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Processing of Middle East Crude with Canadian Oil Sands Bitumen-derived Synthetic Crude Oil

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Light (LGO) and heavy or vacuum gas oil (VGO) fractions from mixed Middle East crudes and respective fractions from a typical Canadian oil sands bitumen-derived synthetic crude oil (SCO) were blended at various ratios (up to 40%) and hydrotreated to investigate the kinetics of sulfur and nitrogen removal, and product quality. Hydrotreatment was carried out in down-flow micro reactors over commercially available NiMo/Al_2O_3 and CoMo/Al_2O_3 catalysts, varying reactor temperature (350-390°C), pressure (5-10 MPa), and space velocity (1-6 h^{-1}). Blending the LGO with SCO enhanced both sulfur and nitrogen removal from Middle East crude LGOs. Ultra-low sulfur diesel (< 10 wtppm) meeting the Japanese cetane number (*CN*) specification could be produced under reasonable operating conditions. Engine tests of the hydrotreated LGOs showed that the emissions of CO, HC, NO_x, and PM (particulate matters) from a diesel engine were correlated with the fuel *CN* and aromatics content. Hydrotreatment of blends of VGO and SCO led to lower sulfur content, but higher nitrogen content in the product oils. The estimated yields of FCC gasoline were slightly decreased by blending the SCO but not significantly.

Keywords: Exhaust emission, Fluid catalytic cracking, Hydrotreatment, Oil sands bitumen, Synthetic crude oil, Ultra-low sulfur diesel

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