Title: Evaluation of Chitosan-Graphene Oxide Composites for Management of Harmful Algal Blooms

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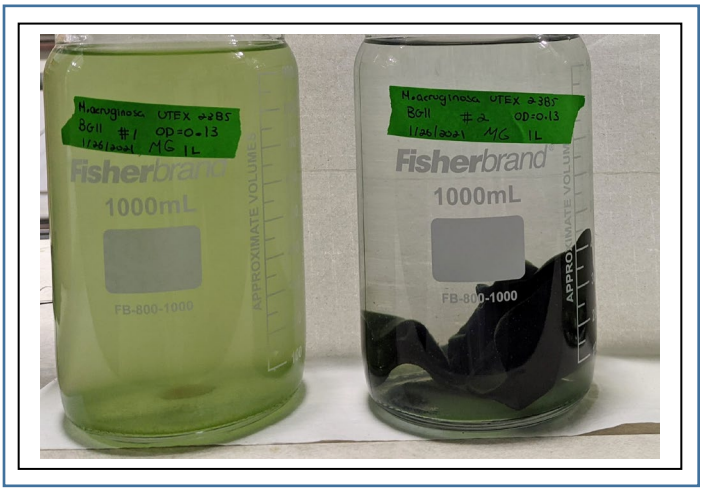
USACE District Liaison: N/A



Problem: Harmful algal blooms (HABs) caused by cyanobacteria and other algal species annually cause water quality concerns in domestic waterways throughout the Nation that damage human health, environmental security, and various industries, including tourism and fishing. Current solutions for HABs are limited. Therefore, sustainable technologies must be developed and tested to ensure management of HABs to protect water quality nationwide for prolonged use and welfare.

Objective: This effort aimed to evaluate the efficacy of a materials-based approach for management of HABs. Innovative polymer composites were fabricated using graphene-based materials and chitosan, a derivative of the world's second-most abundant biopolymer chitin. Removal capacities and rates for various algal species and toxins related to HABs were analyzed following introduction to materials developed for this study to understand interactions and fully determine performance for this application.

Approach: Evaluations were conducted at various scales with novel technologies prepared for HAB management strategies. Individual solutions containing different algal monocultures, including freshwater species with varying degrees of toxicity, were assessed while in contact with composite materials developed utilizing a patented wet-casting technique in addition to related base materials as comparative treatment technologies. Toxins produced by certain algal cultures were also tested following introduction to the technologies included in this study to analyze their removal performances. These assessments were conducted initially at laboratory scale, and favorable technologies were further tested at small pilot scales.

Value to USACE Mission: This project will ultimately provide cost-efficient technologies that can be deployed to manage HABs and mitigate their effects. Furthermore, this project will advance the knowledge base of capabilities for this application to promote further development efforts.

Major Milestones:

Date	Title	Cost
FY21, Q2	Technical Report: Laboratory Evaluations of HAB Management Strategies	$100,000
FY21, Q4	Technical Report: Scaling Efforts for HAB Management Strategies	$200,000
FY21, Q4	Patent Application: Graphene-related HAB Management Technologies	$57,000
FY22, Q1	Master's Thesis: Graphene-based Composite Materials	$50,000
	Total Estimated Cost	**$407,000**

Partner/Leveraging Opportunities: This work will leverage multiple collaborations and other work units including: Rice University, the University of Southern Mississippi, and the University of Mississippi.