TRANSFORMATIVE CATALYTIC TECHNOLOGY FOR ADVANCED BIOFUEL PRODUCTION

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Biodiesel producers are facing challenges of high cost feedstocks and lack of enabling technology to process low grade (low cost) lipids having high free fatty acid (FFA) and water levels. In order for biodiesel producers to become commercially viable, they must be able to use less expensive lipid feedstocks, a wide range of crude bio-oil feedstocks, with varying FFA content, including palm oil (FFA \textasciitilde 12%), residual corn oil (FFA \textasciitilde 15%) from the distiller dried grains (DDGs), animal fats (FFA 2-35%), yellow grease (FFA 5-15%), and brown grease (50-100%). In order to avoid the problems related to homogeneous catalytic system, a transformative heterogeneous catalytic conversion technology using the heterogeneous metallocides catalyst supported by ZrO\textsubscript{2} has been studied in a continuous flow reactor system. The catalyst processing factors (aging, drying, and extruding, and drying) and the reactor scale-up factors (reactor diameter and length ratio, residence time, superficial flow velocity) which determine catalytic activity and durability has been studied. Downward feed flow has a plug flow feature and gives higher FAME yield than upward flow mode. Superficial velocity of the feed gives effects on both the degree of mixing of the reactants and dissolution of the active sites on the catalyst surface due to shear force induced by the viscous flow. In order to decrease shear force, the void space of the catalyst bed should be increased and the reactor diameter and length ratio should be optimized. This technology can potentially reduce the feedstock, operating and processing costs and reenergize the latent biodiesel production facilities to enable to be used for biodiesel production with various non-edible waste lipids.