites are found to be high performance composites with enhanced thermal, mechanical, electrical, biological applications including drug delivery, constructing chemical sensors and gas barrier properties [15–20]. Blending of graphene components with high performance polyimides say, bismaleimide component extends their applications remarkably.

Hence in the present investigation structurally different bismaleimides (BMIs) 4,4'-bismaleimidodiphenyl ether (BMIE), 4,4'-bismaleimidodiphenyl sulphone (BMIS) and 4,4'-bismaleimido-

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Effect of structural variation on the thermal degradation of nanoporous aluminum fumarate metal organic framework (MOF)

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Abstract
Scalable synthesis of aluminum fumarate (Al_FA) metal organic framework (MOF) in aqueous medium and the effect of drying on the crystallinity, apparent activation energy and thermal lifetime are presented. The oven dried (Al_FA_A) at 100 °C (760 mmHg) for 3 h is characterized by Fourier transform infrared spectrophotometer, differential scanning calorimeter, thermogravimetric analyzer, X-ray diffractometer, particle size analyzer, scanning electron microscope (SEM-EDAX) and Brunauer–Emmett–Teller (BET) analysis. The BET surface area, micropore volume (V_{pore}) and mean pore diameter of Al_FA_A are 937 $m^2\ g^{-1}$, 0.38 $cm^3\ g^{-1}$ and 1.6 nm, respectively. The Al_FA_A MOF is thermally stable up to 400 °C when compared to aluminum fumarate dried in vacuum oven at 100 °C (25 mmHg) for 3 h (Al_FA_C) which is stable only up to 350 °C. The thermal degradation kinetics for Al_FA_A and Al_FA_C are reported for the first time using model-free approach. For the reaction extent $\alpha = 0.2$–0.4, a progressive increase in the apparent activation energy for thermal degradation (Ea–D) for Al_FA_A is noted and found to be 205–220 kJ mol^{-1} and is constant after $\alpha = 0.4$. The material Al_FA_C shows Ea–D from 160 to 173 kJ mol^{-1} for α values from 0.2 to 0.7. The difference in the Ea–D values between these materials is attributed to the structural changes and change in the crystalline nature of MOFs. During thermal degradation of Al_FA MOFs, gases like CO, CO_2, H_2O, $CH_2{=}CH_2$ and CH≡CH are evolved.

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Seizure detection in EGG signal with novel optimization algorithm for selecting optimal thresholded offset Gaussian feature

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ABSTRACT

EEG analysis is a responsible device in assessing the neurophysiological disorders associated to the post-synaptic movement happened in the neocortex. In detecting the epileptic seizure disorder, the EEG signals of the patient are diagnosed. In this analysis, the occurrence of epileptiform discharges in between the happening of seizure disorder should be identified. The introduction of automatic computerized process is required to analyze the EEG signals for detecting the seizure disorder. For obtaining the accurate classification result, the features should be carefully extracted. Though it is better to take many features in order to obtain clear and detail information of the signal, the classifier performance will be affected when large number of features is applied. Hence the optimal set of features must be obtained using the suitable optimization algorithm. In this work the Divergence State Estimation based Bio-geography based Optimization (DSEBBO) is presented for feature selection process whereas the for feature extraction method, Thresholded Offset Gaussian (TOG) method is employed. The selected optimal features are applied to the SVM classifier and the results are validated for the proposed method by comparing with the other optimization algorithms as well as other feature extraction methods. From the classification results, it is clearly elucidated that the TOG feature extraction and the utilization of DSEBBO based optimal feature selection strategy gives the better accuracy which is 4.64% more than the method that does not employ feature selection technique.

1. Introduction

Epileptic seizure is the disease caused by the transitory electrical disturbance occurred in the brain. The event of seizures often confused with the occurrence of some other events like stroke or even become undetected in some occasions. Normally, one person of the population of 100 people may undergo seizure in their lifetime [1]. It is always unpropitious since the happening of the event of seizures is unstable and less understandable. In order to diagnose the brain disorders to understand the cause for the event exhaustively, it is recommended to examine the electroencephalograph (EEG) records of the patient. For diagnosing epileptic disorders, it is significant to detect the occurrence of epileptiform discharges in the EEG signal in between the happening of seizure disorder [2]. The World Health Organization (WHO) says that roughly 50 million persons are affected by epileptic seizure [3]. It has also reported that about 4–10 person of population of 1000 people suffer by the epileptic seizure. In a year, approximately 2.4 million persons are diagnosed with epilepsy. The persons are diagnosed for epilepsy when a minimum of two malevolent seizures happened. It is essential to perform the diagnosis on time for providing the medical aids to cure the disease and to decrease the chance of occurrence of seizure in future [4]. The current practice of diagnosing epileptic disorder is to perform the analysis of patient history, neurological tests and some other tests like neuro-imaging and EEG analysis. There are two different epileptiform abnormalities which are termed as inter-ictal that occurs between seizures and ictal that occurs during seizure. These two events can be detected in EEG signals. The epileptiform waves are detected by the presence of spikes, sharp waves and polyspike complexes in the EEG signals [5].

EEG analysis is a responsible device in assessing the neurophysiological disorders associated to the postsynaptic movement happened in the neocortex [6]. The physicians used EEG signals in examining various functions of the brain and also to identify the anomalies like seizure disorder, stroke, Alzheimer disease, sleep

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3D Facial Expression Recognition Using Multi-channel Deep Learning Framework

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Abstract

Facial expression offers an important way of detecting the affective state of a human being. It plays a major role in various fields such as the estimation of students' attention level in online education, intelligent transportation systems and interactive games. This paper proposes a facial expression recognition system in which two channels of featured images are used to represent a 3D facial scan. Features are extracted from the local binary pattern and local directional pattern using a fine-tuned pre-trained AlexNet and a shallow convolutional neural network. The feature sets are then fused together using canonical correlation analysis. The fused feature set is fed into a multi-support vector machine (mSVM) classifier to classify the expressions into seven basic categories: anger, disgust, fear, happiness, neutral, sadness and surprise. Experiments were carried out on the Bosphorus database using tenfold cross-validation with mutually exclusive training and testing samples. The results show an average accuracy of 87.69% using an mSVM classifier with a polynomial kernel and demonstrate that the system performs better by characterizing the peculiarities in facial expressions than alternative state-of-the-art approaches.

Keywords Affective computing · Convolutional neural networks · Deep learning · Emotion recognition · Machine learning · Support vector machines

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Combined global and local semantic feature–based image retrieval analysis with interactive feedback

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Abstract

Nowadays, user expects image retrieval systems using a large database as an active research area for the investigators. Generally, content-based image retrieval system retrieves the images based on the low-level features, high-level features, or the combination of both. Content-based image retrieval results can be improved by considering various features like directionality, contrast, coarseness, busyness, local binary pattern, and local tetra pattern with modified binary wavelet transform. In this research work, appropriate features are identified, applied and results are validated against existing systems. Modified binary wavelet transform is a modified form of binary wavelet transform and this methodology produced more similar retrieval images. The proposed system also combines the interactive feedback to retrieve the user expected results by addressing the issues of semantic gap. The quantitative evaluations such as average retrieval rate, false image acceptation ratio, and false image rejection ratio are evaluated to ensure the user expected results of the system. In addition to that, precision and recall are evaluated from the proposed system against the existing system results. When compared with the existing content-based image retrieval methods, the proposed approach provides better retrieval accuracy.

Keywords

Content-based image retrieval, semantic gap, directionality, contrast, coarseness, busyness, local binary pattern, local tetra pattern, relevance feedback

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Introduction

User expects image retrieval as an important and a promising field as it indulges with images for various purposes. Galleries, education, fashion design, medicine, designing, remote sensing, military applications, and so on are the various applications related to user expected image retrieval. It is often necessary to retrieve a user desired images from the image database with accurate and relevant images for further processing. Hence, an effective system for image retrieval with a reduced semantic gap is proposed.

Image retrieval system is accomplished with two different strategies namely text and content of the image.[1] Image annotation and text descriptors are the basis for retrieving images from the database in text-based image retrieval. Normally, two basic problems arise at the time of using manual annotation based on image retrieval methodology. They are the subjective description of image contents by human and mismatches between image annotations and textual queries. Traditionally, search engines retrieve thousands of images based on the user query. The images are ranked on the basis of keywords in the query. The ambiguity of keyword impacts the text-based image search. Due to wrong semantic meanings, the search results are quite different from the user anticipation. The top 10 images for the input query "cheetah" from Google search engine are shown in Figure 1.

