Rapid Flood Damage Mitigation and Resilience Through Modular Biocement Infrastructure

Delivering fast, cost-effective, and resilient flood protection by transforming local soils into permanent infrastructure through microbial biocementation.

PROBLEM STATEMENT

Flooding causes up to $9.7 billion in annual damage to U.S. transportation infrastructure, impacting roads, bridges, railways, airports, and ports. Current flood mitigation projects require massive volumes of quarried aggregates, which are often sourced from distant locations. The high cost and logistical burden of transporting these heavy materials frequently lead to project delays and cost overruns, slowing efforts to protect critical infrastructure. There is a pressing need for faster, more cost-effective, and sustainable methods to build and repair flood protection systems and resilient transportation networks.

PROJECT PLAN

Objective 1 - Biological Product and Process Development	
	Milestone 1 - Demonstrated biocementation of sand column with optimized strain
Objective 2 - Bioengineered Sandbag Development	
	Milestone 2A - Demonstrated biocementation of biofiber mat
	Milestone 2B - Production of 5 m^2 of prototype textile
Objective 3 - Lab-scale Demonstration of Comprehensive Process	
	Milestone 3 - Demonstrated biocementation of sandbags into single hardened unit
Deliverable - Final Project Report and Transition Recommendations	

APPROACH

This project will develop a modular Microbial Induced Calcite Precipitation (MICP) system that uses bioengineered sandbags filled with local substrates to create durable, erosion-resistant flood mitigation structures. The sandbags will provide initial structural integrity during placement, then gradually biodegrade as the MICP process hardens and consolidates the material into a unified structure. By leveraging adaptive culturing of *Sporosarcina pasteurii*, the system will deliver predictable, scalable biocementation, reducing reliance on quarried aggregates and enabling faster, lower-cost construction of levees, sea walls, and raised transportation corridors.

IMPACT

If successful, this technology could transform flood mitigation and infrastructure resilience by enabling rapid, low-cost construction using locally sourced materials. Its modular design offers potential for a wide range of future applications, including disaster relief, transportation infrastructure repair, erosion control, and coastal resilience projects. By combining the speed of temporary barrier systems with the durability of permanent structures, this approach could support broader civil engineering, environmental restoration, and emergency response efforts.