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Compilation of Research Articles
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1

Title:
Recent advancements in synthesis, properties, and applications of conductive polymers for electrochemical energy storage devices: A review

Journal:
Polymer Engineering and Science

Document Type:
Review

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Abstract:
Conductive polymer (CP) research has exploded in popularity over the years, with applications ranging from nanoelectronics to material science. CPs are, for all sorts of purposes, Nobel Prize-winning compounds, as their inventors received the Nobel Prize in Chemistry in 2000. Conducting polymers have sparked a lot of interest in academic and industrial sectors because they combine the electrical characteristics of semiconductors and metals with the typical benefits of ordinary polymers, such as ease of preparation and low cost production. Conducting polymers have also received a lot of attention because of their unique characteristics, which include customizable electrical properties, excellent optical and mechanical capabilities, ease of synthesis and manufacturing, and superior environmental durability to traditional inorganic materials. In this study, the molecular structures and behaviors of the most common forms of CPs, namely, polyacetylene, polyaniline, polypyrrole, and polythiophene and derivatives of polythiophene are discussed. The transport phenomenon that allow to understand the conduction process, are also described in this review. An in-depth investigation of conducting polymer-based binary, ternary, and quaternary composites with carbon-based materials, metal oxides, transition metals, and inorganic particles is utilized to analyze their applications as supercapacitors and batteries. There are also explanations of recent advancements in their applications in the areas of energy storage systems including batteries and supercapacitors. The development of their applications in the energy storage devices such as supercapacitors, lithium, and other -ions batteries, as well as their current issues and future prospect to advance energy storage systems are broadly discussed. This review is intended to contribute to a better understanding of this conducting polymer and, as a result, to the development of new research areas.

2

Title:
Value addition to ice cream by fortification with okara and probiotic

Journal:
Journal of Food Processing and Preservation

Document Type:
Article

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Abstract:
Synbiotic ice cream offers sufficient viable probiotics and value-added nutrients to satisfy health needs. This study aimed to formulate the optimum synbiotic ice cream incorporated with okara (1–3%) and the probiotic, Lactobacillus plantarum (ATCC 8014). Results showed a viscous texture was produced when more than 2% okara was added to ice cream. This formulation also minimally caused ice cream to melt for around 90 min at a melting rate of 19–76%. Furthermore, ice cream incorporated with okara had an increase in protein content (>5%) and a decrease in fat content (>13%) compared with the control (no okara), indicating that it is a low-fat item. The addition of more than 2% okara increased the viability of L. plantarum on day 60. Overall, 1% okara addition showed significant acceptability for potential symbiotic ice cream formulation. Novelty impact statement: One of the greatest challenges in the ice cream manufacturing industry is the short shelf-life and fast melting rate of milk-based ice cream, as it lowers a storage period and affects the textural characteristic. To overcome the said problems, the use of soybean by-product (okara), a potential prebiotic for dietary fiber source, was found to minimally caused ice cream to melt and was able to increase the viability of Lactobacillus plantarum. The function of dietary fiber is not only able to support the growth of probiotics, but also scientifically proven to strengthen the digestive system and reduce the possibility of developing diseases including cardiovascular diseases, diabetes, constipation, and bowel cancer.

3

Title:
Influence of coconut residue dietary fiber on physicochemical, probiotic (Lactobacillus plantarum ATCC 8014) survivability and sensory attributes of probiotic ice cream

Journal:
LWT, Volume 154, 15 January 2022.

Document Type:
Article

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Abstract:
Probiotic ice cream serves as a functional food, but potential loss of probiotic viability occurs during product formulation, processing, and storage. Hence, this study aims (1) to formulate a probiotic (Lactobacillus plantarum ATCC 8014) ice cream added with coconut residue, (2) to determine the impact of the coconut residue on probiotic ice cream characteristics during 60 days of storage, and (3) to assess the acceptance of the ice cream enriched with probiotics and coconut residue. The ice cream was produced by using non-fat milk powder, milk fat, heavy cream, sugar, egg yolk, stabilizer, and maltodextrin, added with 1% of L. plantarum and different concentrations of coconut residue fiber (0.01–0.03 g/mL). The results revealed that ice cream incorporated with 0.02 g/mL of coconut residue was the best formulation for probiotic ice cream production. Throughout the storage period, it possessed stable probiotic viability, soft texture, low melting rate, high protein, low-fat, appropriate pH for probiotics, and acceptable sensory ratings for overall consumer acceptance. The synergistic combination of coconut residue and probiotics in ice cream is a potentially novel strategy for producing a nutritious dessert item beneficial to human health as well as reducing potential pollution by the agricultural industry.

4

Title:
Performance Evaluation of Advanced Energy Storage Systems

Journal:
Energy and Environment.

