



## UV-assisted photo-catalytic degradation of anionic dye (Congo red) using biosynthesized silver nanoparticles: a green catalysis

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### ABSTRACT

Congo red (CR) is an anionic synthetic dye used in many industrial and scientific applications, has considerable toxic effects when released into the ecosystems without treatment. This study is focussed on its degradation using silver nanoparticles (AgNPs) synthesized from silver nitrate using *Azadirachta indica* leaf extract. The synthesized green colloidal AgNPs were validated and characterized by UV–vis spectra, transmission electron microscopy (TEM), energy dispersive X-ray (EDX) and X-ray diffraction (XRD) analysis. Specific interactions during bioreduction process and biomolecules responsible for capping, reducing and stabilizing were determined by Fourier transform infrared spectroscopy analysis. TEM image confirmed the size of the spherical AgNPs ranging between 11 and 35 nm. EDX and XRD analysis confirmed the metallic form of the synthesized AgNPs, while selected area electron diffraction pattern revealed its crystalline nature. The biosynthesized AgNPs were found to be very effective for the photo-catalytic degradation of toxic industrial anionic dye, CR under UV source. Further optimization of the process variables viz. effect of initial dye concentration, UV irradiation time, catalyst dose, temperature and pH showed significant degradation up to 90% following pseudo-first-order kinetic model. Degraded dye was tested for toxicity by germination test of Bengal Gram (*Cicer arietinum*), which indicated no toxicity. Hence it can be concluded that the current method of synthesis has the potentiality to form stable AgNPs, which can have promising application potential for dye removal in environment management.

**Keywords:** Silver nanoparticle; Green synthesis; Photo-catalytic degradation; Congo red; Degradation kinetics; Mechanism

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