Effect of Microwave Heating on Fatty Acid Methyl Esters, as Related to their Unsaturation Degree

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A study on the effect of microwave heating on the oxidation of fatty acid methyl esters with 18 carbon atoms and different unsaturation degree (methyl oleate, linoleate and linolenate), was performed in 2-mL unsealed vials at various exposure times (0-30 min). Different analytical determinations were utilized to follow their extent of oxidation (peroxide value, conjugated dienes and trienes, *trans* fatty acids, dimers and volatile compounds). The induction lag phase was halved from 6 to 3 min when methyl oleate and linoleate were heated, respectively; no induction period was detected in methyl linolenate, due to the rapid rise of oxidation. In methyl oleate and linoleate, the peroxide value displayed a step increase that led to 51.3 and 109.8 meq O2/kg of methyl ester, respectively, after 30-min exposure; in contrast, methyl linolenate exhibited a bell-shaped behavior, with an increase of peroxide value up to 20 min (24.3 meq O2/kg of lipid), followed by a significant decrease. Conjugated dienes were only found in methyl linoleate and linolenate, which rapidly rose during heating, being 73.2% higher in the latter; in addition, an increase of conjugated trienes (ΔK270= 0.1-0.2) in methyl linolenate was also noted. No *trans* isomerization and dimer formation were detected, but epoxy and hydroxy derivates of methyl esters were found. Volatile compounds increased after 12 min in methyl oleate and after 6 min in methyl linoleate and linolenate. Main volatile compounds were aldehydes, short chain methyl esters, epoxy derivates, ketones, alcohols and hydrocarbons. In conclusion, microwave heating at domestic level may not represent a problem as heating time is usually short (< 3 min). However, composition and sensory changes must be considered for the formulation of prepared food to be subjected to microwave cooking (heating time > 6 min), even though oxidation may follow different oxidative trends and kinetics in a complex food system.