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Photocatalyzed degradation of acid orange 7 dye under sunlight and ultraviolet irradiation using Ni- doped ZnO nanoparticles

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ABSTRACT

The aim of this study was to evaluate the removal of acid orange 7 (AO7) dye using NiO doped ZnO nanoparticles under sunlight and ultraviolet (UV) irradiation. The characterization of catalyst was carried out via FTIR, SEM, XRD and XPS techniques. The result of XPS revealed that nickel was successfully incorporated in the ZnO matrix. In addition, artificial neural networks (ANN) were used to model the process and to generate useful predictions. A significant prediction model with R^2 of 0.991 and adjusted R^2 of 0.991 for sunlight Irradiation and with R^2 of 0.981 and adjusted R^2 of 0.980 for ultraviolet Irradiation were obtained from ANN. The obtained data indicated that there is a significant difference between the type of nanoparticles used in the dye removal. The dose of 0.8 g/l over a detention time of 90 min was able to remove 77% of the dye under sunlight and 93% under ultraviolet irradiation. The results showed that the synthesized nanoparticles could be utilized to photocatalytically degrade the dye at sunlight or using a UV lamp. Alhough there was a slight difference between the decomposition of this dye under sunlight and UV irradiation, using visible light at larger scale is more economical and generates less operational problems than UV light.

Keywords: Acid Orange 7; Nanocatalyst; Photocatalytic; Dye; Sunlight; Ultraviolet; Artificial neural network

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