

Rapid Quantification of Polar Compounds in Thermo-oxidized Oils

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Deep fat frying is one of the most common practices in the preparation and manufacture of foods. The high temperatures used during frying (180 °C or more), in the presence of oxygen and water, induce important chemical changes on the oils, namely by oxidation, polymerization, cyclization, and hydrolysis. The level of polar compounds (PC) is a good indicator of the quality of oils and it is the basis of the international regulations limiting the use of degraded frying fats/oils for human consumption. Regulatory agencies in European countries have established the levels of between 24 and 27% (w/w) PC as the rejection value for heated oils. According to the ISO 8420:2002 standard, the content of polar compounds is determined by adsorption chromatography extraction followed by gravimetric quantification. This method is experimentally simple and accurate, but it is time-consuming and considerable amounts of silica gel and solvents are needed. The aim of this study was to develop a fast and reliable alternative method for polar compounds quantification in heated oils. The heating experiments were carried out at 180°C ($\pm 2^\circ\text{C}$) during 14 hours for peanut, soybean and sunflower oils. In a first step the extraction of polar and nonpolar fractions from the three heated oils, was carried out by solid phase extraction (SPE) followed by gravimetric quantification. This extraction method was validated on a small set of samples by comparison with the results obtained by the standard method. As alternative, the nonpolar fraction was directly quantified by HPTLC/densitometry at 190 nm and the PC fraction was estimated by simple subtraction from the nonpolar one. The PC fraction was also quantified at 325 nm after staining of the same plate with an acidic copper sulphate solution. Whatever the wavelength used, a good linear relationship between SPE and HPTLC was observed, principally for peanut and sunflower oils, demonstrating the feasibility of HPTLC/densitometry as a fast, simple and reliable method for the quantification of polar compounds from frying oils.