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DECOLORIZATION AND MINERALIZATION OF REACTIVE RED 198 IN SALINE WATER: PERFORMANCE COMPARISON OF PHOTOLYSIS, UV/TiO₂, AND UV/ZNO PROCESSES

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Abstract

The objective of this study was to identify differences between three of the most conventional UV-based advanced oxidation processes, namely photolysis, UV/TiO₂, and UV/ZnO for the decolorization and mineralization of reactive red 198 (RR198) model dye in saline media. The study investigated influences of solution pH levels, salt concentration, reaction time and dye concentration on the degradation of RR198. The most effective dye removal and mineralization was observed at pH levels 2, 5, and 7 to 8 in photolysis, UV/TiO₂, and UV/ZnO processes, respectively. An increase of salt (NaCl) concentration reduced the rate of decolorization, with UV/ZnO having the lowest impact. Pseudo-first-order decolorization rate constants of RR198 in saline solution were 0.001, 0.028, and 0.062 min⁻¹ for photolysis, UV/TiO₂, and UV/ZnO, respectively. UV/ZnO attained 96% of dye mineralization at reaction time of 120 min. It was found that ZnO performed much better than TiO₂ in catalyzing the degradation of RR198 in saline media at equal concentrations of catalyst. The degradation of the RR198 in the UV/ZnO and UV/TiO₂ processes was confirmed to be accomplished through [•]OH oxidation.

Key words: oxidation process, photocatalysis, reactive azo dye, saline media, TiO₂, ZnO

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