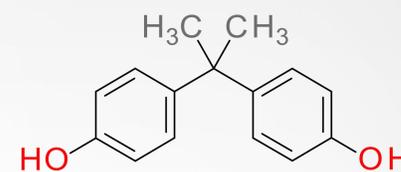




Development and Validation of a Screening Method for Bisphenols and Related Reaction Products in Canned Food

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Bisphenol A and some of its derivatives (e.g. BADGE, BFDGE), are chemicals produced in large quantities, which have the potential to interact with the hormone systems of humans and animals.^{[1][2]} Metal cans for food packaging are often coated with epoxy resin to protect the food from catalytic effects of the aluminium or iron can. The resin was identified as the source of bisphenols and derivatives in the food.^[3]

was to develop a method to measure the concentration of 25 different bisphenol derivatives in canned food. The self-imposed goal was reached successfully. The accuracy of the method is satisfactory, recovery rates between 80 and 120% were found for every of the 25 substances.

This study contains the development and application of a method to detect and quantify the presence of 25 bisphenols (bisphenol di- and oligomers and associated glycidyl ethers and their corresponding HCl- and H₂O derivatives) via LC MS/MS. It also contains the development of a special sample preparation process, to extract the analytes from fatty foods. It was applied to 25 different canned food products such as canned tuna, corned beef and food cat and dogfood. Aim of the project

Some of the observed substances are not well characterized and their potential to influence metabolic processes.^{[3][4]} Due to the negative publicity of bisphenol A a lot of producers switched to other bisphenols, which remain the basis for manufacturing epoxy resins. This allows producers to declare their products bisphenol A free, which is a positive catchphrase in connection with food contact materials.

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In **figure 1.** the preparation process is shown schematically. The whole sample was homogenised. Two grams of the sample were diluted in cyclohexan. The extraction was performed in 5 mL acetonitrile in an ultrasonic bath. The whole extraction process was repeated two more times. The ACN phases were united and freezeed to remove short-chained fatty acids. The extract was diluted 1:10 in H₂O:ACN (1:10) and measured using the LC MS/MS.

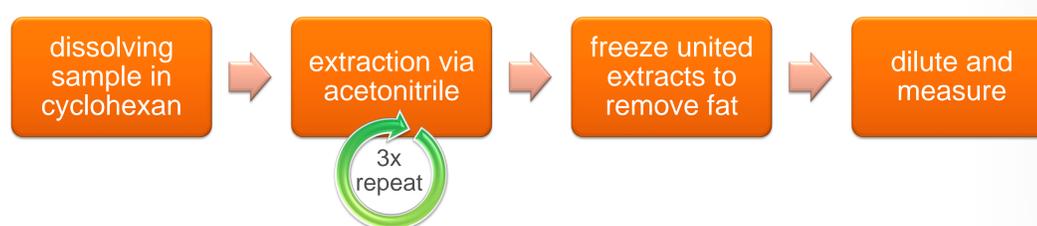


figure 1. step 1: cyclohexan dissolves the fats which contain the bisphenols, step 2: to ensure a complete extraction of bisphenols and derivatives the process had to be performed three times, step3: the united extracts also contain short-chained fatty acids which could be removed by cooling, step4: diluting 1:10 in H₂O:ACN (1:10) improves peak resolution.

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In **figure 2.** a representative example of the results is shown. Most positives remain under the specific migration level of bisphenol A and derivatives, which is determined by the EU Nr. 10/2011.^[6] There are also positive results to non regulated substances e.g. BADGE-BPA, Cyclo-di-BADGE and bisphenol G. The observed concentrations for BADGE-BPA and Cyclo-di-BADGE are within the tolerated range (0.01 mg/kg), given by the EU Nr. 10/2011 for non regulated substances. The only positive result that is above the tolerated limit is shown in **figure 3.** bisphenol G which was found in 4 samples in concentrations over 0.01 mg/kg.

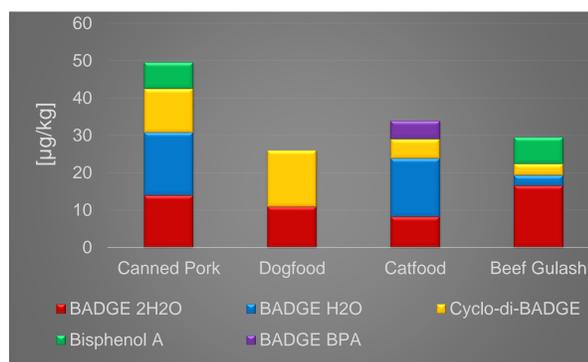


figure 2. examples for positive results for regulated and unregulated substances within the tolerance limit.

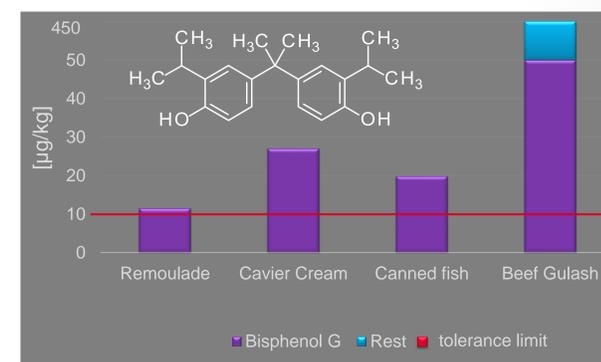


figure 3. examples for positive results to the unregulated substance bisphenol G far above the tolerance limit (redline).

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In some of the tested products large amounts of bisphenol G were found. Bisphenol G is not listed in the positive list of the EU Nr. 10/2011. Its concentration is not allowed to exceed 0,01 mg/kg in food. In some of the tested products the concentration was much higher than the allowed

quantity. The German Surveillance Authority (BfR) has no studies about the toxicity of bisphenol G. Due to the high concentrations, further product testing should be performed.

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