

Development and evaluation of an impedance spectroscopy sensor to assess cooking oil quality

ABSTRACT

When the cooking oil is used repeatedly, several unwanted substances are generated, which may cause health problems. This study was conducted to determine the possibility of using the impedance spectroscopy to differentiate among varying cooking oil quality at various intervals of heating time at constant temperature. The frequency has started from 100 Hz to 100kHz. Fresh, 10-hour, 20-hour, 30-hour, and 40-hour heated cooking oil was prepared by using lab oven at temperature of 180oC. In this study, a sensing probe was designed to measure the electrical properties of the oil samples. The oil samples were analyzed using a viscometer to measure the viscosity of the oil, a sensor to measure total polar compound (TPC), and an impedance probe connected to a LCR meter to measure the electrical properties of the oil. The measurements were analyzed and correlated with oil quality parameters obtained from a viscometer and a sensor of TPC. The discrimination between different heated hours of oil samples was examined and the results were compared to their physico-chemical properties such as viscosity and total polar compounds. The effect of heating of frying oils were successfully evaluated and discriminated using the impedance spectroscopy. Significant correlations ($r = -0.98472$) were found between changes in total polar compound properties of oil and the impedance values.

Keyword: Impedance; Cooking oil; Interdigitated sensor; Total polar compound