Abstract

As a standard procedure plastic coatings are used for the manufacturing of food cans. They were applied either in the form of lacquers or as a foil by lamination to a metal foil. During manufacturing and storage components are able to migrate from the coating into the packed food. The components with a molecular weight below 1000 Da might be absorbed in the gastrointestinal tract and potentially cause toxicological effects in the human body.

During the manufacturing process substances are used which are as monomers partially very toxic such as isocyanates. In addition very toxic substances like primary aromatic amines can develop in the storage period. As starting substances for manufacturing mostly prepolymers are used, which could contain residual monomers. All substances, that are allowed to be used for manufacturing of food packaging, are subject to a limit for global migrate. Specific limits for migration from packaging into food exist only for monomers and a few dimers. Currently there is no difference between absorbable and non absorbable substances by legal regulations, so that absorbable prepolymers which potentially could be as toxic as the monomers they are based on, are only regulated by the limit for the global migrate.

For surveillance of isocyanates a suitable method for the routine was developed. It can be taken not only to control the maximum permitted quantity of isocyanate monomers but also for identification of not permitted isocyanates and for inclusion of oligomeric isocyanates into the maximum permitted quantity. Furthermore there is the possibility to identify the oligomers by applying the second derivatisation reagent in case the concentration of the oligomers is sufficient respectively the latest mass selective detectors are used.

The analysis of raw materials and laminates, which are used for manufacturing of aluminium light weight containers, as well as the kinetic investigations of the laminate curing both provided valuable information with respect to the composition and variation of migrating substances. These results could be used to analyse fabricated food packaging materials.

For the first time literature based procedures as well as the above-mentioned method for determination of isocyanates were tested in extensive investigations for their use in practice with different types of commercially available food packages. In addition it was the first time that food packages were analysed by a toxicological screening with biological methods. Altogether an important contribution for the balance of total migrate and the existence of toxicological relevant substances could be achieved.

The fact that toxicologically relevant monomers are not detectable allows no conclusion that toxicological effects couldn’t be caused by migrating substances from packaging materials. For the first time toxicological effects, caused by migrating substances from aluminium light weight containers, were detectable. However toxicologically relevant monomers were not detectable. The toxicological effects are assumed to be cytotstatic effects, because no

effects were detected when testing for mutagenicity and cytotoxicity. The toxic effects couldn't be reduced down to one fraction or even one defined substance by fractionising the positive tested migrates. The toxic effects were detectable in all of the 3 fractions.

Scientifically proven diffusion models can be used to ensure the compliance with the specific migration limits. While diffusion models could be advantageous for plastic packages, the examination of applicability for plastic coatings showed that only the distribution coefficient and not the diffusion coefficient is of relevance, because of the lower layer thickness compared to plastics.

Even though applicable methods for a screening of toxicological relevant substances are available and a major part of the toxicologically relevant and other migrating substances from preserves for food could be identified, some of the migrating substances still remain unknown after this work. Moreover the toxic effects require further examination.