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Mixing Oil and Water

When the Deepwater Horizon (DWH) oil rig exploded in the Gulf of Mexico in 2010, scientists knew the fallout would be far-reaching — both geographically and temporally. What investigators didn't know until now is that the millions of gallons of chemical dispersants meant to stimulate microbial crude oil degradation in some cases inhibited the microorganisms that naturally degrade hydrocarbons.

A team of marine scientists, led by the University of Georgia and including UC Santa Barbara biological oceanographer Uta Passow, discovered this in laboratory experiments when they mimicked the conditions of the Gulf of Mexico's deep waters immediately following the DWH oil spill. Their findings appear today in the Proceedings of the National Academy of Sciences.

"This paper shows that the species composition completely changes in the presence of chemical dispersants such as Corexit," said Passow, a researcher at the Marine Science Institute. Corexit works by emulsifying crude oil into minuscule droplets that scatter in seawater.

The study examined microbial oil degradation in the DWH plume by simulating concentrations of oil and dispersant as observed during the incident. The team found that the dispersants significantly altered the microbial composition of gulf deep water by promoting the growth of Colwellia, a group of microorganisms themselves 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. During the spill, Passow noted, Marinobacter were not abundant in deep water plume samples, possibly as a consequence of dispersant applications. Study results demonstrate that the naturally occurring communities of oil-degrading microorganisms — particularly Marinobacter — are quite proficient at degrading oil and are even more so in the absence of chemical dispersants.

“Although the most stunning result is obviously that Corexit impacted bacterial composition, and thus oil degradation, the results on marine oil snow production in the different treatments are very intriguing as well,” said Passow. She is an expert on marine snow, a naturally occurring formation of aggregated oil and organic matter.

“It appears that the formation of microbial oil snow is much more complex than we initially thought,” she added. “Not only do different bacteria lead to different types of marine snow, but nutrients and the type of oil addition matter as well. Still, there is much we need to learn about the formation of marine snow in the presence of oil.”

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