EXTRACTABLES FROM FOOD-CONTACT MATERIALS

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Rapra continues to be at the forefront of development of analytical methods for examination of potential extractables from all types of food-contact materials. This expertise is used for clients in compliance testing of products, for research and also in the submission of data to regulatory authorities such as the European Food Safety Authority (EFSA) and the US Food and Drug Administration (FDA). Methods based on gas chromatography/mass spectrometry (GC-MS) and/or liquid chromatography/mass spectrometry (LC-MS) are widely employed. Particular examples with typical chromatograms are shown in Figures 1-10.

a) Monomers such as butadiene, acrylonitrile and vinyl chloride (examined using headspace GC-MS methods)

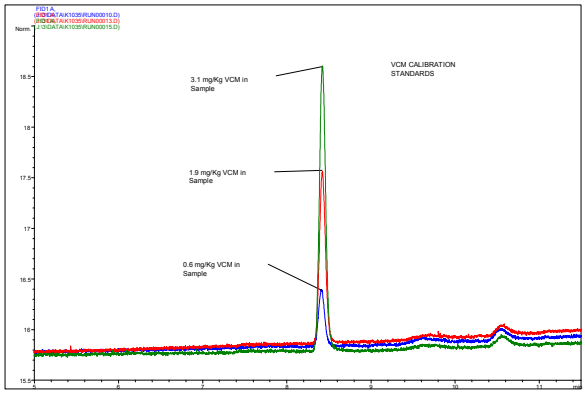

Figure 1 - Quantification of vinyl chloride monomer in PVC

b) Extractables from food contact rubber compounds using GC x GC TOFMS

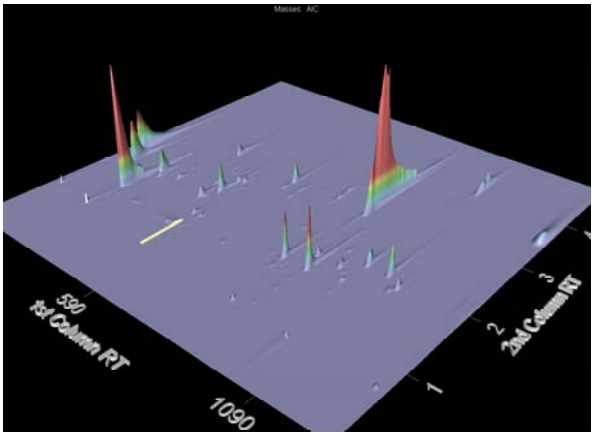

Figure 2 - Examination of the acetone extract from an EPDM rubber sample using two-dimensional gas chromatography. Detection of components by time of flight mass spectrometry

c) Residual solvents

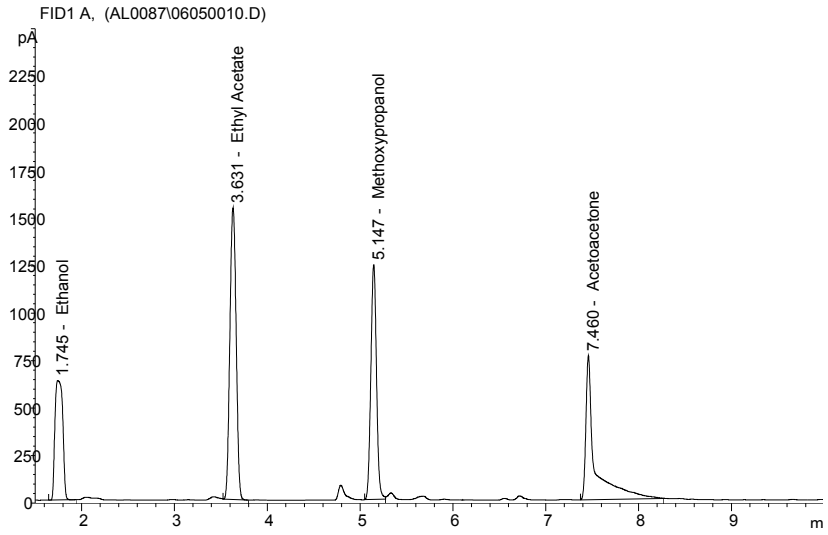

Figure 3 – Detection of ethanol, ethyl acetate, methoxypropanol and acetoacetone by static headspace gas chromatography

d) Antistatic agents for polyethylene and polypropylene

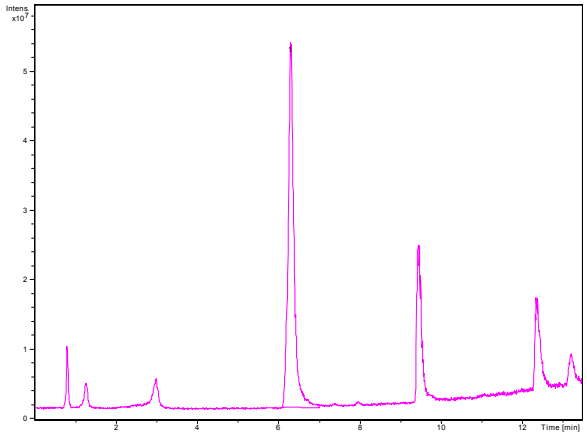

Figure 4 - Detection of a mixed ethoxylated amine antistat by ESI (electrospray) LC-MS (TIC trace)

e) Surfactants and related species from fluorinated coatings (perfluorooctane sulphonate [PFOS], perfluorooctanoic acid [PFOA] and perfluorooctane sulfonylamide [PFOSA])