Document Type:
Review

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Abstract:
Energy systems are progressive and revolutionary for their alternative resources, technical developments, demands, effectiveness and environmental effects. The recently published research's goal is to assess and evaluate the systems that are already in operation and those that will be in the future. Energy can be stored as electrical energy such as supercapacitors (SCs) and superconducting magnetic energy storage (SMES) etc., mechanical energy such as pumped hydro energy storage (PHES), compressed air energy storage (CAES) and flywheel energy storage (FES) etc., chemical energy, electrochemical energy such as batteries and fuel cells etc., and thermal energy. Performance of these energy storage systems (ESSs) have been evaluated in terms of energy density, power density, power ratings, capacitance, discharge-time, energy-efficiency, life-time and cycling-times, and costs. Supercapacitors provide highest power density (>10,0000 W/l), while hydrogen fuel cells provide highest energy density (500-3000Wh/l) among other EESs. Batteries also provide high energy density(200-500Wh/l). The energy efficiency is found highest in SMES system (95-98%), and lowest in TES system (30-50%). Moreover, batteries and supercapacitors have the cycle efficiency above 90%. PHES and CAES seem to be the most cost-effective energy storage systems reviewed in this analysis in terms of $/kWh. In addition, power-based capital cost of supercapacitors is lower (100-300$/kW) compared to energy-based capital cost of supercapacitors (300-2000$/kWh). In comparison with power-based capital costs, the energy-based capital cost of batteries is lower, which is 150-400$/kWh for Lead-acid battery, and <300$/kWh for Li-ion battery. This essay may help researchers in choosing the advanced energy storage technologies for relevant purposes.

5

Title:
Numerical solution for falkner-skan flow of hybrid nanofluid with porosity effect

Journal:
Journal of Applied Science and Engineering (Taiwan), Volume 25, Issue 3, 2022.

Document Type:
Article

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Abstract:
Hybrid nanofluid is known to improve heat transfer performance, and its advantages have led to relatively reasonable expectations for their applications. This research considered a moving wedge, namely the Falkner- Skan model, which is well-known in the aerodynamic field. Hybrid nanofluid has been chosen where the dispersion of alumina and copper nanoparticles with water as the base fluid is considered in the unsteady mixed convection flow over moving wedge. By using similarity transformations, the governing equations are converted into ordinary differential equations and then numerically solved using MATLAB bvp4c solver. The increasing values of porosity parameter caused the velocity of hybrid nanofluid to increase. The results also indicated that, the effect of porosity parameter improved the values of skin friction coefficient but decrease the value of Nusselt number.

6

Title:
Derivative-free SMR conjugate gradient method for constraint nonlinear equations

Journal:
Journal of Mathematics and Computer Science, Volume 24, Issue 2, 2022.

Document Type:
Article

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Abstract: conjugate gradient method projection metho
Based on the SMR conjugate gradient method for unconstrained optimization proposed by Mohamed et al. [N. S. Mohamed, M. Mamat, M. Rivaie, S. M. Shaharuddin, Indones. J. Electr. Eng. Comput. Sci., 11 (2018), 1188-1193] and the Solodov and Svaiter projection technique, we propose a derivative-free SMR method for solving nonlinear equations with convex constraints. The proposed method can be viewed as an extension of the SMR method for solving unconstrained optimization. The proposed method can be used to solve large-scale nonlinear equations with convex constraints because of derivative-free and low storage. Under the assumption that the underlying mapping is Lipschitz continuous and satisfies a weaker monotonicity assumption, we prove its global convergence. Preliminary numerical results show that the proposed method is promising.

7

Title:
Displacement rate effects on mixed-mode I/II delamination of laminated carbon/epoxy composites

Journal:
Polymer Testing, Volume 108, April 2022.

Document Type:
Article

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Abstract:
Mixed-mode delamination is one of the common failures of composites which has not been studied under low-impact loading. This paper studies the influence of displacement rate on mixed-mode I/II delamination of unidirectional carbon/epoxy composites. Single leg bending test is performed at displacement rates of 1, 10, 100, and 500 mm/min. Experimental results reveal that the mixed-mode I/II fracture toughness is invariant with the displacement rate. In addition, scanning electron micrographs shows that shear cusps are more obvious at 1, 10, and 100 mm/min. At 500 mm/min, significant matrix debris is noticed. Furthermore, the proposed three-dimensional rate-dependent fracture criterion is found to well predict the fracture toughness. Numerical simulation using cohesive zone model suggests that the lower numerical peak load is due to lower damage dissipated energy. In addition, the theoretical and numerical traction-separation responses show significant differences, which is also reflected in the numerical phase angle. This implies that the local mixed-mode ratio is not constant throughout the simulation process.

8

Title:
Manual Material Handling Assessments Towards the Working Comfort in an Automotive Manufacturing Company

Journal:
Lecture Notes in Mechanical Engineering, Volume 25, 2022.

Document Type:
Article

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Abstract:
Musculoskeletal disorders remain one of the most prevalent occupational injuries in the manufacturing sector. This study was performed to determine the types of working postures that cause discomfort to workers at a selected tooling plant in an automotive manufacturing company. The working postures of the co-workers were assessed while performing manual material handling activities such as stamping die, grinding, operating machines, assembling jigs, and polishing to reduce the possibility of developing musculoskeletal disorders. Data collections were done through direct observation while the Rapid Upper Limb Assessment was utilized to assess the ergonomic risk state of the working positions. The assessment showed that the assembling process and try-out chores are contributed to the most pain and anguish with the RULA score of seven which indicated in red. It was captured that the body areas such as muscles, neck, torso, legs, and arms are more prone to experience pain and discomfort as they are part of the musculoskeletal system. The critical processes could be intervened by implementing some improvements such as adjusting the angular limitation, preferred angles and reduce the duration of work. By doing this, the risk of MSDs could be reduced.