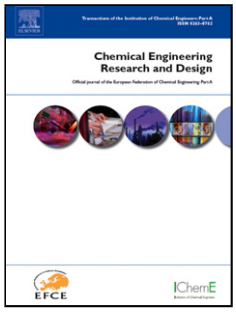

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Relating speed of sound and echo amplitude with biodiesel manufacture

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HIGHLIGHTS

- A real-time method to monitor transesterification was developed
- The method is based on low-power ultrasound pulse/echo approach
- It was possible to identify density variation of the reactional media during the transesterification
- The monitoring method did not interfere with the reaction

ABSTRACT. Biodiesel has a potential not completely exploited as substitute of diesel oil, despite it is known as biodegradable, nontoxic, and has a low-emission profile. The aim of this paper is to propose an ultrasonic method as a tool for real-time monitoring transesterification reactions by using low-power ultrasound based on a pulse/echo scheme. Two catalytic routes were tested, both using degummed soybean oil as source and KOH as catalyser. The difference between catalytic routes was the type of alcohol used (methanol and ethanol). Three different reaction times were studied: 10, 20, and 30 minutes. Low power (less than 100 mW) ultrasonic time-gated bursts were applied to the reactional media at 1 MHz. The eco was measured during the reaction, and small amounts of the reaction media were collected every 2 minutes for chemical analysis. Time of flight and echo waveform amplitude were the ultrasonic parameter of interest. The amplitude of the ultrasonic waveform was related with the variation of the ethanol-transesterification reaction rate and could help in qualitatively monitoring that reaction. Furthermore, density measurements where consistent with the variations observed on time of flight, confirming the possibility of monitoring the reaction using ultrasonic parameters. The behaviour of the ultrasonic parameters varied depending on the alcohol