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Nitrobenzene removal by novel pillared kaolinite-catalyzed Fenton-like reaction

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ABSTRACT

In this study, a novel metal-pillared kaolinite (KDF) Fenton-like catalyst was prepared via a two-step procedure involving intercalating and pillaring. The characterization results indicated that the interlayer spacing, specific surface area, pore area and volume were dramatically enhanced for KDF compared with raw kaolinite, and FeOOH crystals were present in the interlayer spaces of KDF. When KDF was used to catalyze the Fenton-like reaction for nitrobenzene (NB) degradation in the presence of H_2O_2, more than 85% of NB was removed. The influencing factors of H_2O_2 concentration, KDF dosage, NB initial concentration and reaction temperature as well the Fenton-like reaction mechanism were examined. The optimal conditions were determined to be: 10 mmol/L H_2O_2, 75 mg/L NB, and KDF dosage of 1.0 g/L. The first-order kinetic reaction rate constants at different temperatures were fitted by the Arrhenius equation and the activation energy (E_a) was calculated to be 36.34 kJ/mol. The experimental results in the presence of a free radical scavenger showed that the NB degradation mechanism catalyzed by KDF was mainly due to the generation of free hydroxyl radicals. The low percentage of leaching Fe-containing active components showed that the KDF catalyst has good stability, suggesting its potential application in environmental remediation.

Keywords: Pillared kaolinite; Catalysis; Fenton-like; Nitrobenzene; Hydroxyl radical

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