ABSTRACT

Effects on the removal efficiency of nitrobenzene treated by O$_3$/H$_2$O$_2$ in a rotating packed bed (RPB) were optimized with response surface methodology (RSM). Interaction effects between influence of H$_2$O$_2$ concentration, gas-phase ozone concentration, liquid flow rate, and high-gravity factor on the removal efficiency of nitrobenzene wastewater treatment with O$_3$/H$_2$O$_2$ in a RPB were investigated. The results indicate that the influence priority on nitrobenzene removal is high-gravity factor, gas-phase ozone concentration, H$_2$O$_2$ concentration, and liquid flow rate. Significant interaction effects of H$_2$O$_2$ concentration and gas-phase ozone concentration, gas-phase ozone concentration, and high-gravity factor were observed. The optimum treatment conditions after optimizing were H$_2$O$_2$ concentration 5.7 mmol L$^{-1}$, gas-phase ozone concentration 50 mg L$^{-1}$, liquid flow rate 125 L h$^{-1}$, and high-gravity factor 100. Under the optimal reaction conditions, the actual removal efficiency of nitrobenzene could reach 76.1% fast in a short-treatment time of 10 min. And the theoretical value was 78.2%. The deviation between the experiment test result and the predicted value of RSM-fitting equation was 2.68%, which indicate that the RSM-fitting equation could be used to predict the removal efficiency of nitrobenzene treated by O$_3$/H$_2$O$_2$ in a RPB and optimize the treatment conditions.

Keywords: Nitrobenzene; Oxidation; Degradation; Response surface methodology (RSM); High gravity