Green and sustainable silver nanoparticles for waste water treatment

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Abstract

Nanoparticles represent a promising new technology for wastewater remediation, not only because of their high treatment efficiency, but also for their cost-effectiveness, as they have the flexibility for *in situ* and *ex situ* applications. Among nanoparticles, nanosilver has become one of the most popular nanoparticles due to its applications in diverse areas. It is currently being used for a wide variety of commercial products including medical applications, water purification, antimicrobial uses, paints, coatings and food packaging. Improvement in sustainable and eco-friendly protocols for synthesis of silver nanoparticles is a significant step in the field of application nanotechnology. One approach that shows vast potential is based on the biosynthesis of nanoparticles using plant extracts. The present study shows biological synthesis of silver nanoparticles using ethanolic extracts of two medicinal plants. The synthesis was done using *Ocimum sanctum* and *Artemesia annua* leaf extracts. After exposing the silver nitrate solution to the leaf extracts, the rapid reduction of silver ions led to the formation of silver nanoparticles in solution. The synthesized silver nanoparticles were characterized by UV-VIS, TEM, HR-TEM, EDX, XRD, SAED and FTIR. The *Ocimum sanctum* and *Artemesia annua* assisted silver nanoparticles were studied for their potential to remove phenols, textile dyes and microbial contaminants from water. The silver nanoparticles from *Ocimum sanctum* can catalyze the reduction of 4NP within 20 min in presence of $NaBH_4$. The synthesized nanoparticles can efficiently adsorb toxic textile dyes (Reactive Blue 4, Reactive Orange 4 and Reactive Red 120) from aqueous solutions. Further, water sample collected from Yamuna River was tested and treated with biologically synthesized silver nanoparticles. After treatment, a sharp reduction was observed in all the physical and chemical parameters such as pH, odour, color, (dissolved oxygen) DO and Biochemical oxygen demand (BOD) etc in the sample throughout the investigations. The antimicrobial activity of the synthesized nanoparticles was also exploited to remove microbial contaminants from Yamuna River. The nanoparticles show excellent antimicrobial properties and can be reused repeatedly. Using these nanoparticles, pathogenic bacteria, phenols and dyes present in contaminated water can be treated simultaneously without using any chemicals.

Biography

Meryam Sardar has completed her PhD in Biochemistry from Indian Institute of Technology, India. She has obtained her Master's in Biotechnology from Aligarh Muslim University, Aligarh, India. She is presently working as an Associate Professor in the Department of Biosciences, Jamia Millia Islamia, India. She is actively involved in the biotechnological applications of immobilized enzymes and nanoparticles. She has published more than 25 papers in reputed journals and has published four book chapters.

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