CBBG Center for Bio-mediated & Bio-inspired Geotechnics

Permeability of Bio-cemented Sand Mixtures

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Research Background

- 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.
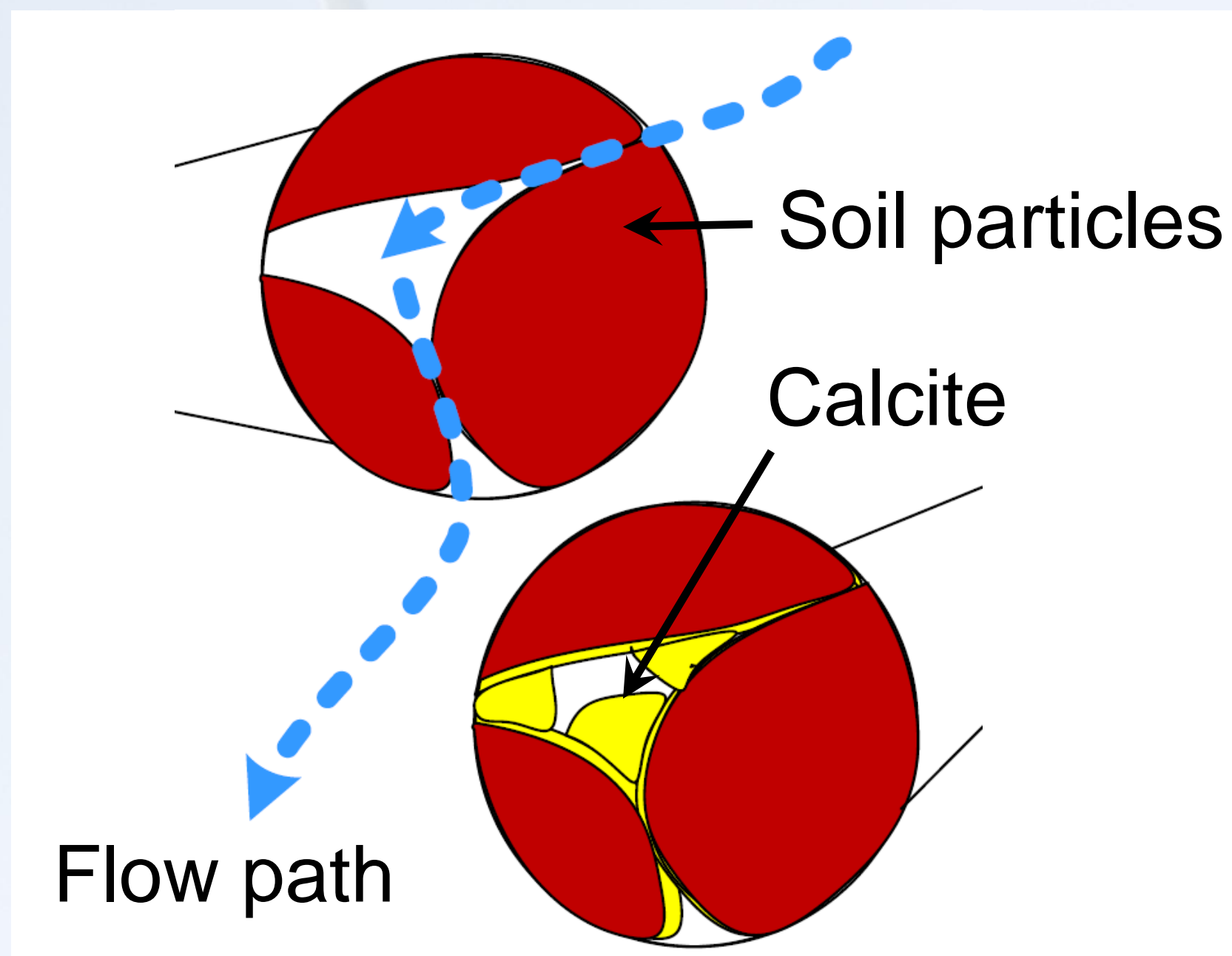