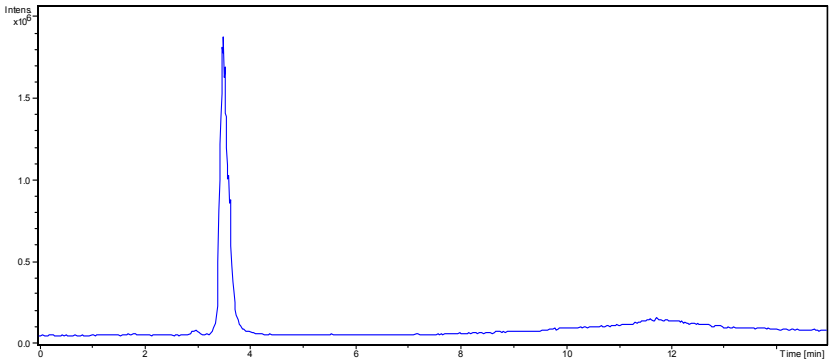

Figure 5 -Detection of pentadecafluorooctanoic acid (PFOA) $CF_3(CF_2)_6COOH$ (Mol wt 414) using –ve ESI LC-MS

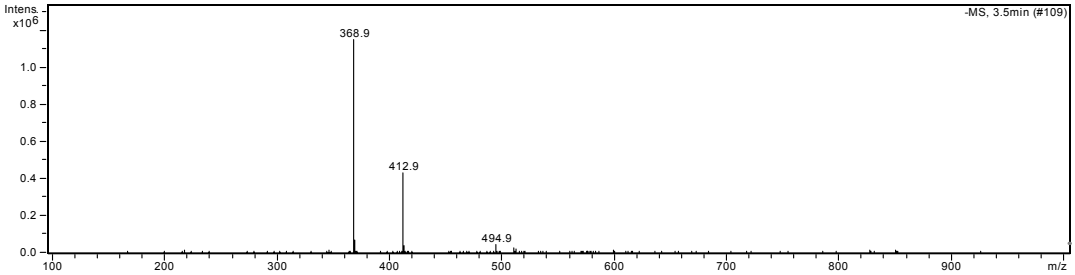

Figure 6 - Mass spectrum of PFOA showing $[M-H]^-$ and $[M-COOH]^-$ ions at m/z 413 and 369 respectively. Quantification can be on this mass transition

e) Aromatic amines from polyurethane foams and laminating adhesives

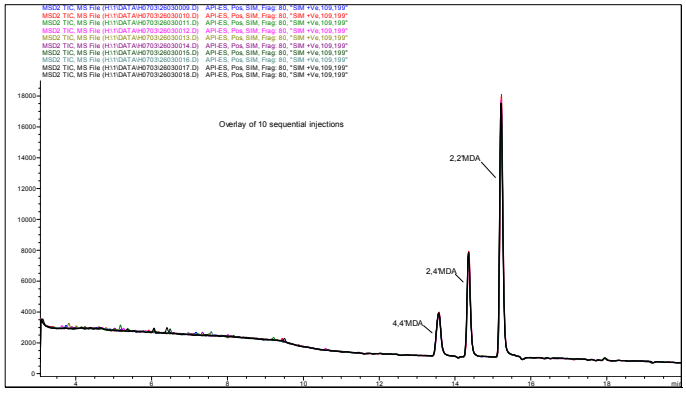

Figure 7 - Overlay of 10 sequential injections of a 50 µg/litre mixture of 4,4', 2,4' and 2,2' MDA, methylene diamine (SIM detection)

f) Manufacturing impurities from ion exchange resins

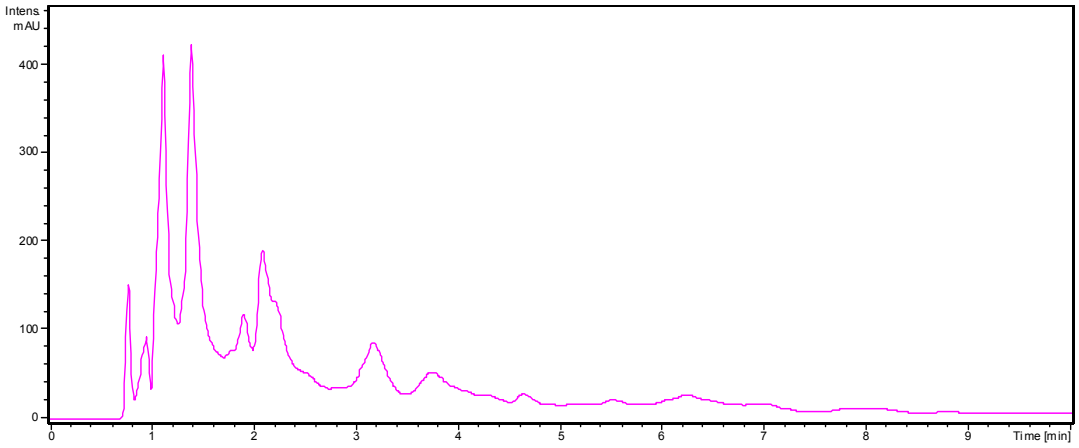

Figure 8 -Extractables from a strong acid cation resin with aromatic sulphonate functionality, identifiable by LC-MS

g) Antioxidants and stabilisers (e.g. phenolics, phosphites, and hindered amine types) from plastics

