**GEOPHYSICAL MONITORING OF MICROBIAL INDUCED CARBONATE PRECIPITATION (MICP) AT THE INTEGRATED FIELD RESEARCH CHALLENGE (IFRC) SITE, AT RIFLE, CO**

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Soil stabilization is essential in addressing problems related to foundation support, road construction and soil erosion. Stabilization methods aim to enhance soil stiffness typically through the formation of a new mineral phase that will act as cementing agent. Microbial induced carbonate precipitation (MICP) is a promising method where common soil borne microbes induce carbonate precipitation through ureolysis. MICP is an attractive cost-efficient method that can achieve the desired soil strengthening with minimal environmental impact and at large spatial scales. Successful field application of soil strengthening methods involves in-situ verification. Direct sampling is expensive, invasive, time consuming and spatially/temporally limited. Therefore, a robust monitoring method with high spatial and temporal resolution is required.

In this study we present results from a field MICP application at the Integrated Field Research Challenge (IFRC) site, at Rifle, CO. The site is suitable for MICP studies due to the presence of ureolytic microbes and detailed subsurface information. Microbial activity was stimulated with molasses, followed by controlled urea injection.

Microbes were captured from groundwater and from artificial sediments suspended in monitoring wells. Bacterial DNA was extracted, and a 16S rRNA gene survey showed specific bacterial cohorts stimulated by injections in the field. Furthermore, chemical analysis showed increasing concentration of ammonia in the treated area.

To track petrophysical changes within soil/water interface, induced polarization (IP) monitoring was conducted. During the experiment subsurface IP images showed increasing phase values in the treatment area, consistent with the formation of a new mineral phase (carbonate?). In agreement to the IP images, shear-wave velocity measurements increased, suggesting an increase in soil stiffness within the treatment area of interest.

Our results support the use of MICP in field scale soil strengthening applications, and confirm the applicability of geophysical methods as robust monitoring tools.