The resultant images belong to different categories, due to the ambiguity in the keyword "cheetah." The main fact behind this issue is inadequate knowledge of the user on the textual description of the output image. The second reason is the diversified meanings of the

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CCSC—DHKEP: Data Confidentiality Using Improved Security Approaches in Cloud Environment

L. Prabahar, R. Sukumar & R. SureshBabu

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Abstract

With the rapid advancement in the mobile and computing technologies, individuals have an inclination to depend more on them in varied range of situations. For ensuring the secured communication among the devices, privacy and security are the most prominent concerns. Accordingly, sophisticated preventive measures that support both secure storage and secret transfer has begun as the need of the hour. Several conventional techniques focuses on the data encryption and key generation approaches to attain reliability. However, there were some short-comings in key aspects such as privacy, key management, and flexibility. So as to overcome existing issues the paper implements a compact, constant-time, and fast improvised ChaCha 20 stream cipher mechanism for encryption and decryption. Likewise, the generation of key is employed with the use of Diffie-Hellman key exchange protocol scheme based on the string comparison. Thus, a secured transmission occurs with a reduced rate of execution time, decryption time, and key generation time. The performance evaluation is made in terms of encryption time, decryption time and the key generation time and are compared with the existing techniques to prove the superiority of this proposed scheme.

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A Comparative Study of Linear Receivers in Spectral Efficiency of Uplink Massive MIMO Systems with Low Resolution ADCs

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Abstract

In Massive MIMO systems, Spectral Efficiency mainly depends on the number of antennas used at the Base Station (BS). In 5G, the data requirement is very much high and the increase in Spectral Efficiency is crucial. This letter proposes the uplink Massive MIMO systems with low resolution ADCs architecture. We show that the massive number of antennas compensate the performance degradation of low resolution ADCs and increase the Spectral Efficiency which will be the major requirements in 5G Internet of Things (IOT) networks. We compare the performance of Massive MIMO systems for different receivers with low resolution ADCs

Keywords: *Massive MIMO, MRC, ZF, MMSE Receivers, low resolution ADC, uplink Spectral Efficiency.*

1. Introduction

Massive multiple Input Multiple Output (MaMIMO) is a new technology for next generation 5G communication networks [1]. MaMIMO can achieve very high Spectral Efficiency by simply increasing the number of antennas at the base station (BS) [2]. The increase in number of antennas increases the Spectral Efficiency as well as the power requirements of the system [3]. The three linear receivers: Maximal Ratio Combiner (MRC), Zero Forcing (ZF) and Minimum Mean Square Error (MMSE) are analysed. MMSE receiver provides good sumrate compared to other linear detectors. ZF outperforms MRC and it requires less statistical knowledge than MMSE receiver. In this work, ZF receiver is considered. The quantized MaMIMO systems give solution for increase in Spectral Efficiency, where each receive antenna in the BS utilizes a relatively low-resolution analog-to-digital converter (ADC). The additive quantization noise model (AQNM) proposed in [11] is widely used to describe the effect of low-resolution ADCs. A new architecture [16] is proposed to increase the sumrate is the mixed ADC architecture. In mixed ADC architecture, some of the ADCs will have high resolution and most of the ADCs will have low resolution ADCs. In [17], the mixed ADC architecture improves the Spectral Efficiency with MRC and ZF receiver is studied. If the coherence interval is small, mixed ADC architecture is preferred. The capacity and estimation accuracy of MaMIMO systems with non-ideal transceiver hardware is analysed and said that the hardware impairments create non-zero errors irrespective of the SNR and the number of base station antenna [5]. The power consumption of the system also suffers the Spectral Efficiency [6]. The uplink Spectral Efficiency of MaMIMO systems with low resolution ADCs over Rician fading channels [7] showed that there is a fixed loss of Spectral Efficiency when the ADC quantization bit is increased. The one-bit ADCs are the least power consumption ADCs which can simplifies the RF chain in MaMIMO system. The capacity of one bit ADC in RF chains of the receiver is analysed in [4], [13] with known channel state information at the transmitter. In [8], a near-maximal likelihood detector for one-bit quantized signals and the linear detectors were proposed in [9], [10].

2. system model

We consider a single-cell multiuser MIMO system. We also assume the uplink transmission in which K single-antenna users (UE) transmit information to M Base station antennas and it

Comparison of missing tooth and dental work detection using dental radiographs in human identification

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Abstract: Victim identification plays a vital role for identifying a person in major disasters at the time of critical situation when all the other biometric information was lost. At that time there is a less chance for identifying a person. The major issues of dental radiographs are dental work and missing or broken tooth was addressed in this paper. This algorithm can be established by comparing both ante mortem (AM) and post-mortem (PM) dental images. This research work is mainly focuses on the detection of dental work and broken tooth or missing tooth, then comparison of active contour model with mathematical model-based shape extraction for dental radiographic images are proposed. In this work, a new mathematical tooth approximation is presented and it is compared with online region-based active contour model (ORACM) is used for shape extraction. Similarity and distance-based technique gives better matching about both the AM and PM dental radiographs. Exact prediction of

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BMC Medical Informatics and Decision Making

TECHNICAL ADVANCE Open Access

The detection of lung cancer using massive artificial neural network based on soft tissue technique

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Abstract

Background: A proposed computer aided detection (CAD) scheme faces major issues during subtle nodule recognition. However, radiologists have not noticed subtle nodules in beginning stage of lung cancer while a proposed CAD scheme recognizes non subtle nodules using x-ray images.

Method: Such an issue has been resolved by creating MANN (Massive Artificial Neural Network) based soft tissue technique from the lung segmented x-ray image. A soft tissue image recognizes nodule candidate for feature extortion and classification. X-ray images are downloaded using Japanese society of radiological technology (JSRT) image set. This image set includes 233 images (140 nodule x-ray images and 93 normal x-ray images). A mean size for a nodule is 17.8 mm and it is validated with computed tomography (CT) image. Thirty percent (42/140) abnormal represents subtle nodules and it is split into five stages (tremendously subtle, very subtle, subtle, observable, relatively observable) by radiologists.

Result: A proposed CAD scheme without soft tissue technique attained 66.42% (93/140) sensitivity and 66.76% accuracy having 2.5 false positives per image. Utilizing soft tissue technique, many nodules superimposed by ribs as well as clavicles have identified (sensitivity is 72.85% (102/140) and accuracy is 72.96% at one false positive rate).

Conclusion: In particular, a proposed CAD system determine sensitivity and accuracy in support of subtle nodules (sensitivity is 14/42 = 33.33% and accuracy is 33.66%) is statistically higher than CAD (sensitivity is 13/42 = 30.95% and accuracy is 30.97%) scheme without soft tissue technique. A proposed CAD scheme attained tremendously minimum false positive rate and it is a promising technique in support of cancerous recognition due to improved sensitivity and specificity.

Keywords: X-ray, Sensitivity, Lung cancer, Subtle, Accuracy

Background

General

Cells (https://www.cancer.net/) were vital units in our lung region, which were having its unique framework. Cancer (https://www.healthline.com) is a syndrome which might appear as an increased abnormal cell uncontrollably. However, it happens across any portion of a body [1]. So, it results in the change in genetic behavior [1] which deter the regular flow (cell may fabricate new cells during early stages and it dies while they were growing old). It might have a possibility for producing cancer in the lymphatic system. Doctors partition cancer into categories based on its foundation. The categories were listed as Carcinomas, Sarcomas, Leukemias as well as Lymphomas (https://www.medicalnewstoday.com/articles/323648) [1].

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Fluctuation and Noise Letters | Online Ready

Effective Technique for Noise Removal and Emotion Recognition in Speech Signals Using Cat Swarm Optimized Spiking Neural Networks

C. Revathy and R. Sureshbabu

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Abstract

Speech processing is one of the required fields in digital signal processing that helps in processing the speech signals. The speech process is utilized in different fields such as emotion recognition, virtual assistants, voice identification, etc. Among the various applications, emotion recognition is one of the critical areas because it is used to recognize people's exact emotions and eliminate physiological issues. Several researchers utilize signal processing and machine learning techniques together to find the exact human emotions. However, they fail to attain their feelings with less computational complexity and high accuracy. This paper introduces the intelligent computational technique called cat swarm optimized spiking neural network (CSSPNN). Initially, the emotional speech signal is collected from the Toronto emotional speech set

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ORIGINAL RESEARCH

Content based video retrieval system based on multimodal feature grouping by KFCM clustering algorithm to promote human–computer interaction

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Abstract
Content Based Video Retrieval (CBVR) is so popular these days, because of the increased utilization of video based analytical systems. Video based analytics is quite effective than image analysis, as a series of actions are captured by the video. This ends up with better decision making ability. The CBVR systems play an important role in boosting the human–computer interaction. This paper presents a multimodal CBVR that takes both the visual and audio information into account for retrieving relevant videos to the user. Two modules are employed by this work to deal with video and audio data. The video data is processed to detect the significant frame from shots and is achieved by Lion Optimization Algorithm (LOA). The features are extracted from the visual data and with respect to the audio data, MHEC and LPCC features are extracted. The extracted features are clustered by Kernelized Fuzzy C Mean (KFCM) algorithm. Finally, the feature database is formed and is utilized in the query matching process during the testing phase. The performance of the proposed work is tested in terms of precision, recall, F-measure and time consumption rates. The proposed CBVR system proves better performance than the existing approaches and is evident through attained results.

