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Process Engineering Implications of First-Order Response Surface Analysis of Microwave-Induced Process Intensification of Coconut Oil Transesterification

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Abstract: Biodiesel from vegetable oils is regarded as an important biofuel which is already produced commercially in many countries. The key step in the production of biodiesel is the transesterification of oil into methyl esters, a reaction which is both reversible and multi-phase. Hence, there are inherent difficulties which may be addressed through process intensification techniques such as microwave irradiation. This work discusses the process engineering implications of the results of 1st-order response surface methodology (RSM) optimization of microwave-based process intensification of the transesterification of coconut oil. Six experimental factors (catalyst dosage, methanol-to-oil ratio, reaction temperature, reaction time, alkali catalyst type and the presence of agitation) are considered. Although only catalyst dosage and the presence of agitation are found to have statistically significant effects on reactor performance, the negative results are nevertheless useful for process engineering decisions with respect to scale-up.

Key Words: microwave-based process intensification; transesterification; coconut biodiesel; response surface methodology; design of experiments