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Optimising load capacity, robustness and air humidity resistance of loam bricks

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Ecologic building materials, such as loam bricks, became of greater economic importance over the last few years.

Studies of the mineralogy, granulometry, chemistry and cation exchange capacity of the raw material are necessary for the optimisation of load capacity, robustness and the resistance of loam bricks against air humidity.

Four different types of loam provided by an Austrian brick company have been analysed: A1, A2, B C. These four samples were analysed with x-ray powder diffraction to characterize their bulk mineralogical composition and clay mineralogy. The x-ray data showed that samples A1 and A2 are similar in composition, containing quartz and feldspar; whereas samples B and C also contained calcite and dolomite. Their clay mineral content ranges between 50 and 70 %.

The granulometrical composition of samples A1 and A2 shows a higher content of the silt fraction and a lower content of the clay fraction ($< 2\ \mu$m) compared to samples B and C.

Chlorite, vermiculite, illite and kaolinite constitute the clay fraction of samples A1 and A2. Smectite could only be found in samples B and C.

In addition the cation exchange capacity was determined as an indicator for the exchange capability of clay minerals. All four samples have a very low exchange capacity (7-14 mmol/100g).

Samples A1 and A2 showed an ideal grain size distribution and an absence of expandable clay minerals, thus they were used for further studies of burst strength and bending tensile strength.

Different additives like finely ground trass, kieselgur, brick-dust, slagstar, Acronal S650, wood shavings and a clay mineral rich loam where added to the loam and homogenised. Little loam bricks were built to quantify burst strength and bending tensile strength. A brick series was coated with a hydrophobic impregnation fluid. The bricks were stored in boxes for 20 days with air humidities of 100% and 75% respectively. After 1, 5 and 20 days the burst strength and bending tensile strength were measured to identify the critical humidity level for brick stability.

The initial strength of loam A1 with Acronal S650 is higher than of the other types. However, it loses strength under the influence of high air humidity. Despite the comparatively small initial strength, loam A1 with slagstar shows the smallest losses after exposure to high air humidity.