Color-coded bacteria can spot oil spills or leaky pipes and storage tanks

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Oil spills and other environmental pollution, including low level leaks from underground pipes and storage tanks, could be quickly and easily spotted in the future using colour coded bacteria, scientists heard today at the Society for General Microbiology's Autumn meeting being held this week at Trinity College, Dublin.

"Because bacteria have simple single-celled bodies it is relatively easy to equip them with a sensor and a brightly coloured 'reporter protein' which shows up under a microscope, alerting us to different substances leaking into the soil or seawater from oil spills, agricultural chemicals or other pollutants," says Professor Jan Van der Meer from the University of Lausanne in Switzerland.

Scientists have successfully shown that living bacteria can be used as a much more environmentally friendly way of detecting pollution than the currently used chemical methods of working out what has happened. "Chemical methods are often cumbersome, require sophisticated equipment, costly reagents or nasty materials," says Professor Van der Meer. "In comparison, our sensing bacteria are very simple to maintain. Tests with the bacteria are therefore extremely easy to carry out and do not require noxious chemicals."

"Our own tests, and checks by other laboratories, have shown that pollution testing using bacteria is a remarkably robust technique and produces reliable results," says Professor Van der Meer. "The heart of our colour sensor system is the bacteria themselves. They reproduce

themselves in a growth medium, which makes the whole set-up really cheap,"

The new technique has already been successfully tested during a research expedition at sea, when the scientists demonstrated that the bacteria could measure different chemicals seeping from oil into the water, showing up as the blue light of bioluminescence in a simple light recording device.

"This can help to trace back the age of a spill and helps us to judge the immediate danger," says Professor Van der Meer. "The environmental benefits of this research are very clear. Our methods and results show how relatively simple and cheap assays could be used as a first line of defence to judge contamination in the environment. Once positive values are obtained, more in-depth studies can be performed using chemical analysis."

In principle, the same methods could also be used in hospitals or even to study food samples, according to the scientists. "Antibiotics in foodstuffs can be measured using bacteria-based assays and we have also measured arsenic contamination in rice," says Professor Van der Meer.

Technical research in this field is heading towards miniaturized sensors which can incorporate many different bacteria types, each of which responds to a different chemical. These miniaturized sensors could be used for rapid screening of samples with unknown compositions, such as water samples, but air could also be monitored for proper quality.

"You could imagine stand-alone systems such as buoys, in which bacteria sensors screen the presence of polluting compounds continuously. We don't think this will affect people in any way. The bacteria that are used for the sensing are harmless and do not multiply very well in the open environment," says Professor Van der Meer. "This makes it very safe.

Although the bacteria are normally maintained in a closed laboratory environment for the assays, it means that in case of an accidental release the bacteria are unlikely to do any harm".

The main problem with detecting oil spills and other toxic compounds at the moment is that many of the most dangerous chemicals do not dissolve in water very well, making them difficult to detect. These oils also have a strong tendency to stick to surfaces like rocks – or seabirds and shellfish – where they can last for many years, making it tricky to detect small leaks or ancient sources of pollution.

"The bacteria can detect different mass transfer rates of the pollutants, and warn us how the pollution is spreading. The bacteria are also sensitive enough to tell between different soil types and the way these hold the pollution chemicals or release them in a way that plants, animals and humans can be affected," says Professor Van der Meer.

Source: Society for General Microbiology