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Water Retention of Mixed Hydrogel Particles and Sandy Soil

YULI WEI, DOUGLAS DURIAN, University of Pennsylvania — We study the water-holding capacity of mixed hydrogel particles and a model sandy soil. To probe static behavior, we develop a custom pressure plate method that measures the expelled water per unit pressure increment per unit cross-sectional area; results are analyzed in terms of the water-accessible pore areas in the granular packing. To probe dynamic behavior, we build a raindrop impingement set-up that measures the retained water inside a dry granular packing during steady rain at a fixed rate. The percentage saturation of the granular packing is deduced. In both studies, we first determine the influence of the packing height and then of the gel concentration and size. Results from pressure plate method show that the swollen hydrogel particles partially clog the pores in the sandy soil, so that less water could be expelled for a given pressure increment. The total water-accessible area determined from the expelled water curve decreases exponentially as the gel concentration increases. Large hydrogel particles are less efficient in clogging the pores when no extra confinement is applied on the packing. Results from the raindrop impingement measurements also show that the water-holding capacity of sandy soil is improved by addition of hydrogel particles.

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