## Development of a compact and portable system for monitoring microbial induced carbonate precipitation in soils

Proposers

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Introduction

Microbial-induced carbonate precipitation (MICP) or biocementation is an *in situ* soil strengthening technique that uses ureolytic bacteria to induce calcium carbonate precipitation. The correct combination of physical and chemical parameters to control MICP is still a major challenge. This proposal aims to develop a lab-on-a-chip device capable of screening the large number of parameters that influence MICP by combining the consolidated know-how in microfluidic and biosensor platforms at INESC-MN, and expertise in the fields of mechanical stability of soils at CERIS, IST, and in biotechnology at IBB, IST. The proposed device will integrate an electronic readout, for feedback control of the critical parameters. The knowledge earned will provide valuable information to design soil improvement solutions using this technique.

Project outline/goal

This proposal describes the development of a compact and portable system for monitoring MICP in soils, using integrated technologies such as microfluidics and microsensors. Among the most important factors to be studied are the number of bacteria, the type, concentration and feeding rate of nutrients and time necessary to achieve the desired result.

The device will consist of a central chamber, where the soil sample will be mounted, and supplied with bacteria and nutrients/reagents by inlet channels. For temperature and pH control, commercially available sensors will be integrated. Integrated biochip sensors for carbonate, ammonium and urease will be developed in-house, when deemed necessary. Permeability tests will be performed to monitor soil stiffness increment as a result of carbonate precipitation. The proposed device will integrate an electronic readout, for feedback control of the critical parameters.

Additionally, once proof-of-concept has been established, the device will be used to determine the best set of conditions to produce the maximum amount of biocement for a specific soil type through trial tests performed under optimized conditions.

Student profile

*Profile sought: preference, but not limited, to students with a background in Biotechnology, Biology and Biochemistry, with interest in material characterization and in the development of microdevices and electronics.*