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Final treatment of young, middle-aged, and stabilized leachates by Fenton process: optimization by response surface methodology

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ABSTRACT

In this study, Fenton's oxidation process was applied after electrodialysis (ED) with bipolar membrane system for the final treatment of the ED-treated young, middle-aged, and stabilized leachates. Response surface methodology (RSM) was applied to evaluate and optimize physical and oxidative performances of Fenton process on treatability of leachate. The interactive effects of four operating variables: H_2O_2/COD rate, H_2O_2/Fe^{2+} rate, initial pH, and reaction time were evaluated by RSM. Three dependent parameters such as COD, TOC, and color removal were measured as responses. The Fenton process was found to be successful to treat all ED-treated young, middle-aged, and stabilized landfill leachate. In terms of COD and TOC removals, the efficiency of Fenton's oxidation increased with increasing leachate age while color removal was found to be higher than 89% in all treated leachate samples. Fenton oxidation treatment enhanced the biodegradability of landfill leachates by 400, 100, and 44% for old, middle-aged, and young leachate, respectively. According to analysis of variances results, three proposed models could be used to navigate the design space with high regression coefficient R^2 varied from 0.86 to 0.99 for three types of leachates. The results of optimized parameters and laboratory studies imply that experimental study data agreed well with the model prediction data.

Keywords: Landfill leachates; Electrodialysis with bipolar membrane; Fenton oxidation; Response surface methodology; Optimization

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