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Future Trends in Nanotechnology Aiming Environmental Applications

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Abstract

Nanotechnology has become increasingly a reality nowadays, and along with it there is a need for discussions related to potential advances, as well as the impacts on the environment and human health that technology can cause. Nanomaterials applications and also implications on the environment have been studied by several groups around the world, and particularly in Brazil, where nanotechnology has been increasingly applied on agriculture and their impacts are still unknown.

Keywords: Nanotechnology; Future trends

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Introduction

Among their diverse applications, nanomaterials have been used for decreasing the toxicity of agrochemicals to non-target organisms [1]. In addition to nano-based systems, others materials can be employed as molecular carriers for agrochemicals, such as the cyclic oligosaccharides cyclodextrins [2]. The study describes the development of a cyclodextrin-silica hybrid system incorporated with atrazine, an herbicide widely applied in the Americas with great contamination potential. The developed complex was shown to effectively decrease the toxicity of atrazine against lettuce seedlings, as demonstrated by the reduction of chromosomal aberrations and nuclear abnormalities in the bioassays in comparison with non-complexed atrazine [3].

Discussion

There is an increasing concern regarding the sustainability of the methods used for the synthesis of nanomaterials. Instead of classical chemical methods, green syntheses of nanomaterials have emerged in recent years, with the use of plant extracts, fungi or bacteria in the procedures. The study reports the bio-based synthesis of silver nanoparticles using soda lignin extract from orange bagasse as a reducing and stabilizing agent. After full sequential extraction, the obtained soda lignin was characterized by nuclear magnetic resonance and then used for the successful production of highly stable silver nanoparticles. Thus, this study is a successful example of how a renewable material extracted from agroindustrial waste can have nanotechnological applications.

The importance of nanotoxicological in vivo studies using alternative models other than mammalians is discussed and given that nanotoxicity occurs at different trophic levels. The minireview reports diverse nanotoxicological studies employing alternative models, such as the above-mentioned zebrafish, the nematode Caenorhabditis elegans, the Drosophila melanogaster, and the microcrustaceans *Artemia salina* and *Daphnia magna*. In this context, this topic is important to promote a discussion regarding the safety of nanomaterials to organisms that can be used to assess environment pollution and to predict effects in more complexes animals, as well as to the establishment of regulatory frameworks.

Conclusion

Nanotechnology has become increasingly a reality nowadays, and along with it there is a need for discussions related to potential advances, as well as the impacts on the environment and human health that technology can cause. The developed complex was shown to effectively decrease the toxicity of atrazine against lettuce seedlings, as demonstrated by the reduction of chromosomal aberrations and nuclear abnormalities in the bioassays in comparison with non-complexed atrazine.

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