NAPHTHENIC ACID REMOVAL FROM PETROLEUM CRUDE OIL UTILIZING SODIUM THIOCYANATE WITH THE AID OF Ni/Ce AND Ni/Ca CATALYSTS

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Final Year Project Report Submitted in
Partial Fulfilment of the Requirements for the
Bachelor of Science (Hons.) Chemistry
Universiti Teknologi MARA

JULY 2017

ABSTRACT

NAPHTHENIC ACID REMOVAL FROM PETROLEUM CRUDE OIL UTILIZING SODIUM THIOCYANATE WITH THE AID OF Ni/Ce AND Ni/Ca CATALYSTS

The Naphthenic Acids (NAs) found in crude oil can leads to corrosion problems in oil refinery equipment, storage, facilities and even reduces the performances of the oil. In this study, catalytic deacidification reaction was done in order to lowering Total Acid Number (TAN) in crude oil to below than one mg KOH/g utilizing sodium thiocyanate with the aid of Ni/Ca and Ni/Ce catalysts. The catalyst were supported on the alumina through Incipient Wetness Impregnation (IWI) methods and calcined at calcination temperature of 800, 900 and 1000°C. Ni/Ca and Ni/Ce catalyst were characterized by using X-ray Diffraction Spectroscopy (XRD), Brunauer-Emmett-Teller (BET), Fourier Transform Infrared Spectroscopy (FTIR) and Thermogravimetry Analysis-Differential Thermal Analysis (TGA-DTA) to study physical properties of the catalyst. The results shows that Ni/Ca(10:90)/Al_2O_3 and Ni/Ce(10:90)/Al_2O_3 catalyst successfully reduced number of acids in crude oil to below that 1.00 mg KOH/g. Ni/Ca(10:90)/Al_2O_3 catalyst reduced TAN of crude oil from original TAN, 2.80 mg KOH/g to 0.28 mg KOH/g while Ni/Ce(10:90)/Al_2O_3 catalyst reduced to 0.65 from 2.80 mg KOH/g at 1000°C calcination temperature and catalyst loading of 4 bead (0.50%). This proven by BET results that shows both catalysts have the highest surface area, average pore diameter and pore volume at calcination temperature of 1000°C that allows more molecular NAs to enter pores of the catalyst. XRD analysis proposed Al_2O_3 face centered cubic (fcc) was active site for Ni/Ca(10:90)/Al_2O_3 catalyst while CeO_2 fcc was the active site for Ni/Ce(10:90)/Al_2O_3 catalyst. Stretching of S-C=N thiocyanate and pure metal oxides stretching modes were detected on Ni/Ca(10:90)/Al_2O_3 catalyst at wavelength of 2075.90 and 567.51 to 468.94 cm^{-1} respectively by FTIR analysis after catalytic deacidification process which indicates that there were impurities have adsorbed on the catalyst. The catalytic reaction was fixed at reaction time of 15 minutes and temperature at 27°C. As a conclusion, both catalysts can reduce TAN to less than 1.00 mg KOH/g. However, Ni/Ca(10:90)/Al_2O_3 catalyst shows more potential catalyst compared to Ni/Ce(10:90)/Al_2O_3 catalyst since it can lowered down acid number in crude oil to most lowest value than Ni/Ce(10:90)/Al_2O_3catalyst.

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