Editorial

Fate and Effects of Nanomaterials

The scientific community admits in a general way that nanomaterials (NMs) are those made up of materials with at least one of their spatial dimensions less than 100 nm. Thus, it is possible to develop nanomaterial with only one dimension in the nanoscale (i.e.: nanosheets), two nanoscale dimensions (i.e.: nanotubes) and three nanoscale dimensions (i.e.: nanoparticles). At these sizes, the materials show very special physical-chemical properties due mainly to their high specific surface area, which means that they can possess high reactivity and a very high number of possible interaction points. These would be more complex considering that nanomaterials would be solid, porous or hallow, crystalline or amorphous, organic or inorganic and any combination of them. Moreover, nanomaterials can be subjected to various surface functionalization.

Nanomaterials has a long history. Indeed, they were found in structures obtained more than one thousand years ago. Although, the continue growing interest and development experienced nowadays is mainly due to the ability to engineer, manipulate and image systems in the nanoscale.

The synthesis of nanoparticles is generally carried out under controlled thermodynamic conditions and from atoms or molecules. In this way, nanoparticles especially designed for applications in a wide range of technologies that affect the electronics, telecommunications, medical, pharmaceutical, chemical, automotive, aerospace and energy industries, among many others, can be obtained. Unlike, there are nanoparticles that are unintentionally produced, such as productions during combustion processes. In all cases, the physical and chemical properties are extremely important, since they will determine the correct function of the nanoparticles or the products that contain them as well as their degree of toxicity or safety.

As a result, these NPs possesses new properties not completely known yet. For example, they can cause toxicity through mechanisms not described so far, ranging from the simple physical union to the cells to the triggering of complex processes that lead to an elevation of oxidative stress. On the other hand, the properties of these NPs will generate new advances in science and technology. For example, they can interact with therapeutic molecules, reach specific organs or penetrate cells by various mechanisms. Thus, study the fate and effect nanomaterials is important not only from the point of view of toxicology but also from the possible use of NPs in therapeutic formulations.

This thematic issue gathers information from the Fate and Effects of Nanomaterials with emphasis in the potential therapeutic uses. Moreover, it also generates a forum for discussion of nanotoxicological effects, including the effect in different biological systems (i.e.: insect, fish and cells).

The review of Dusica Maysinger and Jeff Ji, highlights the effect of some nanostructures that can alter the state of activation of microglia and astrocytes in different biological models. The focus is on some “hard” nanoparticles (e.g. gold nanoparticles and gold nanoclusters) and some “soft” (e.g. dendritic polyglycerol nanostructures). They present effects of these nanostructured materials in dissociated neural cells, cells in 3D and in vivo models [1].

The article of Sajjad Molavipordanjani and Seyed Jalal Hosseinimehr summarizes and integrates the current state of knowledge on different strategies for conjugation of biomolecules to nanoparticles and their application in tumour targeting [2].

Cazenave et al., describe the current state-of-the-art on nanotoxicity using fish as models. This review gives a current overview of the main effects and toxicity mechanisms of nanoparticles and highlights the knowledge gaps, which still are needed to be further investigated [3].

Kuldeep Rajpoot outlines the enormous promise that SLNs have as promising nanomaterials for efficient delivery of various Active Pharmaceutical Ingredients (APIs) for healthcare improvements [4].

Mauricio De Marzi and co-authors present different studies that have been carried out to evaluate the response of immune cells in the presence of nanoparticles and its possible applications in the biomedical field [5].

Regarding the use of nanoparticle-mediated drug delivery systems to treat infectious diseases in CNS, an interesting article by Marcos Vinicius da Silva and collaborators, summarizes the use of nanoparticles as an extremely applicable alternative. It is highlighted that the transport of drugs with chemical and physical characteristics that prevent them from reaching the CNS at therapeutic concentrations can provide stability, restricted release and increased bioavailability in specific areas [6].

The review of Professor Lúcio R. Cançado Castellano group highlights current applications of biopolymer-based nanofibers as drug delivery systems and scaffolds. Important techniques employed to produce natural nanofibers are presented. Moreover, some evidences regarding toxicology and cell interactions using natural nanofibers are discussed [7].
The topics developed by Ratiram Chaudhary et al., are emerging technologies on metal/metal oxide nanoparticles and their characteristics such as size, shape, particle dissolution on their induced toxicity. The focus is on the toxicity and current and future issues and applications [8].

Finally, Santo Orihuela et al., summarized the state of knowledge on silica nanoparticles (SiNPs) used in pest insect management. Besides, aspects of their synthesis, mode of action, and toxic effects on non-target organisms and environment are reviewed [9].

REFERENCES


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