Optimization of landfill leachate oxidation at extreme conditions and determination of micropollutants removal

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**ABSTRACT**

The advanced oxidation of macro- and micro-organic pollutants from the landfill leachate using the Fenton reaction was investigated. Central composite design with response surface methodology was applied to evaluate the interaction and relationship between operating variables (i.e., pH, reaction time, ferrous iron and H$_2$O$_2$ dosages) and to develop the optimum operating condition. Based on statistical analysis, quadratic models for the two responses (chemical oxygen demand [COD] and aromatic content [UV$_{254}$]) proved to be significant with very low probability values (<0.001). The obtained optimum conditions were 1,755 mg/L Fe$^{2+}$ and 26,422 mg/L H$_2$O$_2$ concentration, pH 3.72 and 99 min reaction time. The results obtained by the predicted model were 70% and 54% removal for COD and UV$_{254}$, respectively, with optimum conditions. The predicted results fitted well with the results of the laboratory experiment. A wide range of analysis was conducted for micropollutants and some volatile organic compounds, pharmaceuticals, pesticides, plasticizers, polycyclic aromatic hydrocarbons and heavy metals were detected. Removal efficiencies of some micropollutants including bis(2-ethylhexyl) phthalate, anthracene, benzene hexachloride, dieldrin, diuron, chlorpyriphos and diclofenac were between 90% and 99% with Fenton oxidation at the optimum condition. It was also determined that heavy metals decreased as a result of co-precipitation after oxidation.

**Keywords:** Leachate; Advanced oxidation; Optimization; Central composite design; Micropollutants; COD; UV$_{254}$

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