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PHOTO-DEGRADATION OF REACTIVE TEXTILE DYE EFFLUENTS USING MAGNESIUM OXIDE NANOPARTICLES

N.M.S.S.B. Karunatilake* and M.M.M.G.P.G. Mantilaka

Postgraduate Institue of Science, University of Peradeniya, Peradeniya, Sri Lanka
**07sanjeewa@gmail.com*

Photocatalytic degradation is one of the most effective methods to degrade organic waste into environmentally-friendly products. In this study, nanoparticles of MgO were synthesized to degrade a major type of textile dye called Reative Yellow for the first time. Although bulk MgO insulator does not show any photocatalytic activity, its nanoparticles show the activity due to the structural defects which induce reactive exited electrons and holes on surface promoting photocatalytic degradation reactions. In the synthesis method of MgO nanoparticles, freshly distilled methyl methacrylate monomer and $MgCl_2$ (100 mL) were added, dropwise, to 1.0 M Na_2CO_3 (100 mL) solution with $Na_2S_2O_8$ (1.0 g) initiator dissolved in it. In order to synthesize $MgCO_3$/poly (methyl methacrylate) (PMMA), the reaction mixture was stirred for 2.0 h while the temperature was set at 80 °C. Then $MgCO_3$/PMMA composite was washed with hot water and calcined at 650 °C for 3.0 h to produce MgO nanoparticles. Photocatalytic activity of MgO nanoparticles was investigated by adding MgO nanoparticles (0.020 g) into 5 ppm Reactive Yellow (5 mL) solution and irradiating the mixture with UV radiation using 200 W Xennon arc lamp in time intervals of 10, 20, 40, 60, 80 and 100 min. X-ray diffraction pattern confirms that the product is comprised of MgO nanoparticles with average crystal size of 40 nm while electron microscopic methods confirms their spherical morphology. Dye degradation efficiency calculated using UV-Visible spectra of the dye demonstrates considerable dye degradation (68% degradation after 100 min). Degradation efficiency should further be investigated with improvements in nanoparticle topology.

Keywords: Magnesium oxide, Nanoparticles, Photocatalytic degradation, Reactive textile dye waste