

Siliceous waste material supported MOF-5 for carbon monoxide capture at low temperature

Abstract

This study investigated the removal of carbon monoxide (CO) by using modified metal-organic framework-5 (MOF-5) adsorbent. The incorporation of siliceous waste materials (i.e., rice husk ash (RHA) and coal fly ash (CFA)) and the effect of sonication and triethylamine (TEA) were investigated to determine their effect on CO capture performance. Experimental results showed that the combined use of sonication, TEA and the presence of siliceous waste materials in MOF-5 resulted in a significant increase in the CO adsorption capacity from 1.8 mg/g (pristine MOF-5) to 8.18 mg/g (modified MOF-5-RHA₁₀₀₀-CFA(2:1)-TEA/UB/b). Kinetic studies showed that the pseudo-second-order kinetic model could more accurately predict the CO adsorption on the modified MOF-5 adsorbent, suggesting that chemisorption is the main mechanism for CO capture. Characterization techniques using BET, FTIR, and SEM/EDX verified structural and compositional changes in the modified MOF-5. This study provided valuable insights into the potential of siliceous waste material supported MOF-5 for efficient CO capture, suggesting future research directions in understanding the sonication effect and optimizing synthesis conditions for improved sustainability and performance.

Keywords

Climate change; CO capture; Emission; MOF-5