

The Chemical Profile of Palm and Olive Oil as Affected by Repeated Frying of Potato Sticks and Heating. A study by HPSEC

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This work investigates the chemical changes imparted to palm and olive oil (a) during repeated batch frying of potato sticks (without replenishment of the oil or fat) and (b) during pure oil heating with the same duration as repeated batch frying (without potatoes in the fryer). To the best of our knowledge, it is the first time, that frying and heating experiments were conducted under the same time-temperature profile. This allowed quantitative comparisons of the effect of the potato presence and absence from the fryer in the oil and fat. Four series (of 40 consecutive batches each and lasting 46hrs each) of repeated frying experiments were 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 oil heating experiments were conducted applying the same temperature profiles as those obtained during the repeated frying experiments. The steep temperature drop during the potato addition in the frying experiments was made possible to reproduce in the oil/fat heating experiments thanks to a custom-made high cooling rate refrigeration system.

HPSEC analysis was performed in whole oil and fat samples as well as in the polar fraction of the samples taken at different batches along the repeated frying series. This analysis revealed the formation of three classes of polymerization products with respect to molecular size in palm oil during repeated frying. The polymerization products were of both polar and unpolar nature. The rate of polymerization depended on heating time, on the number of frying batches, on the presence or absence of potatoes from the fryer and on the applied frying load.

Olive oil behaved differently from palm oil during frying; it did not only polymerize but it hydrolyzed as well. Four classes of polymerization products with respect to molecular size were detected of both polar and unpolar nature. The rate of hydrolysis and polymerization in olive oil during frying depended only on heating time. In the absence of potatoes from the fryer, olive oil underwent only polymerization; the rate of polymerization in that case was the same as in the frying experiments.