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# Soil hydrophobicity; preliminary results of an investigation of the effect of grain size and percentage of hydrophobic grains in a model system

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Soil water repellency is most common in sandy soils where the soil particles become coated with a layer of organic material. This produces a porous material with slightly hydrophobic surfaces. Wettability of materials is known to depend upon both the surface chemistry of the material and the topography of the surface; porous materials in particular have been shown to amplify slight hydrophobicity of their surfaces to produce extreme hydrophobicity. Soil follows this trend, the texture converting slight hydrophobicity to super-hydrophobicity; drops of water can roll across the surface of the most hydrophobic soils.

Within soil studies water drop penetration time (WDPT) and molarity of ethanol droplet (MED) tests are used widely and within materials-science contact angle studies are more common. Contact angle tests are extremely useful for perfect materials but are difficult to apply to dynamically variable or porous systems, such as soil surfaces. Water drop penetration time can distinguish samples with measurable penetration times but the test saturates at zero and infinity, exacerbated by the amplification effect of the soil structure. There will probably be variation in samples with infinite penetration time that will not be detectable using this test. The molarity of ethanol test covers this eventuality but may not always respond in the same way to changes in texture and surface chemistry.

We present preliminary results from a study aimed at investigating the effect of soil chemistry and particle size on hydrophobicity and experimentally comparing the common measurement techniques. We use a model system of particles with controlled size, shape and surface chemistry to produce artificial soils with even pore size and

known local hydrophobicities. Real soils consist of mixtures of particles of a range of surface chemistries and sizes and complex shapes; using a model system enables us to consider these factors separately and in different combinations.

Silica sand and spherical silica particles were coated with silanes to fix their surface chemistry. Equivalent flat surfaces could be produced by treating glass slides in the same manner, allowing the equivalent contact angles on a flat surface to be measured. This will aid interpretation of the artificial soil results. Hydrophobic and hydrophilic particles could be mixed in known ratios to approximate real soils. Molarity of ethanol (MED), drop penetration time (WDPT) and contact angle could be measured and compared on packed beds of these particles.