Keywords Human–computer interaction · Content based video retrieval (CBVR) · Video analysis · Feature extraction · Significant frame detection

1 Introduction

The exploitation of digital videos is extremely increasing, due to the advent of smart phones, digital cameras and so on. Besides numerous applications such as healthcare, marketing, surveillance and entertainment deal with video data for analysis and decision making. For instance, several advanced medical applications record the health status of the patients in a live mode and store the video for future analysis. The surveillance applications strongly rely on the video footages for tracking the objects. All the captured videos are stored in the database for further analysis and the volume of the database is quite bigger.

The main objective of video storage is to analyse the videos with respect to decision making or comparison. For effective data analysis, video retrieval is more significant, as it helps in extracting relevant videos and better decision making can be done. Traditionally, the required videos are extracted by means of text based queries, such that the videos associated with the query are retrieved for the user. For instance, the title, description or comments of the video are considered, when the text query is passed. However, the text query based video retrieval cannot extract relevant videos from a pool of videos, as the video retrieval completely depends on the query text and the text being utilized to describe or comment the videos (Hu et al. 2011; Veltkamp et al. 2013).

Additionally, the text query based video retrieval system involves more computational and time complexities, as mentioned by Jawahar et al. (2005). The issues faced by the text query based video retrieval system are surmounted by the Content Based Video Retrieval (CBVR) system. In CBVR, the term 'content' refers to the features of the videos, which can be colour, texture, shape and so on. The CBVR system

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Eagle Eye CBVR Based on Unique Key Frame Extraction and Deep Belief Neural Network

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Abstract
Great efforts have been paid to develop Content Based Video Retrieval (CBVR) due to the exponential growth of video datasets with several types of data such as visual, audio and metadata. This paper proposes Eagle Eye a new Content Based Video Retrieval Framework through applying new methods for the major three important parts of CBVR. A Subspace Clustering Algorithm is implemented with binary codes that are extracted from different videos. We introduce a Local Histogram based shot boundary detection algorithm to detect shot boundaries. Then Unique Key Frame Summarization algorithm with detected shots is applied. An integrated Local Binary Pattern, Coherence based filter and HOG algorithm is used for the Feature extraction and best features are selected and stored along with the video indices. The extracted features were then utilized to train a classifier. A Deep Belief Neural Network classifier trains each extracted feature of query frame and matches the best features of the query frames with other video features. Then we enhance the video retrieval by introducing video hashing method, combining low level and high-level semantic features for the elimination of repetitive video in the retrieval. We used precision, accuracy, sensitivity and specificity metrics to assess the applicability of the projected technique. Xiph.org and Youtube datasets are used for the valuation analysis. The experimental results show that the Eagle Eye provides better performance and less processing time compared to the other methods.

Keywords Content based video retrieval (CBVR) · Key frame extraction · Shot boundary detection · Deep neural networks · Eagle eye

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Gravitational search algorithm-based UPQC for power quality improvement of WECS

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Abstract: The design of merged presentation of UPQC and WECS is conscientious for extenuating the PQ problems of distribution scheme in the work. The projected scheme is unruffled of WECS, sequences and shunt APF joined to DC link that is capable to compensate the voltage sag, swell, harmonics and voltage interruption. Currently, the recompense approach of UPQC is examined with GSA. Here, GSA is engaged to enhance the control pulses of UPQC. To acquire optimal performance of the distribution system, these faults are diminished and producing the optimal control signals. The expected scheme is capable to bring in the active power to grid also its competence in augmentation of power quality in distribution scheme. The presentation of the expected GSA-based UPQC scheme is corroborated over simulations by MATLAB/Simulink and compared with the traditional approaches such as ANFIS-based UPQC and GA-based UPQC.

Keywords: unified power quality compensator; UPQC; gravitational search algorithm; GSA; adaptive neuro-fuzzy inference system; ANFIS; genetic algorithm; series and shunt APF; voltage; current; real and reactive power.

Reference to this paper should be made as follows: Anitha, R. and Jeyadevi, S. (2020) 'Gravitational search algorithm-based UPQC for power quality improvement of WECS', *Int. J. Operational Research*, Vol. 37, No. 2, pp.259–292.

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Modified Cascade Controller Design for Unstable Processes With Large Dead Time

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ABSTRACT In this article, a simple controller design with the fractional order calculations applies to unstable cascade processes with a significant time delay. Series cascade control system consists of two loops in which the inner loop is designed using the IMC principle based on the synthesis method. The primary controller is designed with the FOPI-FOPD controller to ensure stable and satisfactory closed-loop performances for the unstable processes. For the primary controller, five tuning parameters are involved, which tuned using the centroid of the convex stability region method. Different examples are given to illustrate the superiority of the proposed design over some existing designs. Results obtained from simulation reveals that with the proposed control design, enhanced closed-loop control performances are obtained for nominal and perturbed conditions.

INDEX TERMS Series cascade control, unstable time-delay process, fractional-order PI/PD, internal model control, convex stability region.

I. INTRODUCTION

Many of the industries are dealing with unstable processes. Unstable poles in the unstable process, in many cases, provide extreme overshoot and more substantial settling time [1]. In such a case, the standard PID controller is not suitable for standard tuning methods. Hence, many authors have been studied during the past decades about the various control methods of the unstable process with larger delay time. Some researchers have compensated the unstable process adequately with Smith delay compensation. However, the Smith predictor does not apply to the unstable process with the substantial delay time [2]–[4]. As pointed out by many researchers, a particular cascaded structure has often provided an enhanced closed-loop performance than the standard feedback control. The cascade control structure consists of the primary and secondary loops, where the fast dynamics are handled by the secondary loop and slow dynamics are handled by the primary loop. Cascade controller design is a special control structure which deals with the stable and unstable process (plural) with delay time effectively [5]–[10]. The inner and outer loops of the cascade control structure are employed with Proportional–Integral–Derivative (PID) controllers which are low order controllers. Two different strategies such as a series cascade control system (SCCS), a parallel cascade control system (PCCS), are extensively used for stable and unstable industrial processes to achieve enhanced closed-loop performance respectively. Proportional-Integral (PI) controller is often used in the primary loop and the proportional (P) control is used as a secondary controller in

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Fuzzy logic controller-based boost and buck-boost converter for maximum power point tracking in solar system

A Rajavel[1] and N Rathina Prabha[2]

Abstract

Due to the concern with energy emergencies, the energy obtained from the sunlight is considered as the most capable conventional resources. Hence, the maximum power point tracking approach is necessary for obtaining the enhanced efficiency from the solar panels. In the case of direct current (DC) application, the output obtained from the photo-voltaic (PV) array cannot be directly connected to the electronic devices. For regulating the output from the PV array, the DC-DC converter is provided in between the load and the array. The converter design plays a significant role to track the maximum power point of the solar panel. This paper describes the design of three converters, namely the boost, buck-boost and buck converter, along with the fuzzy logic controller. It varies the time for switching ON and OFF of the converter concerning changes in the solar panel power. The result of converter power and solar panel for different irradiation is compared for various DC-DC converters. The fuzzy logic controller is employed in the generation of optimal control pulse for the DC-DC converter. Moreover, in the solar photovoltaic system, the steady-state operation is performed and the various solar irradiance results are analyzed. The proposed approach is compared with the various DC-DC converters like buck-boost converter, buck converter and boost converter to prove the efficiency. Then, the performance analysis of the current, voltage and power of PV is analyzed.

