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Treatment of landfill leachate by hybrid coagulation and adsorption on modified waste activated sludge

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ABSTRACT

Currently, the production, treatment and management of landfill leachate are recognized as one of the greatest problems related to environmental and economical operation of sanitary landfills. Hence, in the current research, leachate treatment was studied using hybrid chemical coagulation using poly-aluminum chloride (PACl)-adsorption process using modified waste activated sludge (MWAS). The samples of leachate were collected from landfill site of Zahedan, Sistan and Baluchestan province, Iran. In the optimum conditions of coagulation process (pH = 8 and 400 mg/L PACl), the average 5-d biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), total phosphorus (TP), and total suspended solids (TSS) removals were approximately 67.5%, 69.3%, 63.6%, 73.1%, and 81.3%, respectively. Afterwards, the adsorption process on MWAS was applied for further treatment of the landfill leachate. Results illustrated a good performance for the adsorptive removal of major parameters including BOD_5, COD, TKN, TP, and TSS at initial pH of 8 and adsorbent dose of 12 g/L for contact time of 120 min. The adsorption data were in good agreement with Langmuir and Freundlich isotherms. The adsorption capacity calculated from the Langmuir isotherm was 103.09 mg COD/g of MWAS (at 308 K). Thermodynamic study of the adsorption process for the leachate treatment by MWAS showed the spontaneous nature of adsorption. Furthermore, based on the enthalpy magnitude, the process was found to be endothermic physisorption. Finally, the findings demonstrated the applicability of MWAS in the adsorptive leachate treatment.

Keywords: Landfill leachate; Chemical coagulation; Adsorption; Waste activated sludge

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