Successive Optimisation of Waste Cooking Oil Transesterification In A Continuous Microwave Assisted Reactor

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ABSTRACT

This paper presents an optimization study of waste cooking oil (WCO) transesterification in a continuous microwave assisted reactor (CMAR). The custom-built CMAR employed an integrated proportional-integral-derivative controller for accurate control of temperature and reactant flowrate. The fatty acid methyl ester contents in the sample were determined using gas chromatography mass spectrometry (GC-MS). The results from two-level factorial design showed that the methanol to oil molar ratio, amount of $NaOCH_3$ catalyst and reaction time influenced markedly the biodiesel conversion, with the significance of 45.99%, 6.76% and 3.21%, respectively. Further analysis using a successive optimization method generated by the Box–Behnken design predicted an optimum biodiesel conversion of *circa* 97.13% at 0.68 wt% of catalyst loading, 11.62 : 1 of methanol to oil molar ratio and 4.47 min of reaction time. Experimental validation of the optimum conditions showed an excellent agreement, with a minimum deviation of 0.18% from three replicates. The biodiesel produced in this work also met the specification of ASTM D6751.

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