

Oil removal from industrial wastewater using flotation in a mechanically agitated flotation cell

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Abstract

This paper investigates the flotation of oil from wastewater in a laboratory-scale mechanically agitated flotation cell. Mechanical flotation cells are used commercially for oil flotation but, to the authors' best knowledge, there are no studies on their flotation performance in the literature. Some researchers have suggested that mechanically agitated systems are inappropriate for oil flotation as the high shear rates may break up the fragile organic flocs. The chemical pretreatment operating factors of pH and type of acid adjuster, coagulant type and dosage and flocculant dosage were firstly investigated. When using H_3PO_4 for pH adjustment, a preferential pH of 5.5 was identified. When using H_2SO_4 , a pH of 5.5 was not optimal. The acid type was subsequently the determining factor. $\text{Al}_2(\text{SO}_4)_3$ was a more effective coagulating agent than lime, based on coagulant and flocculant dosages required (0.5mg/l when using $\text{Al}_2(\text{SO}_4)_3$ and 1.5 mg/l when using lime). The flotation cell operating factors of aeration rate and impeller speed were subsequently investigated. Oil removal rates were found to increase at higher levels of aeration and agitation. This suggests that oil flotation is both possible and beneficial in high-shear turbulent environments. However, residual oil concentrations could not be reduced to below 50 to 100 mg/l which is higher than the desired target of 50 mg/l.

Keywords: oil flotation; wastewater, mechanical flotation cell