Nanotek-2013

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference on
Nanotek & Expo

December 2-4, 2013 Las Vegas, USA

Nanoparticles synthesis through bio-reductions by microorganisms and plants

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Abstract

Biosynthesis of metal nanoparticles is an environmentally-friendly method (green chemistry) without use of harsh, toxic and expensive chemicals. After a comprehensive literature review, which was published in a review article and 2 book chapters, we focused our attention to the most promising organisms. Silver nanoparticles were produced at room temperature using biotransformations by 3 novel bacteria, a filamentous fungus, 2 yeasts (1 novel), and 5 novel plants.

In case of the bacteria, *Lactobacillus casei, L. paracasei, L. rhamnosus*, the biosynthesized silver nanoparticles were spherical, single (25–50 nm) or in aggregates (100 nm) attached to the surface of biomass or were inside and outside of the cells.

In case of the fungus, *Fusarium oxysporum*, although this synthesis was not novel, the reaction mixture was successfully optimized to increase the yield of the enzymaticaly produced nanoparticles. The shape and size of the nanoparticles were similar to the case of bacteria.

The yeasts, *Saccharomyces cerevisiae* and *S. boulardii* (novel) produced mono-dispersed spherical to oval, single (9-26 nm) or aggregated (130 nm) nanoparticles.

In case of plants, ethanolic extract of *Punica granatum* (pomegranate) fruit peel generated single, poly-dispersed, spherical nanoparticles (20-50 nm). Separate ethanolic extracts of *Rhus coriaria* (Sumac) fruit, *Datura metel* leaf, and *Elaeagnus angustifolia* fruit produced aggregated poly-disperse silver nanoparticles with spherical and triangular shapes (20-50 nm). Interestingly, ethanolic extract of *Juglans regia (walnut)* leaf produced single, mono-dispersed, spherical nanoparticles (1-5 nm).

Biography

Hassan Korbekandi, biotechnologist, graduated from faculty of pharmacy of Isfahan University of Medical Sciences (IUMS), in 1993, and obtained his Ph.D. from chemical engineering department, UMIST University (Manchester) in 2003. He was a member of pharmaceutical biotechnology department since 1993, and now he is working for genetics & molecular biology department of IUMS University. His research interests are bionanotechnology, pharmaceutical biotransformations, protein engineering, bioinformatics and probiotics. He has published 19 papers and 3 book chapters.