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Formation and oxidation of cyclic fatty acid monomers of alpha-linolenic acid: Effects of cis / trans isomers and ring size

Paul Angers

Laval University, Canada

The process of frying involves many chemical reactions leading to the loss of quality and early termination of usable life of fats and oils. The chemical reactions causing the degradation of fats and oils used for frying are numerous and depend upon a number of factors which include their initial composition, the processing conditions, and storage as well as the mode of utilization. Most of our knowledge on high temperature degradation products from fatty acids relates to volatile compounds and polymers. In addition, oxidation reactions at high temperature (150-200˚C) may lead to a new array of cyclic and isomerized compounds which constitute major breakdown products in frying oil and inevitably become part of the diet. Although a few studies have reported on the metabolic effects of CFAM, much is unknown about the health impacts of CFAM and their oxidized products formed during frying of unsaturated vegetable oils. CFAM are unsaturated FA that are prone to oxidative reactions like any unsaturated FA, resulting in the formation of the lesser known class of compounds oxidized CFAM (CFAM-Ox) which are very likely to exhibit certain activities analogous to prostanoid-like phytoprostanes, and consequently, could interfere with certain critical biological functions. In addition, the kinetics of the formation of both CFAM and CFAM-Ox are not well known. Thus, the main objectives of the present work was to evaluate the effects of cis and trans isomers of alpha-linolenic acid (Ln) on the formation of CFAM, and to monitor the oxidation of the CFAM. All-cis Ln, isomerized Ln and high mono-trans isomers were subject to heat treatment at 275°C for up to 24 h. The oxidation of di-unsaturated CFAM obtained from linolenic acid was performed under oxygen at temperatures ranging from 160 to 200 ˚C for up to 24h. CFAM were formed from mono-trans isomers at an accelerated rate, compared to those from the cis isomers. Generally, the oxidation of 5-membered ring CFAMs happened at faster rates than either 6-membered ring CFAMs; presumably, because of the presence of bis-allylic positions in the methylene interrupted structure of 5-membered ring CFAM, in contrast to the 6-membered ring, which contain double bonds separated by two methylene groups.

Biography

Paul Angers has completed his PhD in Organic Chemistry at Université Laval and postdoctoral studies from Purdue University. He has worked as professor of Food Chemistry at Université Laval since 1998. He has published more than 80 papers in reputed journals and has made over 100 presentations at scientific conferences.

paul.angers@fsaa.ulaval.ca