Keynote Speaker

Highly Efficient Solar Water Disinfection: Design, Preparation and Applications

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Abstract

Renewable solar energy can be used all over the world for water purification. Employing indirect radical oxygen species generated from photocatalytic reactions emerged to be a promising approach. However, dissolved oxygen, which is only slightly soluble in water, restricted the generation speed via oxygen reduction reaction. Here in, a highly-efficient metal-free nano-coating for solar water disinfection was prepared by assembling edge-oxygenous-functionalized graphitic carbon nitride nanosheets, which showed a bacteria inactivation of > 99.9999 % in only 30 min and twenty-fold first-order disinfection rate compared with the most efficient previously reported carbon nitride based photocatalyst. The efficiently exposed carboxyl (-COOH) and carbonyl (-C=O) at the edge of the carbon nitride nanosheets were firstly proved to accelerate hydrogen peroxide (H₂O₂) via water oxidation reaction pathway with tremendous activity. Moreover, a fixed bed reactor modified by the nano-coating firstly achieved bacteria inactivation in the flowing water. The presented water oxidation reaction cannot only be employed by carbon-nitride based photocatalysts, but also other photocatalysts in which peroxides usually poison oxygen evolution reactions.

Fig. 1. Disinfection schematics of CN_T30 and FEE-CN-NS. Solar-water disinfection mechanism of (A) direct ROS and (B) indirect ROS. (C) Schematic diagram of indirect inactivating bacteria using H₂O₂ generated by water oxidization which is catalyzed by CN_T30.