

Epoxy Fatty Acids in Fats and Oils and their Formation during Heating

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Lipid oxidation causes many degradation reactions regarding the chemical, sensory and nutritional properties of food. The detrimental effects to health of oxidized dietary fats are of concern and have to be investigated. In the great number of oxidation products epoxy fatty acids play an important role for they are readily absorbed in humans. A tolerable daily intake (TDI) was established at 1 mg/d*kg body weight for epoxy fatty acids migrating from PVC based food contact material in infant foods.

Epoxy fatty acids can be determined with common procedures for the determination of the fatty acid composition, which is one of the most common analytical procedures applied all over the world in lipid analysis. In case of oils with unknown composition or interfering substances a purification step using a SPE cartridge can be used. Compared to the determination of polar compounds by column chromatography and gravimetric quantification the procedure is automatable and precise.

The content of epoxy fatty acids originating from heated frying oils, unheated edible oils and fatty foods is reported. Surprisingly, the presence of significant amounts of epoxy fatty acids in chocolate, pumpkin seed oil and sweet almond seed oil was detected at levels up to 5 g/kg. Higher levels at up to 17 g/kg were found in used frying fats and oils. The formation of epoxy fatty acids during heating was studied over a range of oils (rapeseed, soybean, sunflower, peanut and palm oils), time (0 to 16 h) and temperature (160 to 190 °C) in order to characterize the influence of these parameters. In addition the effect of different batches of the same kind of oil on the formation of epoxy fatty acids during heating was assessed.

The amount of epoxy fatty acids formed during heating was compared to the common limits for the evaluation of frying fats like the amount of polar compounds and polymerized triglycerols. The content of epoxy fatty acids is highly influenced by the kind of oil in test and is not a linear function of the polar compounds or the polymerized triglycerols.

Exceeding the TDI for ESBO with epoxy fatty acids from food is not expected for a balanced nutrition. However, for children and young people eating frequently fried foods in addition to an elevated chocolate consumption might have some relevance.