Journal of Cluster Science

Bio-synthesis of silver nanoparticles using agroforestry residue and their catalytic degradation for sustainable waste management

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Abstract

The sustainable synthesis of nanoparticles provides an eco-friendly and interesting approach in the domain of clean synthesis and nanobiotechnology. The in vitro synthesis of silver nanoparticles from the aqueous extract of an indigenous South African plant: Ekebergia capensis is reported in this paper. The rapid fabrication of Ag NPs were observed by visual colour and was confirmed using UV spectroscopy; the emergence of a yellow–brownish colour confirmed the yield of silver nanoparticles. Also, a time course study on the effect of concentration of AgNO(sub3) was undertaken. The synthesized Ag NPs was characterized by TEM, XRD, and DLS whilst, FTIR and GC–MS provided information on the functional groups adhered to the surface of the Ag NPs. The XRD peak of synthesized Ag NPs showed their crystalline structure. DLS and TEM studies revealed spherical or near spherically shaped Ag NPs of particle size 20–120 nm. Furthermore, the catalytic performance of Ag NPs in the degradation of Allura red (AR) and Congo red (CR) were characterised by UV spectrophotometry. The Silver nanoparticles were observed to have excellent catalytic properties on the degradation of AR and CR which is confirmed by the dyes mineralized in (submax) values. The catalytic process involved the electrons relay effect and is attributed with time.