Speeding up nature's oil spill cleaners

September 11 2014

Imagine if oil spills could be completely cleaned up soon after a marine accident. And this could be made possible thanks to none other than warrior microorganisms who attacked and completely broke down the oil. The latter might sound like a science fiction movie, but it actually happens in nature. Regardless of human methods used to deal with oil spills, the sea has its own self-cleaning abilities. Bacteria naturally appear in the sea wherever there is an oil leak and eat most of the pollution. But once crude oil is spilled in a pristine marine environment, it takes at least one week before such biodegradation processes begin to take effect.

Now, the EU funded project, Kill-Spill, due to be completed in 2016, is trying to accelerate the natural degradation processes of these microorganisms. "Our main objective is to come up with new technologies to enhance natural bio-degradation carried out by sea microbes by offering microbes everything necessary to eat up all the oil faster," says project coordinator Nicolas Kalogerakis, professor of biochemical engineering at the Technical University of Crete, in Greece. This means that oil spills may be cleaned up faster and more easily without the use of chemical substances. In effect, humans may help nature do its job faster.

Depending on the type of crude oil, natural bioremediation takes about 12 months for light crudes. According to Kalogerakis, Kill-Spill aims to reduce that to less than half by stimulating the microorganisms with the missing nutrients like nitrogen and phosphorous and by reducing toxicity of dispersants by using bio-based products such as biosurfactants. "For heavier crude oils we expect a similar trend," Kalogerakis tells

youris.com.

The approach developed by the project's researchers consists in spraying the oil with a biodegradable compound made from fermenting vegetable oils. "This spray breaks the oil up into smaller droplets. These can then be attacked by the microorganisms in the environment," explains Kalogerakis.

The researchers then take samples of the polluted sea water and cultivate microorganisms from it. "We create a large biomass of oil-eating bacteria and then we spray them back over the oil spills. So we are simply accelerating the natural process of marine self-cleaning," Kalogerakis explains. In order to stimulate the bacteria to eat, the researchers developed particles that release nutrients like phosphorus and nitrogen, which are delivered directly to the bacteria.

The technologies that will be produced by the project are expected to be field-tested in open sea oil spills from the Eastern Mediterranean to Disko Bay in Greenland and in large mesocosms, according to Kalogerakis. "Several other innovative products that are being developed will also be benchmarked with existing solutions. These will use analytics, biosensors, and 'omics' and will be checked for eco-efficiency to merit green label," Kalogerakis adds.

Experts believe that oil spill response systems have the potential to be effective in reducing damage, but only if the oil type and sea conditions allow it, if the spill can be rapidly contained and if the right equipment is in the right place at the right time. "A spill in heavy weather, far offshore, deep underwater or in areas of ice cover will likely remain extremely difficult, if not impossible, to deal with effectively" comments David Santillo senior scientist specialised in environmental chemistry at the Greenpeace Science Unit, based at Exeter University, UK. Santillo believes that research should take into account the

consequences for the marine environment as a result of the treatments applied. "Some conventional spill systems use chemicals that are known to be harmful for marine life and some can render the oil less visible and harmful at the surface but more toxic to marine species beneath the surface" Santillo tells youris.com

Another expert comments on the challenges the project faces regarding in-the-field applicability. Each spill is unique and therefore its clean-up needs detailed planning and extreme caution. "In this context, the effort recorded within the project is significant," says Nikolaos Ventikos, an assistant professor at the Laboratory for Maritime Transport, National Technical University, Athens, in Greece. "However the major problem when we are focusing for oil spill confrontation on biotechnologies and bioremediation is the application of such techniques on the site of the spill. Hence away from the lab, or from controlled conditions," he adds, "One size fits all is a principle that is very difficult to be applied in this field of operations."

Confronting an oil spill is made more challenging by the fact that many other factors need to be taken into account. These include the time of alert, the spill source, the environmental conditions, the geomorphology, the type and quantity of spilled oil, the season, and human related activities.

Another expert adds that it is a prudent and logical goal to develop environmentally neutral products for mitigating the results of oil spills while limiting additional stress on the environment. "All spill remediation strategies, including biological ones, have the potential to impact natural ecosystems in ways that may not be immediately obvious, so resource managers have a challenging job in choosing potential remediation strategies, especially because each spill is different," says Dana Wetzel, manager of the Environmental Laboratory for Forensics at Mote Marine Laboratory, in Sarasota, Florida, USA. Wetzel and her lab

advance research on organic contaminants in the environment while developing novel techniques for understanding how stressors, including oil components, affect marine animals and environmental health.

Provided by Youris.com