Better bacteria-busting techniques could make oil extraction greener and cheaper

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Credit: Newcastle University

Simple tweaks to oilfield practice could provide the offshore industry with a more sustainable solution to environmental and commercial threats posed by harmful bacteria in subsea oil deposits.

Research funded by the Engineering and Physical Sciences Research Council (EPSRC) and led by Newcastle University is investigating ways to tackle the problems linked to sulphate-reducing bacteria in offshore oil deposits.

First evolving billions of years ago, sulphate-reducing bacteria thrive in oxygen-free, watery environments. With the ability to lie dormant for very long periods, sulphate-reducing bacteria 'breathe' sulphates but 'exhale' toxic, corrosive hydrogen sulphide (H2S) when they are activated.

Known as 'reservoir souring', this increases the oil's sulphur content and so reducing its market value. Hydrogen sulphide is also highly toxic, posing a potentially deadly hazard to workers on offshore platforms, while its corrosiveness can damage pipelines and rigs, leading to oil leaks and spills.

Working with a range of private sector, public sector and academic partners from the UK and overseas, the Newcastle-led team is investigating a number of easy-to-implement, cost-cutting measures, such as adjusting the water temperature used during oil production.

As part of its work to understand how sulphate-reducing bacteria become activated in oil reservoirs, the team is investigating the widespread practice of pumping seawater into an oil reservoir to reduce temperatures and make extraction easier but which poses problems from a reservoir souring perspective.

Research lead Dr Casey Hubert, a Visiting Professor at Newcastle University from Canada's University of Calgary, said:

"Seawater is rich in sulphates, which sulphate-reducing bacteria use for their metabolism.

"Our results suggest that warming the injected seawater, so that the temperatures in a hot reservoir drop down to say 70°C rather than 50°C, could prevent sulphate-reducing bacteria activity without significantly affecting the oil extraction process."

Bacterial markers on the sea bed

Industry has already shown substantial interest with additional funding secured from large supermajors in the oil and gas sector.

One method currently used by the offshore industry to mitigate the impact of sulphate-reducing bacteria in oil reservoirs is to inject nitrates to stimulate the growth of another type of bacteria that out-compete sulphate-reducing bacteria for food. The Newcastle-led team also see major potential here to improve current practice and make it greener.

"We're working on ways to predict more accurately the nitrate dose that will be needed in any particular context, taking precise local conditions into account", Dr Hubert says.

"Adjusting the nitrate dose offers ways to better manage corrosion risks associated with reservoir souring and in some cases could cut costs if lower doses could be used. Our aim is to work with industry so that the nitrate souring control technique is understood thoroughly and sees widespread use."

The project is also exploring whether the presence of heat-loving ('thermophilic') bacteria on cold sea-floors might be a tell-tale sign of the presence of oil reservoirs below. If so, mapping and tracking the distribution of such bacteria, which might have seeped out of the reservoirs, could be a valuable, environmentally less invasive tool for oil companies to use when seeking new reserves – as well as helping to reduce the risk of unsuccessful drilling. Testing of the idea is now

beginning off Canada's Atlantic coast.

Dr Hubert concludes: "Our overall aim is to identify ways of making oil recovery more environmentally friendly. If we end up continuing to rely on fossil fuels for a few more years or decades then the imperative must be to meet our energy needs efficiently and with minimum impact on the environment."

Provided by Newcastle University