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Cost-Effective Materials for Hydrocarbons Recovery from Produced Water

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Abstract : Produced water (PW) is one of the largest by-volume waste streams and one of the most challenging effluents in the oil and gas industry. This is due to the variation of contaminants that make up PW. Severalmaterialshavebeen developed, studied, and implemented to remove hydrocarbonsfrom PW. Adsorption is one of the most effective ways ofremoving oil fromPW. In this work, three new and cost-effective hydrophobic adsorbentmaterials based on 9-octadecenoic acid grafted graphene (POG) were synthesized for oil/water separation. Graphene derived from graphite was modified with 9-octadecenoic acid to yield 9-octadecenoic acid grafted graphene (OG). The newsynthesized materials which called POG25, POG50, and POG75 were characterized by using N_2-physisorption (BET) and Fourier transform infrared (FTIR). The BET surface area of POG75 was the highest with 288 m^2/g, whereas POG50 was 225 m^2/g and POG25 was lowest 79 m^2/g. These three materials were also evaluated for their oil-water separation efficiency using a model mixture, whichdemonstrated that POG-75 has the highest oil removal efficiency and the faster rate of the adsorption (Figure-1). POG75 was regenerated, and its performance was verified again with a little reduced adsorption rate compared to the fresh material. The mixtures that used in the performance test were prepared by mixing nonpolar organic liquids such as heptane, dodecane, or hexadecane into the colored water. In general, the new materials showed fast uptake of the certain quantity of the oildue to the high hydrophobicity nature of the materials, which repel water as confirmed by the contact angle of approximately 150˚. Besides that, novel superhydrophobic material was also synthesized by introducing hydrophobic branches of laurate on the surface of the stainless steel mesh (SSM). This novel mesh could help to hold the novel adsorbent materials in a column to remove oil from PW. Both BOG-75 and the novel mesh have the potential to remove oil contaminants from produced water, which will help to provide an opportunity to recover useful components, in addition, to reduce the environmental impact and reuse produced water in several applications such as fracturing.

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