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Comparison of Novozyme 435 and Purolite D5081 as heterogeneous catalysts for the pretreatment of used cooking oil for biodiesel production

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HIGHLIGHTS

- We compared an immobilised enzyme, Novozyme 435 to an ion-exchange resin, Purolite D5081.
- Both catalysts gave high conversion of FFAs to biodiesel.
- A much lower concentration of methanol was required when using Novozyme 435.
- Novozyme 435 results in a much faster initial reaction rate compared to Purolite D5081.

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ABSTRACT

The catalytic performance of two types of catalysts, an ion-exchange resin, Purolite D5081 and an immobilised enzyme, Novozyme 435, was compared for the esterification pretreatment of used cooking oil (UCO) for the preparation of biodiesel. The reactions were carried out using a jacketed batch reactor with a reflux condenser. The effect of mass transfer limitations was investigated and it was shown that internal and external mass transfer limitations were negligible. An immobilised enzyme, Novozyme 435, was investigated because it has been shown to give high free fatty acids (FFAs) conversion. This catalyst has been compared to an ion-exchange resin, Purolite D5081, which was developed for the esterification of UCO for the production of biodiesel. It was found that a conversion of 94% was achieved using Purolite D5081 compared to 90% conversion with Novozyme 435. However, the optimum methanol to FFA ratio for Purolite D5081 was 98:1 compared to 6.2:1 for Novozyme 435. In addition, it has been found that with Novozyme 435 there are side reactions which result in the formation of additional fatty acid methyl esters (FAMEs) and FFAs at longer reaction times.