[TECHNOLOGY BRIEF]

Rapid Analysis of Bisphenol A in Infant Products Using the Xevo TQD

GOAL

To develop a rapid, routine method for the extraction and quantification of bisphenol A in complex infant products using the ACQUITY UPLC® System, coupled with Xevo® TQD.

BACKGROUND

Bisphenol A (BPA) is an additive primarily used in the production of polycarbonate plastics and epoxy resins. These synthetic materials are widely used in packaging to protect the safety and integrity of foods and beverages. Polycarbonates are used to produce many food and beverage containers, such as beverage bottles, tableware, and other food containers. Epoxy resin coatings prevent corrosion of metal cans and lids, along with contamination of food and beverages.

BPA is an endocrine disruptor that can mimic the body's hormones and may lead to negative health effects. In 2001, concerns about the estrogenic activity of BPA were raised prompting several governments to release reports questioning the safety of its use in consumer products. Canada became the first country to take action on BPA through their Chemicals Management Plan, which listed BPA as a toxic substance.

Low levels of quantification can be achieved while simultaneously minimizing any potential matrix interference from the complex samples.

Xevo TQD System.

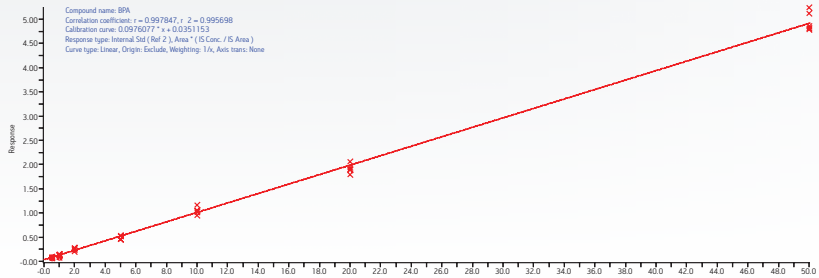

Figure 1. Extracted calibration curve for infant formula samples.

The United States Food and Drug Administration (US FDA) released a report in 2010 expressing some concerns regarding BPA exposure to fetuses, infants, and young children that has encouraged further studies into the safety of BPA. A recent European Union directive (EU directive 2011/8/EU) has banned the use of BPA in the manufacture of infant feeding bottles.

THE SOLUTION

Infant formula and baby food were subjected to a short and rigorous extraction protocol prior to analysis. The samples were first extracted with the Waters® DisQuE™ dispersive sample preparation product, that uses the widely accepted QuEChERS protocol. The first tube containing sodium citrate, sodium chloride, and magnesium sulphate was mixed with the 10 g sample and 10 mL of acetonitrile. The supernatant was thoroughly mixed then centrifuged to a 5:1 enrichment, and further cleaned using solid phase extraction (SPE) with Oasis® HLB Cartridges. The final organic eluate following SPE was diluted 50:50 with water, filtered, and injected for LC/MS/MS. This avoided the time-consuming evaporation and reconstitution steps often associated with SPE. The filtered extracts were analyzed using a high pH, methanol gradient on a 1.7 µm ACQUITY UPLC BEH C_{18} Analytical Column. The analysis was performed with a Xevo TQD in negative ion electrospray (ESI) mode using multiple reaction monitoring (MRM). A deuterated BPA D16 internal standard was used to correct for variations in both extraction and ionization efficiencies. Resulting MRM chromatograms of the quantification ion for a 1 µg/kg (1 ppb) spike in infant formula and baby food are shown in Figure 1. A calibration from 0.5 to 50.0 µg/kg demonstrated good linearity, as shown in Figure 2, and recoveries were in the range of 95% to 110%.

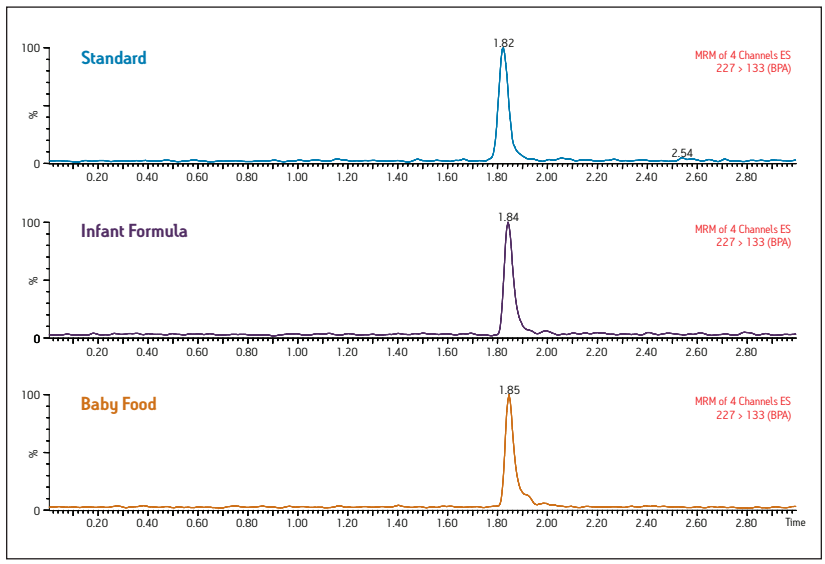

Figure 2. MRM chromatograms of BPA for infant formula and baby food sample spiked at 1 ppb.

SUMMARY

The ACQUITY UPLC System coupled with the Xevo TQD enabled the low level detection of bisphenol A from baby food and infant formula. The use of an additional SPE cleanup step following the QuEChERS extraction protocol ensured that low levels of quantification were achieved through pre-concentration and simultaneously minimized any potential matrix interference from the complex samples. Avoiding the time-consuming evaporation and reconstitution steps of the standard SPE protocol increased the sample throughput. In combination with the rapid, sensitive, and selective analysis afforded by UPLC®/MS/MS, laboratory efficiency can be maximized.

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