New strain of bacteria discovered that could aid in oil spill, other environmental cleanup

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Researchers have discovered a new strain of bacteria that can produce non-toxic, comparatively inexpensive "rhamnolipids," and effectively help degrade polycyclic aromatic hydrocarbons, or PAHs - environmental pollutants that are one of the most harmful aspects of oil spills.

Because of its unique characteristics, this new bacterial strain could be of considerable value in the long-term cleanup of the massive Gulf Coast oil spill, scientists say.

More research to further reduce costs and scale up production would be needed before its commercial use, they added.

The findings on this new bacterial strain that degrades the PAHs in oil and other hydrocarbons were just published in a professional journal, *Biotechnology Advances*, by researchers from Oregon State University and two collaborating universities in China. OSU is filing for a patent on the discovery.

"PAHs are a widespread group of toxic, carcinogenic and mutagenic compounds, but also one of the biggest concerns about oil spills," said Xihou Yin, a research assistant professor in the OSU College of Pharmacy.

"Some of the most toxic aspects of oil to fish, wildlife and humans are from PAHs," Yin said. "They can cause cancer, suppress immune system

function, cause reproductive problems, nervous system effects and other health issues. This particular strain of bacteria appears to break up and degrade PAHs better than other approaches we have available."

The discovery is strain "NY3" of a common bacteria that has been known of for decades, called Pseudomonas aeruginosa. It was isolated from a site in Shaanxi Province in China, where soils had been contaminated by oil.

P. aeruginosa is widespread in the environment and can cause serious infections, but usually in people with health problems or compromised immune systems. However, some strains also have useful properties, including the ability to produce a group of "biosurfactants" called rhamnolipids.

A "surfactant," technically, is a type of wetting agent that lowers surface tension between liquids - but we recognize surfactants more commonly in such products as dishwashing detergent or shampoo. Biosurfactants are produced by living cells such as bacteria, fungi and yeast, and are generally non-toxic, environmentally benign and biodegradable. By comparison, chemical surfactants, which are usually derived from petroleum, are commonly toxic to health and ecosystems, and resist complete degradation.

Biosurfactants of various types are already used in a wide range of applications, from food processing to productions of paints, cosmetics, household products and pharmaceuticals. But they also have uses in decontamination of water and soils, with abilities to degrade such toxic compounds as heavy metals, carcinogenic pesticides and hydrocarbons.

Although the type of biosurfactant called "rhamnolipids" have been used for many years, the newly discovered strain, NY3, stands out for some important reasons. Researchers said in the new study that it has an

"extraordinary capacity" to produce rhamnolipids that could help break down oil, and then degrade some of its most serious toxic compounds, the PAHs.

Rhamnolipids are not toxic to microbial flora, human beings and animals, and they are completely biodegradable. These are compelling advantages over their synthetic chemical counterparts made from petroleum. Even at a very low concentration, rhamnolipids could remarkably increase the mobility, solubility and bioavailability of PAHs, and strain NY3 of P. aeruginosa has a strong capability of then degrading and decontaminating the PAHs.

"The real bottleneck to replacing synthetic chemicals with biosurfactants like rhamnolipid is the high cost of production," Yin said. "Most of the strains of P. aeruginosa now being used have a low yield of rhamnolipid. But strain NY3 has been optimized to produce a very high yield of 12 grams per liter, from initial production levels of 20 milligrams per liter."

By using low-cost sources of carbon or genetic engineering techniques, it may be possible to reduce costs even further and scale up production at very cost-effective levels, researchers said.

The rhamnolipids produced by NY3 strain appear to be stable in a wide range of temperature, pH and salinity conditions, and strain NY3 aggressively and efficiently degrades at least five PAH compounds of concern, the study showed. It's easy to grow and cultivate in many routine laboratory media, and might be available for commercial use in a fairly short time. Further support to develop the technology is going to be sought from the National Science Foundation.

"Compared to their chemically synthesized counterparts, microbial surfactants show great potential for useful activity with less environmental risk," the researchers wrote in their report. "The search

for safe and efficient methods to remove environmental pollutants is a major impetus in the search for novel biosurfactant-producing and PAH-degrading microorganisms."

Provided by Oregon State University

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