

Decarboxylation of Waste Coconut Oil and Comparison of Acid Values

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Abstract : Green diesel is an upcoming category of biofuels, which has more practical advantages than biodiesel. Production of green diesel involves production of hydrocarbons from various fatty acid sources. Though green diesel is chemically similar to fossil fuel hydrocarbons, it is more environmentally friendly. Decarboxylation of fatty acid sources is one of green diesel production methods and is less expensive and more energy efficient compared to hydrodeoxygenation. Free fatty acids (FFA), undergo decarboxylation readily than triglycerides. Waste coconut oil, which is a rich source of FFA, can be easily decarboxylated than other oils which have lower FFA contents. These free fatty acids can be converted to hydrocarbons by decarboxylation. Experiments were conducted to carry out decarboxylation of waste coconut oil in a high pressure hastelloy reactor (Toption Goup LTD), in the presence of soda lime and mixtures of soda lime and alumina. Acid value (AV) correlates to the amount of FFA available in a sample of oil. It can be shown that with the decreasing of AV, FFAs have converted to hydrocarbons. First, waste coconut oil was reacted with soda lime alone, at 150 °C, 200 °C, and 250 °C and 1.2 MPa pressure for 2 hours. AVs of products at different temperatures were compared. AV of products decreased with increasing temperature. Thereafter, different mixtures of soda lime and alumina (100% Soda lime, 1:1 soda lime and alumina and 100% alumina) were employed at temperatures 150 °C, 200 °C, and 250 °C and 1.2 MPa pressure. The lowest AV of 2.99 ± 0.03 was obtained when 1:1 soda lime and alumina were employed at 250 °C. It can be concluded with respect to the AV that the amount of FFA decreased when decarboxylation temperature was increased. Soda lime:alumina 1:1 mixture showed the lowest AV among the compositions studied. These findings lead to formulate a method to successfully synthesize hydrocarbons by decarboxylating waste coconut oil in the presence of soda lime and alumina (1:1) at elevated temperatures such as 250 °C.

Keywords : acid value, free fatty acids, green diesel, high pressure reactor, waste coconut oil

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