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Fungus mediated synthesis of biomedically important cerium oxide nanoparticles

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ABSTRACT

Nanomaterials can be synthesized by chemical, physical and the more recently discovered biological routes. The biological routes are advantageous over the chemical and physical ones as unlike these, the biological synthesis protocols occur at ambient conditions, are cheap, non-toxic and eco-friendly. Although purely biological and bioinspired methods for the synthesis of nanomaterials are environmentally benign and energy conserving processes, their true potential has not been explored yet and attempts are being made to extend the formation of technologically important nanoparticles using microorganisms like fungi. Though there have been reports on the biosynthesis of oxide nanoparticles by our group in the past, no attempts have been made to employ fungi for the synthesis of nanoparticles of rare earth metals or lanthanides. Here we report for the first time, the bio-inspired synthesis of biomedically important Cerium oxide (CeO_2) nanoparticles using the thermophilic fungus *Humicola* sp. The fungus *Humicola* sp. when exposed to aqueous solutions of oxide precursor Cerium (III) nitrate hexahydrate ($CeN_3O_9.6H_2O$) results in the extracellular formation of CeO_2 nanoparticles containing Ce (III) and Ce (IV) mixed oxidation states, confirmed by X-ray Photoemission Spectroscopy (XPS). The formed nanoparticles are naturally capped by proteins secreted by the fungus and thus do not agglomerate, are highly stable, water dispersible and are highly fluorescent as well. The biosynthesized nanoparticles were characterized by UV-vis