

Photodesorption of specific organic compounds from titanium dioxide particles in aqueous media

Mohammad Shahid^a, Ibrahim El Saliby^a, Andrew McDonagh^b, Jong-Ho Kim^c,
Ho Kyong Shon^{a,*}

^a*School of Civil and Environmental Engineering, University of Technology, Sydney (UTS), P.O. Box 123, Broadway, NSW 2007, Australia*

Email: Hokyong.Shon-1@uts.edu.au

^b*School of Chemistry and Forensic Science, University of Technology, Sydney (UTS), P.O. Box 123, Broadway, NSW 2007, Australia*

^c*The Research Institute for Catalysis, Chonnam National University, Gwangju 500-757, South Korea*

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ABSTRACT

This study investigates the photodesorption of organic compounds (beef extract, peptone, humic acid, tannic acid, sodium lignin sulphonate, sodium lauryl sulphate, arabic gum powder and arabic acid) from TiO₂ (1 g/L in water, pH 7). After a period to reach adsorption equilibrium, photodesorption experiments were conducted in a recirculated reactor at a constant flow rate of 150 mL/min with a UV light intensity of 24 W. Photodesorption was observed only for sodium lauryl sulphate (50%), sodium lignin sulphonate (43.47%), beef extract (20.35%) and tannic acid (10.5%) indicating that photodesorption is specific to some organic compounds but not to all. Using liquid chromatography-organic carbon detection, untreated beef extract and sodium lignin sulphonate were found to contain significant amounts of humic substances (~1,000 g/mol), which decreased in concentration after dark phase adsorption, while a significant increase in low molecular weight (<350 g/mol) concentrations was observed after photodesorption. UV-treated sodium lauryl sulphate photodesorbed to give both higher molecular weight (HMW) and lower molecular weight (LMW) organics. Thus, the HMW fractions of organic compounds decomposed into smaller compounds after UV irradiation, which subsequently desorbed from TiO₂ surface. However, untreated tannic acid contained a larger proportion of LMW acids, which shows a high adsorption affinity to TiO₂ during adsorption and poorly desorbs upon irradiation.

Keywords: Adsorption; Dissolved organic carbon; Organic compounds; Photodesorption; Titanium dioxide

*Corresponding author.

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