



Degradation of CEX antibiotic from aqueous environment by US/S₂O₈²⁻/NiO process: optimization using Taguchi method and kinetic studies

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ABSTRACT

The extensive production and consumption of antibiotics have led to an increasing occurrence of antibiotic residuals in various aquatic compartments, presenting a significant threat to both the ecosystem and human health. This study aimed to investigate the removal of cephalixin (CEX) antibiotic from aqueous solutions by ultrasonic/persulfate/nickel oxide NPs (US/S₂O₈²⁻/NiO) hybrid process. To increase the removal efficiency, affecting parameters on the US/S₂O₈²⁻/NiO hybrid process were investigated and optimized by adopting the Taguchi design of experiments approach. The controllable factors such as solution pH, reaction time, initial concentration of CEX antibiotic, S₂O₈²⁻ concentration and NiO nanoparticle were optimized. Under optimum conditions (pH = 3, reaction time = 90 min, CEX = 20 mg/L, NiO = 5 mg/L and S₂O₈²⁻ = 400 mg/L) and using the US/S₂O₈²⁻/NiO process, the CEX, COD and TOC removal efficiencies were 96.05%, 68.02% and 47.14%, respectively. The studies to determine the percentage contribution of each controllable factor was also carried out. The pH of the solution was identified as the most influential factor, and its percentage contribution value was up to 70% in the studied process. Considering the parameters of the kinetics, it was found that the removal CEX antibiotic using the hybrid process obeys the pseudo-first-order kinetics. The results showed that US/S₂O₈²⁻/NiO hybrid process could be optimally used to treat the wastewater containing antibiotics such as CEX and could be considered as an effective and eco-friendly method.

Keywords: Advanced oxidation processes; Cephalixin antibiotic; US/S₂O₈²⁻/NiO process; Kinetic studies; Taguchi method; Aqueous solution

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