

# Classical conductivity sensor used to evaluate the biodiesel quality

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A sensor can be defined as a system to receive a signal or physical stimulus that responds with a signal usually electric, and transmits to a controller. For this purpose, it was used a conductivity cell as a sensor in combination with the electrochemical impedance spectroscopy (EIS) for monitoring the biodiesel quality, that is a low conductivity/highly resistive medium. The aim of this work is to evaluate the biodiesel quality and degradation by EIS using a classical conductivity cell. A classical two platinum-electrode conductivity cell (constant cell  $\kappa = 0.11$  and  $1.96 \text{ cm}^2$  surface area of each electrode) set in parallel at a fixed distance of approximately 2.16 mm was employed. Electrochemical impedance spectroscopy measurements (EIS) were performed at open circuit potential after 1h of immersion and stabilization in the 50 kHz to 5 mHz frequency range and potential disturbance of 30mV rms. The biodiesel samples for evaluation of quality were collected at the end of the transesterification reaction of refined soybean oil with ethanol after each stage of the purification process. The electrochemical impedance results showed that the impedance modulus values at low frequencies increases with the purification stages, while the residual impurities concentration, water and alcohol are minimized or eliminated, which results in the increase of biodiesel resistivity. The biodiesel purification was also evaluated by Raman spectroscopy assigned especially to the residual alcohol content evidenced by the reduction of  $\text{CH}_2\text{-OH}$  functional group peak intensity at  $883\text{cm}^{-1}$ . In Rancimat equipment model 843 was carried out the forced oxidation of the biodiesel in order to evaluate the biodiesel degradation. Electrochemical impedance measurement using a classical conductivity cell is a useful tool that allows evaluating the quality and the degradation of biodiesel, since the higher impedance modulus values are associated to a more purified biodiesel.

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