Photocatalytic Bacteria Disinfection and Degradation of Endocrine Disruptors Simultaneously using Visible-light-driven Photocatalysts

Irene M.C. Lo, PhD, JP

Chair Professor
Department of Civil & Environmental Engineering
The Hong Kong University of Science & Technology
Academician, European Academy of Sciences and Arts
Email: cemclo@ust.hk

In this study, an innovative magnetic TiO_2-based photocatalysis technology which provides simultaneous photocatalytic disinfection and endocrine disruptors (e.g., BPA) degradation without the formation of hazardous byproducts is proposed. TiO_2 is the focus in numerous investigations due to its promising capacity in photocatalysis, highly stability and efficiency costs. However, TiO_2 can only absorb UV light which accounts for 3-5% of the solar spectrum and is also difficult to separate from treated water due to its fine size. These limitations of TiO_2 restrict its practical application in sewage treatment. For this reason, novel magnetically separable photocatalysts ($TiO_2/Fe_3O_4@SiO_2$) activated by visible light were developed through combining superparamagnetic nanoparticles ($Fe_3O_4@SiO_2$) with modified TiO_2. Then, a serial of combinations of photocatalysts were synthesized through doping, co-doping and Ag deposition. The various kinds of TiO_2-based photocatalysts were comparatively tested to analyse their performance for simultaneous photocatalytic disinfection and BPA degradation. The efficiency and reusability of photocatalysts, and mechanisms of *E. coli* and BPA removal by photocatalysis in the batch study and prototype experiments were also investigated. A complete removal of E. coli (106 CFU/mL) and BPA in synthetic wastewater were achieved using Ag/Fe,N-TiO2/Fe3O4@SiO2 in 90 minutes under visible light irradiation, but it requires longer time in real wastewater. In addition, the magnetically separable photocatalyst can be separated by hand-held magnet or electromagnetic field, and a high recycling efficiency and stability over multiple treatment cycles can be obtained.