Comparative study of naproxen degradation in water by UV/persulfate and UV/H₂O₂ processes

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ABSTRACT

This study comparatively investigated naproxen (NPX) degradation by UV/persulfate (UV/PS) and UV/H₂O₂ processes under different conditions. Direct UV photolysis of NPX was limited. The degradation rate of NPX was largely enhanced by UV/PS and UV/H₂O₂ processes due to high-reactive radicals (SO₄•⁻ or/and •OH) formed. The second-order rate constants of NPX with SO₄•⁻ and •OH were determined as 7.81 × 10⁹ and 6.22 × 10¹⁰ M⁻¹ s⁻¹, respectively. The pseudo-first-order rate constant (k) of NPX increases linearly with the initial concentration of PS in UV/PS process, whereas the k in the UV/H₂O₂ process contains the best dosage of H₂O₂. Acidic conditions were found to be favorable for NPX removal in UV/PS process, while the maximum NPX removal was observed at pH 6 in UV/H₂O₂ process. Further, the Cl⁻ promotes NPX degradation in both of the processes, and the effect of HCO₃⁻ on degradation of the NPX was opposite in two processes. Humic acid shows a higher inhibition in UV/H₂O₂ process in comparison with that in UV/PS process. The lower mineralization efficiency indicates that the products of NPX were more reluctant to the two systems compared with its parent drug. These results indicated that both processes are potential alternatives to control water pollution contaminated by drugs such as NPX.

Keywords: Naproxen; UV; Sulfate radicals; Hydroxyl radicals; Degradation; Kinetics

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