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The synthesis, characterization and application of different morphologies of ZnO in the photocatalytic degradation of Rhodamine B

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Coloured dye waste waters released by textile industry into the environment cause negative effects to living organisms due to their toxicity. A technique called advanced oxidation processes, which employs semiconductor photocatalysts (e.g. ZnO) in conjunction with light, has been developed to effectively degrade dyes in aqueous solution through oxidative species. Advanced oxidation processes have received attention because the oxidative species (Hydroxyl radicals and electron-hole pairs) fully degrade the dyes into carbon dioxide and water as opposed to other traditional techniques. In this study, rod, spherical and bullet like ZnO nanoparticles are synthesized using microwave assisted digestion and their structural, optical and photocatalytic activity is investigated. The photocatalytic degradation of Rhodamine B was carried out by irradiating an aqueous solution of the dye of known concentration (20 ppm) containing ZnO using a solar simulator. The degradation process was followed by monitoring the change in the absorbance of the excitation peak of Rhodamine B at 553 nm spectrophotometrically. Results indicated that the degradation efficiency of the model dye (i.e. Rhodamine B) varied depending on the morphology of the ZnO nanoparticles. The difference in photocatalytic efficiency between the three different ZnO morphologies was attributed to surface area differences together with the proportion of polar exposed surfaces. The spherical ZnO nanoparticles were found to be the more photocatalytically active due to the fact that their high surface area allowed for large amount of dye molecules to be degraded quickly. Herein, we demonstrated that varying the type of morphology of ZnO nanoparticles can be used as a method of improving the rate at which organic dyes are degraded in water.

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