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Green synthesis of ZnO and Cu-doped ZnO nanoparticles and investigation of their photodegradation ability for textile dyes

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This work describes the synthesis of ZnO and Cu-doped ZnO nanoparticles using aqueous extracts of *Oxalis stricta* leaves and the photocatalytic degradation ability of these nanoparticles. Synthesis of ZnO and Cu-doped ZnO nanoparticles was carried out using zinc acetate and copper acetate with aqueous extract of *Oxalis stricta,* which is a natural product with reducing power, inherent stabilizing, growth terminating and capping properties. The nanoparticles were characterized by UV-vis, and X-ray diffraction spectroscopy. Broad absorption bands centered at 368 and 440 nm were observed for ZnO and Cu-doped ZnO nanoparticles respectively. The observed characteristic sharp diffraction peaks for the ZnO naoparticles in the XRD analysis attributed to the hexagonal wurtzite structure for ZnO nanoparticles. Similar XRD pattern was obtained for Cu-doped ZnO indicating no structural changes due to doping with Cu. It was also revealed that not all Cu atoms were embedded to the crystal lattice of zinc oxide. Photocatalytic degradation of three textile dyes, Vat yellow 33, Reactive brown 11 and Reactive green 19 in the presence of synthesized nanoparticles was investigated under different set of conditions. It was found that the synthesized ZnO and Cu-doped ZnO nanoparticles have high photo-catalytic degradation towards common textile dyes. Of these two types of nanoparticles, Cu-doped ZnO nanoparticles exhibited the highest photodegradation activity of 99% for all three textile dyes. This is believed to be due to decreasing of electron-hole recombination rate of ZnO by doped Cu during irradiation. This is further evident from the band gaps found for ZnO (3.36 eV) and Cu-doped ZnO (2.81 eV) nanoparticles formed with *Oxalis stricta* extract. The present study revealed a safer method involving effective use of eco-friendly green synthesized ZnO and Cu-doped ZnO nanoparticles for treatment of waste water contaminated with textile dyes, Vat yellow 33, Reactive brown 11 and Reactive green 19.

Keywords: Oxalis stricta ZnO nanoparticles, Cu-doped ZnO nanoparticles, Photocatalytic degradation and Textile dyes

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