# Does the shape of crude oil remnants impact rate of biodegradation?

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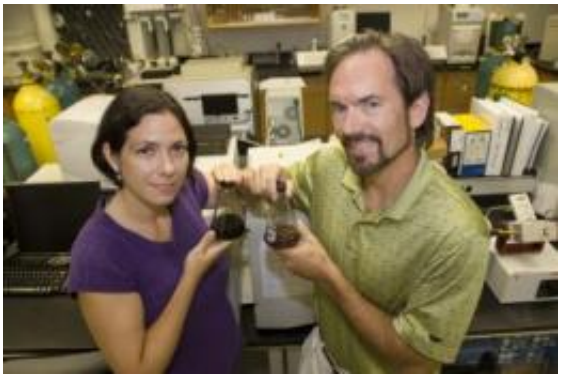

Amy Pruden-Bagchi and Mark Widdowson, faculty members in Virginia Tech's Charles E. Via Jr. Department of Civil and Environmental Engineering, are determining how microbes digest different shapes of oil left by the Gulf of Mexico oil spill. Credit: Virginia Tech Photo

Virginia Tech College of Engineering researchers have received a $60,000 one-year National Science Foundation grant to study how naturally occurring microbes can best be used to eat away remaining crude oil spilled in the Gulf of Mexico. Their choice of weapon: Geometry.

Fueled by oxygen, naturally occurring bacteria can slowly destroy blobs and slicks of crude oil without the use of additional chemicals. Faculty researchers at Virginia Tech's Charles E. Via Jr. Department of Civil and Environmental Engineering (CEE) hope to determine if the shape of

crude oil remnant - be it a flat syrupy sheet or a tar ball - can affect deterioration rates. The researchers also will study how a lack of oxygen can hinder microbe growth, and how carbon leaching from dissipating oil can further fuel these oil-eating microbes, a two-step process known as mass transfer and biodegradation. Remaining toxic chemicals left behind by the spill also will be studied at Virginia Tech labs in Blacksburg.

"This research has the potential for improving our understanding of the long-term persistence of chemicals in the environment. In terms of clean up, there are many problems left to solve regarding the most toxic and recalcitrant pollutants that dissolve out of liquid sources, not just associated with oil spills, but at industrial sites, etc.," says Mark Widdowson, professor and assistant department head of CEE. He is spearheading the research with Amy Pruden-Bagchi, associate professor of CEE.

Widdowson and Pruden-Bagchi stipulate that oil remnants that have the geometric shape of flat surfaces will dissipate slower compared to tar balls that can be "surrounded" by microorganisms. "Each has a unique geometry where the rate of dissolution is controlled by exposed surface area," Widdowson and Pruden-Bagchi wrote in their grant proposal. "For oil layers, aerobic biodegradation on the underside of the deposit will be severely limited by oxygen availability."

More than 200 million gallons of oil is estimated to have spilled into the Gulf after the April 20 blowout at BP's Deepwater Horizon, an incident which also killed 11 people. More than 500 miles of shoreline is affected along the Gulf Coast, which "underscores the urgent need for research that will lead to accurate predictions of the long-term persistence of the crude oil in coastal environments," the researchers wrote in their proposal. Unknown is how the various chemicals used to more quickly disperse massive bodies of crude oil will affect future oxygen levels. If

oxygen levels remain low in high-chemical-use areas, microbes likely will not grow fast.

Remaining crude oil buried by sand, debris or grasses can remain for years. "There are some reports in Alaska, where you can dig a few inches in the ground and find oil left over from the Exxon Valdez spill," said Pruden-Bagchi of the 1989 incident that spilled anywhere from 11 million to 32 million gallons - numbers vary by source -- of crude oil in the Prince William Sound. "Limited oxygen is a big part of the problem."

Before the grant was officially awarded, Widdowson and Pruden-Bagchi led a student team to the lower coast of Alabama to collect samples in late July. Additional funding for this trip and the study came from two Virginia Tech research programs, the Institute for Critical Technology and Applied Science (ICTAS) and the Institute for Society Culture and the Environment (ISCE).

In Alabama, along oxygen-rich beaches, they found no large oil slicks or massive tar balls, but smaller, raison-shaped chunks of oil with the texture of soft licorice. In oxygen-poor wetland areas, thick, sludgy raisin-shaped balls of oil are still being reported. The researchers already have received assistance from the U.S. Coast Guard and the Environmental Protection Agency in surveying and sampling the crude oil.

"Most of the remaining oil will end up in the marshes and on the sea floor, and may not be obvious as it is on the beaches," said Pruden-Bagchi. Future trips to the Gulf coast are planned.

Widdowson and Pruden-Bagchi are focused on sharing the information with those handling the Gulf Coast disaster and future oil spills, but also plan to submit their findings for publication in peer-reviewed scientific

journals. Pruden-Bagchi also conducted an oil spill clean-up activity for regional middle school students through Virginia Tech's Imagination summer camp, held in July.

Both lead researchers are familiar with the Gulf Coast. Pruden-Bagchi's spouse has relatives conducting research at Mobile's University of South Alabama, while Widdowson has lived in Alabama. "My wife and I both attended Auburn University and occasionally managed to slip away to the Gulf beaches, including Gulf Shores. We were attracted by the beauty of the white sand and crystal clear ocean."

Provided by Virginia Tech