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Sono- and Photocatalytic Degradation of Indigocarmine in Water Using ZnO

Authors : V. Veena, Suguna Yesodharan, E. P. Yesodharan

Abstract : Two Advanced Oxidation Processes (AOP) i.e., sono- and photo-catalysis mediated by semiconductor oxide catalyst, ZnO has been found effective for the removal of trace amounts of the toxic dye pollutant Indigocarmine (IC) from water. The effect of various reaction parameters such as concentration of the dye, catalyst dosage, temperature, pH, dissolved oxygen etc. as well as the addition of oxidisers and presence of salts in water on the rate of degradation has been evaluated and optimised. The degradation follows variable kinetics depending on the concentration of the substrate, the order of reaction varying from 1 to 0 with increase in concentration. The reaction proceeds through a number of intermediates and many of them have been identified using GCMS technique. The intermediates do not affect the rate of degradation significantly. The influence of anions such as chloride, sulphate, fluoride, carbonate, bicarbonate, phosphate etc. on the degradation of IC is not consistent and does not follow any predictable pattern. Phosphates and fluorides inhibit the degradation while chloride, sulphate, carbonate and bicarbonate enhance. Adsorption studies of the dye in the absence as well as presence of these anions show that there may not be any direct correlation between the adsorption of the dye on the catalyst and the degradation. Oxidants such as hydrogen peroxide and persulphate enhance the degradation though the combined effect and it is less than the cumulative effect of individual components. COD measurements show that the degradation proceeds to complete mineralisation. The results will be presented and probable mechanism for the degradation will be discussed.

Keywords : AOP, COD, indigocarmine, photocatalysis, sonocatalysis
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