

Emulsified Oil Removal in Produced Water by Graphite-Based Adsorbents Using Adsorption Coupled with Electrochemical Regeneration

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Abstract : One of the big challenges for produced water treatment is removing oil from water in the form of emulsified droplets which are not easily separated. An attractive approach is adsorption, as it is a simple and effective process. However, adsorbents must be regenerated in order to make the process cost effective. Several sorbents have been tested for treating oily wastewater. However, some issues such as high energy consumption for activated carbon thermal regeneration have been reported. Due to their significant electrical conductivity, Graphite Intercalation Compounds (GIC) were found to be suitable to be regenerated electrochemically. They are non-porous materials with low surface area and fast adsorptive capacity which are useful for removal of low concentration of organics. An innovative adsorption/regeneration process has been developed at the University of Manchester in which adsorption of organics are done by using a patented GIC adsorbent coupled with subsequent electrochemical regeneration. The oxidation of adsorbed organics enables 100% regeneration so that the adsorbent can be reused over multiple adsorption cycles. GIC adsorbents are capable of removing a wide range of organics and pollutants; however, no comparable report is available for removal of emulsified oil in produced water using abovementioned process. In this study the performance of this technology for the removal of emulsified oil in wastewater was evaluated. Batch experiments were carried out to determine the adsorption kinetics and equilibrium isotherm for both real produced water and model emulsions. The amount of oil in wastewater was measured by using the toluene extraction/fluorescence analysis before and after adsorption and electrochemical regeneration cycles. It was found that oil in water emulsion could be successfully treated by the treatment process and More than 70% of oil was removed.

Keywords : adsorption, electrochemical regeneration, emulsified oil, produced water

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