Bisphenol A – consumption inevitable

Fast determination of bisphenol A residues in plastic bottles, containers and cans

Bisphenol A (2,2-Bis(4-hydroxyphenyl) propane) is one of the most significant industrial chemicals worldwide and has been used since 50 years in the manufacture of polycarbonates and epoxy resins for various applications. Polycarbonates are used as packing materials (plastic bottles, airtight containers), as lenses, as data carriers (CD's) and as foils. Epoxy resins are used as adhesive-, lacquer and cast resins for instance for coating of cans (BADGE – Bisphenol A diglycidyl ether) and dental fillings. In Germany alone, more than 400,000 tons of bisphenol A are used every year.

New results from the USA

The estrogen-like action of bisphenol A (BPA) has been known since the 1930's. As the release of BPA from plastic materials and resins was at that time believed to be low, the health risk for humans was considered to be negligible. Now that scientists in the United States have found new evidence for the teratogenic effect of BPA, this compound is again the centre of attention. Researchers have determined that very low BPA dosages can lead to genetic defects in mice.

Environmental agency advises restriction

Polycarbonates based on BPA used for baby bottles and drinking mugs and epoxy resins used for coatings of cans have been increasingly critically examined. Although toxicologists have not agreed until now on the assessment of the health risks caused by BPA and the use of BPA in baby bottles could not be prohibited, the German Federal Environmental Agency had already requested urgently to restrict the use of BPA in food packaging and especially in baby bottles.

LCMS offers higher sensitivity

BPA is commonly analysed via GCMS or HPLC. In order to attain a higher sensitivity and selectivity for the determination of traces of BPA in food samples, an HPLC method with mass spectrometric detection was developed and is described below. The single quadrupole LCMS-2010A was used as mass spectrometric detector. Using this method, BPA could be detected accurately in the lower ppb range. The chromatographic separation could be carried out in less than 5 minutes using a 2 mm reversed phase column. The BPA is deprotonated during electrospray ionisation and shows a mass of 227 m/z in the negative mode.

Using the SCAN mode in the total ion chromatogram (TIC), 50 ppb BPA can be detected. In the corresponding mass spectrum the quasi-molecular ion (M-H)- is detected at 227 m/z (Figure 1).

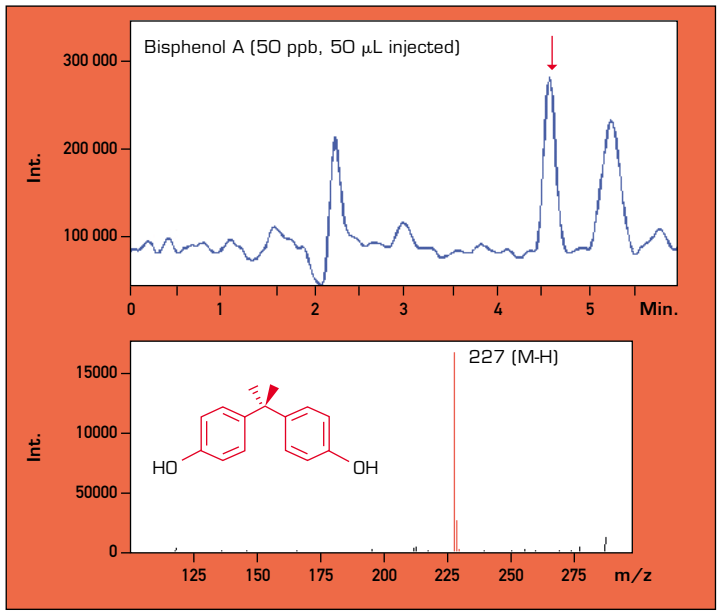

Figure 1: Bisphenol A: structural formula, TIC (scan neg. 100 - 300 m/z) and mass spectrum (M-H)-

In the single ion-monitoring mode (SIM mode) for mass 227, BPA can be determined to concentration levels as low as 0.05 ppb (Figures 2 and 3) using this method. The use of such highly sensitive detection methods for BPA residues in foods allows for accurate monitoring of released BPA amounts and forms the basis for further investigation into health risks, which can result from the use of BPA in packaging materials.

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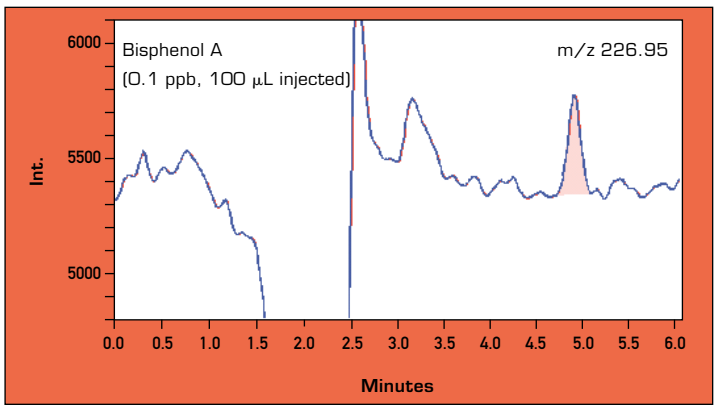

Figure 2: Detection of 0.1 ppb Bisphenol A in SIM mode

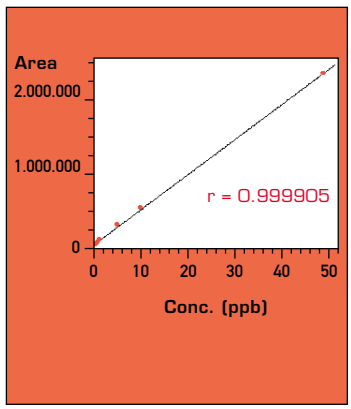

Figure 3: Calibration 0.05 up to 50 ppb