Study on Water Purification Using Tungsten Trioxide Photocatalyst under Visible Light

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Abstract

This research investigates the application of photocatalytic purification of water under solar light irradiation through 3 aspects. Photocatalytic degradation of microcystin-LR (MC-LR) under simulated solar light using three classes of tungsten trioxide (WO_3)-based nanoparticles: CuO/WO_3, Pd/WO_3, and Pt/WO_3 was investigated. Photocatalytic activity was higher during the degradation of MC-LR with Pt/WO_3 than with Pd/WO_3 or CuO/WO_3. The pH value influenced the rate of degradation. The MC-LR degradation can be described by pseudo-first-order reaction kinetics, and the reaction rate increased with increasing light intensity. The influence of chloride ions and metal ions on the photocatalytic oxidation of MC-LR was also evaluated in this study. Chloride ion (Cl^-) could enhance the MC-LR degradation at a concentration of 0.02 mM and could inhibit degradation at concentrations of 0.1 mM and 0.2 mM. The presence of Cu^{2+} and Fe^{3+} improved MC-LR removal from the samples. This study suggests Pt/WO_3 photocatalytic oxidation with solar light is a promising treatment for water containing MC-LR.

The photocatalytic inhibition of algal growth under solar light was investigated using M. *aeruginosa* as the model algae and Pt/WO_3 as the photocatalyst. The experiment results shows that the algal growth was successfully controlled by the Pt/WO_3 and the total MCs was also degraded to a low level. The algae cells decreased

from 1.3×10^6 to 0.1×10^6 and the total MCs concentration was dropped from 624 to 100μg/L after 6 days of photocatalytic treatment after 6 days of treatment

The comparison between photocatalytic method and electrochemical method was investigated through the experiment of degradation of phenol. It is obvious that the reacation rate of electrochemical oxidation was much higher than that of photocatalytic oxidation. Under the optimized condition of each method, complete removal of 10mg/L phenol was achieved by photocatalytic method through 8 hours while it only took 2 hours for electrochemical method to achieve complete removal of phenol.