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PERFORMANCE EVALUATION OF FLAT PLATE SOLAR REACTOR FOR TiO_2 ASSISTED PHOTOCATALYTIC DYE DEGRADATION IN TREATMENT OF TEXTILE EFFLUENTS UNDER NATURAL SUNLIGHT

SUHASINI DESAI, G. S. TASGAONKAR, NEELA R. RAJHANS AND DATTA DANDGE

Abstract

Heterogeneous photocatalysis is an advanced oxidation process (AOP), which can be successfully used to oxidize many organic pollutants present in aqueous systems. Photocatalytic degradation has proven to be an effective method for mineralizing commercial dyes. Textile industries produce large volume of coloured dye effluents which are toxic and non-biodegradable. Dyes have serious environmental effects due to both the toxicity of compounds and the colouring of water bodies. Dyes have high chemical stability and they do not get completely degraded by conventional methods. Application of effective technology to achieve complete textile dye degradation is a challenge which can be met with TiO_2 Assisted heterogeneous photocatalysis. TiO_2 assisted photocatalytic process is of special interest, since it can use natural sunlight.

Performance evaluation of flat plate reactor is an important issue from the viewpoint of scaling-up of the process. Robust performance evaluation needs to take into account varying irradiation conditions and different operating parameters. In this paper, we have investigated the influence of dye concentration and incident light intensity on the decolourisation kinetics of Methyl Orange under natural sunlight. Apparent rate constant has been explored as an appropriate performance factor for evaluation of flat plate collector under study. The performance data has been collected by conducting degradation reaction trials under variable irradiance conditions on a falling film flat plate reactor under natural sunlight. Apparent rate constant has also been correlated to catalyst loading and optimal catalyst loading is found for Methyl Orange degradation.

Keywords: Heterogeneous photocatalysis, Solar Reactor, Textile Effluents, Dye Photodegradation, TiO_2, Natural sunlight, Irradiation Intensity, Apparent Reaction rate constant.