Changes in the Physical and Chemical Properties of Thermally and Oxidatively Degraded Sunflower Oil and Palm Fat

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Deep-fat frying is an important process used worldwide for the preparation of foods. By oxidation, hydrolysis, decomposition and oligomerisation a large number of different polar compounds evolve, which change the physico-chemical, nutritional and sensory properties of the oil or fat. Since a large quantity of the frying fat is adsorbed by the frying good an effective quality control of the frying fat is required. The existing standard methods of the German Society for Fat Science (DGF) for the assessment of the quality of frying fats are very time consuming and expensive.

Therefore, the intention was to find an inexpensive and sensitive rapid physical method and to develop a measuring instrument, which allows a quantitative determination of the quality of frying fats "online" in the deep-frying pan.

Sunflower oil and palm fat were thermally and oxidatively degraded in an open beaker at atmospheric pressure under intensive stirring for 76h at 175°C. To assess the development of the physical properties during heat-treatment, viscosity and especially the dielectric constant of these two oils were studied, as the dielectric constant is directly correlated with the amount of polar compounds. Since the temperature in a deep-frying pan can vary in a wide range and the dielectric constant shows a strong temperature dependence, it was necessary to measure the temperature dependence of the dielectric constant of different degraded oils. Additionally, their chemical properties were characterized by HPSEC and FTIR-spectroscopy.

The obtained results allow the development of a measuring instrument based on the determination of the dielectric constant at different temperatures, which enables the evaluation of the quality of used frying fats “online” in the fryer.