

Catalytic study of Ni/Ce/Al₂O₃ and Ni/Ca/Al₂O₃ on the removal of naphthenic acid from petroleum crude oil utilizing sodium thiocyanate in ethanol

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ABSTRACT

The naphthenic acids (NAs) present in the crude oil can lead to the corrosion problems in oil refinery equipment apart from reduces the performances of the oil. In this study, the method to remove NA were done by means of extraction using sodium thiocyanate in ethanol with the aid of Ni/Ca/Al₂O₃ and Ni/Ce/Al₂O₃ catalysts at 27 °C reaction temperature. The catalyst was prepared by incipient wetness impregnation method (IWI) and calcined at three different temperature, 800, 900 and 1000 °C respectively. The efficiency of the extraction was affected by the catalyst calcination temperature. Both catalysts calcined at 800 and 900 °C gave total acid number (TAN) value more than 1 mg KOH/g while by using Ni/Ca(10:90)/Al₂O₃ and Ni/Ce(10:90)/Al₂O₃ calcined at 1000 °C the TAN value were reduced to 0.28 and 0.65 mg KOH/g respectively. Brunauer-Emmett Teller (BET) result shows both catalysts have large surface area that provide more reaction sites when calcined at 1000 °C. X-ray Diffraction Spectroscopy (XRD) analysis of Ni/Ca/Al₂O₃ catalyst revealed that the active site was dominated by the Al₂O₃ species while CeO₂ was the active site for Ni/Ce/Al₂O₃ catalyst. In conclusion, both catalysts reduced the TAN value of acidic crude oil efficiently.

KEYWORDS

Acidic crude oil; Crude oil; Catalyst; Naphthenic acid; Total acid number

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