Keywords

Fuzzy logic control, buck-boost converter, boost converter, buck converter, PV voltage, current, solar irradiance, power, MPPT

Introduction

Among the sustainable power resources, the photo-voltaic (PV) energy obtained from the solar panel is considered as the most essential and reasonable asset due to its prevalence, maintainability and is found widely all over the world (Bingül and Karahan, 2011, 2012). The yield qualities of the PV module rely upon the voltage, irradiance and cell temperature of the solar array. Meanwhile, the solar array generates non-linear qualities and it becomes necessary in demonstrating those non-linearities that are utilized in tracking the maximum point of the solar framework applications (Ambikapathy et al., 2017; Sangwongwanich and Blaabjerg, 2019; Sankar et al., 2019; Seyedmahmoudian et al., 2018). The maximum power point tracking (MPPT) algorithm is employed in extracting the maximum power from the working environmental conditions, like cell temperature and irradiance. The modification of the impedance value is determined by the PV and load that are employed in changing the non-linear characteristic curve. Due to the quick variation of insulation, the non-linear characteristic of PV current-voltage seems to be complex in evaluating the MPPT (Bounechba et al., 2014; ; Hua and Shen, 2002; Padmanaban et al., 2019; Shahid et al., 2018; Sundaraj et al., 2020).

In general, the maximum power point (MPP) has the capability of supplying the maximum power from the solar PV array at a specific point, which further leads to an efficient production of electricity. The MPP comprises of a non-linear locus point that accordingly diverges its cell temperature and solar irradiances. In order to enhance the system efficiency, from the solar photo voltaic panel it is necessary to track the power from the MPPT. The power obtained from the PV panel employs in enhancing the optimization processes. Numerous approaches such as perturb and observe (P&O) approach, incremental conductance (INC) are established broadly to track the MPPT. Recently, one of the well-known techniques known as the fuzzy logic (FL) control-based MPPT strategies is used for PV (Chin et al., 2011), due to its simplicity and imprecise inputs. With the utilization of fuzzy logic control (FLC), the maximum power is obtained under varying climatic conditions. The duty cycle of the boost converter provides the output of FLC. By modifying the duty cycle of boost converter, the maximum power can be accomplished. The inverter is used in the conversion of direct current/alternating current (DC/AC), which drives the load. The

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ORIGINAL PAPER

Synthesis, characterization and applications of nano-Ag-tagged poly(ε-caprolactone-block-tetrahydrofuran)

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Abstract

A diblock copolymer consists of ε-caprolactone, and tetrahydrofuran was synthesized by using a novel natural amino acids such as penicillamine and tyrosine as a chemical initiator in the presence of stannous octoate as a catalyst through bulk polymerization method under nitrogen atmosphere with mild stirring condition. The synthesized diblock copolymer was treated with $AgNO_3$ to form a nano-Ag-tagged diblock copolymer. The above-synthesized polymer systems were characterized by various analytical tools such as FTIR spectroscopy, NMR spectroscopy, fluorescence emission spectroscopy, circular dichroism, gel permeation chromatography, FESEM, HRTEM, EDX, DSC and TGA. Its applications toward catalytic reduction of *p*-nitrophenol (NiP), wound healing activity and low-temperature splinting activity were tested. Due to the incorporation of poly(tetrahydrofuran) (PTHF), the % elongation value of the diblock copolymer was increased but the DSC and TGA results showed depressed results. The HRTEM declared the size of Ag nanoparticle as < 50 nm. From the values of UV–visible absorbance, apparent rate constant (k_{app}) was determined and compared with the literature report.

Keywords Diblock copolymer · Synthesis · HRTEM · Splinting activity · Catalytic reduction

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ORIGINAL RESEARCH

Characterization and applications of amino acid-bridged nano-Ag end-capped diblock copolymer

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Abstract

Ring opening polymerization of ε-caprolactone and tetrahydrofuran was carried out under inert atmosphere with the monomer-to-initiator ratio of 100 and treated with $AgNO_3$ to form Ag nanoparticle-centered diblock copolymer. Amino acids such as alanine (Ala) and asparagine (Aspar) were used as a lone chemical initiator at 160 °C in the presence of stannous octoate as a catalyst. The resultant Ala- and Aspar-bridged diblock copolymer was characterized by Fourier-transform infrared (FTIR), ^{1}H nuclear magnetic resonance spectra, differential scanning calorimetry, thermogravimetric analysis, field-emission scanning electron microscopy, high-resolution transmission electron microscopy (HRTEM), gel permeation chromatography (GPC) and circular dichroism spectroscopy techniques. The FTIR spectrum showed a peak corresponding to the tetrahydrofuranium ion and confirmed the diblock copolymer formation. The diblock copolymer formation was confirmed by an increase in M_w in the GPC analysis. The HRTEM showed the size of the Ag nanoparticles was less than 10 nm. The Ag end-capped diblock copolymers were tested for catalytic reduction of *p*-nitrophenol (NiP) and the apparent rate constant (k_{app}) for the reduction of NiP was calculated as 1.15×10^{-2} s^{-1} with the help of UV–Visible spectrophotometer. The Ag nanoparticle-centered diblock copolymer was tested for low-temperature splinting application. Mechanical properties of the polymers were also tested.

Keywords Ring-opening polymerization · Diblock copolymer · Fourier-transform infrared spectroscopy · Gel permeation chromatography · Catalytic reduction

Introduction

Recently, the ring-opening polymerization (ROP) technology has played a vital role in the preparation of versatile aliphatic linear polyesters because of its excellent hydrolyzability and bio-degradability. They play an important role in bio-medical engineering. In 2003, Albertsson et al. [1] used an ROP technique for the preparation of poly(ε-caprolactone) (PCL). Enzyme-catalyzed ROP of CL was reported in 2002 [2], and was shown to depend on the structure of catalyst, nature of the initiating group and the reaction temperature with respect to time [3].

Among the catalysts used for the preparation of PCL, stannous octoate (SO) was the first member in the queue. Diethyleneglycol-initiated ROP of CL was thoroughly studied by Li et al. [4]. PEG-initiated bio-resorbable PCL was synthesized for tissue engineering applications [5]. Recently, multifunctional initiator-initiated ROP of CL was reported in the literature [6]. Other functional moieties, such as methoxyPEG [7], multifunctional initiator [8], benzylalcohol [9], natural amino acids [10] and α-amino acids [11] were used as initiators for the ROP of CL.

However, to the best of our knowledge, there are no literature reports that indicate Ala- and Aspar-initiated ROP of CL. To have a better understanding of the ROP of CL by amino acids, the present investigation was carried out resulting in a comparative study of the two different amino acid-initiated ROPs of CL, particularly study of their thermal and morphological properties.

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ORIGINAL PAPER

Conjugated hydrophobic and hydrophilic blocks through a drug moiety as a leading macromolecular system for sustainable drug delivery

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Abstract
Ring-opening polymerization (ROP) of ε-caprolactone (CL) had been performed at 160 °C in the presence of drug molecules such as penicillin g (Pen), streptavidin (Strep) and terramicin (Ter) as a lone chemical initiator using the catalyst, stannous octoate (SO) under N_2 atmosphere. The prepared drug bridged poly (ε-caprolactone) (PCL) was further copolymerized with tetrahydrofuran (THF) and the diblock copolymers were examined using the various analytical tools (FT-IR, DSC, TGA, SEM, FE-SEM, EDX, UV-visible and GPC). The functionalities of the drug bridged diblock copolymers were concluded by FT-IR spectra. The formation of the diblock copolymer was further understood from the increase in M_w. The drug release activity of homo and diblock copolymer had been tested with the drug release model and mechanism. The mechanical properties are also studied.

