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EDITORIAL

Green composites: material for a sustainable world

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Growing concern over environmental issues and the gradual shortage of fossil fuel resources has heightened interest in the development of sustainable materials. Indeed, the trend toward bio-based materials not only is attractive in terms of environmental impact but also constitutes an alternative solution to materials based on fossil sources. The concepts such as life cycle analysis, sustainability, green chemistry, and eco-friendly products are centered on the circular economy loop to develop reusable materials. Thus, a new regenerative economic view based on a balance between economy, environment, and society aims at a circular production/consumption system seeking to maximize the resources use and avoid or, at least, minimize environmental impact.

Green composites are considered the next generation sustainable materials. This special issue entitled "Green composites: material for a sustainable world" covers a wide area in green composites including preparation, characterization, application, and life cycle analysis of composite materials developed from natural sources. The scope of recently developed green composites as an alternative to existing technologies, and the new horizons of applications like biomedical, tissue engineering, packaging, tires, life cycle analysis, construction, and beverages are discussed in detail in this special issue.

Green composites are now essential components in medicine. Henri Vahabi discussed how green materials can be used in bone tissue engineering. The use of biopolymer/natural fibre biocomposite scaffolds to mend damaged bone was highlighted. Cataract eye lenses that have been discarded after surgery contain a substantial amount of protein. Swagata Dasgupta used sorbitol as a plasticizer to create films from discarded cataract lens emulsions retrieved after surgery. Siavash Iravani's intriguing overview discusses the therapeutic activities of alginate, fucoidan, carrageenan, agarose, and ulvan, as well as their distinctive architectures, physical, and chemical properties, in regenerative medicine and tissue engineering.

Toxoplasmosis is a parasite infection that mainly affects adults and causes no symptoms. Abdolrazagh Marzban demonstrated that encapsulating Nepeta cataria essential oils in a chitosan nanocomposite boosted the efficiency of its antiparasitic effects in an experimental research. Navid Rabiee developed a nanocomposite based on rGO/MWCNT and green ZnO nanoparticles. The impact of chemical and physical interactions in drug delivery systems was explored using different weight ratios of nanocomposite to the model drug, DOX. Shaheer Akhtar created crystalline CeO2 nanoparticles from Citrus limon leaf extract and used them as replacement catalase to catalyse various catalase enzyme applications. CeO2 nanoparticles imitate catalase, allowing H2O2 to be degraded. Mukhtar Ahmed identified the protoscolicidal activity of biosynthesized zinc oxide nanoparticles (ZnO NPs) generated from Mentha longifolia L. leaf extract in his experimental work. They discovered that the ZnO NPs have scolicidal action and that, because of their small size, they may be used in pharmaceuticals.

Food packaging and biomedical applications have both benefited from nanocomposites made of bio-based polymers. Daniel Hermida Merino reported on a series of freestanding films containing various concentrations of commercial PLA and gelatine produced from waste fisheries to produce biocompatible coatings with promising biomedical uses in an experimental investigation. The essential indices of food packaging materials are hydrophobicity and wettability. Nilofar Asim gave an overview of current developments in cellulose-based hydrophobic food packaging. The use of

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nanocellulose in food packaging, according to the author, could improve the functional aspects and safety of food packaging. Giuseppe Cavallaro published another intriguing paper in which he used nonisothermal thermogravimetry to analyse the kinetic features of the thermal degradation of biopolymer films. A positively charged biopolymer, chitosan, was chosen, whereas a negatively charged biopolymer, alginate, was picked. Chitosan appears to be the most promising biopolymer for the manufacturing of long-lasting films, according to the study.

In another article, Kandasubramanian Balasubramanian describes green composites made entirely of renewable and sustainable materials such as soy protein, PLA, starch, cellulose, and chitin, which might be used in a variety of industrial applications. Hermida Merino and colleagues created a variety of hybrid bionanocomposite hydrogels made up of graphene nanoparticles, gelatin, and chondroitin, with the goal of using them as a biocompatible matrix in biomedical applications. The mechanical, thermal, and other physical properties of the material were studied as well. Beer is the world's most popular alcoholic beverage, and its popularity continues to rise. The literary works related with the by-products of beer manufacture were summarised by Aleksander Hejna. He proposed that substituting brewers' leftover grain for traditional lignocellulosic fillers in wood-polymer composites could improve thermal oxidation resistance.

In his review essay, Omar El Seoud discussed the manufacture and applications of cellulose, chitin, and silk fibroin composites. He stated that these green composites could take the place of petroleum-based non-biodegradable composites in various applications. The manufacturing and application of composites created from agricultural leftovers such as almond shells, arecanut husk, walnut shells, wheat bran, and oil palm empty fruit bunch are described in a literature collection compiled by Emel Kuram. Ramesh and his colleagues detailed the extraction of fibres from plant leaves in their review article. These fibres could be utilised to make composite materials. The review covered the manufacture, characterisation, and use of leaf fibre-based biocomposites. Dalila Hammiche reported the use of Prickly Pear Seed fibres as reinforcement in Poly Lactic Acid Biocomposites. Various analytical techniques were used to characterise the generated biocomposites. At a higher temperature, the composite samples were found to be thermally stable. Increases in fibre content from 0 to 20% enhanced Young's modulus while lowering tensile strength and elongation. Green composites can be made from agro-industrial wastes and by-products, which have a lot of promise. Mara Alejandra Garcia gave an overview of recent research on the production of biocomposites made of biopolymers, natural fillers, and active agents.

Heavy metal poisoning of water is one of the major worries in the current situation. Ajay Kumar highlighted current progress in the remediation of heavy metals such as lead, mercury, cadmium, and chromium from wastewater using lignin and lignin-based biosorbents. Chandan Rana presented research on the use of natural dye in the manufacturing of low-cost, high-efficiency solar cells. The fabrication of natural dye-sensitized solar cells based on pure SnS, as well as doped SnS nanoparticles, has been done. As a natural dye and photosensitizer, Acalypha wilkesiana leaf extract was used. Debabrata Rautaray investigated the impact of silica and nanoclay on the curing, processing, and mechanical properties of solution SBR-based tyre tread materials. The use of nanoclay, according to the authors, could be an effective green option for tyre makers to address some of the industry's difficulties.