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Pre-treatment of used cooking oil for the manufacture of biodiesel using heterogeneous catalyst

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There is a great deal of concern regarding the use of fossil fuels and as a result alternative fuel sources are currently being investigated. Vegetable oils can be converted to biodiesel (fatty acid methyl esters, FAME) by means of a transesterification reaction. Some of the problems associated with using virgin vegetable oils can be eliminated with used cooking oil (UCO) as the raw material. UCO contains free fatty acids (FFAs) and other impurities due to cooking which result in side reactions during transesterification. Esterification can be used to convert FFAs into FAME, creating an acid free feedstock for biodiesel production. For this study three heterogeneous ion-exchange catalysts (Purolite D5081, Purolite D5082 and Amberlyst 36) have been investigated. The ASTM D974 titration method was used to monitor the FFAs concentration during the experiments. The highest FFAs conversion was found to be 88% using Purolite D5081 as catalyst, whilst Purolite D5082 and Amberlyst 36 achieved approximately 78% and 44% conversion, respectively. Once esterification is complete the separation steps, phase separation, filtration and methanol removal are required to ensure the material is suitable for transesterification.

Keyword: Biodiesel, esterification, ion-exchange resin, used cooking oil, heterogeneous catalyst, separation.