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UV-H_2O_2 ADVANCED OXIDATION OF ANIONIC SURFACTANT: REACTION KINETICS, EFFECTS OF INTERFERING SUBSTANCES AND OPERATING CONDITIONS

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Abstract

This paper deals with the degradation kinetics of an anionic surfactant (sodium dodecyl sulfate, SDS) under UV and UV-H_2O_2 advanced oxidation process (AOP). Experiments were performed in a batch reactor which emits monochromatic light centered at 253.7 nm. The photon flux of the UV reactor was $1.9(\pm0.1)\times10^{-4}$ Einstein/L-min. Under direct UV, only 45% SDS degradation was observed at a fluence of 40.65 J/cm^2 for initial SDS concentration of 0.35 mM. The apparent fluence-based pseudo-first order rate constant was found to be $1.77(\pm0.24)\times10^{-5}$ cm^2/mJ. However, very fast degradation (almost 100%) was observed for UV-H_2O_2, process at a fluence of 0.45 J/cm^2. The apparent fluence-based rate constant in this case was found to be about 450 times higher than direct photolysis. Further, using a probe compound (para chlorobenzoic acid) competition kinetics study was performed to determine the second order hydroxyl radical rate constant for SDS. The rate constant thus obtained was $8.18(\pm0.26)\times10^9$ M^{-1} s^{-1}. Effects of different operating parameters like H_2O_2 concentration, initial SDS concentration and water quality parameters, including pH (7 - 12), alkalinity (0 - 10 mM HCO_3^-) and nitrate concentration (0 - 1 mM as NO_3^-), were investigated. The observed rate constants were influenced by all the studied parameters and these parameters were optimized for field application. Degradation of SDS was also carried out in municipal wastewater. In conclusion, UV-H_2O_2 AOP is an efficient treatment method for SDS in environmental matrices.

Key words: direct photolysis, hydroxyl radical rate constant, scavenging effect, sodium dodecyl sulfate, wastewater

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