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SUMMARY

F 817/1

Testing methods and development of test criteria for the evaluation of the leaching of environmentally relevant substances from fresh concrete – continuation project

SUMMARY

In the research project "Testing methods and development of test criteria for the evaluation of the leaching of environmentally relevant substances from fresh concrete - F 817" /1/ the leaching from fresh concrete should be quantified. The evaluation should be based on a simple lab test. The transformation to in-situ-conditions should be done using numerical transportation simulations. A more complex lab test close to realistic conditions of concrete in contact with flowing groundwater (dynamic test) was used to calibrate the transport simulations. It turned out that the release determined in the simple lab test with standing groundwater is inappropriate as a source term for flowing groundwater. Therefore in this continuation project different factors of influence on the total release and the time dependent process of release should be determined. The influence of the leachate (water-saturated sand and tap water respectively) was regarded and the velocity of flow of the groundwater. The examined parameters were pH value, conductivity, K, Na, Ba, Cd, Cr, Mo and V.

For the determination of the release in water-saturated sand fresh concrete was applied on a sandbed and removed after hardening (static test). Sand samples were taken in layers, dried and leached. A depth profile of the leached elements could be provided by analysing the elutes. It was shown that the particle size of the sand has a measurable influence on the pollutant release. Since only the water-soluble part of the pollutants was determined, it is possible that this effect is attributed to a stronger adsorption on finer sand particles. The static test is unsuitable for the determination of the release development, because the main leaching processes take place during the first hours and in this test results can only be attained after a sufficient hardening of the concrete. The total release is a lot lower than the release arising in flowing groundwater.

The release out of fresh concrete in direct contact with water was determined in a tank test for fresh concrete. This test makes it possible to determine the release in the course of time because the water is changed and analysed at specified times. The release of the toxic elements chromium, molybdenum and vanadium is high within the first hours after the application, then the concentrations in the elute go down to the detection limit. Transport simulations show that this course of release is qualitatively in good agreement with the release process in flowing groundwater. The total release is higher than in the static test, but still too low to calculate the concentrations determined in the dynamic test.

In order to seize the influence of the velocity of flow, fresh concrete was applied on a sandbed with flowing ground water. Three velocities were regarded: 0,39 m/d, 0.86 m/d and 1.36 m/d. Using the lowest velocity the highest concentrations were attained due to the lower dilution. Unfortunately a comparison of the total release at the different velocities was not yet possible, since the tests were not carried out long enough. However it can be stated that for the parameters chromium, molybdenum and vanadium the release is a lot higher than in the tank test for fresh concrete. Sodium, barium and cadmium were not evaluated in this test, since the concentrations were too small compared with the background contents. Further tests shall be accomplished, in order to quantify the influence of the velocity of flow on the total release. Doing so it will be possible to specify velocity-dependent factors that could be used to extrapolate results of the tank test for fresh concrete. These values can be used as input parameters for the transportation program.

/1/ Brameshuber, W. ; Vollpracht, A.: Prüfverfahren und Entwicklung von Prüfkriterien zur Bewertung der Auslaugung umweltrelevanter Stoffe aus Frischbeton. Aachen : Institut für Bauforschung, 2003. - Forschungsbericht Nr. F 817