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Determination of soil effective pores distribution by using in-situ infiltration tests of Newtonian and non-Newtonian fluids.

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The knowledge of pore size distribution of soils allows to improve the understanding of their hydrodynamic functioning. The access to this information is usually acquired by complex methods such as X-ray tomography or mercury porosimetry. These methods turn out to be time-consuming and sometimes environmentally harmful. This study aims to define the distribution of hydraulically effective pores of a porous medium by in-situ infiltration tests. It presents an experimental approach based on the infiltration of water and N-1 non-Newtonian fluids in a soil in order to establish an independent system of N Hagen-Poiseuille flow equations providing a set of N mean pore radii (Ri) and their corresponding weights (wi) among the hydraulically effective porosity (Abou Najm et al 2016). This method is simple, inexpensive and repeatable as much as needed to cover the spatial heterogeneity. It relies on the combination of the Beerkan protocol (single ring infiltration tests) to the use of four Xanthan Gum solutions (i.e. Non Newtonian fluids). Rheological properties of these solutions are given by Zhong et al. (2013). This method was applied on a draining ditch and a nearby parking lot ensuring the runoff of rainwater towards the receiving ditch. Some parts of the parking surface were subject of alterations and cracks because of invasive plants colonization. Tests were conducted on both altered and intact areas. This study enabled to compare pore distributions of the studied structures and to depict the impact of aging on the parking lot structure. The resulting pore size distributions were compared to the particle size distributions in order to explore the possibility of a correlation between soil texture and soil structure.

References

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