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Editorial

Nanoparticles for Environment, Engineering, and Nanomedicine

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In recent years, the nanoscience and nanotechnology community has moved toward a more comprehensive integration of nanosciences and nanotechnologies with other emergent technologies and topics of interests such as biotechnology, biomedical engineering, environmental remediation, molecular communication networks, quantum computing, and data-driven design of new materials (materials informatics). Nanoinformatics along with materials science modeling has caught the attention of materials scientists because of several reasons: (1) it is aimed at creating comprehensive databases of physical and chemical properties of materials based on which quantitative structure-activity (QSAR) and structure-properties (QSPR) relationships might be advanced; (2) by incorporating optimization methods (Monte Carlo, genetic algorithms, neural networks) and data analytics techniques (data mining, network analysis, k-clustering, machine learning, and deep learning), it helps to optimize quantum mechanical calculations aimed at designing new molecules and materials, and (3) it is permitting to reduce the time of design and translation into applications as well as the cost of new materials. Nanoinformatics is proving itself as a very successful tool assisting bioinformatics, drug design, photovoltaic materials science design, superconducting materials, and topological insulators discoveries for quantum computing, catalytic converters for environmental remediation, and magnetic nanoparticles for biomedical applications and computer memories.

The nanomedicine has been generally defined as the medical application of nanotechnology. This application leads to a better repair, protection, and improvement of a great majority of human biological systems. The integration of nanotechnology in medicine, more commonly known as nanomedicine, allows new hope in the field of health. As an emerging discipline, nanomedicine is gradually being created by opening up new perspectives on key issues: optimizing drug delivery, specifically targeting tissues or cells, more optimal controlling the rate of release of the drug into the body, and providing early and accurate detection of diseases.

Nanomedicine uses nanodevices and nanostructures for tissue engineering and diagnosis and prevention of various diseases. The nanomedicine devices, which build "nanoparticles and nanotubes, for example," depend on chemistry and chemical engineering. However, the application of nanomedicine devices for disease treatment is strongly dependent on molecular biology, biochemistry, and medically related disciplines. Therefore, the nanomedicine requires a collaborative effort from a high variety of other disciplines.

By interacting with biological molecules at the nanoscale level, nanotechnology has opened a large field of research and subsequent application. Synthetic nanoscale devices and biomolecules interactions have been able to be designed both in the extracellular environment and inside the cells of the human body. The physical properties have been able to be explored better at the nanoscale level than those observed at the microscopic scale, such as the surface/volume ratio.

The medical applications of nanotechnologies are very promising, due to the possibility offered by miniaturization and ultraminiaturization in order to interact in a targeted way with biological entities such as tissues, cells, and even molecules. Nanotechnology is therefore a real hope in the development of new medical techniques for diagnosis, therapy, or patient follow-up. Currently, nanomedicine is involved in several areas: (1) the diagnosis that leads to the identification of a disease through the detection of specific symptoms of the pathology; (2) therapy and specific treatment of a disease; (3) regenerative medicine that aims to allow regeneration of damaged human tissue or organs; and (4) the sensor systems, which is a set of interfaces detecting, in the form of an electrical signal, a physical phenomenon in order to represent it and to acquire data on it.

On the other hand, due to their high surface area and enhanced reactivity, nanomaterials offer a profound potential for remediation of various contaminants in the environment. Importantly, the small size and corresponding ability for subsurface transport provide opportunities for in situ remediation of contaminated sites. Over the last two decades, research endeavors have focused on producing, characterizing, and applying various nanomaterials for treatment of a multitude of organic and inorganic contaminants in water and soils. Nevertheless, several areas require further investigation. For instance, the production of nanomaterials remains costly, employs hazardous chemicals, and requires downstream cleanup for size and composition control. In this regard, we need to develop, optimize, and validate innovative green synthesis techniques to sustainably scale-up production of novel nanomaterials. Recent research has shown opportunities for multispecies nanocomposites to outperform monometal nanomaterials. We need to continue efforts to explore and understand novel composites to improve sorption and photocatalysis of traditional and emerging contaminants in water/wastewater treatment and environmental remediation scenarios. Finally, as nanomaterials are incorporated into more consumer and industrial products, the impacts of synthesis techniques and nanomaterial properties on bacterial and animal cells must be evaluated to ensure the responsible manufacture and deployment of these exciting materials. The articles included in this special issue touch on these areas and more.

These days, green synthesis of nanoparticles using biodegradable materials, especially phytochemicals, has drawn a new and exciting area of research in the field of nanotechnology. Due to their vast range of applications, the synthesis of metal nanoparticles of different shapes and sizes is of great interest. The phytosynthetic approach provides various advantages, including cost-effectiveness, being simple, being green, being eco-friendly, and biocompatibility. However, little attention has been paid to the morphological effects of the organic-coated nanoparticles on engineering and medical fields. This special issue highlights the synthesis of various nanoparticles using mortiño berry, avocado leaves, cochineal, *Ambrosia arborescens,* curcumin, N-acetylcysteine, and so on and their application in environmental remediation, nanomedicine, insecticide, and organic devices.

Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of this Special Issue.

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