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Optimization of UV/H_2O_2/Fe_3O_4 process to remove aniline from aqueous solutions using central composite methodology

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ABSTRACT

Aniline with a benzene ring in its structure is a toxic, carcinogenic and mutagenic compound that causes many diseases in humans. Various methods have been developed to remove this pollutant from the environment among which the advanced oxidation has been successful in obtaining higher aniline removal efficiency. In this study, a UV light and Fe_3O_4 nano catalyst were used to remove aniline. In this study, the efficiency of aniline removal was studied as a dependent variable and aniline, hydrogen peroxide and iron nano catalyst concentrations, time and pH were investigated as independent variables. The concentration of aniline was measured by spectrophotometer. The optimization of the process was determined using the response surface method design and the central composite design model. Design Expert software was used to analyze the data. The results showed that the aniline removal efficiency decreased with increase in nano-catalyst concentration, hydrogen peroxide concentration and time and decreased with increasing pH and aniline concentration. To achieve maximum efficiency (78.1%), the optimal values for pH; initial concentration; time; nanoparticle content and H_2O_2 content were 3.2; 101 mg L^{-1}; 50 min; 0.45 g L^{-1} and 31.08 mmol L^{-1}. The results showed that the photo-Fenton process has a desirable ability to remove aniline from aqueous solution at pilot scale. Therefore, it was suggested to study the efficiency of this process as one of the clean and environmentally friendly methods at full scale on real wastewater.

Keywords: Aniline; Iron nanoparticles; Advanced oxidation; Response surface methodology; Central composite design

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