ABSTRACT

PHOTOCATALYTIC DEGRADATION OF C.I. BASIC BLUE 41 DYE USING IMMOBILIZED TIO2 UNDER ARTIFICIAL AND SOLAR IRRADIATION: PROCESS EFFICIENCY AND TOXICITY ASSESSMENT

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Very stable C.I. Basic Blue 41 (BB41) dye was successfully degraded in deionized water and in salt-laden acidic wastewater samples using immobilized TiO2-silica gel beads under artificial UV-A and solar irradiation. Adsorption of BB41 on the surface of the TiO2 photocatalyst accounted for the significant removal of the dye in aqueous medium (> 60% in deionized water and 30-60% in the wastewater samples). Adsorption of BB41 on TiO2 followed both Langmuir and Freundlich adsorption isotherm models. Complete decolorization and destruction of organic compounds in the contaminated water were possible only through the combined TiO2 and UV-A reactions. Artificial UV-A irradiation led to rapid 100% removal of BB41 from deionized water and wastewater. Photocatalytic degradation or mineralization of the organic compounds occurred more slowly but increased continuously with time. Mineralization is consistent with the Langmuir-Hinshelwood kinetic model, indicating the photocatalytic nature of the degradation process. Compared to the photocatalytic reactions observed in deionized water, destruction of organic compounds in the wastewater occurs more slowly, suggesting that salts and other organic compounds present in wastewater can attenuate photocatalytic reactions. Using TiO2 and solar irradiation, less decolorization and mineralization were effected. However, the BB41 degradation and TOC removal trends observed were similar to those found for the combined TiO2 and UV-A process. As the results demonstrate, sunlight may be a viable alternative source of photons for the photocatalytic degradation process. Toxicity tests using *Chlorella ellipsoidea*, *Moina macrocopa*, and *Artemia salina* revealed significant toxicity reduction (26-68%) of the tested wastewater sample with photocatalytic treatment. Of the three organisms used, *C. ellipsoidea* appeared to be a potential alternative test organism for inexpensive toxicity testing in tropical environments.