Using marine bacteria for bioremediation of petroleum-based pollutants

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Abstract: Cleaning up marine-based oil spills promptly and thoroughly is crucial for protecting the environment. One method for achieving this is bioremediation, the utilization of microorganisms to break down the oil. While effective, this process can take months to completely remove the oil, prompting researchers to explore ways to accelerate it. Since the 2010 Deepwater Horizon oil spill, there has been a new interest in the use of nanoparticles to expedite the natural oil biodegradation process. In our 2022 review article, we coined this "nano-enhanced bioremediation". These nanoparticles can play an essential role in enhancing the accessibility of oil to microorganisms. Our research has focused on investigating the impact of three different nanoparticles - silica, silver, and lignin - on the oil-degrading capabilities of the marine bacterium Alcanivorax borkumensis. Interestingly, we have found that the charge of the nanoparticles influences their binding to both the bacterium and the oil. By manipulating the charge using a positively charged polyelectrolyte, chitosan, we have demonstrated that we can engineer nanoparticles to accelerate the breakdown of spilled oil. The findings hold promising implications for a more sustainable approach to addressing large-scale oil spills. Additionally, building on the well-known oil-degrading abilities of A. borkumensis, our ongoing studies are exploring its potential for breaking down polyethylene, offering hope for environmentally friendly solutions to this ubiquitous pollutant.

About the speaker: Amber is currently an assistant professor in the Doshi Department of Chemical and Biochemical Engineering. She recently joined the department this semester. Before coming to this department, she worked as an assistant professor at the University of North Alabama. Her PhD in Chemical Engineering was completed at Louisiana State University under the supervision of Bhuvnesh Bharti, a physical chemist, and Michael Benton, a microbiologist. This interdisciplinary guidance has influenced her to focus on research related to using a chemical engineering approach to address environmental issues. Before earning her PhD, she briefly worked as an analytical chemist and process engineer at Westlake Chemical. She is a member of various organizations, including AIChE, ACS, the Society of Women Engineers, and the National Society of Black Engineers. She has received awards for her research at the Soft Matter Conference in 2022 and the Colgate Smile with Science Symposium.