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Non-volatile products of triolein produced at frying temperatures characterized using liquid chromatography with online mass spectrometric detection

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Abstract

Oxidation products from triolein under model heated frying conditions have been analyzed using liquid chromatography with an evaporative light scattering detector and atmospheric pressure chemical ionization (APCI) mass spectrometric detection. Triolein was heated at 190°C with 2% water added each hour, to simulate the moisture of a frozen product, until polar components reached approximately 30%. The samples were separated using reversed-phase high-performance liquid chromatography with APCI–MS detection. Triolein oxidation products included hydroperoxides, epoxides and a ketone. Other products were formed by shortening of an acyl chain on the intact triolein. Normal and oxygen-containing products formed by the dimerization of triolein were also observed. Other products included chain addition products formed by addition of acyl chain subunits to intact triolein to form higher molecular weight products. Published by Elsevier Science B.V.

Keywords: Vegetable oils; Triolein; Triacylglycerols; Hydroperoxides; Epoxides

1. Introduction

Chemical reactions in vegetable oils at heated frying temperatures have long been known to produce a complex mixture of volatile and non-volatile products. Volatile compounds have been shown to include small molecules such as short-chain hydrocarbons, aldehydes and ketones. Many volatile compounds are lost into the air above the frying vessel, but they may be captured and identified using gas chromatography (GC) [1]. Because these compounds are amenable to conventional GC analysis, numerous studies have been reported and and these have been thoroughly reviewed [2,3]. Other products formed by heated vegetable oils include non-volatile decomposition products (NVDPs). NVDPs remain in the oil and contribute to the discoloration and unpleasant taste of overused oils. A large number of NVDP are formed, and these can be difficult to analyze because they are not amenable to GC analysis, and some are not amenable to normal liquid chromatographic techniques. Generally, NVDPs fall into two categories: (i) dimers and

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