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Press Release

Oil dispersants can suppress natural oil-degrading microorganisms, study shows

Researchers simulate Deepwater Horizon spill in the Gulf of Mexico

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The use of chemical dispersants meant to stimulate microbial crude oil degradation can in some cases inhibit the microorganisms that naturally degrade hydrocarbons, according to a new study led by scientists from the Universities of Tübingen and Georgia.

Samantha Joye, Georgia Athletic Association Professor of Arts and Sciences, and Dr. Sara Kleindienst of Tübingen's Center for Applied Geoscience, base their findings on laboratory-simulated conditions that mimic Gulf of Mexico deep waters immediately following the Deepwater Horizon oil spill. Their results are published in the latest *Proceedings of the National Academy of Sciences*.

The team found that the presence of dispersants significantly altered the microbial composition of Gulf deep water by promoting the growth of *Colwellia,* a group of microorganisms capable of dispersant degradation. However, when oil alone was added to parallel samples in the absence of chemical dispersants, the growth of natural hydrocarbon-degrading *Marinobacter* was stimulated.

Chemical dispersants were applied in an unprecedented volume to the sea surface and deep waters of the Gulf of Mexico after the 2010 spill. As a first line of defense, 7 million liters of chemical dispersants were applied to increase the breakdown of oil compounds by microorganisms. The uncontrolled oil well blowout released more than 750 million liters of oil into the Gulf. For their study, Joye and Kleindienst simulated the Deepwater Horizon conditions at a depth of 1200 meters - where both oil and dispersants were present in high concentrations.

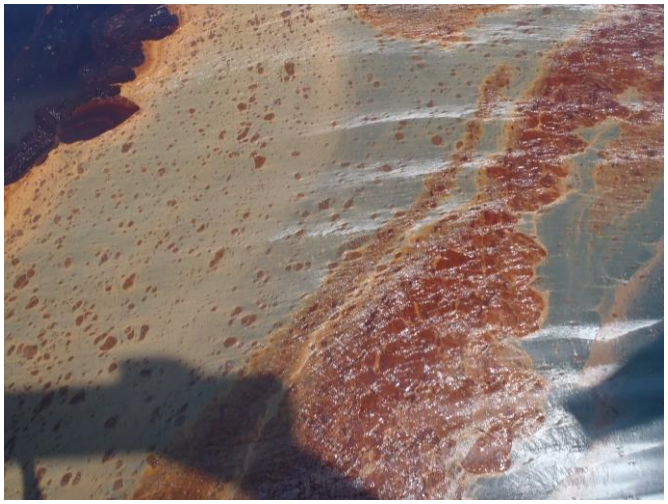
"We were able to demonstrate that chemical dispersants did not accelerate the breakdown of oil at such depths. Some types of substances were broken down faster without them," said Dr. Michael Seidel, co-author from the University of Oldenburg. The researchers used

radioactive markers to watch how microbes broke down two families of substances which in large part make up crude oil. In the presence of dispersants, this activity was less - this was “a key finding in the study,” according to Kleindienst. Similar effects were observed in a surface-water experiment.

The simulation also revealed that *Marinobacter* - proteobacteria which degrade the hydrocarbons in oil - multiplied even without dispersing agents. But their numbers were reduced by the addition of dispersing agents, while other micro-organisms of the genus *Colwellia* multiplied. “This same group was found in large numbers in deep water during the *Deepwater Horizon* disaster,” said Kleindienst. Chemical analyses showed that types of *Colwellia* are probably responsible for the decomposition of dispersants. “Interestingly, natural oil degraders like *Marinobacter* did not rise in number in deep water during the disaster. They were likely overgrown by dispersant degraders like *Colwellia* or hindered directly by the dispersing agents,” she concludes.

Kleindienst says more experiments are needed to assess the risks to ecosystems different from that of the Gulf of Mexico. “We need to better understand the exact effects of dispersants from the cell level - such as their influence on the activities of oil-degrading micro-organisms - up to the ecosystem level. That will be a deciding factor in whether it really makes sense to use dispersants after an oil spill,” Kleindienst says.

Microcosms simulating the chemical conditions of the *Deepwater Horizon* disaster. Oil, dispersants, or a mixture of the two, with and without nutrients, were added to sea water from a depth of 1200m in the Gulf of Mexico. Photo: Sara Kleindienst



Large-scale oil pollution on the surface of the Gulf of Mexico following the *Deepwater Horizon* spill. Photo: Samantha Joye

Publication:

S. Kleindienst , M. Seidel , K. Ziervogel , S. Grim , K. Loftis , S. Harrison , S. Malkin , M. J. Perkins, J. Field , M.L. Sogin , T. Dittmar , U. Passow , P.M. Medeiros , S.B. Joye (*in press*). Chemical dispersants can suppress the activity of natural oil-degrading microorganisms. *Proceedings of the National Academy of Sciences*

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