

## Monitoring Synthesis of Biodiesel through Online Density Measurements

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**Abstract :** The transesterification process of triglycerides with alcohols that occurs during the biodiesel synthesis causes continuous changes in several physical properties of the reaction mixture, such as refractive index, viscosity and density. Amongst them, density can be an useful parameter to monitor the reaction, in order to predict the composition of the reacting mixture and to verify the conversion of the oil into biodiesel. In this context, a system was constructed in order to continuously determine changes in the density of the reacting mixture containing soybean oil, methanol and sodium methoxide (30 % w/w solution in methanol), stirred at 620 rpm at room temperature (about 27 °C). A polyethylene pipe network connected to a peristaltic pump was used in order to collect the mixture and pump it through a coil fixed on the plate of an analytical balance. The collected mass values were used to trace a curve correlating the mass of the system to the reaction time. The density variation profile versus the time clearly shows three different steps: 1) the dispersion of methanol in oil causes a decrease in the system mass due to the lower alcohol density followed by stabilization; 2) the addition of the catalyst (sodium methoxide) causes a larger decrease in mass compared to the first step (dispersion of methanol in oil) because of the oil conversion into biodiesel; 3) the final stabilization, denoting the end of the reaction. This density variation profile provides information that was used to predict the composition of the mixture over the time and the reaction rate. The precise knowledge of the duration of the synthesis means saving time and resources on a scale production system. This kind of monitoring provides several interesting features such as continuous measurements without collecting aliquots.

**Keywords :** biodiesel, density measurements, online continuous monitoring, synthesis

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