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Transition metal doped ZSM-5 for production of speciality chemicals (BTX) and fuel-grade hydrocarbons from Corn Distiller's Oil

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Catalytic conversion of Corn Distiller's Oil into fuel grade hydrocarbons using Mo/ZSM-5 in a fixed-bed reactor

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Current research in the field of transforming vegetable oils such as corn, sunflower and soyabean into biofuels using heterogeneous catalysts has been limited to production of straight chain alkanes with minimum isomerization and aromatic content, resulting in poor cold flow properties; making it unsuitable for drop-in gasoline/diesel purposes or the production of sustainable aviation fuels. Biodiesel production using these catalytic processes result in production of oxygenated compounds, which further lowers the high heating value of the fuel.

The present study evaluates a novel method for continuous production of drop-in biofuels in a fixed bed reactor using Mo/ZSM-5; feedstocks such as oleic acid and linoleic acid in the presence of water, resulting in improved reaction rates for deoxygenation of triglycerides and fatty acids in the form of either CO, CO_2 or H_2O followed by saturating and reforming the straight chain hydrocarbons into linear aromatic benzenes with excellent cold flow properties, high heating values, low ignition temperatures, etc. The process described here requires no addition source of hydrogen for the saturation of the olefins present after deoxygenation reaction.

The fixed-bed reactor system has been continuous operated at predefined flow rates with oleic acid and linoleic acid for a period of 8 days before the catalyst gets deactivated. Over 85% liquid yields have been obtained after the reaction with about 99% deoxygenated content present in the final product. The pour point and cloud point were - 35 °C and -37 °C respectively. Based on this, further investigation related to the catalytic activity, regeneration studies and process optimization has been evaluated. This study highlights a promising route to produce speciality

chemicals such as ethyl benzene and toluene as well as biofuels with similar characteristics as that of green diesel/gasoline, resulting in lowering our commercial dependencies for these resources on fossil fuels such as crude oil.