

### **Abridged version**

Reinforced concrete structures in contact with fermentation substrates and fermentation residues of agricultural origin are usually designed and constructed on the basis of DIN 11622-2:2015<sup>1</sup>. The constructions must be made in a way that liquids classified as generally water-polluting according to AwSV<sup>2</sup> cannot escape out. This requires a liquid-impermeable construction that must be sufficiently resistant to the expected mechanical, thermal and chemical influences.

The research project summarises and evaluates the findings discovered in several research projects on the flow behaviour of separation cracks in reinforced concrete tanks with selected liquids (liquid manure, fermentation substrates, fermentation residues, silage effluent). Regardless of the very large variance of possible real liquids and their properties influencing the flow behaviour, it's been shown that the separation cracks that occur on storage tanks when implementing the limitation of the calculated crack width to 0.2 mm do not lead to a permanent leakage of water-polluting substances. This applies to all storage liquids enriched with solids, regardless of the liquid pressure level. However, temporary or permanent moisture penetration with sintering cannot be ruled out and in practice also affects separation cracks in vertically oriented building components (wall areas). Moisture penetration and traces of sintering found in randomly inspected containers in agricultural facilities also occurred with visually measured crack widths that were smaller than 0.2 mm. They do not pose a threat in terms of protecting the water, but they do have an impact on the durability of the structures.

The durability of reinforced concrete structures used for agricultural purposes is primarily determined by the resistance of the concrete to the effects of liquids that chemically attack the concrete or have a corrosive effect on the reinforcing steel. In addition to compiling and evaluating investigation results from previous research projects, tactile tests were carried out in which selected reference media acted on a crack crossing the reinforcement over a period of 180 days. Some of the identified effects require longer-term consideration. The investigations reveal that the end of the initiation phase and the depassivation of the reinforcing steel had just been reached at the end of the impact. The damage to be expected afterwards could not yet be proven during the observation period. However, it cannot be concluded from this that no damage will occur in the longer term.

On top of the stress caused by organic acids, the effect of concrete-damaging salts, which are usually contained in agricultural liquids as well as their influence on the durability of reinforced concrete structures is also discussed.

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<sup>1</sup> DIN 11622-2:2015-09; Silage and liquid manure containers, containers in biogas plants, bunker silos and trench silos - Part 2: Silage and liquid manure containers and containers in biogas plants made of concrete

<sup>2</sup> AwSV Ordinance on Installations for Handling Water-polluting Substances dated 18th April 2017