Changes in Palm and Olive Oil Viscosity and Density Induced by Prolonged Oil Heating and Repeated Frying of Potato Sticks at Different Frying Loads. Correlation with the Chemical Profile Obtained by HPSEC

Eleni P. Kalogianni[a,b], Stylianos Rafaelides[a], Thodoris D. Karapantsios[b], [a] Deparment of Food Technology, Technological Educational Institution of Thessaloniki, [b] Department of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece.

This work investigates the changes in the viscosity and density imparted to palm and olive oil (a) during repeated batch frying of potato sticks (without replenishment of the oil/fat) and (b) during pure oil heating (thermal oxidation) with the same duration as repeated batch frying (without potatoes in the fryer). Apart from these measurements the chemical profile of palm and olive oil is also determined by HPSEC analysis and the objective is to seek possible associations between viscosity and density changes with chemical alterations.

Four series (of 40 consecutive batches each one lasting 46hrs) of repeated frying experiments are conducted by combining two oil types (palm oil and olive oil) with two frying loads (1/7 and 1/35 $Kg_{potatoes}/L_{oil/fat}$). In addition, four series (lasting 46 hrs each) of pure oil heating experiments are conducted applying the same temperature profiles as those obtained during the respective repeated frying experiments.

The viscosity of both palm and olive oil increases significantly throughout the repeated frying and prolonged heating process under all the tested conditions. The changes in palm oil viscosity depend on a number of parameters: the time the fat spent at elevated temperatures, the presence or absence of potato sticks in the fryer and the potato-to oil ratio, Yet, palm oil viscosity is essentially insensitive to differences in the applied temperature profile. The viscosity of olive oil is less affected by repeated frying than palm oil and its changes depend only on the time the oil spends in elevated temperatures. To our knowledge, this is the first time that palm and olive oil viscosity changes are correlated to HPSEC results. In doing this, linear regression analysis gives a very high ($R^2 \geq 0.99$) regression coefficient. Contrary to viscosity, the measured changes in the density of the oil and fat induced by repeated frying are rather small and are related chiefly to polymerization.