

## Treatment of tropical stabilised landfill leachate using palm oil fuel ash: isothermal and kinetic studies

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### ABSTRACT

Landfill leachate is a hazardous by-product of landfills which can lead to surface and groundwater contamination if not properly managed, bringing a series of adverse effects to the natural environment, welfare, and human health. Landfill leachate must be treated to meet the discharge standards before discharging to the environment. This study aimed to treat stabilised landfill leachate using palm oil fuel ash (POFA). The adsorbent used in this study was POFA activated via KOH (treated palm oil fuel ash (TPOFA.KOH)) with impregnation ratio of POFA:KOH equal to 1:1. Batch adsorption studies were conducted to evaluate the effect of contact time, shaking speed, and adsorbent dosage. Removal efficiencies of chemical oxygen demand (COD), colour, and ammoniacal nitrogen (NH<sub>3</sub>-N) achieved in this study were 75.44%, 85.37%, and 18.68%, respectively. Isothermal study was conducted to examine the adsorption capacity of POFA by Langmuir and Freundlich models, whereas the kinetic study was conducted to examine the adsorption mechanism of POFA by pseudo-first and pseudo-second-order models. Consequently, the adsorptive removal of colour, COD, and NH<sub>3</sub>-N onto POFA were favourably fitted to Langmuir isotherm with maximum adsorption capacities of colour, COD, and NH<sub>3</sub>-N at 28.329 Pt-Co/g, 27.778, and 0.0508 mg/g, respectively, indicating that TPOFA.KOH has high adsorption capacity for organic compounds compared with NH<sub>3</sub>-N. The kinetic data agreed satisfactorily with the pseudo-second-order which indicated that the adsorption process was controlled by chemisorption.

*Keywords:* Adsorption; Kinetics; Palm oil fuel ash; Stabilised landfill leachate; Waste management

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