



A comparative study of the photocatalytic efficiency of Degussa P25, Qualigens, and Hombikat UV-100 in the degradation kinetic of congo red dye

Suhas R. Patil^{a,c,d,*1}, U.G. Akpan^{c,e}, B.H. Hameed^c, S.K. Samdarshi^{a,b,2}

^aSchool of Physical Sciences, North Maharashtra University, P.B. No. 80, Jalgaon, Maharashtra, India
Fax: +91 257 2235642; email: suhaspatil55@yahoo.co.in

^bDepartment of Energy, Solar & Energy Materials Laboratory, Tezpur University, Tezpur, Assam 784028, India

^cSchool of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, Nibong Tebal, Penang 14300, Malaysia

^dDepartment of Physics, Dr. Annasaheb G.D. Bendale Mahila Mahavidyalaya, Jalgaon, Maharashtra 425 001, India

^eChemical Engineering Department, Federal University of Technology, P.M.B. 65, Minna, Nigeria

Received 18 September 2011; Accepted 30 January 2012

ABSTRACT

The photocatalytic efficiency of three TiO₂ photocatalysts; Degussa P25, Qualigens, and Hombikat UV 100 has been investigated on the degradation kinetic of congo red dye. The crystal phases, structures, and crystallite sizes of the catalysts were analyzed by X-ray diffraction, microstructure, and morphology by transmission electron microscopy, and surface area and pore-size distributions by nitrogen physisorption. The results of the kinetic study revealed that the activities of the photocatalysts were dependent on their particle sizes, and the best activity was obtained with Hombikat UV-100, which was of the smallest particle size, was mesoporous, and had the largest surface area. The activation energy required for the degradation of the congo red dye was found to increase proportionately with the particle size of the catalysts. The effects of various operational parameters such as catalysts dosages, initial dye concentration, and temperature were systematically studied in order to achieve maximum degradation efficiency. The results of the investigations suggest that Hombikat, another model photocatalyst, can be used more effectively in the place of Degussa P25 in photocatalytic degradation of congo red dye.

Keywords: Congo red dye; Photocatalysts; Photocatalysis; Adsorption; Dye removal; Dye degradation

¹Present address: Department of Physics, Dr. Annasaheb G.D. Bendale Mahila Mahavidyalaya, Jalgaon-425 001, Maharashtra, India.

²Present address: Solar & Energy Materials Laboratory, Department of Energy, Tezpur University, Tezpur, Assam 784028, India.

*Corresponding author.