EnBiorganic Technologies' Malcolm Burbank Wins US Air Force Revetment Challenge

Feasibility study on utilizing microbial-induced calcite precipitation (MICP) to create highly portable, fast-deploy soil revetment structures proves successful

The revetment test wall was subjected to test fire from 50 yard distances and successfully stopped every shot

:AS VEGAS, NV, UNITED STATES, October 20, 2023 /EINPresswire.com/ -- EnBiorganic Technologies LLC. and Boise State University's Department of Civil Engineering recently concluded a feasibility study on employing microbial-induced calcite precipitation (MICP) to create highly portable, fast-deploy soil revetment structures. The method employs local soil and indigenous bacteria to produce calcite precipitation, which strengthens the soil, making it capable of absorbing massive pressure loads.

Dr. Malcolm Burbank, lead technologist and microbiologist with EnBiorganic Technologies—a world leader and trailblazer in the research and deployment of microbiology-based technology solutions—is part of a team of engineering students and faculty from Boise State University won the Air Force Revetment Challenge (AFRC).

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> *Dr. Malcolm Burbank, EnBiorganic Technologies*

Dr. Burbank serves as a principal investigator on the project with Dr. Bhaskar Chittoori, Chair and Professor for Civil Engineering at Boise State University. They lead students from the Boise State University Civil Engineering department, who researched the use of microbial induced calcite precipitation (MICP) to strengthen local soil from a given location to build a stronger, more effective revetments. Revetments are sloped barrier structures formed to secure a site from artillery, bombing, or stored explosives.

The focus of the research was to determine the feasibility of developing revetment structures—relatively small, protective barricades—to protect critical Air Force assets from aircraft blowback, small arms fire and shrapnel, using MICP with locally available soil.

Geocell with material and MICP treatment for creation of "wall blocks"

This research project details the design, construction, and testing of revetment walls, using geotechnical data to determine the structures' infill and foundation soils. Various required soil properties were specified, along with GEOWEB MSE design parameters and safety factors. The key innovation involved converting the pressure load of a bullet (equivalent to that of 200 mph winds) into retained soil pressure, using just materials found on the build site, plus an additive to catalyze the MICP process.

MICP treated soil form created with Geocell is now ready for stacking to create a revetment structures

Two construction methods—kinetic and static—were studied, using lightweight polyethylene "geocells" to hold soil treated with MICP. The resulting filled forms were stacked to create the freestanding vertical barriers. These barriers were then tested at a site in Bowmon, Idaho.

The revetment structures were tested virtually, using design software calculations, as well as mechanically, by having various caliber bullets fired into them. The experimental results demonstrated the effectiveness of the wall designs in resisting penetration from the bullets.

The kinetic method of wall construction performed better in penetration tests, compared to the static method. This is likely due to varying CaCO3 precipitation between the structures. Weather challenges and temperature conditions were also noted as factors influencing the process. The overall findings highlight the potential of the analyzed structures to withstand specific pressures and offer insights into optimal design and construction methodologies of barriers intended for specific applications, such as object penetration resistance.

The study contributes to the field of geotechnical engineering, offering innovations in ground improvement using locally sourced materials and microbial-induced techniques. It details an approach to potential applications in coastal and military protective infrastructure. The study also proves that—ultimately—this innovative technology could work in commercial, municipal, civilian, and emergency management applications. Larger structures could be made for efforts such as reinforcing ground stability for building foundations in seismic zones, creating safety zones in underground mines, and quickly constructing adequate and durable temporary shelters for those displaced by natural disasters.

“Bhaskar and I have worked closely over the past several years to explore other applications for MICP, and have enjoyed many successes,” explains Dr. Burbank. “This success will allow us to move forward with testing MICP to make protective barriers for our military.”

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USA based EnBiorganic Technologies LLC, founded in 2019, bridges science and technology to contribute to a living planet. We are driven to build innovative solutions based on a foundation of solid science. Our team is focused on solving big issues that will have a significant impact, in our backyard and beyond. Our current breakthroughs in wastewater solutions, HAB remediation, animal agriculture and now soil structure enhancement create value for our clients, while protecting the planet’s most valuable resources. Learn more at https://enbiorganic.com.

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