LC-MS with APCI ionisation can be used to identify and quantify most types of antioxidants and stabilisers used with plastic and rubber materials. Mass spectra below are for the hindered phenolic antioxidant Irganox 1010 of mass 1177

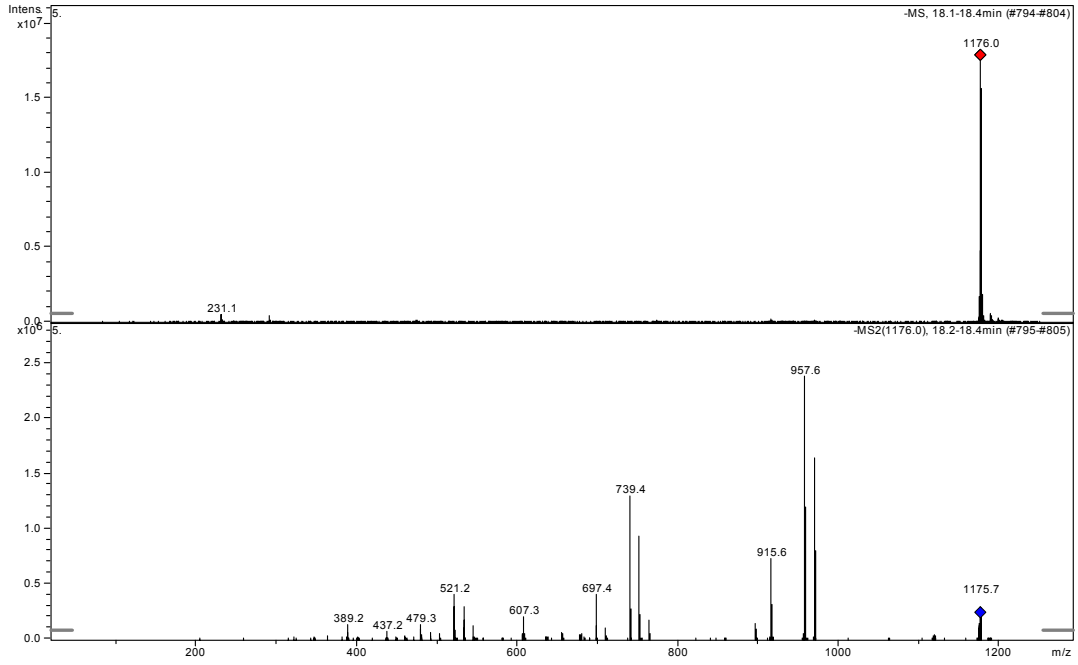

Figure 9 - Ion-trap MS [M-H]⁻ and MS² ions [m/z 1176.0→ 957.8, 915.6, 739.4] for Irganox 1010, APCI ionisation

h) BADGE hydrolysis and chlorohydrin products from epoxy coatings

BADGE (diglycidyl ether of bisphenol A) and its reaction products can be specifically identified and quantified using LC-MS.

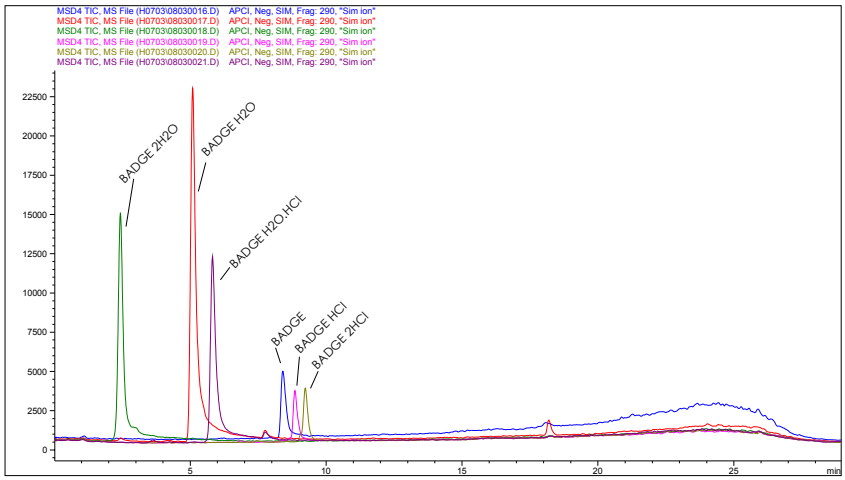

Figure 10 - BADGE derivatives at 0.5mg/kg levels in acetonitrile showing the difference in response for the various derivatives (SIM 211 ion)