Keywords Drugs · Diblock copolymer · DSC · FE-SEM · TGA · Drug release

Introduction

Recently, the pharmaceutical chemists and polymer scientists are combined and actively working for sustainable drug release from the polymer backbone. The sudden release of all the drug molecules from the polymer backbone leads to overdose sometimes that causes side effects to the patients. The reason behind the drug release is a hydrogen bonding mechanism. Once there are any changes in the temperature or pH, the hydrogen bond between the polymer backbone and drug molecule breaks, and all the drug molecules are delivered at a time. In order to outwit this problem, a sustainable drug release is required. Before having a look into the sustainable drug release (SDR), a study is made on the conventional drug release. In 2011, Ogaji et al [1]. reviewed the conventional drug release study using bio-polymeric backbone. In 2014, smart polymer-based drug delivery was reported by Priya and co-workers [2]. In 2017, the application of polymers in drug delivery was thoroughly explained by Oh. [3] Drug delivery of theophylline was made by polymer blends [4]. A biocompatible poly(ester amide) was used for drug release study [5]. Like this, other polymers such as poly (glycolic acid) [6], poly(organophosphazenes) [7], PEG-co-PAA [8], PCL [9] and PEG-PCL [10] were used for drug delivery application. To obtain a sustainable drug delivery, again polymers are used as drug carriers, for eg. Methacrylic acid-co-ethyl acrylate copolymer [11], heptadiyne based copolymer [12], polysaccharide [13], silk fibroin [14] and polydopamine [15]. Chitosan-based hydrogels were used for sustainable drug delivery [16]. Jeyaraman and his research team utilized PVA for the sustainable release of rifampin [17] and amoxicillin [18]. NIR light-controlled drug release of amine-functionalized PEG was available in the literature [19]. The controlled release of folic acid by poly (CL-co-THF) was reported in the literature [20]. PCL was used for controlled drug delivery in cancer treatment [21]. Meenarathi and co-workers [22] reported the sustainable release of furosemide from the PECH backbone via hydrolysis mechanism. In 2017, Kamaly et al. [23] reviewed

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Synthesis and investigation of thermal properties of PMMA-maleimide-functionalized reduced graphene oxide nanocomposites

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Abstract

Reduced graphene oxide (RGEO) and N-[4-(chlorocarbonyl)phenyl]maleimide-functionalized reduced graphene oxide (MFRGEO) were used as nanofillers for polymethyl methacrylate (PMMA) matrix nanocomposites to enhance thermal stability. Methyl methacrylate containing nanofiller of four different weight percent (0.2, 0.4, 0.6, and 0.8) was polymerized using ultrasonic radiation-assisted bulk polymerization. The Fourier-transform infrared spectra showed the absence of chemical interaction between the filler and the matrix phase. Morphology of nanocomposites studied using scanning electron microscope confirmed the assistance aided by ultrasonication in the uniform dispersion of nanofiller in the PMMA matrix. Thermogravimetric (TG) study revealed the presence of MFRGEO enhanced the thermal stability of PMMA by shifting the entire degradation to higher temperature. The thermal stability of PMMA nanocomposite was improved by as much as 40°C at just 0.8 wt% loading of MFRGEO. Differential TG study also supported the role of maleimide functionalization on RGEO in the enhancement of thermal stability of PMMA by means of retarding the degradation rate of unsaturated chain ends in the PMMA matrix. Unlike MFRGEO, RGEO failed to enhance the thermal stability of PMMA.

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Research Article

Polyoxometalate functionalized matrix material: synthesis, characterization, reductive and thermal degradation kinetics

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Abstract
One-pot synthesis of polyoxometalate (POM) based hybrid material **1** was synthesized by mixing copper nitrate, silicomolybdic acid and urea under hydrothermal condition. The reduction ability of **1** was examined by employing 2,4,6-trinitrophenol (2,4,6-TNP) and 4-nitrophenol (4-NP) in the presence of sodium borohydride in water. The catalytic reduction into the corresponding amine was monitored by UV–Visible spectroscopy. The rate and order of catalytic reduction were studied through chemical kinetics and follows pseudo-first-order. The efficiency of the catalyst was investigated by employing used catalyst **1** for at least ten cycles. Leaching experiments and performance of the reusability of catalyst were supported by FT-IR analyses. In addition, the electrochemical reduction ability of catalyst **1** was also executed by Cyclic Voltammetry (CV). Catalyst **1** was characterized by Fourier-Transform Infrared spectroscopy (FT-IR), Powder X-ray diffraction (PXRD), UV-Diffused Reflectance (UV DRS), Scanning Electron Microscope (SEM), Energy Dispersive X-ray Spectroscopy (EDX), X-ray Photoelectron Spectroscopy (XPS), and Bruner–Emmet–Teller analyses (BET). Solid-state decomposition kinetics of **1** was performed from Thermogravimetric Analysis (TGA) data by fitting into model equations such as Flynn–Wall–Ozawa (FWO) and corrected (C-FWO).

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Research Article

Structural, Thermal, Morphological, Adsorption, and Catalytic Properties of Poly(BPDAH-co-ODA/PPDA)-Ag/V_2O_5 Nanocomposites

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Abstract

Thermally stable polyimides (PIs) were prepared by condensation technique at 160 °C for 5 hours in N-methylpyrrolidone (NMP) medium under N_2 atmosphere both in the presence and absence of metal (Ag) and metaloxide (MO) (V_2O_5) nanoparticles (NPs). The synthesized polymers are characterized by Fourier Transform Infra Red (FT-IR) spectroscopy, ^{1}H Nuclear Magnetic Resonance (^{1}H NMR) spectroscopy, Differential Scanning Calorimetry (DSC), Thermal Gravimetric Analysis (TGA), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Field Emission Scanning Electron Microscopy with Energy Dispersive X-Ray (FE-SEM and EDX). The FT-IR spectrum showed a peak at 1786 cm^{-1} corresponding to the C=O stretching of dianhydride. The aromatic proton signals appeared between 6.7 and 7.5 ppm in the ^{1}H-NMR spectrum of the resultant PIs. The oxydianiline (ODA) based PI with Ag NP loaded system exhibited the highest T_g value. The apparent rate constant values for the adsorption and catalytic reduction of p-nitrophenol (PNP), Cr^{6+} and rhodamine 6G (R6G) dye were determined with the help of UV-visible spectrophotometer. Among the catalysts, the system loaded with V_2O_5 NP has higher k_{app} values. The experimental results are critically analyzed and compared with the previously available literature values.

Keywords: Polyimides; Synthesis; Characterization; DSC; FESEM; k_{app}

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1. Introduction

Polyimides (PIs) are a class of polymers which are familiar for their thermal stability, processability and mechanical properties. It has a wide domestic application. Recently, various methodologies are developed for their synthesis. By using novel techniques a number of PIs are synthesized and their structure-property relationship has been analyzed. It was found that a good number of PIs with different chemical structure had been commercialized to meet out the daily requirement of human beings. Such a thermally stable candidate can be generally prepared by condensation reaction in an economic route (*i.e.*) the reaction between dianhydride and diamine. Industrially important dianhydrides are pyromellitic dianhydride, benzophenone tetracarboxylic dianhydride and oxyphthalic dianhydride. In polymer industries,

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Kinetics of thermal degradation of intumescent flame-retardant spirophosphates

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Abstract. The thermal degradation behaviour of various spirophosphates synthesized using SDP (phenol), SDOC (*o*-cresol), SDMC (*m*-cresol), SDPC (*p*-cresol), SDDMP (2,4-dimethylphenol) and SDTMP (2,4,6-trimethylphenol) with 3,9-dichloro-2,4,8,10-tetraoxa-3,9-diphosphaspiro-[5,5]-undecane-3,9-dioxide (SDCDP) are investigated using thermogravimetric analyzer. The spirophosphates show multistage degradations in the temperature range 180–550°C. The second stage of degradation is more prominent and the substituent effect is clearly reflected at this stage of degradation. The compound SDP showed superior performance since it has the greatest char yield value (44%) and LOI value (27%). The model free kinetic methods of Flynn-Wall-Ozawa and Vyazovkin methods are used to calculate the apparent energy of activation for the thermal degradation (E_a-D) of these spirophosphates. The material SDTMP showed the highest E_a-D values.

Keywords. Spirophosphates; intumescence; thermogravimetric analysis; degradation kinetics; flame retardants.

1. Introduction

Polymeric materials (due to light weight, durability, mechanical performance and resistance towards chemicals, etc.) are advantageously used in many fields (household products, defence materials, aerospace parts and marine parts, etc.). However, the use of polymeric materials is restricted due to its fire risk properties [1,2]. Usually the incorporation of flame-retardant additives or the development of flame-retardant coatings for polymer is the convenient method to impart polymer flame retardancy [3,4]. At present, research has been focused on to develop environmental friendly flame-retardant systems. The patents and literature on environmental friendly flame retardants illustrated the importance of phosphorus-based flame retardants and indicated as very good alternate for halogenated flame retardants. The research on phosphorus-based flame retardants is originated with ammonium polyphosphate (APP) [5].

Phosphorus-based intumescent systems are attracted by many researchers, since it forms nonoxidizable multi-cellular charred layer in the fire condition. The formed char insulate and protect the materials of interest. The acid source, carbonific and spumific agents required to formulate the intumescent system has more than one functional group. Thus the mechanism of intumescence is complex in nature [6–9].

Previously, the authors synthesized a series of spirophosphates by reacting spirodichlorodiphosphate with phenol, *o*-cresol, *m*-cresol, *p*-cresol, 2,6-dimethylphenol and 2,4,6-trimethylphenol [10,11]. The materials were pyrolysed at 500°C for a constant period (5 s) and the volatile products evolved were analysed using GC-MS. From these results attempts were made to elucidate the degradation mechanism of spirophosphates, which will add to the present understanding of the intumescent behaviour of phosphorus-based compounds. The research carried out on various spirophosphates has been reviewed [12].

