A novel green one-step synthesis of Silver nanoparticles using *Soymida febrifuga* aqueous root extract: Catalytic activity and Antimicrobial studies

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Green synthesis of metallic nanoparticles has gained significance and has proved to be a potential alternative to physical and chemical routes. [1] Plants are natural reservoirs of reducing biomolecules which can be exploited for the green synthesis of nanoparticles. [2] In the present study, the water soluble biomolecules present in *Soymida febrifuga* root have been used as reducing agents for the reduction of silver ions to silver nanoparticles. The aqueous root extract of *Soymida febrifuga* was mixed with silver nitrate solution and heated for the synthesis of silver nanoparticles. The synthesized silver nanoparticles were characterized using UV-Visible Spectrophotometry, Fourier Transform Infrared Spectrophotometry (FTIR), X-Ray Diffractometer (XRD), Nanoparticle Analyzer, Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM). The catalytic efficacy of silver nanoparticles was investigated in degradation of Methylene blue dye in presence of sodium borohydride. The antimicrobial efficacy of the synthesized AgNPs was analyzed and studied against two gram positive and two gram negative bacterial strains. A visual colour change in the solution to reddish brown indicated the formation of silver nanoparticles which was confirmed by the Surface Plasmon band found at 420 nm. In order to identify the compounds responsible for bioreduction of silver ions and formation of stable nanoparticles, the functional groups present in *Soymida febrifuga* aqueous root extract were investigated using FTIR. The XRD studies of the synthesized silver nanoparticles showed face-centered cubic structure of AgNPs and confirmed their crystalline nature. The Nanoparticle Analyzer was used to determine the size of the particles, size distribution, polydispersity index and zeta potential value. The morphology and topography of the synthesized silver nanoparticles were determined using SEM. The TEM micrograph revealed well dispersed and mostly spherical nanoparticles with a particle size less than 20nm. The polycrystalline rings observed in the Selected Area Electron Diffraction (SAED) pattern also revealed the crystalline nature of the silver nanoparticles. The as synthesized AgNPs acted as effective green nanocatalyst in the degradation and removal of the Methylene blue dye. The AgNPs synthesized from aqueous root extract of *Soymida febrifuga* have exhibited clear zones of inhibition against Bacillus subtilis (gram negative), Pseudomonas putrida (gram negative), Staphylococcus aureus (gram positive) and Escherichia coli (gram positive). A simple cost-effective, eco-friendly and green route of synthesis of silver nanoparticles was developed. Only 15 minutes were required for the synthesis of silver nanoparticles. The method can be scaled up for industrial use, for treatment of industrial effluents and as antimicrobial agents.

Keywords: Silver nanoparticles, *Soymida febrifuga* root, Antimicrobial activity, Catalytic activity

References:

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