THERMALLY ACTIVATED PERSULFATE FOR THE DEGRADATION OF AMPICILLIN IN AQUEOUS SOLUTION: KINETICS, TRANSFORMATION PRODUCTS AND ECOTOXICITY ASSESSMENT

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ABSTRACT

Pharmaceuticals, especially antibiotics, have been repeatedly detected in treated wastewater and surface water and have become a matter of growing concern over the past years. Their extensive use in human and veterinary medicines can adversely affect public health and the aquatic environment [1]. The biodegradation of antibiotics in activated sludge systems remains low. Consequently, alternative treatment technologies are required to eliminate these pollutants. Advanced oxidation processes (AOPs) have attracted considerable attention because of their distinct ability to effectively degrade persistent organic compounds to simple, harmless molecules by generating highly reactive radicals [2]. Heat-activation of persulfate has been considered an effective and simple way to generate $SO_4^{\bullet-}$ to remove numerous pollutants.

This work examined the oxidation of ampicillin (AMP), a very common representative β-lactamic antibiotic, by thermally activated persulfate process. The reaction system achieved total degradation of 500 μg L^{-1} AMP within only 45 min at 50 ^oC, pH= 6, and sodium persulfate (SPS) concentration of 50 mg L^{-1}. Under these experimental conditions, the observed kinetic constant was estimated equal to 0.0565 min^{-1}. It was found that the rate of AMP degradation enhanced as the initial concentration of SPS and the reaction temperature increased in ultrapure water, while it was decreased as the water matrix's complexity increased and under the presence of 250 mg L^{-1} chlorides, 250 mg L^{-1} bicarbonates, or 10 mg L^{-1} humic acid. Seven by-products derived from the degradation of AMP were identified using LC/MS/MS. Ecotoxicity experiments with microalgae *Chlorella sorokiniana* showed no reduction in microalgae growth after 72 hours contact time for concentrations of AMP and SPS equal to 1 and 50 mg L^{-1}, respectively, and a reaction time of 45 and 120 minutes.

KEYWORDS: Antibiotic, Advanced oxidation processes, Sulfate radicals, Ecotoxicity, Water matrices

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