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Bandgap tuned Co²⁺-doped ZnO for the photocatalysis of Methylene Blue and Rhodamine B

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Water pollution and the insufficiency of proper clean energy sources have resulted in the need for developing environmentally safe technologies and processes to combat this concern. One of the major constituents of wastewater are dyes, that are carcinogenic and immune to conventional physical and chemical remediation techniques. Thus, suitable techniques need to be designed to degrade these pollutants into harmless moieties before discharging them into aquatic systems. In this study, bandgap tuned Co²⁺-doped ZnO has been used as a UV/visible light photocatalyst on the degradation of methylene blue and rhodamine B, a model organic dye. X-Ray diffraction patterns of the sample annealed at 500℃ showed the formation of highly crystalline phase-pure ZnO with no impurities. The bandgap was calculated from diffuse reflectance spectroscopy and the point of zero charge was evaluated using the pH drift method. The rate of degradation was investigated for different pH values and a suitable pH was optimized for the most effective degradation. The performance of this Co²⁺-doped ZnO photocatalyst under visible light was superior compared to other known reports. The efficiency of degradation was improved significantly by adding H₂O₂ and the amount of degradation was quantified using a simple methanolic extraction technique. ZnO is an environmentally friendly mineral and this study demonstrates the use of an effective and efficient, eco-friendly technique for combating water pollution.

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