

Treatment of residual lubricating oil using rice husk-based material as ecological adsorbent

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Abstract

One of the most significant environmental problems the world population faces is the inadequate disposal of petroleum derivatives. Lubricant oil is a hazardous waste due to its properties and characteristics. This study is a new proposal for using rice waste as an adsorbent to remove lubricating oils from a water medium. Rice husk from local industries was prepared using four different techniques: thermal treatment, alkaline treatment, acid treated and without treatment. The experiment used a mineral-based lubricating oil for gasoline and ethanol engines as adsorbate. Adsorbents were characterized using thermal gravimetric analysis (TGA), differential scanning calorimetry (DSC), morphological structure (SEM), energy-dispersive spectroscopy (EDS), Fourier transform infrared (FTIR) spectroscopy, and X-ray diffraction (XRD) analysis. Specific surface area and pore size distribution (BET/BJH). The adsorbent without treatment showed the smallest surface area ($0.79 \text{ m}^2 \text{ g}^{-1}$), while the adsorbent produced using acid treatment showed the largest ($3.71 \text{ m}^2 \text{ g}^{-1}$). The adsorption kinetic behavior was obtained by adjusting the pseudo-first-order, pseudo-second-order, and Elovich models. Elovich models showed more adequate results to represent the kinetic profile. The adsorbents showed high adsorption capacities, ranging from 1650 to 2000 mg g^{-1} . The adsorbent produced using heat treatment (RH-H) was the most efficient for removing lubricating oil.

Keywords

Adsorption, Lubricating oil, Rice husk, Adsorption capacities