It is well known that the flame retardancy of the materials also depends on the thermal stability, degradation rate, char forming rate and char yield. Thermogravimetric (TG) analysis is one among the standard procedures to investigate the thermal stability and the degradation of a material. Getting appropriate data and calculations will provide the kinetic triplets, the apparent activation energy for thermal degradation (E_a-D), the frequency factor (A) and the reaction model $f(\alpha)$. As per the recommendations of Flynn–Wall–Ozawa (FWO) [13,14] and Vyazovkin (VYZ) [15], multiple heating

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pH, Viscosity of Hydrophobic Based Natural Deep Eutectic Solvents and the Effect of Curcumin Solubility in it

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Abstract: Turmeric contains curcumin as one of the active constituents, which gives yellow color and possesses lots of pharmacological actions. Even though curcumin has lots of pharmacological actions till now, it has not been approved as a medicine due to its low water solubility, permeability, and poor bioavailability. Deep eutectic solvent (DES) can be prepared by simply mixing two or more solid components, [among the two one is hydrogen bond donor (HBD) and another is hydrogen bond acceptor (HBA)] at a definite molar ratio where the solid components by self-association converted into a liquid at room temperature (RT). Natural deep eutectic solvents (NADES) are a specific subgroup of DES containing primary plant-based metabolites such as organic acids, alcohols, amino acids, or sugars. In this work, natural hydrophobic DESs were prepared with Camphor, Menthol, and Thymol. This was prepared from different ratios of Menthol:Thymol 1:1 to 1:5 and 1:1 to 5:1 (MT-DES); Camphor:Thymol 1:1 to 1:5 and 1:1 to 5:1 (CT-NADES); Camphor:Menthol 1:1 to 1:5 and 1:1 to 2:1 (CM-NADES). The pH and viscosity of prepared DESs were determined with the help of a digital pH meter and Brookfield viscometer. The solubility of curcumin in different NADESs was determined at room temperature (RT) to higher temperatures. The formation of different clear DES was obtained with slight heat. There was no difference in pH for the NADESs prepared without and with heat. Regarding the viscosity CM-DES (1:1) showed less viscosity when compared to other NADESs. The solubility of curcumin was found to be nearly double when it was dissolved in NADES for 1 hr at 35-40°C compared to 48 h stirring at 500 rotations per minute (rpm) at RT. Among different NADESs, curcumin solubility was found to be more in CM (1:1) ratio when compared to other NADESs.

Keywords: camphor; curcumin solubility; hydrophobic natural deep eutectic solvent; menthol; pH; thymol; viscosity.

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Evaluation of physicochemical properties and catalytic activity of poly(PMDAH-co-ODA/PPDA) nanocomposites towards the removal of toxic pollutants

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HIGHLIGHTS

- Catalytic activity of PI nanocomposite was assessed towards the reduction of toxic pollutants.
- The catalytic efficiency was assessed by determining the k_{app} values.
- The reduction of NiP was 98% in 5 min for P3 and 99% in 7 min for P5 system.
- The reduction of Cr(VI) was 100% in 7 min for P2 and 99% in 6 min for P5 systems.
- The reduction of R6G was 100% for P2 and 99% for P3 nanocomposites in 6 min.

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ABSTRACT

Synthesis of Polyimides (PIs) between pyromellitic dianhydride (PMDAH) and oxydianiline (ODA) or p-phenylenediamine (PPDA) in the presence and absence of V_2O_5 and Ag nanoparticles (NPs) were carried out under N_2 atmosphere at 160 °C for 5 h with vigorous stirring in N-methylpyrrolidone (NMP) solvent. The prepared PI and its nanocomposites were analyzed by FT-IR spectroscopy, ^{1}H NMR spectroscopy, FE-SEM, SEM, DSC and TGA like analytical instruments. The FE-SEM showed various surface morphologies for different PI nanocomposites. The particle size of the prepared nanoparticles was calculated as less than 60 nm for Ag and 15 nm for V_2O_5 nanoparticles by HR-TEM. The PI nanocomposites embedded with Ag nanoparticles (P2 and P5) showed a higher thermal stability than the pristine PIs (P1 and P4) and PI/V_2O_5 nanocomposites (P3 and P6). Further, the possible application of metal (Ag) and metal oxide (V_2O_5) NPs embedded PI nanocomposites was assessed on the catalytic reduction of highly toxic Cr(VI), Rhodamine 6G (R6G) dye and p-nitrophenol (NiP) pollutants with the help of a reducing agent ($NaBH_4$). The apparent rate constant (k_{app}) values were calculated to assess the catalytic efficiency of the prepared PI and its nanocomposites. The PI/Ag nanocomposite (P2) system showed an efficient catalytic reduction than the other systems.

1. Introduction

Recently, the polymer scientists invent a new polymer for certain end uses applications. Depends on the application, the structure of the polymeric materials is designed. In this work, novel PI and its nanocomposites were synthesized by an *in-situ* method, and further its application towards the catalysis field is extended. Liu et al. (2012) reported the bis [benzimidazole] based polyimide. Wang et al. (2017a,b) prepared the aminopyridinoxy benzophenone based PI to analyse its properties. Thiruvasagam et al. (2013) reviewed about the AB-type monomers and PIs in detail. PIs containing multiple alkyl side chains were reported in the literature (Wang et al., 2007). Pseudo Trogers base based PI was studied for the application of membrane gas separation by Ma et al. (2017).

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Efficient catalytic activity of novel fluorescent polyimide embedded Ag and V_2O_5 nanoparticles towards the removal of hazardous pollutants

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ABSTRACT

A novel fluorescent polyimide (PI) made up of perylenetetracarboxylic dianhydride (PTCDAH) and *p*-phenylenediamine (PPDA) was prepared with or without Ag and V_2O_5 nanoparticles at 160 °C for 5 h under N_2 atmosphere with vigorous stirring. The influence of nanomaterials on the rate of polymerization (R_p) was determined. The synthesized PI and PI nanocomposites were characterized to analyse their chemical functionality (FT-IR), surface morphology (FE-SEM) and thermal properties (DSC and TGA). The catalytic reduction of Cr (VI), *p*-nitrophenol (NP) and rhodamine6G (R6G) dye was analysed using the prepared PI and PI nanocomposites as a catalyst. It was found that the R_p of PI nanocomposites was higher than pristine PI system. The PI/Ag nanocomposite system exhibited higher degradation temperature (T_d) and apparent rate constant (k_{app}) values towards the reduction of R6G dye.

1. Introduction

The applications of polyimides (PIs) are moving towards the manufacturing of high-performance materials owing to their high thermal and mechanical properties. As the absence of chromophoric group in PIs, their applications are restricted in bio-medical engineering as a bio-probe due to its high performance. Generally, PIs are colourless and lack of fluorescent property, which restricts their use in the biomedical field. Moreover, the PIs containing nanoparticles can be used in the catalysis field. To outwit the above-mentioned problem, a chromophoric group containing PI was synthesized in the present investigation. Moreover, this PI can be used as an adsorbent and catalyst for its good adsorption behaviour. The PI nanocomposites exhibit better performance than the pristine PI. The main objective is to synthesize the PI nanocomposites and extend their application towards the catalysis field as a polymer-supported catalyst. Generally, PIs are synthesized by condensation between a dianhydride and a diamine in an appropriate solvent medium. For instance, the condensation between pyromellitic dianhydride (PMDAH) and p-phenylenediamine (PPDA) was available in the literature (Hsiao and Chen, 2002). In 2011, the PI made up of tetraphenyl propylenedianyhydride moieties was reported by Chen et al. (2011). Hietpas and co-workers (Hietpas and Allara, 1998) prepared the PPDA based PI thin film. The other dianhydrides like PMDAH (Ajaj and Kareem, 2016), bis-(4-phenylethylenephthalic anhydride) (Yamaguchi and Aoki, 2006), biphenyltetracarboxylic dianhydride (Chang et al., 2015) and hexafluoro isopropylidiene diphthalic anhydride (Liaw et al., 2015) were used with PPDA for the preparation of PI. Sensui and his research team (Sensui et al., 2009) reported the asymmetric PI based BPDA-PPDA segments. It was noted that a few reports are available on PPDA based PI in the literature so far. This motivated the authors to carry out the present research work.

