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Preparation of Chemically Activated Carbon from Waste Tire Char for Lead Ions Adsorption and Optimization Using Response Surface Methodology

Authors : Lucky Malise, Hilary Rutto, Tumisang Seodigeng

Abstract : The use of tires in automobiles is very important in the automobile industry. However, there is a serious environmental problem concerning the disposal of these rubber tires once they become worn out. The main aim of this study was to prepare activated carbon from waste tire pyrolysis char by impregnating KOH on pyrolytic char. Adsorption studies on lead onto chemically activated carbon was carried out using response surface methodology. The effect of process parameters such as temperature (°C), adsorbent dosage (g/1000ml), pH, contact time (minutes) and initial lead concentration (mg/l) on the adsorption capacity were investigated. It was found that the adsorption capacity increases with an increase in contact time, pH, temperature and decreases with an increase in lead concentration. Optimization of the process variables was done using a numerical optimization method. Fourier Transform Infrared Spectra (FTIR) analysis, XRay diffraction (XRD), Thermogravimetric analysis (TGA) and scanning electron microscope was used to characterize the pyrolytic carbon char before and after activation. The optimum points 1g/ 100 ml for adsorbent dosage, 7 for pH value of the solution, 115.2 min for contact time, 100 mg/l for initial metal concentration, and 25°C for temperature were obtained to achieve the highest adsorption capacity of 93.176 mg/g with a desirability of 0.994. Fourier Transform Infrared Spectra (FTIR) analysis and Thermogravimetric analysis (TGA) show the presence of oxygen-containing functional groups on the surface of the activated carbon produced and that the weight loss taking place during the activation step is small.

Keywords : waste tire pyrolysis char, chemical activation, central composite design (CCD), adsorption capacity, numerical optimization
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