

Short Chain and Oxy Fatty Acids as Marker for Deterioration of Fats and Oils During Heating

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During a frying process the triglycerides of the frying fat undergo various degradation reactions. By this polymerized triglycerides and polar compounds are formed, which are the most often analyzed parameters to characterize the quality of frying fats. Besides this also short chain volatile and non-volatile compounds develop from the beta cleavage of hydroperoxides. While the content of volatile compounds decrease during use and storage of the frying fat due to their volatile properties, other oxidation products like short fatty acids are bound to glycerine and show stable contents, which do not contribute to polar or polymerized compounds.

Heptanoate, octanoate as well as epoxy fatty acids derived from oleic, linoleic and linolenic acid are the most prominent alteration products detected by common procedures of fatty acid methyl ester analysis using a base catalyzed transesterification procedure. This fast and in many cases automated method is one of the mostly used in nearly all laboratories dealing with lipid analysis. The correlation between the content of heptanoate, octanoate and the epoxy fatty acids to the content of polymerized and oxidized compounds was compared in dependence of different types of oils and fats high in oleic, linoleic or linolenic acid and in dependence of temperatures from 120 °C to 200 °C and storage time for up to 20 hours. Besides these also polar and polymerized compounds together with short chain and epoxy fatty acids were analyzed in real frying fat and oil samples in order to reflect the influence of frying products on these parameters.

Short chain fatty acids show a very linear increase during heating time with steeper slopes for increase along with higher heating temperatures having highest levels of about 6 g/kg fat or oil. Polar and polymerized compounds are present in much higher amounts up to about 60 %. Polar compounds show a non linear increase, which is more temperature dependent than polymerized compounds and short chain fatty acids. Therefore better correlations were found for polymerized compounds and short chain fatty acids than for polar compounds and short chain fatty acids.