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Ultrasound enhanced heterogeneous activation of peroxymonosulfate by a bimetallic
Fe-Co/SBA-15 catalyst for the degradation of Orange II in water

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Abstract

Mesoporous silica SBA-15 supported iron and cobalt (Fe-Co/SBA-15) was prepared and used as catalyst in the ultrasound (US) enhanced heterogeneous activation of peroxymonosulfate (PMS, HSO_5^-) process. The effects of some important reaction parameters on the removal of Orange II by US/Fe-Co/SBA-15/PMS process were investigated. The results indicated that the removal rate of Orange II was not significantly affected by the initial pH, and it increased with the higher PMS concentration, reaction temperature, Fe-Co/SBA-15 dosage and ultrasonic power. Furthermore, sulfate radicals ($\text{SO}_4^{\cdot-}$) were assumed to be the dominating reactive species for the Orange II decolorization. Moreover, the Fe-Co/SBA-15 catalyst showed high activity during the repeated experiments. The intermediate products were identified by GC-MS, thereby a plausible degradation pathway is proposed. In addition, the chemical oxygen demand (COD) removal efficiencies at 2 and 24 h were 56.8% and 80.1%, respectively and the corresponding total organic carbon (TOC) removal efficiencies were 33.8% and 53.3%. Finally, toxicity tests with activated sludge showed that the toxicity of the solution increased during the first stage and then decreased significantly with the progress of the oxidation.

Keywords: Fe-Co/SBA-15, sulfate radicals, ultrasound, peroxymonosulfate, toxicity.

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