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Oxidation of Organic Dye using Nanocrystalline rare earth metal ion doped CeO₂ under UV and Visible Light irradiations

M. Prathap Kumar, G.A. Suganya Josephine, A. Sivasamy*
Chemical Engineering Area
CSIR-Central Leather Research Institute
Adyar, Chennai – 600020

Abstract

Advanced Oxidation Process using semiconductor photocatalysts is an emerging technique to remove toxic organic molecules from aqueous phase. Design and development of newer photocatalytic systems are scarce in the literature. Hence, the present research focuses on rare earth doped semiconductor materials such as cerium doped dysprosium oxide was synthesized by co-precipitation method and characterized by XRD, FT-IR, UV-DRS, FESEM, EDAX analysis and HRTEM techniques. FESEM confirms that particles were spherical ranged from 23 to 31nm. EDAX confirmed the presence of Ce, Dy and O elements in the prepared photocatalysts. Photocatalytic efficiency of the prepared catalyst was evaluated in the degradation of a model organic dye such as Orange G dye under UV and Visible light irradiations. The photodegradation efficacy of the prepared material was evaluated by varying parameters like aqueous pH, catalyst dosage and dye concentration for photodegradation of the dye molecules. 15mg of photocatalyst showed excellent activity with 94% degradation under visible light and 10mg of photocatalyst showed better activity for 10ppm of OG dye with 96% for UV light irradiation under neutral pH. Kinetic studies obeys pseudo-first order reaction. The Chemical Oxygen Demand (COD) level decreases for both Visible and UV light irradiation. Effect of electrolytes such as NaCl, KCl, Na₂CO₃ and MgSO₄ were investigated and the catalyst exhibited good activity in both UV and Visible light irradiations.

Keywords: degradation, semiconductors, photocatalysis, rare earth doping, cerium oxide

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