生物與毒性分析

以極致液相層析與大氣壓氣相層析/串聯式質譜術分析食品包材中的全氟及多氟烷基化合物

Determination of Per- and Polyfluoroalkyl Substances in Food Packaging with Ultra-Performance Liquid Chromatography and Atmosphere Pressure Gas Chromatography/Tandem Mass Spectrometry

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Abstract

Per- and polyfluoroalkyl substances (PFASs) are widely used as coating materials on food-contact packaging. They are persistent, bioaccumulative, and could induce several adverse health effects. There are limited reports about the concentrations of short-chain PFASs in food packaging. This study determined seven types of 31 PFASs on grease-proof paper with ultra-performance liquid chromatography (UPLC) and atmospheric pressure gas chromatography (APGC) coupled with a tandem mass spectrometer (MS/MS).

Twenty-eight PFASs were analyzed with UPLC-MS/MS at negative UniSpray ionization. The signal intensities with mobile phase compositions of 5-mM ammonium acetate$_{(aq)}$ (pH 6.40) and methanol were 1.2-3.5 times higher than those of other tested aqueous mobile phases (0.1% acetic acid, 10-mM ammonium acetate, 10-mM *N*-methylmorpholine, Milli-Q water) on a Waters Atlantis Premier BEH C18 AX column, and the peak widths of analytes were between six and nine seconds. When the pH of 5-mM ammonium acetate$_{(aq)}$ was adjusted to 7.0 with ammonia hydroxide, the analyte peaks were less tailing and had higher signal intensities. Moreover, the chromatographic conditions and signal intensities PAPs (6:2 PAP, 8:2 PAP) were further improved with a Waters Atlantis Premier BEH C18 column with mobile phase compositions of 10-mM *N*-methylmorpholine$_{(aq)}$ (pH 9.65) and methanol. Three fluorotelomer alcohols (FTOHs) were analyzed with APGC-MS/MS; the performance of using a ZB-WAX column offered narrow peak widths of the analytes and 12-35 times higher signal intensities than those using a DB-5ms column.

Samples of 10 cm^2 were cut into pieces and were extracted by the CEM EDGE automated extraction system with acetone at 90°C, which obtained 1-3 times more analytes than other tested extraction conditions.

關鍵字：全氟/多氟烷基化合物、食品包材、自動加壓流體萃取系統、極致液相層析/串聯式質譜儀、大氣壓氣相層析/串聯式質譜儀
Keywords: per- and polyfluoroalkyl substances (PFASs), food packaging, EDGE automated extraction system, UPLC-MS/MS, APGC-MS/MS