Ghaemy et al. (Gahemy and Nasab, 2010) synthesized the organo-soluble fluorescent PI and characterized to assess its thermal, photophysical and chemiluminescence properties. A highly fluorescent PI was synthesized through the charge transfer complex formation reaction (Wakita et al., 2009). Electron acceptor group containing 1, 2, 4-triazole based fluorescent PI was reported in the literature (Zhou et al., 2015). 1,2-diaryl quinoxaline based diamine was utilized for the preparation of fluorescent PI (Bazzar et al., 2013). Perylene tetracarboxylic acid based fluorescent PI was synthesized by Huang et al. (2011) and its electronic property was examined. The fluorescent PI was also reported by other researchers (Icil and Icli, 1997; Liao et al., 2015; Zhang et al., 2010; Usui et al., 2005; Banda et al., 2015; Wu et al., 2013; Niu et al., 2004). Sribala and co-workers (Sribala et al., 2017) reported the

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A Study On Employee Welfare Measures In Construction Industry In India

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Abstract: In India, the welfare benefit to the employees whether it be statutory or voluntary is available only to the workers employed in formal sector, who are hardly 10%. Left over 90% of the labors, who are more than 40 crores in number, and employed in unorganised / informal sector like construction, agriculture industry is either deprived their rights. In this project, an attempt has been made to study of the welfare measures available in construction industries. The statistics have been composed through primary survey by administrating a detailed questionnaire to section of the employees selected at random. The percentage analysis is used to know the satisfaction level of the employees regarding welfare measures as suggested in the Factories Act, 1948.

Key words: Job, Labour, Productivity, Safety, Satisfaction, Security, Wages, Welfare

1. INTRODUCTION

Human resource is an significant factor in the growth of the construction industry and therefore understanding the labour behavior is very much essential to progress the effectiveness of production (Ganeshprabhu et. al 2016). Labour is considered to be most essential of a nation as they make all prosperity from natural assets and is the pillar for the development of the nation. Utilization of any resource largely depends on the efforts and the worth of the labour assets of the nation. Labours are essential as they need to operate the machineries and equipment. They holding responsibilities and modernizing new procedure in order to increase the effectiveness of the process and enable a nation to get industrially developed. Building and Construction industry is familiar as the unorganized sector involving financial activity after agriculture in India with massive temporary and casual labour. Such industries make demand for both skilled and semi-skilled labour power. The labors face inherent risk to life/vital body parts due to job-related dangers with lack of basic facilities and insufficient welfare amenities. Lack of safety, lack of skills, lack of quality materials, low wages, communication barriers like that mostly make mental pressure to the labours and it totally disturbs the labour production efficiency (P.Ganeshprabhu et al. 2015) The proprietors benefit from fulfilled personnel as they are more likely to revenue from lower staff income and higher productivity if their workers knowledge a high level of job satisfaction (Spector 1997). However workforces are fulfilled with some work provision necessities, most of the labors are very displeased with working situation and work benefit of the work provision requirement (Humphrey Danso 2012).

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In spite of statutory requirements and enforcing agencies in the welfare amenities were absent and hence welfare examination and empowerment of welfare examiners are essential (Koshan 1975). Women building workers stated that labour welfare benefits and schemes were not at all appropriate to them (Tikoo et all 2013). An administration's necessity to attract and hold valued workers in a highly competitive labour market is a strong inspiring factor for increased administrative awareness and action with regard to implementation and management of Work life Balance WLB policies (Helen De Cieri et al 2007). The female workforces that they were not provided with any basic facilities except drinking water on the sites and the women workers were engaged in unskilled jobs (manually carrying/transferring construction materials) facilities except drinking water on the sites) (SEWA 2000)

The Government of India passed the legislation namely, Building and Other Construction Workforces (Regulation of employment and conditions of services) Act, 1996 but not enforced properly. According to the Report of the Committee of Labour Welfare setup by the Government of India in 1969, labour welfare refers to “the measures, which promote the physical, psychological and general well-being of the working population.

2 OBJECTIVES OF THE STUDY

- To study the current welfare measures adopted by the organization.
- To recognize the impact of the welfare measures upon the worker’s health and productivity.
- To pin point disparity in the existing welfare facilities.
- To identify the place of deviation in the implementation of welfare measurers from the statutory regulation of the Factories Act.
- To recommend suitable remedies related to welfare problem so as to increase the job satisfaction and productivity.

3 METHODOLOGY

The methodology followed in the project work is formulated in the form of flow chart as below

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Original Research

Spatial Time Dependent Reliability Analysis of Carbonation with Climate Change

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Abstract

The ambiance around the concrete structures could be affected by a dynamic climate, particularly after a long time, results in declination of durability at a quicker rate. The increase in carbon dioxide concentration and temperature can increase the carbonation depth of concrete. Carbonation-induced corrosion of concrete structures in Bern and Seoul under a dynamic climate is investigated during this work by considering high and medium greenhouse gas emissions scenarios RCP 8.5 and RCP 4.5 respectively. This analysis takes into account the effect of change in temperature, carbon dioxide levels and relative humidity on diffusion coefficients considering relative humidity as a time-dependent variable. This work also evaluates the failure probability of durability based on the reliability concept by considering the coefficient of variation of carbonation depth and cover depth. Reliability index of 1.28 which infers the probability of corrosion initiation less than 10% is used for inference.

Keywords: corrosion, climate change, exploratory spatial data analysis

Introduction

Reinforced concrete is extensively used in the construction of buildings as it is comparatively cheap and provides large durability. Durability gets reduced drastically by corrosion when the reinforced concrete structures are situated in environments with high CO_2 concentrations. Carbonation is induced when the atmospheric carbon dioxide reacts with cement hydrates and forming calcite. This chemical reaction significantly decreases the pH in the porous solution and thus it induces corrosion of the reinforcing steel. Parameters governing carbonation depend on temperature, atmospheric carbon dioxide concentration and relative humidity, all related with time and climate change [1].

Study on the influence of climate change on the durability of concrete structures using statistical regression analysis of a number of pertinent experimental and field data resulted that temperature, concentration of CO_2, and relative humidity play a vital role in the concrete carbonation rates [2]. Park et al presented a probabilistic approach to predict the service life of concrete structures subjected to carbonation based on the climate scenario IS92a which considered natural logarithm of time in prediction of CO_2 concentration from the year 2000 to 2100 and linear variation in the prediction of temperature based on meteorological data from Korea Meteorological Administration [3].

Yoon et al. developed a durability model considering the effect of increase in the concentration of CO_2 on

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Original Research

Engineering Behaviour of Sustainable Concrete with Steel Mill Scale

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Abstract

In the current research work steel mill scales, waste from steel industries has been tested out as a fractional replacement for sand. Steel mill scale is a waste product obtained from the steel production industries and it has an adverse effect on the environment. Steel mill scale has become a good substitute for fine aggregates in the construction industry. The experimental parameter was the percentage of steel mill scale substitution (0%, 20%, 40%, 60%, 80% and 100%) by weight to fine aggregate content in M30 grade concrete and the results obtained from these mixes are compared with original M30 grade concrete. Compressive strength, split tensile strength, flexural strength and micro-structural characters of such concrete were evaluated. The interaction of steel mill scale within the concrete has been methodically investigated using micro-structural studies. It was found that very small particle size of steel mill scale fills the voids between the fine and coarse aggregate thus makes dense concrete. The test outcomes suggest that recycling steel mill scale by utilizing as a fractional replacement for fine aggregate offers a viable cost effective and environmentally friendly solution at 60% replacement.

Keywords: waste product, sustainable concrete, waste management, steel mill scale, river sand, compressive strength, split tensile strength, flexural strength, SEM

Introduction

In the present Indian context, there is a growing necessity in minimizing the usage of natural river sand in concrete production. In this regard, the construction industry has previously captivated various industrial waste as a substitute for natural aggregates. The consumption of construction aggregates all over the world, in terms of volume, is likely to attain 62.9 billion metric ton by the end of 2024, up from 43.3 billion metric ton in 2016 [1]. Natural sand demand in India reached 950 million metric ton in 2015 from 300 million metric ton in 2000 [2]. It is expected to reach 1430 million metric ton in 2020. According to the report, sand will experience the maximum demand in India. As the living standards of the human beings

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RESEARCH ARTICLE

Application of reliability index in statistical model to assess durability of concrete made with plastic waste aggregates subjected to carbonation

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Abstract
One of the feasible solutions for the solid waste management problem is to use recycled plastic waste as a replacement for natural aggregates in construction applications, which reduces pollution and protects natural resources from depletion. Corrosion of steel reinforcement due to carbonation is one of the important factors affecting the durability of reinforced concrete, which leads to a decrease in serviceability and safety of structures. This study aimed to compute the probability of corrosion initiation using the reliability index for concrete whose coarse aggregate was partially replaced with high impact polystyrene (HIPS). This study employed a statistical carbonation depth prediction model incorporating recycled aggregates which relate carbonation in concrete with 28-day compressive strength, cement content, aggregates' equivalent water absorption, and CO_2 content in the atmosphere. A reliability index of 1.28, which infers the probability of corrosion initiation less than 10%, has been used for inference. Results showed that a slight increase in concrete cover for concrete with HIPS replacements was required to exhibit similar service life as that of conventional concrete.

