

Adsorptive Desulfurization of Using Cu(I) - Y Zeolite via π -Complexation

Authors : Moshe Mello, Hilary Rutto, Tumisang Seodigeng, Itumeleng Kohitlhetse

Abstract : The accelerating requirement to reach 0% sulfur content in liquid fuels demand researchers to seek efficient alternative technologies to challenge the predicament. In this current study, the adsorption capabilities of modified Cu(I)-Y zeolite were tested for the removal of organosulfur compounds (OSC) present in tire pyrolytic oil (TPO). The π -complexation-based adsorbent was obtained by ion exchanging Y-zeolite with Cu⁺ cation using liquid phase ion exchange (LPIE). Preparation of the adsorbent involved firstly ion exchange between Na-Y zeolite with a Cu(NO₃)₂ aqueous solution of 0.5M for 48 hours followed by reduction of Cu²⁺ to Cu⁺. Fixed-bed breakthrough studies for TPO in comparison with model diesel comprising of sulfur compounds such as thiophene, benzothiophenes (BT), and dibenzothiophenes (DBT) showed that modified Cu(I)-Y zeolite is an effective adsorbent for removal of OSC in liquid fuels. The effect of operating conditions such as adsorbent dosage and reaction time were studied to optimize the adsorptive desulfurization process. For model diesel fuel, the selectivity for adsorption of sulfur compounds followed the order DBT> BT> Thiophene. The Cu(I)-Y zeolite is fully regeneratable and this is achieved by a simple procedure of blowing the adsorbent with air at 350 °C, followed by reactivation at 450 °C in a rich helium surrounding.

Keywords : adsorption, desulfurization, TPO, zeolite

Conference Title : ICAEEAE 2023 : International Conference on Applications of Energy Engineering and Alternative Energy

Conference Location : Dubai, United Arab Emirates

Conference Dates : February 16-17, 2023