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Assessment of water repellency indices: Contact angle for hydrophobized sands

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Alternative soil-based covers are commonly recognized as useful and interesting technical-solutions for landfill final cover systems. However, the material used for constructing of these capping layers is expensive and not affordable by developing countries. The capping system can vary from a simple soil layer to multiple layers. Capillary barriers consisting of inclined fine over coarse soil layers recognized as another cover system. In developing the concept of hydrophobic capillary barriers, development of possible technique to enhance the impermeable properties of capillary barriers, which consists of turning the coarse grain surface of subsoil water repellent by mixing it with low-cost and locally available hydrophobic material were discussed. Soil water repellency is the common phenomenon that reduces water infiltration; enhance surface runoff and erosion, and forming of preferential flow pattern in the soil. The soil water repellency is affected by composition and content of the organic matter. The relationship between the composition of organic matter and soil physical properties like water repellency is largely unknown. Soil water repellency is an important soil property varying with soil water contact time. In the present study, the effects of hydrophobic organic matter contents on the water repellency of the hydrophobized sands were investigated. Secondly, the time dependency of the sessile drop contact angle was determined. Lastly, the effect of wetting and drying process on contact angle were evaluated.

The degrees of water repellency of hydrophobized sands were assessed using the water drop penetration time test (WDPT), the molarity of ethanol droplet test (MED) and the sessile drop method (SDM). Water repellency category of the hydrophobized sands showed strong repellency at an oleic acid content of 0.25 g kg-1 to 5 g kg-1. Directly measured contact angles using the SDM were in good agreement with indirectly obtained contact angles using the MED test. The contact angle decreased exponentially and almost reached apparent equilibrium after 25 minutes of the soil-water contact time. The wetting and drying of hydrophobized sand were performed by hanging water column system. The contact angle measured before and after wetting and drying process showed the good agreement. The contact angle measured after wetting and drying process decreased exponentially and almost reached apparent equilibrium after 20 minutes of the soil-water contact time.