Center for Bio-mediated & Bio-inspired Geotechnics

Permeability of Bio-cemented Sand Mixtures

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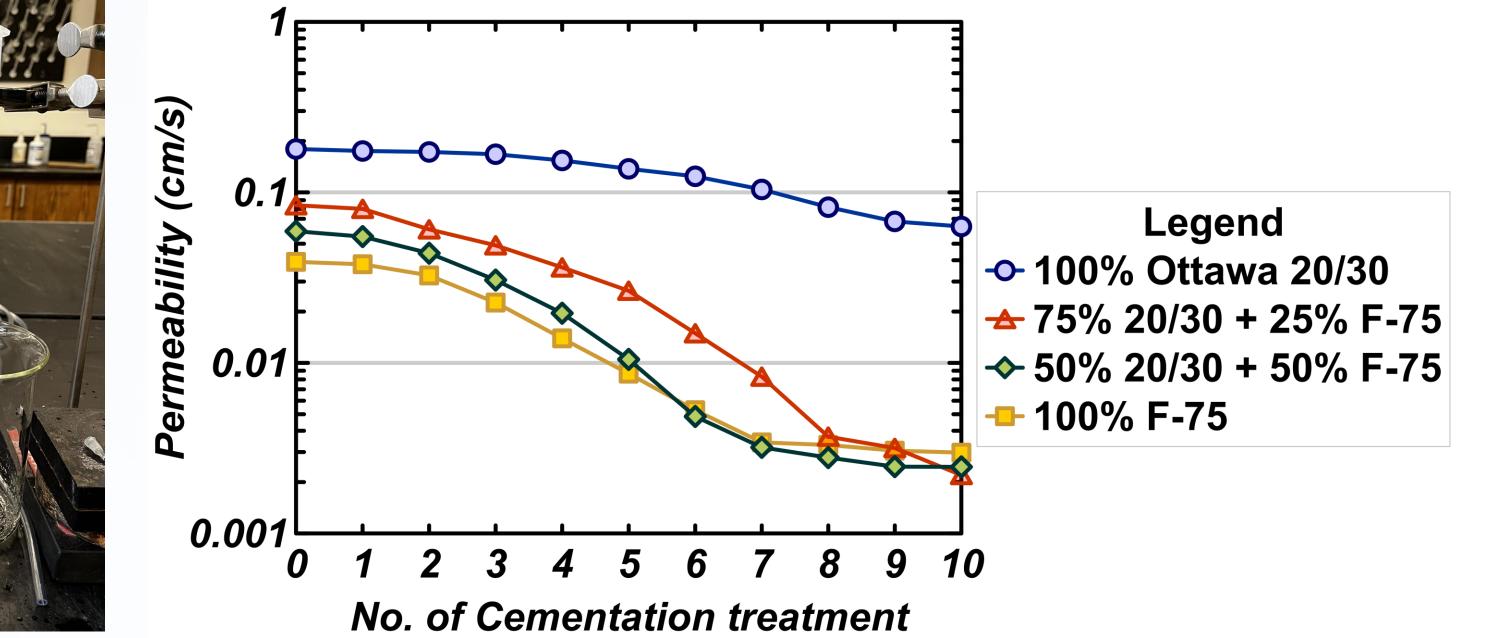
2023 Research Experience for Teachers, Georgia Institute of Technology

Research Background

Research Objectives

Research Conclusions

- Microbially induced calcite precipitation involves the bonding of soil particles with the help of microbes.
- Due to cementation and interparticle bonding, permeability of bio-cemented samples can reduce.
 - Flow path
- To investigate the effect of MICP on hydraulic conductivity of sand mixtures.
- 4 sand mixtures were used: 100% Ottawa 20/30, 75% Ottawa 20/30 + 25% F-75, 50% Ottawa 20/30 + 50% F-75, and 100% F-75.
- Permeability decreased for all samples with each cementation treatment, with highest reduction observed for 75% Ottawa 20/30 +25% F-75.
- Permeability was found to be function of grain size, soil packing, and calcite content.
- The precipitated calcite was found to be about 1-2%.





Source: Almajed et al. (2021)



Lesson Description

- Students will use urease hydrolysis by microbes to cement waste materials for beneficial applications in civil projects.
- Students will use sand samples to compare the MICP cementing capability and hydraulic conductivity in all the samples.

Lesson Objectives

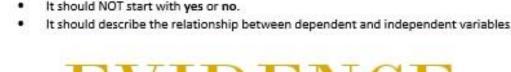
- Students will study the beneficial role of microbes in soil improvement and sustainable development.
- Students will do a lab investigation to collect data, analyze & write a Claim Evidence Reasoning.



Lesson Outcomes

- Students will engage in 3 weeks long lab investigation to propose sustainable solutions to problems related to recycling of waste material and improving the shear strength and stiffness of soil for civil engineering with Microbially Induced Calcite Precipitation (MICP) method.
- Students will make connections with the Lesson & the Lab by writing a Claim, Evidence &





EVIDENCE

Scientific data used to support the claim

Evidence must be:

- Sufficient Use enough evidence to support the claim.
- Appropriate Use data that support your claim. Leave out information that doesn't support the claim.
- It should use one or both types of key observations:
 Qualitative (Using the senses)
 - Quantitative (Numerical)

REASONING

Ties together the claim and the evidence

- Shows how or why the data count as evidence to support the claim.
- Provides the justification for why this evidence is important to this claim
- Includes one or more scientific principles that are important to the claim and evidence.
- emember: Be sure to read what you have written to be sure it makes sense as a whole explanation.



Acknowledgement This material is based upon work primarily supported by the Engineering Research Center Program of the National Science Foundation under NSF Cooperative Agreement No. EEC-1449501. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect those of the National Science Foundation.





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