Title:

Heterogeneous catalyst activation and process intensification of biodiesel synthesis using ultrasound

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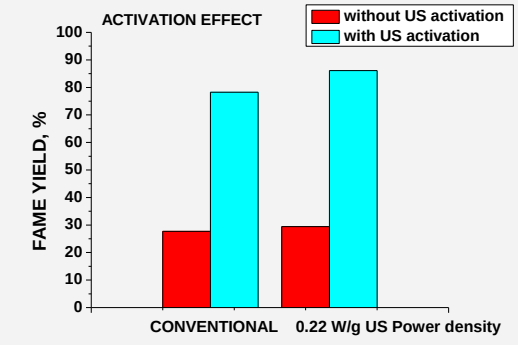
Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

Biodiesel is commonly produced via transesterification of triglycerides and alcohols in the presence of catalysts. Heterogeneous catalysts such as metal oxides, mixed oxides, supported alkali metals, zeolites, hydrotalcites, etc., have been widely studied to replace homogeneous bases. CaO can be used as heterogeneous catalyst due to its high basicity, non-corrosiveness while being environmentally friendly.

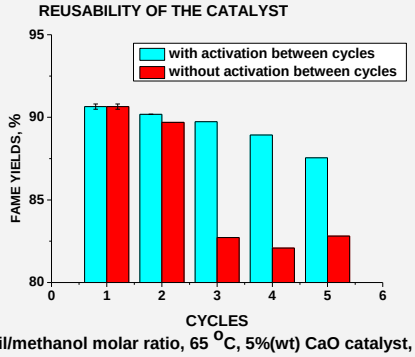
This paper presents the influence of ultrasounds (US) for catalyst activation and on intensification of the heterogeneous catalysed transesterification reaction.

The catalysts used were based on metal oxides modified with Li. They were obtained by wet-impregnation followed by drying and calcination. Catalyst characterization was performed by different methods including: DLS, SEM, TGA, FTIR and XRD.

The transesterification of sunflower oil was carried out under the following conditions: oil:methanol molar ratio 1:6, at reflux at atmospheric pressure, catalyst/oil 1-5 wt. %, reaction time 30-240 min and a stirring rate of 800 rpm. Reaction intensification with ultrasounds was performed using VIBRACELL VCX750 equipment with the following parameters: pulse sonication 5 s ON/ 5s OFF, US power density 0.2-0.4 W/g. The reusability of the catalyst was also studied.



1/6 oil/methanol molar ratio, 65 ^{O}C, 5%(wt) CaO catalyst, 120 min



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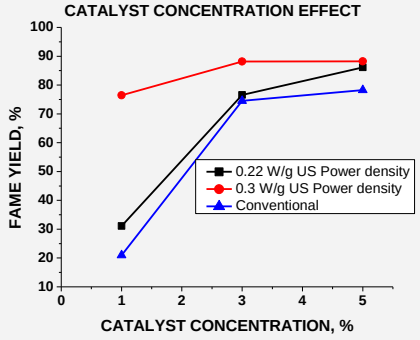
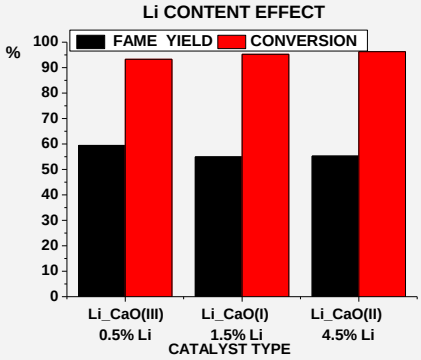


1:6 oil:methanol molar ratio, 65ºC, CaO catalyst, 120 min



1:6 oil:methanol molar ratio, 65ºC, 120 min, 0.3 W/g US Power density

Ultrasounds induced a remarkable activation of catalyst by sonication in methanol, which

resulted in the process intensification by enhancing the mass transfer between the different phases of the reaction.

The US effect was proved to be critical during the CaO catalyst activation step. This is sustained by the increase of reaction yield in conventional conditions, while for a non-activated catalyst US provided only marginal increase in reaction yield.

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