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Photocatalytic degradation of benzotriazole: by-products, bio-toxicity and kinetic study

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ABSTRACT

Benzotriazoles (BTAs) are high production volume substances that are widely used in various industrial processes and in households. In this study, the photocatalytic and photolysis degradation of benzotriazole was studied on the TiO_2 nanoparticles coated on the fixed bed, which was treated in two light sources including UV_C (250 nm) and natural solar in quartz glass tubes fitted with design compound parabolic concentrators (CPC). The effects of samples kinetic reaction, TOC and COD removal, by-products and bio-toxicity were evaluated. Characterization of the TiO_2 nanoparticles samples was performed by FE-SEM, XRD, UV-VIS spectrophotometer, and BET measurements. The highest photocatalytic and photolysis activity for the degradation of BTA has been obtained for the TiO_2/UVc and UV_C whit 99% and 45 efficiencies in 120 min. Also, the highest photocatalytic and photolysis activity for the degradation of BTA has been obtained for rector CPC and 84% and 36% efficiency in 120 min. The photocatalytic degradation reaction of BTA was monitored by HPLC, TOC, and GC-MASS analyses. The GC-MASS analysis results indicate that degradation of BTA occurs through products triazole, tolyltriazole and anilin were identified ring cleavages followed by subsequent reactions with OH radicals. The metabolites show toxic effects, but they are not as toxic as benzotriazole, resulting in a general decrease in toxicity as a result of photocatalytic degradation.

Keywords: Photocatalytic and photolysis degradation; Benzotriazole; Compound parabolic concentrators; Solar; TiO_2; UV_C

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