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Response surface methodology-assisted optimization of intensified process for fatty acid methyl ester production from waste cooking oil in an oscillatory baffled reactor

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Intensification of transesterification reaction is crucial to minimize biodiesel production capital cost and economize its industrial production to make it an affordable and competitive fuel. The Oscillatory Baffled Reactor (OBR) is a novel process intensification reactor, which can significantly improve mass transfer and heat transfer in a chemical reaction. In this research work, optimization of Fatty Acid Methyl Ester (FAME) production from waste cooking oil was carried out using the OBR setup. Response Surface Methodology (RSM) technique was applied to find the optimum values of reaction factors, namely Reynolds number, inter-baffle space and reaction temperature (independent experimental variables) in order to maximize reaction conversion efficiency (the response). The most desirable (0.934 of 1) combination of findings to reach the highest reaction conversion of 81.92% includes: Reynolds number of 240, inter-baffle space of 5 cm and reaction temperature of 60°C. The RSM could successfully model the reaction conversion by a quadratic regression equation with p-value of 0.0286 and R-squared value of 0.8549. The suggested optimum values were investigated in a real experiment and could be successfully verified with less than 0.0062% error.

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