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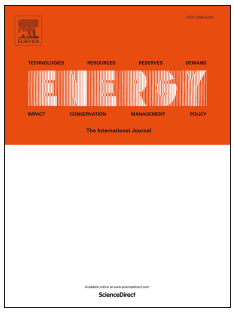

Process intensification of the transesterification of palm oil to biodiesel in a batch agitated vessel provided with mesh screen extended baffles

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Process intensification of the transesterification of palm oil to biodiesel in a batch agitated vessel provided with mesh screen extended baffles.

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Abstract:

One of the major challenges in the production of biodiesel is the immiscibility of oil and methanol. The extent of dispersion between the two phases controls the mass and heat transfer rates and consequently the rate of the transesterification reaction. In this study, we report a novel design of a batch agitated vessel used for the production of biodiesel from palm oil. The new reactor is provided with static stainless steel mesh screen baffles to promote dispersion between the two immiscible reactants. The effect of the key parameters was investigated. The reaction yield was expressed in terms of FAME (fatty acid methyl ester) concentration. The optimum transesterification reaction conditions that yielded the highest biodiesel yield (97%) were as follows: methanol to oil molar ratio of 6:1, a reaction temperature of 60 °C, a one percent (wt.%) NaOH solution, a mesh screen size of 12″ and an agitation speed of 250 rpm. In order to test whether the produced biodiesel can replace diesel oil in combustion engines we evaluated the biodiesel quality, the engine performance and the emission characteristics of a B20 (20% biodiesel and 80% petroleum diesel) blend. A reduction in carbon monoxide and a marginal increase in nitrogen oxides emissions was observed.

Keywords: Biodiesel, Palm oil methyl ester, Base-catalyzed transesterification, Baffled reactors, Performance, Emission.