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Selective removal of Sulfur and Nitrogen compounds from Model Feed: Synthesis, characterization and adsorption application of alumina-based adsorbents

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Abstract

A novel adsorbent based on a support + linker + π-acceptor formulation has been developed and applied for the direct selective removal of refractory heteroatoms (sulfur and nitrogen species) present in various oil feeds. Pristine mesoporous Al2O3 and 10wt.% TiO2-Al2O3 were synthesized and used as supports for immobilizing ethylenediamine (EDA) linker followed by the π-acceptor, 2, 7- Dinitro-9-fluorenone (DNF). The materials were characterized using BET, FTIR, TGA techniques to ascertain their physicochemical properties. From the adsorption studies using model compounds (thiophene and pyridine) in ultra-low sulfur diesel (ULSD) feedstock, the Al2O3-EDA-DNF (adsorbent A) showed 41.5% sulfur removal efficiency, whiles its 10 wt.% Al2O3-EDA-DNF (adsorbent B) counterpart gave 51.0% removal efficiency. For these adsorbents, no significant removal of nitrogen species was observed with the model feed; however, when the adsorbents A and B were used for adsorption of a pre-treated oil feed, different results were obtained. Adsorbent A successfully removed 85.7 % and 24.3% of the sulfur and nitrogen impurities, respectively, whereas adsorbent B removed 74.8% of the sulfur but negligible amounts of nitrogen species. This successful removal can be attributed to the textural properties of the supports used for the synthesized adsorbents.

Biography: Anakaren is an MSc. Student who will graduate in May 2020. Her research is focused on the removal of nitrogen and sulfur from gas oil feeds to improve the quality of final products and meet environmental regulations.

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