



Optimization of Washing Conditions and Adsorption Process for Petroleum Hydrocarbon Removal from Drill Cuttings

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Abstract

The offshore drill cuttings (DC) contaminated with total petroleum hydrocarbon (TPH) are recognized as hazardous wastes which require the proper management and disposal. A potential washing process has been widely applied; however, the process requires high volume of washing agent causing high treatment cost. Therefore, the performance of various influenced factors on TPH removal from DC by washing and subsequent purification of washing solution through an adsorption process was investigated. DC were washed with the organic solvent, i.e. ethyl lactate (EL) by various five factors: EL to DC ratio ($L/S = 3-10 \text{ mL.g}^{-1}$), washing time (1-20 min), mixing speed (50-150 rpm), water to DC ratio ($R/S = 1-10 \text{ mL.g}^{-1}$), and rinsing time (1-10 min). The TPH removal efficiency is highly dependent on L/S ratio followed by mixing speed and washing time, respectively. The washing condition provided the maximum TPH removal efficiency up to 87% at the L/S of 10 mL/g, washing time of 20 min, mixing speed of 100 rpm, R/S of 10 mL/g, and rinsing time of 1 min. The adsorption experiment was carried out to remove TPH from washing solution generated from the optimum washing condition. Two types of commercial granular activated carbon (GAC) including coal-based and coconut shell-based were applied. The results show, the coal-based GAC performed well in removing TPH from washing solution than coconut shell-based, because of the small particle sizes of coal-based GAC lead to higher surface area than coconut shell-based. Thus, coal-based GAC is recommended as an alternative for solvent recovery in DC washing process to minimize the chemical waste as well as the overall operational cost.

Keywords: *Drill cuttings, Ethyl lactate, Washing process, Total petroleum hydrocarbon, Activated carbon*