



Citric acid-pyrolysis synthesis of bismuth titanate series compounds and their photocatalytic degradation

Yu ying Mo^a, Biyang Tuo^{a,b,*}, Jianli Wang^c, Guanghua Nie^{a,b}, Yun Tang^{a,b}

^aSchool of Mining, GuiZhou University, Guiyang 550025, China, Tel. +86-18177164464; email: myy_gzu@163.com

^bNational and Local Joint Laboratory of Engineering for Effective Utilization of Regional Mineral Resources from Karst Areas, Guiyang 550025, Tel. +86-15286080806; emails: bytuo@gzu.edu.cn (B.Y. Tuo), 307885481@qq.com (G.H. Nie), 642205669@qq.com (Y. Tang)

^cCollege of Material and Advanced Manufacturing, Hunan University of Technology, Zhuzhou 412000, email: whwangjianli@163.com

Received 31 October 2022; Accepted 2 April 2023

ABSTRACT

Bismuth titanate based photocatalytic materials with different Bi/Ti ratios were synthesized by citric acid-pyrolysis method and used for the treatment of dye wastewater containing tartar yellow (TA). X-ray diffraction, UV-Vis diffuse reflectance spectroscopy, scanning electron microscopy, Fourier-transform infrared spectroscopy, X-ray photoelectron spectroscopy were used to analyze the performance of bismuth titanate based photocatalytic materials before and after the treatment of wastewater. The results showed that Bi₁₂TiO₂₀ prepared at a Bi/Ti ratio of 12:1, a metal ion to citric acid substance ratio of 1:1 and a roasting temperature of 600°C had a high photocatalytic activity and was able to achieve a degradation rate of 96.18% for TA and conformed to the proposed first order kinetic equation. The vacancies and superoxide radicals are the main active substances in the photocatalytic degradation process. Bi₁₂TiO₂₀ (Bi/Ti = 12:1) has a loose and porous mesh structure with good crystallinity and a forbidden band width of 2.41 eV. Bi₁₂TiO₂₀ (Bi/Ti = 12:1) has excellent stability and is expected to provide theoretical basis and guidance for TA dye wastewater treatment industry.

Keywords: Citric acid-pyrolysis method; Bismuth titanate; Tartar yellow; Photocatalytic degradation

* Corresponding author.