Source: Almajed et al. (2021)

Research Objectives

- 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.
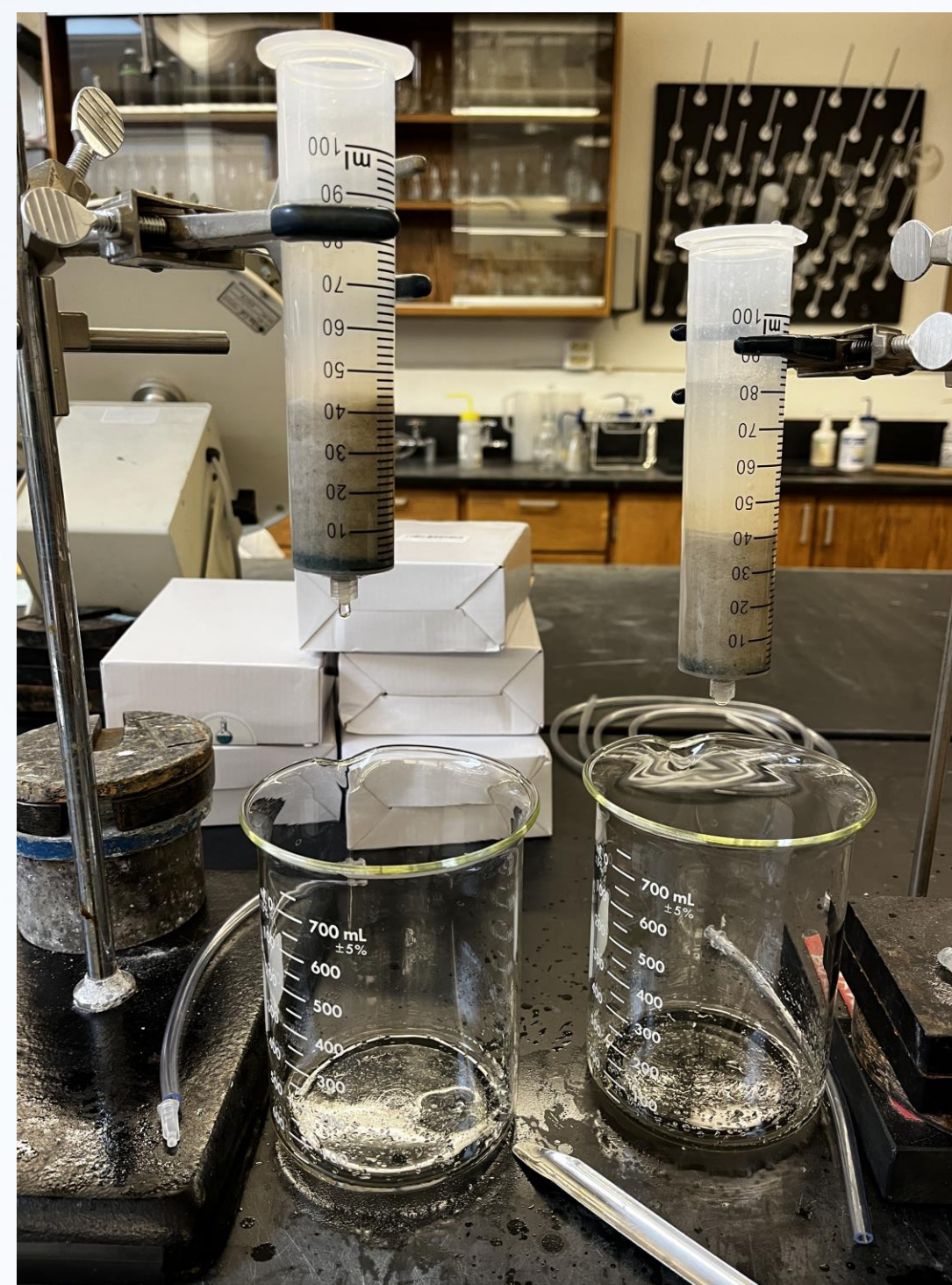
Research Conclusions

