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Engineering water repellency in granular materials for ground applications

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Synthetic water repellent granular materials are a novel technology for constructing water-tight barriers and fills that is both inexpensive and reliant on an abundant local resource – soils. Our research is verifying its stability, so that perceived risks to practical implementation are identified and alleviated. Current ground stabilization measures are intrusive and use concrete, steel, and glass fibres as reinforcement elements (e.g. soil nails), so more sustainable approaches that require fewer raw materials are strongly recommended. Synthetic water repellent granular materials, with persistent water repellency, have been tested for water harvesting and proposed as landfill and slope covers. By chemically, physically and biologically adjusting the magnitude of water repellency, they offer the unique advantage of controlling water infiltration and allow their deployment as semi-permeable or impermeable materials. Other advantages include (1) volumetric stability, (2) high air permeability and low water permeability, (3) suitability for flexible applications (permanent and temporary usage), (4) improved adhesion aggregate-bitumen in pavements. Application areas include hydraulic barriers (e.g. for engineered slopes and waste containment), pavements and other waterproofing systems. Chemical treatments to achieve water repellency include the use of waxes, oils and silicone polymers which affect the soil particles at sub-millimetric scales. To date, our research has been aimed at demonstrating their use as slope covers and establishing the chemical compounds that develop high and stable water repellency. Future work will determine the durability of the water repellent coatings and the mechanics and modelling of processes in such soils.