



Photocatalytic reduction of phosphorus in the acid pickling milling wastewater from high-phosphorus hematite mineral processing

Zhang Yi^{a,b}, He Feng^{a,*}, Xiao Enrong^a, Zhang Yimin^c, Xia Shibin^{a,c,*}, Wu Zhenbin^a

^aState Key Laboratory of Freshwater Ecology and Biotechnology, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan 430072, China

Tel. +862768780832; Fax: +862768780675; email: hefeng@ihb.ac.cn, xiashibin@126.com

^bGraduate School of Chinese Academy of Sciences, Beijing 100039, China

^cSchool of Resources and Environmental Engineering, Wuhan University of Technology, Wuhan 430070, China

Received 27 October 2010; Accepted 17 October 2011

ABSTRACT

The photocatalytic reduction of phosphorus in the acid pickling milling wastewater from high-phosphorus hematite mineral processing was innovatively performed in the absence of oxygen and in the presence of hole scavenger under visible light irradiation with Sr-doped TiO₂ in the study. Types and ratio of hole scavenger, effect of reduction time, dosage of Sr-doped TiO₂ and initial phosphorus concentration on the reduction of phosphorus were investigated. Experimental results indicated that the gaseous product of the photocatalytic reduction was identified to be phosphine. The optimum amount of formic acid and TiO₂ were 60 mmol l⁻¹ and 2.0 g l⁻¹, respectively, and the phosphorus removal could reach 99.96% when used to treat the actual mineral processing wastewater. The photocatalytic reduction of phosphorus could be described by first order kinetic equation, and the reaction rate was proportional to the concentration of reactants.

Keywords: Photocatalytic reduction; Phosphorus; Titanium dioxide; Visible light; Doping; Formic acid;

*Corresponding authors.