

Formation of Volatile Degradation Products in Refined and Virgin Rapeseed and Sunflower Oil During Frying

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During frying oil as heat transfer medium is exposed continuously to elevated temperature in the presence of air and moisture. The result is a degradation of the frying medium by different chemical reactions including oxidation and polymerization leading to volatile and non-volatile decomposition products. The volatile decomposition products including aldehydes, ketones, alcohols, acids, esters, hydrocarbons and aromatic compounds are removed from the frying medium by the steam formed during the frying process and operators can be exposed to these compounds during processing. Therefore the knowledge about the composition of these compounds is important to improve industrial safety.

The present work shows the results of a comparison between refined, virgin and virgin high-oleic rapeseed and sunflower oils, respectively with regard to the content and composition of volatile compounds formed during the frying process.

During frying of French fries at 175°C for 40 h the fumes were trapped by adsorption on activated charcoal and the captured volatile compounds were eluted with diethyl ether before analysis by GLC-FID and GLC-MS.

About 20 compounds were found in the fumes of the oils, including E,E-2,4-decadienal and 4-HNE, but only low amounts of acrolein and no benzene or benzo(a)pyrene. The corresponding oils were also analysed and showed the same composition as the fumes. The composition of the volatile compounds of the fumes strongly depended on the fatty acid composition of the frying medium. The investigation shows that oils with higher contents of monounsaturated oleic acid were more suitable for the frying process concerning the formation of volatile degradation products.