Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Vegetable Oils using Solid Phase Micro Extraction (SPME)-GCxGC-TOF-MS

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Polycyclic Aromatic Hydrocarbons (PAHs) are a large class of organic compounds produced through incomplete combustion or pyrolysis of organic matter. They can be assimilated by humans through ingestion, inhalation, or skin contac. The occurrence of PAHs in food is due to environmental contamination (deposition of airborne particulates on crops or growth in contaminated soil), technological processing (i.e. grilling and smoking) and in low amounts from contaminated packaging material. Due to the lipophilic nature of these compounds, fats and oils can be highly contaminated. The US Environmental Protection Agency (EPA) highlighted 16 PAHs as priority pollutants.). Investigations on PAHs have generally focused on these PAHs (EPA PAHs) or on benzo(a)pyrene (BaP) (considered the most hazardous).

In early 2005 the European Commission (EC) fixed a new limit for the amount of the only BaP on foods and furthermore the EC recommended that all the Member States investigate the levels of the 15 PAHs pointed out by the Opinion of the Scientific Committee on Food (SCF) expressed in 2002 and the one PAH (benzo(c)fluorene) highlighted by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in 2005 (16 EC PAHs). The EC will review the maximum level for PAHs by the 1st April 2007. The most widespread technique for PAHs analysis are high performance liquid chromatography (HPLC) coupled with spectrofluorimetric detector and gas chromatography- mass spectrometry (GC-MS). Recently increasing number of methods using comprehensive two-dimensional chromatography have been reported (both LCxLC) and GCxGC. The high separation power of GCxGC, allow separating the target compounds from the interferences and providing chemically structured chromatograms. The narrow peaks obtained from the fast separation in the second dimension (2D) require fast detectors. Time of flight mass spectrometry (TOFMS) detector has been largely used to achieve this aim and to allow the identification of the numerous separated compounds. The aim of this work was to develop a SPME method for analysis of PAHs in vegetable oils using a GCxGC-TOFMS. Considering the new European legislation the study was focused on the EC PAHs. The combination of SPME with GCxGC-TOFMS was shown to

be a very powerful and valid tool for PAHs analysis in edible oils. The possibility to use the fiber directly in an organic solution offers a very rapid preparation step. The separation power of GCxGC allows eluting the target compounds in an area of the chromatogram free of interferences, improving the accuracy and identification of these components.

Regardless the possibility of competition in the sorption process between the PAHs that could compromise the accuracy, the method set seems to be a powerful tool for a fast analysis of PAHs for the heavier PAHs highlighted by the EC. The high specificity for planar compounds avoids interferences by alkylated PAHs, which may be present. The result obtained, in term of linearity, accuracy, LOD, LOQ and repeatability, for BaP could provide a validated rapid target analysis for quality control in oils.