

Summary of results of the research project “Laboratory comparison test for the standardisation of inverse column elution according to the Schössner method and validation of parameters and criteria for the ecotoxicological assessment of construction materials using ammonium oxidation and soil respiration test as components of an ecotoxicological test battery for the assessment of impacts of construction materials on soil” (Assessment of ecotoxicological impacts of construction materials on soil III)

According to the principles for the “Assessment of impacts of construction materials on soil and groundwater” by the German Institute for Structural Engineering ecotoxicological tests are to be applied for the terrestrial test systems. Within two research projects the suitability of Rapid Test by Ammonium Oxidation (DIN ISO 15685) and Soil Respiration Curves (DIN ISO 17155) for the assessment of construction materials on soil (an agent for the sanitation of sewage pipes and a soil injection agent) were tested. The results of the projects approved the suitability of the test procedures for assessing the impacts of construction materials on soil organisms.

The intention of this further leading project was to validate the assessment criteria and scales regarding the impact of construction materials on soil.

Three soil injection agents – a cement glue product, a polyacrylate and a polyurethane resin were eluted according to column elution by the Schössner method. The obtained eluates were mixed with a sandy test soil and further incubated. The ecotoxicological impact on soil was analysed using the above mentioned methods. Additionally the luminescent bacteria test (DIN EN ISO 11348-2) and the algae growth inhibition test (DIN 38412-33) as well as the degradation test according to OECD 301 E (OECD Screening test) were performed.

There was no effect of the construction materials in luminescent bacteria test. Algae test showed only effects for polyacrylates. In the degradation test cement glue appeared to be not degradable. Cement glue had only minor effects in all testing procedures.

The polyacrylates had significant impacts on all tested organisms – nitrification was reduced until 28%. In contrast soil respiration curves showed a boosting until 47% according to the easy degradability of the substances. This approved the results of the first two research projects. There was a positive correlation between sum parameter DOC and the given impacts in the terrestrial and aquatic test procedures.

The actual results encouraged the selection of assessment parameters. In soil respiration test parameter cumulative CO₂ accumulation (C_R) as well as NO₂-N for potential nitrification proved one's worth.

The limit of 25 % deviation from the control for assessment criteria to estimate the non-tolerable impact of construction material eluates was with the actual results proved, too.

Boosting of above 25 % regarding to the results of biological reduction processes should not be evaluated in a negative way per se.

Another objective was the testing of the inverse elution method of Schössner in a laboratory comparison test for creating the basis of standardisation of the elution procedure.

The comparison analysis regarding to the standardisation of the inverse column elution was performed in three laboratories. Two construction materials were eluted (polyacrylate and cement glue) – with 3 parallels using drinking water for the elution process. The parameters total organic carbon, pH, conductivity, turbidity and temperature as well as colour, odour and affinity to frothing formation were tested. Additional for the eluate of cement glue heavy metals were determined.

The results of the laboratory comparison test showed acceptable reproducibility of the parameters for polyacrylate (injection) and cement glue (installation).

Looking to the parameters total organic carbon, pH and conductivity there was a good reproducibility of the column elution method with variation coefficients for both, cement glue and polyacrylates, beyond 25 %. Highest variation coefficient appeared for the parameters chrome and turbidity with up to 58 %.

The form of the created samples and the different conductivities of eluents (drinking waters) were identified for having the most important influence on the comparability of the procedures.