

BIOFUELS AND BIOENERGY

Use of 4-dodecylbenzenesulfonic acid catalyst on the methanolysis of the rapeseed oil in meso-integral EDIÄHG UHDFWRU

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This study investigates the use of 4-dodecylbenzenesulphonic acid (DBSA) as a catalyst for fatty acid methyl ester (FAME) production from rapeseed oil, using a mesoscale oscillatory baffled reactor ("meso-OBR") as a screening platform. The effects of oscillatory mixing intensity, methanol-to-oil molar ratio, catalyst to oil molar ratio and residence time on the conversion to FAME were evaluated. The reaction conditions were optimised using the Design of Experiments (DoE) methodology. A Box-Behnken design with one block, three variables (methanol to oil molar ratio, catalyst to oil molar ratio and residence time) and three replicates of the central point was used. A response surface model was able to predict the FAME conversion over a broad range of operating conditions. ANOVA analysis revealed that the catalyst to oil molar ratio and residence time were more significant than the methanol to oil molar ratio. 100% conversion of rapeseed oil to FAME was achieved under mild reaction conditions 6.5:1 methanol to oil molar ratio, 0.48:1 of catalyst to oil molar ratio and 120min. The DBSA catalyst allowed operation at a significantly lower molar ratio than in conventional acid catalysis: below 7:1, as opposed to the 9:1 typically used with sulphuric acid. Furthermore, the degree of agitation required was greatly reduced, due to its behaviour as a surfactant. Only 180 min was required to accomplish the reaction compared with 19hr that for sulphuric acid. Finally, very little DBSA

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