Title:

Fabrication of B/O-doped graphitic carbon nitride photocatalysts for efficient degradation of ciprofloxacin under visible light

Authors & affiliations:

Chitiphon Chuaicham[a], Karthikeyan Sekar[a,b], and Keiko Sasaki[a*]

[a]*Department of Earth Resources Engineering, Kyushu University, Fukuoka 819-0395, Japan*

[b]*Department of Chemistry, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu 603203, India*

Abstract:

Abstract should not be longer than 300 words. Figures and diagrams are allowed. You can add figures and tables up to **1 page**.

Series of Boron and Oxygen doped metal-free graphitic carbon nitrides (B/O-CN) were prepared as photocatalysts via a facile one-pot synthesis technique using melamine and boric acid precursors. The B/O-CN samples were used for the photocatalytic degradation of ciprofloxacin (CIP), an antibiotic model pollutant. The optimized B/O-CN caused complete degradation of CIP in 20 min, with a rate constant value was factor of 6 times higher than that of pristine graphitic carbon nitride. The significant removal rate of CIP degradation using the optimized B/O-CN was attributed to its excellent charge separation and transportation of photogenerated electrons-hole pairs. The charge transport properties were confirmed by photoluminescence, transient photocurrent response, and electrochemical impedance spectroscopy results. Moreover, the energy-resolved distribution of electron trap (ERDT) pattern of the composite sample suggested formation of a new electronic level by the B and O atoms, which was in agreement with the density functional theory (DFT) results. The excited electrons were trapped to avoid charge recombination, resulting in enhanced photocatalytic performance. A photocatalytic degradation mechanism of CIP using B/O-CN was proposed based on the optical properties, ERDT, and activity test results of B/O-CN. The LC-MS results prove the de-structure of CIP molecules into small acid molecule by the B/O-CN. Additionally, a biotoxicity of the degraded solution (CIP), after photocatalytic treatment was examined by observation of the growth of E. coli in the treated solution. It is clear that the CIP solution degraded by B/O-CN showed less biotoxicity than the original solution, which was confirmed the photocatalytic treatment process could reduce the harmfulness of the contaminated pharmaceutical wastewater. Thus, the optimized B/O-CN can be employed as a potential visible-light-driven photocatalyst for the detoxification of wastewater containing CIP.