- 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%.
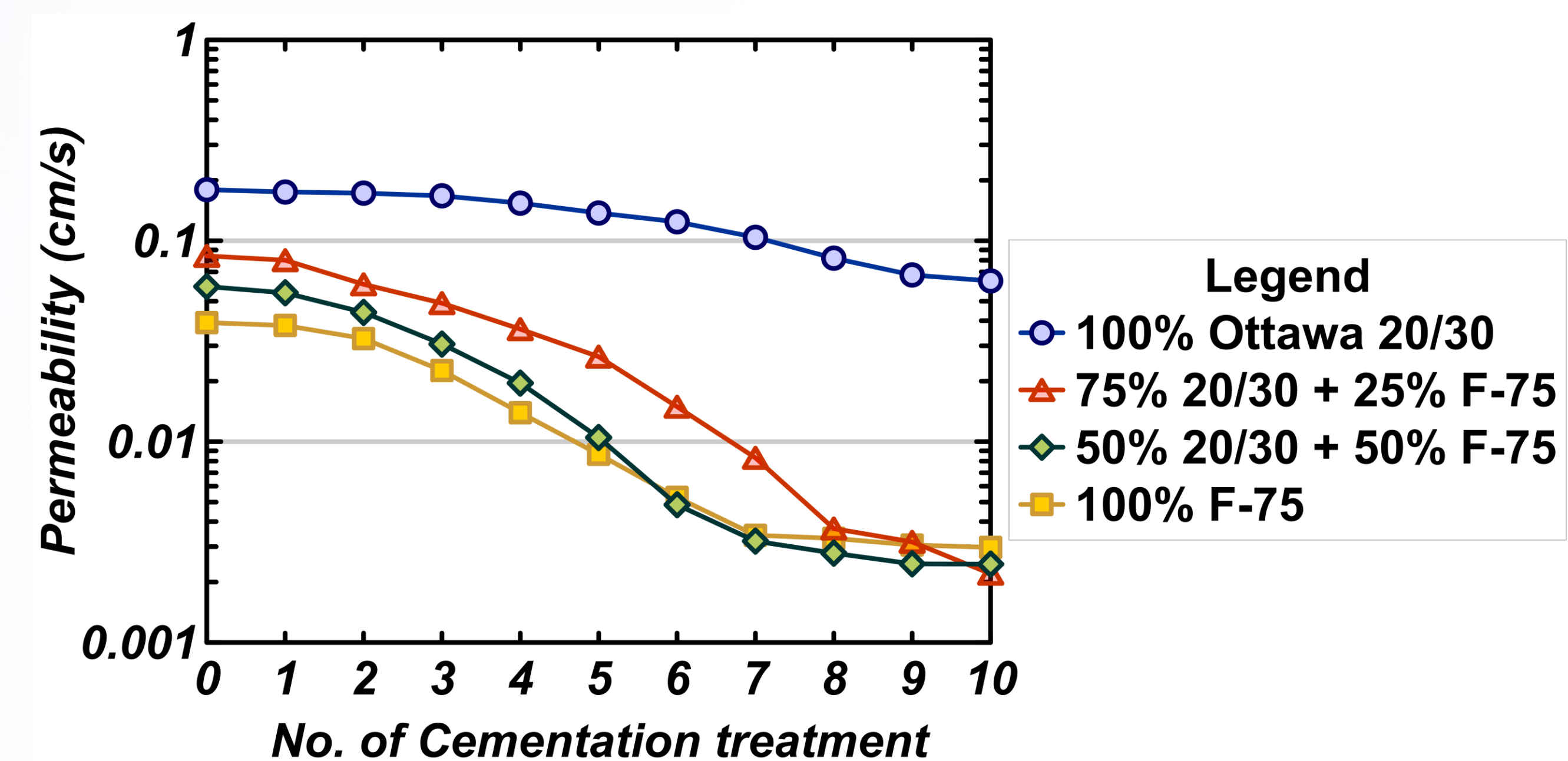
Lesson Description

