Bisphenols in Food

Migration of BPA, BPF, BADGE, BFDGE and NOGE from Food Contact Materials

Bisphenols are part of the so-called endocrine disruptors. These substances are harmful to human health by altering the hormonal system. They can be natural (phytohormones) or synthetically produced. The most commonly known synthetic substances with a potentially endocrine effect are base products for plastics like phthalates and bisphenol A. The latter is used for producing polycarbonates and epoxide resins.

Bisphenol A diglycidyl ether (BADGE), bisphenol F diglycidyl ether (BFDGE) and novolac glycidyl ethers (NOGE) result from polymerisation process of epoxy resin out of bisphenol A (BPA), bisphenol F (BPF) or novolac and not fully chemically bound monomers may migrate into food.

Sources of Exposition

Possible sources of exposition to BPA are polycarbonate based food contact materials like containers and bottles for food and drinks. Moreover, bisphenol A is used as colour creating agent in thermal paper like receipts and tickets. BPA and related compounds are even used for the production of epoxy resin based inner layers of tins and drinking cans, twist-off caps and food containers.

Toxicological Assessment

Bisphenols are compounds from the group of diphenylmethane derivatives. BPA – the substance mostly analysed out of the entire group – affects the human body like the female sex hormone estrogen and thus destroys the hormonally controlled communication in between the cells. BPA is associated with a number of diseases, like adipositas, heart diseases, chest and prostate cancer, diabetes, fertility disorders, birth defects and brain aberration. Other bisphenols and related compounds, like BPF, BADGE, BFDGE and NOGE, have so far hardly been examined. However, similar effects are suspected.
The proven migration of BADGE, BFDGE, NOGE and their derivatives into food demands a toxicological evaluation for the estimation of possible human health risks.

**Jurisdictional Regulations**

In November 2005, the European Commission (Regulation (EC) No 1895/2005) established specific migration limits (SML’s) for epoxid derivatives. For the sum of BADGE and its hydrolysed derivatives a SML of 9 mg/kg food and for the BADGE chlorohydrins (BADGE HCl, BADGE 2 HCl und BADGE H2O HCl) a SML of 1 mg/kg of food was set. The use of BFDGE and NOGE in the manufacture of food contact materials is prohibited due to the absence of toxicological data.

By the Regulation (EU) 2018/213 of 12 February 2018 the Commission lowered the limit for the migration of bisphenol A from packaging materials to food from 0.6 mg/kg to 0.05 mg/kg. This Regulation shall apply from 6 September 2018.

Guideline 2011/8/EU prohibits the use of bisphenol A for the production of baby bottles made of polycarbonate.

**Expertise & Analyse**

Our experts from the Competence Center for Organic Contaminants have long term experience in the area of trace analysis via LC-MS/MS and offer the analysis of BPA, BPF, BADGE, BFDGE and NOGE in food and food commodities.

The innovative UHPLC-ESI-MS/MS-method allows direct measuring of BPA and BPF without prior derivatisation and with a very high reliability, repetitiveness and comparable precision.

For food ultra-low limits of quantification can be given, such as 1 µg/kg for BPA and 2 µg/kg for BADGE.

![Chromatogram of a tomato sauce with 1 µg/kg for each BPF / BPA](image)