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Authors: Arash Fella Jahromi, Maria Elektorowicz

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Electrokinetically Assisted Oil-Water Phase Separation in Oily Sludge with Implementing Novel Controller System

Arash Fella Jahromi ^{1*}, Maria Elektorowicz ¹

¹ Department of Building Civil and Environmental Engineering Concordia University, 1455 De Maisonneuve Blvd. W., Montreal, Quebec, H3G 1M8, Canada

^{1*} Corresponding author e-mail: a_fella@encs.concordia.ca

Highlights

- Novel controller has been employed to an electrokinetic system for demulsification of hazardous oil sludge.
- Percolation theory is applied to control an electrical system for treatment of water-in-oil emulsions.
- Controller secures the four-phase separation during extended exposure time.
- Novel controller enhances the mobility of phases to increase oil to water volumetric ratio.

Abstract

Upstream and downstream petroleum industry generate of significant amounts of oily sludge per day. On the other hand, a disposal of such sludge requires expensive pre-treatments following local regulations. Conventional processes, like centrifugal separation provide sludge volume reduction and water extraction. However, water-in-oil emulsion requires extra stages for phase separation, which overall increases the costs. Therefore, electrokinetically (EK) assisted oil-water phase separation method was considered. In this study, a novel implemented controller, installed into the EK system, permitted to increase the length of exposure time to electrical field, while a significant decrease of energy consumption was observed. The controller, implemented based on Percolation Theory and applied to a linear horizontal EK system, showed enhanced sludge demulsification and improvement the quality of separated fractions. TGA analysis showed a superior quality of liquids extracted by EK with controller comparing to liquids without controller or generated by centrifuging process. A reaction rate with respect to temperature to assess the presence of

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