Keywords Carbonation · Waste plastic · Statistical modeling · Reliability index · Probability of corrosion initiation

Introduction

Favier (2019) insisted on the need for the use of recycled materials, which highlights the need for structurally more efficient buildings to consume fewer materials. Due to technological development and the low cost of electronic products, consumers throw away old electronic products such as computers, mobile phones, televisions, printers, laptops, washing machines, air conditioners, and refrigerators, which result electronic waste as almost three times the rate of municipal waste globally (Senthil Kumar and Baskar 2015a, b). Ignatyev et al. (2014) discussed the various established recycling technologies and insisted on the need for more R&D activities to overturn the increasing number of discarded polymer materials. India produces more than 0.44 million tonnes of e-waste annually, and only 4.5% of that e-waste gets recycled because of the lack of proper infrastructure, legislation, and frameworks for recycling and disposing of electrical waste and appliances (Senthil Kumar and Baskar 2015a, b). According to official statistics, it is estimated that Australia recovered 0.39 million tonnes of plastic from 3.5 million tonnes of plastics consumed in the financial year 2018–2019 (O'Farrell 2019). Every year, over 6.5 billion tonnes of discarded plastic and rubber trash are generated worldwide, and their disposal poses a significant environmental danger due to their long time to degrade (Li et al. 2020b). The accumulation of mixed plastic garbage necessitates immediate attention. Incorporating mixed plastic waste as a partial replacement for natural aggregates in concrete could be a viable option for recycling a large volume of plastic trash.

According to the review by Shamsuyeva and Endres (2021), the development of a Circular Economy Model for plastics products necessitates strong collaboration between scientists, standards committees, and industry. Gu and Ozbakkaloglu (2016) provided a comprehensive review of 84 studies dealing with concrete containing plastic aggregates or plastic fibers. Four hundred thirty-five experimental mixes employing plastic as aggregates or fibers, from 53

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Oxidative removal of stabilized landfill leachate by Fenton's process: process modeling, optimization & analysis of degraded products

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In this study, the stabilized landfill leachate which has a BOD : COD ratio of 0.045 was treated using Fenton's process. The effect of process parameters like reaction time, pH, dose of $FeSO_4$ and dose of H_2O_2 was estimated using One Factor At a Time (OFAT) and the linear, interactive and quadratic effects between the factors were studied using Face Centered Central Composite Design (CCF). In the OFAT approach, reaction time: 5 minutes, pH: 3.0, dose of $FeSO_4$: 30 mM, and dose of H_2O_2: 30 mM were optimized. In CCF, the statistically optimized model shows maximum removal of organic substances at an $FeSO_4$ concentration of 14.44 mM, pH 3.0 and 29.12 mM of H_2O_2. The regression co-efficient R^2 = 0.9079, adj R^2 = 0.854 and adequate precision = 14.676. The degradation of organic substances was assessed by measuring the Chemical Oxygen Demand (COD). Total Organic Carbon (TOC) and Gas Chromatography-Mass Spectroscopy (GC-MS) were investigated for the sample corresponding to the maximum COD reduction.

1. Introduction

Leachate is a liquid extract which oozes out of solid waste, due to degradation of the solid waste and due to percolation of rain water through the waste.[1–3] Due to percolation of leachate through the soil and migration of leachate by surface runoff contaminates the soil, groundwater and surface water bodies in and around the landfill site.[4,5] The leachate contains various organic substances (both biodegradable and non-biodegradable), inorganic substances (chloride, magnesium, sodium, potassium, ammonia nitrogen, bicarbonates *etc.*), heavy metals, and toxic substances.[6,7] The volume of leachate production and the concentration of the contaminants present in the leachate vary due to the composition of the constituents present in the solid waste, method of landfill, age of solid waste landfill, seasonal changes (change in temperature, rainfall pattern), and environmental conditions of the landfill (aerobic, anaerobic & facultative).[6,8] The characteristics of the leachate determine a suitable method of treatment that can be adapted to the specific leachate.[3] Young leachate (age of landfill 1–2 years) where the biochemical oxygen demand (BOD_5)/chemical oxygen demand (COD) is >0.6 is amenable for biological treatment. Stabilized leachate (age of landfill 5–10 years) and a BOD_5/COD ratio < 0.3 can be treated by physicochemical treatment methods.[9,10]

Leachate contains trace organic contaminants (OC), which have high impact on environment and living beings and it cannot be removed completely by conventional treatment (biological treatment and physical/chemical treatment) or membrane treatment, while the membrane bioreactor is capable of removing these contaminants completely but it is expensive.[11] Advanced Oxidation Process (AOP) was capable of destructing bio refractory compounds in wastewater.[10] Common AOP was carried out by different combinations of oxidants (O_3, H_2O_2, and combination of both), catalyst (metal salt/electrodes) and irradiation methods (ultraviolet radiation, visible light, ultrasonic sound and microwave).[12–14] In the Fenton process the catalyst ferrous ion combines with oxidizing agent hydrogen peroxide under acidic condition and produces OH radicals which oxidize the organic substance present in the wastewater as the reaction shown in eqn (1).[5,15] The hydroxide radicals have higher oxidation potential ((E_0 = 2.80 V) than ozone (E_0 = 2.07 V)).[16] Ferric ion generated in this process combines with hydrogen peroxide and regenerates the catalyst ferrous ion as the reaction shown in eqn (2).[5,15]

$$Fe^{2+} + H_2O_2 \rightarrow Fe^{3+} + \cdot OH + OH^- \quad (1)$$

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RESEARCH ARTICLE

INVESTIGATION OF MECHANICAL PROPERTIES OF PAVER BLOCK MADE WITH EVA POLYMERS AND FLY ASH

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Ethyl Vinyl Acetate (EVA), M-Sand

Abstract

The aim of the project is to replace cement with fly ash and course aggregate with Ethyl Vinyl Acetate (EVA) in paver block. In this thesis paver block design is by using cement concrete mixture of mix design M30 which is composed of 10mm coarse aggregate cement and fine aggregate (M-sand).In this thesis the cement is partially replaced with fly ash and partial replacement of EVA with coarse aggregate in paver block at various level of 5, 10, 15, and 20 percentage of its weight. The paver block curing process is done for 7days and 28days. After curing it is checked for its compression strength, water absorption test and densitytest.

Introduction:-

Block paving also known as Brick paving is a commonly used decorative method of creating a pavement or hardstanding. The main benefit of bricks over other materials is that individual bricks can later be lifted up and replaced. This allows for remedial work to be carried out under the surface of the paving without leaving a lasting mark once the paving bricks have been replaced. Typical areas of use would be for driveways, pavement, patios, town centres, and precincts more commonly in road surfacing. Bricks are typically made of concrete or clay, through other composite materials are also used. Each has its own means of construction. The biggest difference is the way they set hard ready for use. A clay brick has to be fired in a kiln to bake the brick hard. A concrete brick has to be allowed to set. The concrete paving bricks area porous form of brick formed by mixing small stone hard-core, dyes, cement and sand and other materials in various amounts. Many block paving manufacturing methods are now allowing the use of recycled materials in the construction of the paving bricks such as crushed glass and crushed old building rubble.There are many different laying patterns that can be achieved using block paving. The most common of these is the herringbone pattern. This pattern is the strongest of the block paving bonds as it offers the most interlock, therefore making it a good choice for driveways and road surfacing. A herringbone pattern can be created by setting the blocks at either 45 degrees or 90 degrees to the perpendicular. Other popular types of pattern include stretcher bond and basket weave; with the latter being better suited to paved areas that will only receive light foot traffic, due to its weaker bond.

Material Property:-

Ethylene-Vinyl Acetate:

Ethylene-Vinyl Acetate (EVA) also known as Poly Ethylene – Vinye Acetate, is the copolymer of ethylene and vinyl acetate. The weight percent vinyl acetate usually varies from 10 to 40%, with the remainder being ethylene. This amount of vinyl acetate greatly effects the character of the material. Higher quality EVA will have a higher percentage of vinyl acetate while EVA with very little vinyl acetate can be hard, brittle, and feel like cardboard.

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