Electrochemical Synthesis of Mg-doped ZnO Nanotapers as Photocatalyst for Degradation of Bisphenol under Solar Light Irradiation

Min Wang¹, Shaochun Yuan^{1,2,*}, Bo Lv^{2,*}, Huaxian Yang³

¹ School of River and Ocean Engineering, Chongqing Jiaotong University, Chongqing, 400074, PR China

² Engineering Research Center for Sponge City Construction of Chongqing, Chongqing, 400020, PR China

³ Southwest Municipal Engineering Design & Research Institute of China, Chengdu, 610081, PR China

*E-mail: yuanse@cqjtu.edu.cn(Shaochun Yuan) and haimiancq@163.com(Bo Lv)

doi: 10.20964/2021.02.56

Received: 23 October 2020/ Accepted: 19 December 2020 / Published: 31 December 2020

This paper released electrochemical synthesis of Mg doped ZnO nanotapers for degradation of bisphenol A (BPA) as toxic aquatic pollutant under UV and visible light irradiations. The pure and Mg-doped ZnO nanotapers photo-catalysts were prepared through an electrical field assisted method. The morphological, structural and optical properties of samples were characterized through the SEM, XRD and UV-Vis absorption spectra, respectively. The morphological and structural studies exhibited that the high density of pure and doped ZnO nanostructures were grown in vertically aligned taper-like shape and hexagonal wurtzite structures. Moreover, the doping process led to creation of the cubic MgO structure in ZnO nanotaper with (111) and (220) planes. The optical characterizations showed that the higher absorption peak was observed for doped samples due to the creation of oxygen deficiency and defects in grain structure of film. The E_g values were obtained 3.48 eV and 3.09 eV for pure ZnO and Mg-doped ZnO nanotapers films, respectively. The electrochemical studies by CV and EIS techniques showed the improvement of specific capacitance of electric double layer and film's conductivity by Mg doping into ZnO matrix. The photocatalytic measurements displayed that the PBA degradation efficiencies were of 64.19 % and 100% for pure ZnO and Mg-doped ZnO nanotaper photo-catalysts for 70 minutes under UV irradiation, respectively. Therefore, the degradation efficiency of ZnO nanotapers was significantly improved by Mg doping. Furthermore, the PBA degradation efficiencies were 43.40 % and 100 % for pure and doped samples after 60 minutes under visible irradiation which indicates promotion of the degradation rate for Mg-doped ZnO nanotapers in visible irradiation. E_g value was decreased for doped samples due to the presence of Mg^{2+} inside the Zn^{2+} sites of the ZnO lattice which improve the charge separation. As a result, Mg-doped ZnO nanotapers film not only photo-excited in the UV region but also its photocatalytic activity was delayed in the visible region.

Keywords: Mg-doped ZnO nanotapers; Electrochemical technique; Photocatalyst; Bisphenol A; Photo-degradation

[FULL TEXT](#)

© 2021 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).