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Assesment of hydraulics properties of technosoil constructed with waste material using Beerkan infiltration

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For the characterization of hydraulics soils functions, in situ infiltration experiments are commonly used. The BEST method based on the infiltration through a single ring is well suited for soils containing coarse material. Technosols built from Civil engineering waste material such as brick waste, concrete waste, track ballast and demolition rubble wastes contain large part of coarse material. In this work, different materials made of civil engineering wastes mixed with organic wastes are tested for greening applications in an urban environment using in situ lysimeters. Beerkan infiltrations experiments were performed on these technosols. Experimental data are used to estimate hydraulics properties through the BEST method. The results shows from a hydraulic point of view that studied technosols can achieve the role of urban soil for greening application.

Five combinations of artefacts were tested either as “growing material” (one combination) or “structural material” (4 combinations) - as support for traffic. Structural materials consisted in 27 wt.% earth material, 60 wt.% mineral coarse material and 3 wt.% organic material. These constructed technosols were studied in situ using lysimeters under two contrasted climatic conditions in two sites in France (Angers, in northwestern France and Homécourt, in northeastern France).

Constructed technosols exhibited high porosities (31-48 vol% for structural materials, 70 vol% for the growing material). The dry bulk density of the growing material is estimated to 0.66 kg/m3 and 1.59 kg/m3 for structural material. The particle size distribution analysis, involving manual sieving (> 2 mm) and complemented by a grain size analysis (< 2 mm) were used as described in the BEST method (2006) for the estimation of the shape parameter n of hydraulics functions (Van-Genuchten –Mualem, 1980). This n parameter was estimated to 2.23 for growing materials and 2.29 for structural materials. Beerkan infiltrations experiments data were inversed using the BEST method, the results exhibited high saturated hydraulic conductivities 10.7 cm/h for structural materials and 14,8 cm/h for the growing material.

Beerkan infiltration experiements are well suited for assesment of hydraulic properties of technosol constructed with civil engineering wastes. According to the estimated hydraulics functions, the studied technosols can be classified between a sand and a loam soil. It shows that these materials can achieve the role of alternative to the consumption of natural arable earth for urban greening applications such as gardens, parks and trees lines.