

Synthesis, structural and morphological characterization of zinc oxide nanostructures and evaluation of their comparative toxicity against model pathogens

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The re-emergence of infectious diseases due to microbial contamination of food products has led to the development of next generation of drugs or agents to control the bacterial infections. The emergence of most of the biological processes at the nanoscale has paved way for a combined application of nanotechnology and biology which could possibly lead to a solution to the problem. The availability of nanoparticles especially zinc oxide (ZnO) incorporated commercial goods like sunscreen, coatings and paints has been increasing. However, their environmental impact and the toxicity mechanism are still controversial.

In this work, we report the synthesis of wurtzite-type ZnO nanostructures functionalized with essential amino acids (L-threonine and L-glutamine), that are not readily available and needs to be supplied externally to the human body. Optical absorption studies reveal significant blue-shift of the absorption edge from the bulk and emission studies indicate the presence of sufficient amount of surface defects. Morphological analysis shows the formation of hexagonal platelets in the presence of L-glutamine and nanorods with hexagonal facets in the presence of L-threonine. As an application study, these synthesized nanostructures were tested for antimicrobial activity against 4 model pathogens by disc diffusion method and also by measuring the optical density. Shape-dependent toxicity has been observed. The nanostructures synthesized, were studied for dissolved zinc ion concentration and cellular internalization, and both these factors were observed to contribute to the toxicity to some extent in addition to the release of reactive ion species (ROS) from ZnO when in solution.

Biography

Meghana Ramani is a PhD candidate in Centre for Nanosciences and Nanodevices, SRM University. She has 2.5 years of research experience and one publication in peer reviewed journal. Her work is focused on the synthesis and characterization of zinc oxide nanostructures and evaluation of their shape- and size-dependent toxicity towards microorganisms. The mechanism for the toxicity and their application as an antibiotic is her major focus of study. She also plans to design these nanostructures as drug carriers in the near future.

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