

Study on bacteria and calcite fixation on soils and consequent durability of the improvement achieved by biocementation. Development of monitoring tools

Summary

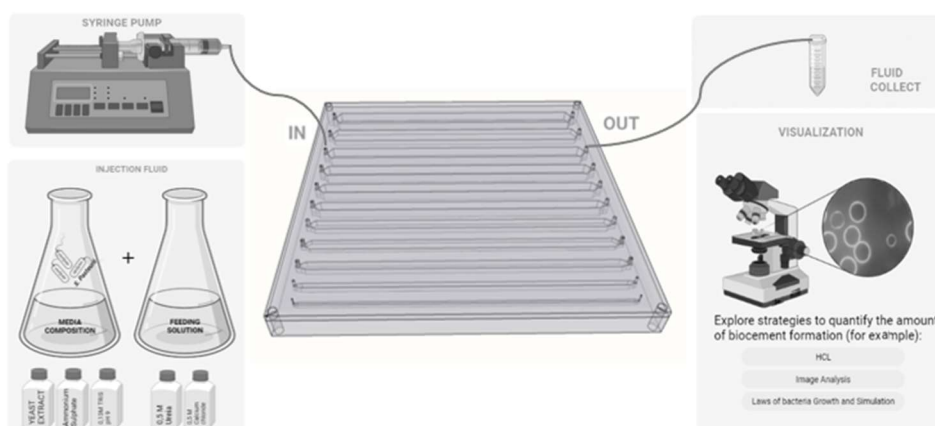
Biocementation consists in the exogenous inclusion of microorganisms (bacteria or enzymes) and additives, capable of promoting the local precipitation of calcium carbonate (biocement) that binds soil particles and rock fractures. The research methods fit within the field of biotechnology, based on biochemical-geological phenomena with the objective of improving soils and rock masses by modifying their hydromechanical properties, resulting in long-term improvements.

The project focuses on the experimental investigation of this treatment's durability through the detailed investigation of the occurrence of the precipitation process, fixation of bacteria and calcite minerals through two different study procedures: Small scale (from microfluidic devices) and real scale in rock fractures. The results will allow the definition of the monitoring tools that will be applied in the treatment of rock fractures and rehabilitation of stone monuments. In the present time, although several studies have demonstrated the effectiveness and potential of the treatment by biocementing, its durability is still unknown. In this context, the main objective of the present study is to develop a study on the experimental investigation of the durability of the treatment and on the definition of monitoring and maintenance tools capable of verifying the process of precipitation and fixation of calcite minerals in the long term.

This work will be structured around two main axes: i) the study of the main factors that promote the effective fixation of bacteria on the surface of soil particles and the monitoring of the conditions of calcite mineral formation, in detriment of other soluble polymorphs of calcium carbonate; ii) the study of durability, considering realistic field conditions, and the monitoring and maintenance tools to be used during and after treatment, as a method to understand the amount of calcite and chemical products of biological activity.

Keywords

Biocementation, biominerals, calcite, calcium carbonate (CaCO_3), durability microfluidic devices.



Scheme of the Microfluidic devices under development to study the precipitation of biocement under different conditions (pH, flow velocity, etc).



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Period

2020-2025

Funding

FCT scholarship (2020.09111.BD)