- 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.
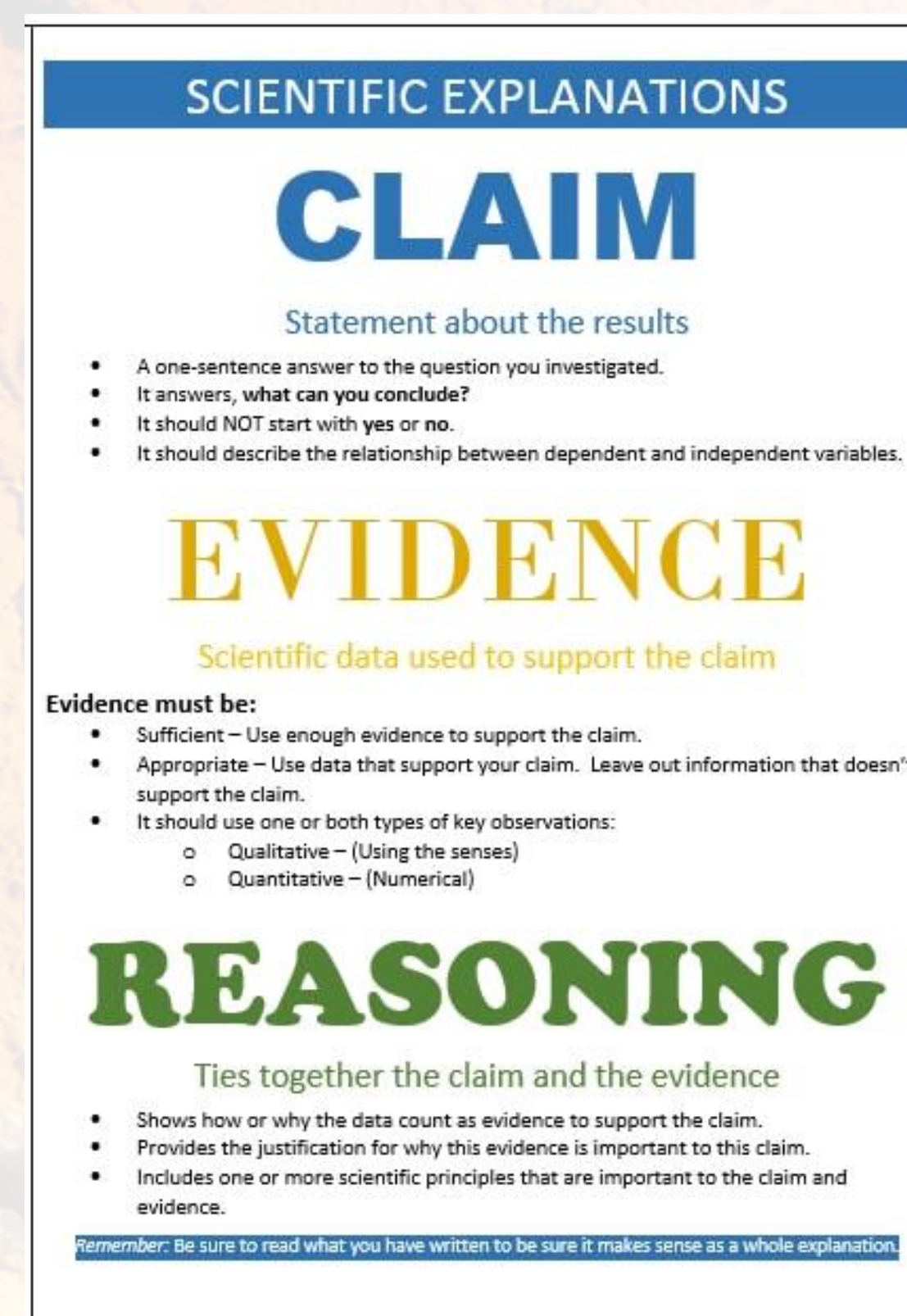
Lesson Outcomes

- 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 & Reasoning.

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