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Sulfamethoxazole Degradation by Conventional Fenton and Microwave-Assisted Fenton Reaction

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Abstract : Pharmaceutical products, such as sulfamethoxazole (SMX) are rejected in the environment at trace level by human and animals (ng/L to mg/L), in their original form or as byproducts. Antibiotics are toxic contaminants for the aquatic environment, owing to their adverse effects on the aquatic life and humans. Even at low concentrations, they can negatively impact biological water treatment leading to the proliferation of antibiotics-resistant pathogens. It is therefore of major importance to develop efficient methods to limit their presence in the aquatic environment. In this aim, advanced oxidation processes (AOP) appear relevant compared to other methods, since they are based on the production of highly reactive free radicals, and especially ●OH. The objective of this work was to evaluate the degradation of SMX by microwave-assisted Fenton reaction (MW/Fe/H2O2). Hydrogen peroxide and ferrous ions concentrations, as well as the microwave power were optimized. The results showed that the SMX degradation by MW/Fe/H2O2 followed a pseudo-first order kinetic. The treatment of 20 mg/L initial SMX by the Fenton reaction in the presence of microwave showed the positive impact of this latter owing to the higher degradation yields observed in a reduced reaction time if compared to the conventional Fenton reaction, less than 5 min for a total degradation. In addition, increasing microwave power increased the degradation kinetics. Irrespective of the application of microwave, the optimal pH for the Fenton reaction remained 3. Examination of the impact of the ionic strength showed that carbonate and sulfate anions increased the rate of SMX degradation.

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