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# Experimental Studies on the Hydraulic Effects of Fungal-Mycelia in Sandy Soil

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One gram of soil can contain up to 100 million to 1 billion microrganisms and up to 1 million different species of microorganisms. Despite this fact, geotechnical engineers have, until fairly recently, ignored biological activity in the soil or possible biological amendments that could be introduced. Over the last ten years research has focused on bioaugmentation strategies (i.e. the injection of a single strain of bacteria) to alter hydraulic and mechanical behaviour of porous and fractured media (e.g. microbially induced calcite precipitation). One challenge of bioaugmentation technologies is the transportation of bacteria within the ground. This study investigates for the first time the potential use of fungal networks for ground engineering applications. Fungi produce hyphae, long filamentous structures which collectively are called a mycelium. Mycelium can grow to vast sizes, with individual mycelia (in forest floors) covering areas up to 9km2 in North America. As such there is great potential 'to grow'fungal mycelia for earth infrastructure over large areas.

We investigated the hydraulic behaviour of sandy soils treated with fungal mycelia using P. ostreatus (oyster mushroom) in order to: (i) Assess the level of hydrophobicity induced and (ii) understand the influence of P. ostreatus mycelia on water flow through the soil profile. To investigate these, we grew mycelia in petri dishes and conducted water drop penetration tests to ascertain induced hydrophobicity. We also determined the surface water evaporation rates for soils with mycelia and those without, at different starting moisture conditions. Next, we set up a 1-dimensional infiltration column test with mycelia inoculated and incubated to grow overtime throughout the soil profile. The infiltration column was instrumented with tensiometers and Time Domain Reflectometer (TDR) probes for the real-time measurement of suction and water content. Soil infiltration water fronts were obtained for both treated and untreated soils in respective columns. The presence of fungal mycelia resulted in significantly altered hydraulic characteristics of the soils. Mycelia induced extreme hydrophobicity on fine sands and reduced surface water evaporation rates. Infiltration time was slower for fungal-treated soils than untreated soils. These results highlight the potential for fungal mycelia to be used in the creation of semi-permeable or impermeable barriers in a range of ground engineering applications.

Key words: fungal mycelia; soil hydraulics; ground improvement; 1-D infiltration;

## References

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