Synergetic degradation of reactive dye Acid Red 1 by cobalt-doped lignite fly ash

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ABSTRACT

Degradation studies on a reactive dye Acid Red 1 are carried out by lignite fly ash (LFA) and cobalt-doped over LFA under UV-C radiation. In India, disposal of fly ash is a major problem. As fly ash is an inert material containing small quantities of photoreactive, inorganic oxides like TiO₂, CaO and Fe₂O₃, this paper makes an effort to use it to overcome the degradation of dye and disposal of the fly ash problem. The chemical composition of LFA is analysed by X-ray fluorescence. Scanning electron microscopy with energy dispersive X-ray spectroscopy and X-ray diffraction are carried out to characterise the physical and photophysical properties of the catalyst. The optimum parameters affecting the dye degradation are found for LFA and cobalt-doped LFA under UV-C light. The kinetic coefficients for both catalysts are also determined. Cobalt-doped LFA proved the most effective, followed by LFA, and the corresponding efficiencies are 99 and 95%, respectively, at the end of 60 min. The reuse of cobalt-doped fly ash and fly ash are also tested, and it is found that the efficiency for the first reuse is 93 and 88%, respectively, at the end of 60 min.

Keywords: Dye degradation; Acid Red 1; Photocatalyst; Lignite fly ash; Cobalt-doped lignite fly ash

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