

Differential scanning calorimetric analysis of edible oils: comparison of thermal properties and chemical composition

ABSTRACT

The thermal profiles of 17 edible oil samples from different plant origins were examined by differential scanning calorimetry (DSC). Two other confirmatory analytical techniques, namely gas-liquid chromatography (GLC) and high-performance liquid chromatography (HPLC), were used to determine fatty acid (FA) and triacylglycerol (TAG) compositions. The FA and TAG compositions were used to complement the DSC data. Iodine value (IV) analysis was carried out to measure the degree of unsaturation in these oil samples. The DSC melting and crystallization curves of the oil samples are reported. The contrasting DSC thermal curves provide a way of distinguishing among these oil samples. Generally, the oil samples with a high degree of saturation ($IV < 65$) showed DSC melting and crystallization profiles at higher temperature regions than the oil samples with high degree of unsaturation ($IV > 65$). Each thermal curve was used to determine three DSC parameters, namely, onset temperature (T_o), offset temperature (T_f) and temperature range (difference between T_o and T_f). Reproducibility of DSC curves was evaluated based on these parameters. Satisfactory reproducibility was achieved for quantitation of these DSC parameters. The results show that T_o of the crystallization curve and T_f of the melting curve differed significantly ($P < 0.01$) in all oil samples. Our observations strengthen the premise that DSC is an efficient and accurate method for characterizing edible oils.

Keyword: Crystallization; Differential scanning calorimetry; Edible oil; Fatty acid composition; Gas chromatography; High-performance liquid chromatography; Melting; Thermal properties; Triacylglycerol composition