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Sulfurized porous carbon for enhanced mercury removal: Process optimization using response surface methodology

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This study focuses on the surface modification of porous material which involves the sulfurization process of activated carbon using elemental sulfur and its application to remove aqueous $HgCl_2$. The sulfur impregnation will allow sulfur to make a carbon sulfur complex at the surface and thus enhances the removal of mercury over virgin carbon due to the formation of mercuric sulfide on the surface. The process of sulfurization was optimized using a popular response surface methodology (RSM) with Box-Behnken design suggested by a statistical software MINITAB-15 and the mercury removal efficiency was examined by studying the effect of impregnation temperature, carbon to sulfur ratio and time of impregnation. The temperature for impregnation was selected in the range of 250 to 600 °C, carbon to sulfur ratio (CSR) was selected in the range of 0.5 to 4 and the impregnation time of 15 to 45 minutes. The reaction was conducted in an inert atmosphere under nitrogen flow. The optimum conditions were found out to be an impregnation temperature of 544 °C, CSR of 0.53 and impregnation time of 43 minutes with the predicted value of $HgCl_2$ adsorption to be 85 mg/g. The experimental value obtained was 83 mg/g which makes the process satisfactorily in agreement with the model predicted value.

Biography

Kashif Rashid is a graduate student and is doing Master of Science in Chemical Engineering from The Petroleum Institute, Abu Dhabi, UAE.

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