*Desalination and Water Treatment*
www.deswater.com

doi: 10.1080/19443994.2015.1090922

57 (2016) 18217–18228
August

Taylor & Francis
Taylor & Francis Group

# Degradation of patent blue V dye using modified photocatalytic reactor based on solar and UV irradiations

Rachana R. Dalbhanjan[a], Nishantbhaskar S. Pande[a], Barnali S. Banerjee[a], Shruti P. Hinge[b], Ashish V. Mohod[a,*], Parag R. Gogate[b,*]

[a]*Department of Chemical Engineering, AISSMS College of Engineering, Kennedy Road, Near RTO, Pune 411001, India, Tel. +91 9881217678; email: rachanadalbhanjan3219@gmail.com (R.R. Dalbhanjan), Tel. +91 9890114781; email: nishantttbhaskar@gmail.com (N.S. Pande), Tel. +91 8658146730; email: banerjeebarnali0@gmail.com (B.S. Banerjee), Tel. +91 8600047170; email: avmohod@aissmscoe.com (A.V. Mohod)*

[b]*Chemical Engineering Department, Institute of Chemical Technology, Matunga, Mumbai 400019, India, Tel. +91 9579791983; email: hinge.shurti@gmail.com (S.P. Hinge), Tel. +91 22 33612024; email: pr.gogate@ictmumbai.edu.in (P.R. Gogate)*

Received 9 March 2015; Accepted 29 August 2015

ABSTRACT

The pollution effects caused by coloured wastewater streams due to the presence of biorefractory dyes are significant, directing the need for a concentrated effort for development of efficient treatment schemes. The present work reports the investigations related to the treatment of patent blue V containing wastewater using modified photocatalytic reactor providing the understanding into the effect of various process parameters and intensification using additives. Comparison of obtained results with natural (solar radiation) and artificial (fluorescent lamp, 11 W) sources confirmed the efficient treatment using the artificial source as expected though significant extent of degradation was also obtained based on the use of solar light. Modifications based on the use of glass coating at the interior of the reactor for possible enhanced utilization of the incident energy showed better degradation efficacy. The removal efficacy was also observed to be dependent on the operating parameters viz. initial concentration and pH with maximum extent of degradation being obtained at initial concentration of 10 ppm and pH of 2.5. Using optimized conditions, the maximum extent of degradation obtained in the present work for different approaches was 86.4% for UV/$TiO_2$, 64.7% for solar/$TiO_2$, 68.4% for UV/ZnO, 59.0% for solar/ZnO, 92.8% for UV/$H_2O_2$, 72.1% for solar/$H_2O_2$, 81.56% for UV/ferrous sulphate and 66.22% for solar/ferrous sulphate. UV irradiation with modified glass surface photoreactor has been established to be best degradation approach for the removal of patent blue V dye from the wastewater and use of different additives can help in enhancing the extent of degradation. The work has also showed the ways to improve the extent of degradation using solar-based treatment which can be very useful, especially in developing tropical countries like India.

*Keywords:* Patent blue V removal; UV irradiation; Solar light; Modified photoreactor; Degradation; Additives

*Corresponding authors.