Simultaneous Photocatalytic Degradation of Bisphenol A and Disinfection Using Magnetically Separable Photocatalysts Activated by Visible Light

Irene M.C. LO[1,*] and Juhua HE[2]

[1]Chair Professor of Civil and Environmental Engineering
[2]Research Assistant of Environmental Engineering Program
The Hong Kong University of Science and Technology
Clear Water Bay, Hong Kong
*Presenting author:Email: cemclo@ust.hk; Fax: 852-23581534

Abstract

Bisphenol A (BPA),one of the representative endocrine disruptors which interferes with function of endocrine systems in humans and wild life,is usedin large quantities worldwide in polycarbonate plastics and epoxy resins production. BPA is detected in natural waters and sewage with unsatisfactory removal through conventional sewage treatment. It also forms disinfection byproducts after chlorination, thereby posing even higher risks on human health. Therefore, an innovative treatment technologywhich is capable of simultaneous BPA removal and bacteria disinfection without using chlorination is desired.Photocatalysis is an environmentally friendly treatment technology, but the traditional photocatalysts are only activated by UV light and their separation from water/wastewater is difficult due to their nano-size. In this study, magnetic separable photocatalystshave been developed by combining superparamagnetic nanoparticles (Fe_3O_4@SiO_2) with modified TiO_2(TiO_2/Fe_3O_4@SiO_2)for degradation of BPA under visible light irradiation. Different combinations of TiO_2/Fe_3O_4@SiO_2through doping and co-doping (using Fe or/and N) and Ag deposition, were synthesized and comparatively tested.Under visible light irradiation, BPA was totally removed by Fe,N-TiO_2/Fe_3O_4@SiO_2after 120 min, whereas16% and 35% of BPA were removed by Fe-TiO_2/Fe_3O_4@SiO_2 and N-TiO_2/Fe_3O_4@SiO_2, respectively. Ag deposition on Fe,N-TiO_2/Fe_3O_4@SiO_2further enhanced its photocatalytic activity. Acomplete removal of BPA can be achieved using Ag/Fe,N-TiO_2/Fe_3O_4@SiO_2 after 60 minutes of visible light irradiation.Since Ag/Fe,N-TiO_2/Fe_3O_4@SiO_2 has the best BPA photocatalytic degradation performance, its photocatalytic disinfection performance was further investigated. Photocatalytic disinfection of E. coli (as a model organism) showed that a completedisinfection can be achieved by Ag/Fe,N-TiO_2/Fe_3O_4@SiO_2 after 45 minutes of visible light irradiation. Overall, Ag/Fe,N-TiO_2/Fe_3O_4@SiO_2 shows a promising property for simultaneous photocatalytic degradation of BPA and disinfection.

Acknowledgement
The authors gratefully acknowledge the Research Grants Council (RGC) ofHong Kong for providing financial support under the GeneralResearch Fund (16200117) for this research.

Biography
Prof. Irene M. C. Lo is currently a ChairProfessor in the Department of Civil and Environmental Engineering at The Hong Kong University of Science and Technology (HKUST) and has been joining HKUST since 1992. She received her Master and PhD degrees in Civil (Environmental) Engineering from the University of Texas at Austin. Prof. Lo is an elected Academician of the European Academy of Sciences and Arts (EASA). She is the first Hong Kong scholar inducted into the EASA. She is an elected Fellow of the Hong Kong Institution of Engineers (FHKIE), and elected Fellow of the American Society of Civil Engineers (FASCE). Prof. Lo has held 2 patents, edited 9 technical books, and published over 270 SCI journal articles and conference papers with citation over 8000+. Her research areas include magnetic nanomaterial-based technology for water and wastewater treatment; soil/sediment/groundwater remediation; fate and transport of nanoparticles; and solid waste treatment and management.