



Possible control approaches of the Electro-Fenton process for textile wastewater treatment using on-line monitoring of DO and ORP



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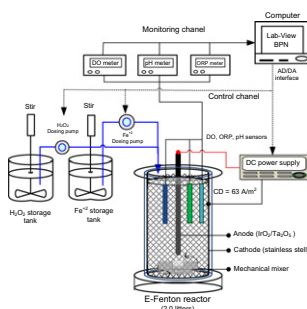
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HIGHLIGHTS

- ▶ The DO and ORP profiles have high correlations with the trends of H_2O_2 , Fe^{+2} and Fe^{+3} variations.
- ▶ The DO and ORP profiles can help to identify the overdose of H_2O_2 .
- ▶ The ANN models can precisely predict the COD removal efficiency and required Fe^{+2} doses.

GRAPHICAL ABSTRACT

Schematic diagram of the E-Fenton reactor and the correlating monitoring and control units in this study.



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ABSTRACT

The Electro-Fenton (E-Fenton) process combines the advantages of electrochemical and Fenton processes, which is an effective and popular advanced oxidation process (AOP) for treating textile wastewater. Dynamically regulating the E-Fenton process is still difficult; however, it is critical for reducing operation costs and enhancing process performance. This paper presents the potentials of on-line monitoring of Oxidation Reduction Potential (ORP) and Dissolved Oxygen (DO) as key parameters to control the E-Fenton process for textile wastewater treatment. Experimental results have shown that the monitored DO and ORP profiles have high correlations with the trends of H_2O_2 , Fe^{+2} and Fe^{+3} variations, which can help to identify over-dosing of H_2O_2 . Both the multiple regression and the Artificial Neural Network (ANN) models were applied to predict the required Fe^{+2} doses using the monitoring ORP, DO, and COD removal targets. Very precise prediction results with the correlation coefficients (R^2) of 0.95–0.99 were performed by the multiple regression models and the ANN models, respectively. As a result, the monitoring of DO and ORP have high potentials to effectively control the E-Fenton and contribute to the benefit of chemical cost savings.

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1. Introduction

The Fenton series processes are very popular and effective advanced oxidation processes (AOPs) for many industrial wastewater

treatments [1,2], especially for textile wastewaters which contain high levels of color, refractory organics, and suspended solids (SS) are difficult to treat using conventional wastewater processes [3–6]. However, high consumption of chemical reagents and high production of chemical sludge are typical problems for the conventional Fenton process [1,7]. The E-Fenton process combined the advantages of electrochemical and Fenton processes. The E-Fenton process has been investigated for treating both organic and inorganic pollutants in many industrial wastewaters, and performed

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