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XXVIII. Cross-Linked Polyurethanes as Adhesive Layers for Food Packaging Materials

As of 01.01.2010

There are no objections to the use of polyurethanes as extensive adhesive layers¹ in the manufacture of packaging materials (composite materials, mainly laminated films) made of plastic and/or paper and/or aluminium foil for commodities in the sense of § 2, Para. 6, No 1 of the Food and Feed Code (Lebensmittel- und Futtermittelgesetzbuch), provided they are suitable for their intended purpose and comply with the following conditions:

Are the composite materials composed of two or more layers of materials, each consisting exclusively of plastics, which are bound together by means of polyurethane adhesives, these materials must comply with the Commission Regulation (EU) No 10/2011.

1. The following starting materials may be used:

(For starting materials already regulated by the Commission Regulation (EU) No 10/2011, the specific limits laid down therein apply.)

- a) Polyester polyols (= hydroxyl-terminated polyesters) based on
 - Carbonic acid
 - Adipic acid
 - Phthalic acids
 - Trimellitic acid (= Benzene-1,2,4-tricarboxylic acid)
 - Sebacic acid
 - Maleic acid
 - Ethandiol
 - 1,2-Propanediol
 - 1,3-Butanediol
 - 1,4-Butanediol
 - 2,2-Dimethyl-1,3-propanediol
 - 1,1,1-Trimethylol propane
 - Diethyleneglycol
 - 1,6-Hexanediol
 - Glycerol
- b) Polyether polyols (= hydroxyl-terminated polyethers)
- c) Reaction products with terminal hydroxyl groups made from the polyols listed under a) and b) with
 - 2,4-Toluene diisocyanate
 - 2,6-Toluene diisocyanate

¹ In contrast to adhesive seams, which under normal conditions of use have no or only an insignificant area of contact with foodstuffs, this Recommendation deals with thin, extensive adhesive layers, which, because of the intervening material, can have no direct contact with the foodstuff, but for which a certain degree of migration through the intervening material cannot be completely ruled out.

When such composite materials are manufactured, the adhesives used contain reactive, low-molecular components. The stipulations laid down in this Recommendation, particularly those under No 4 for laminated films, are intended to avoid the possibility of any residues that may be present migrating through the covering layers into the foodstuff.

diphenylmethane-4,4'-diisocyanate
hexamethylene-1,6-diisocyanate

- d) Reaction products with terminal isocyanate groups, made from
- α) 2,4-Toluene diisocyanate and 2,6-Toluene diisocyanate with 1,2-propanediol, 1,3-butanediol and 1,1,1-trimethylol propane
2,4-Toluene diisocyanate and 2,6-Toluene diisocyanate and diphenylmethane-4,4'-diisocyanate with polyether polyols or polythioether polyols listed under b)
Hexamethylene-1,6-diisocyanate with water
 - β) 2,4-Toluene diisocyanate and hexamethylene-1,6-diisocyanate through polymerisation
 - γ) Diphenylmethane-4,4'-diisocyanate, in which approx. 6 % of the isocyanate groups are converted to uretonimine groups.
2. Adducts of the starting materials listed under No 1 may have the following polymers added to them, provided polyurethanes predominate in the total mixture:
- a) Cellulose nitrate according to DIN 53 179²
 - b) Copolymers of vinyl chloride and vinyl acetate and/or vinyl propionate that comply with Recommendation II³, and which may contain free hydroxyl groups.
 - c) Epoxy compounds made from (4,4'-dioxo-2,2'-diphenyl)-propane and epichlorohydrin
 - d) Vinylidene chloride copolymers that comply with Recommendation XXXIV⁴
3. The following may be used:
- a) Caprolactam as accelerator, max. 1.0 %
 - b) Triisopropanolamine^{5, 6} as chain extender, max. 5.0 %
4. After evaporation of the solvent, 1 m² of finished product must contain no more than 10 g polyurethane adhesive per adhesive layer.
There must be no detectable residues of solvents or amines in foodstuffs that come into contact with the laminated films and/or migrates made with food simulants⁷.

² German Standard, DIN 53 179 "Determination of viscosity adjustment of industrial nitrocellulose (collodion wool)"

³ Recommendation II "Plasticizer-free polyvinyl chloride, plasticizer-free copolymers of vinyl chloride and mixtures of these polymers with other copolymers, and chlorinated polyolefins containing mainly vinyl chloride in the total mixture"

⁴ Recommendation XXXIV. "Vinylidene Chloride Copolymers with a Predominant Content of Polyvinylidene Chloride"

⁵ As an additive, triisopropanolamine must not contain more than 5 % diisopropanolamine.

⁶ Migration of this substance into foodstuffs and aqueous simulants is regulated by the Commission Regulation (EU) No 10/2011.

⁷ On testing for primary aromatic amines see: Amtliche Sammlung von Untersuchungsverfahren nach § 64 LFGB, L. No 00.00-6: "Untersuchung von Lebensmitteln - Bestimmung von primären aromatischen Aminen in wässrigen Prüflbensmitteln".