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Fe_3O_4 and $Fe_3O_4/Fe^{2+}/Fe^0$ catalyzed Fenton-like process for advanced treatment of pharmaceutical wastewater

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ABSTRACT

Batch experiments were conducted for advanced treatment of pharmaceutical wastewater (after biological treatment) in a series of Fenton-like systems. Fe_3O_4-H_2O_2 system had the highest reactivity for COD removal comparing to classic Fenton and Fe^0-H_2O_2 systems. Effects of crucial experimental factors were investigated, including H_2O_2 and Fe_3O_4 dosage, pH, and reaction time. To reach 20% COD removal, the optimal conditions were pH of 3.0, Fe_3O_4 dosage of 1.0 g/L, and H_2O_2 dosage of 10 mg/L. Comparing with the classical Fenton's reaction, the Fe_3O_4-H_2O_2 system saved 75% H_2O_2, reduced 47% excess sludge, and slightly improved the COD removal. Furthermore, in order to meet the upcoming new local standard, Fe^{2+} and Fe^0 were introduced into Fe_3O_4-H_2O_2 system to form a hybrid system, $Fe_3O_4/Fe^0/Fe^{2+}$-H_2O_2 (pH of 3.0, Fe_3O_4 of 1.0 g/L, Fe^0 of 0.23 g/L, Fe^{2+} of 34 mg/L, and H_2O_2 of 40 mg/L). Fe^0 and Fe^{2+} not only improved the COD removal and decreased iron sludge, but also enhanced the reuse of catalysts. Compared to the classic Fenton process, 80% H_2O_2 dosage was saved and 94% iron sludge was decreased. Meanwhile, the cost decrease by 1.66 RMB/m^3-wastewater.

Keywords: Fe_3O_4; Fe^0; Pharmaceutical wastewater; Heterogeneous Fenton-like process

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