Microbially enhanced coal seam methane

CSIRO is currently developing a program on microbial enhancement of coal seam methane production, to understand the processes involved and how to apply that knowledge to replenish depleted and unproductive coal seams.

Benefits of coal seam methane

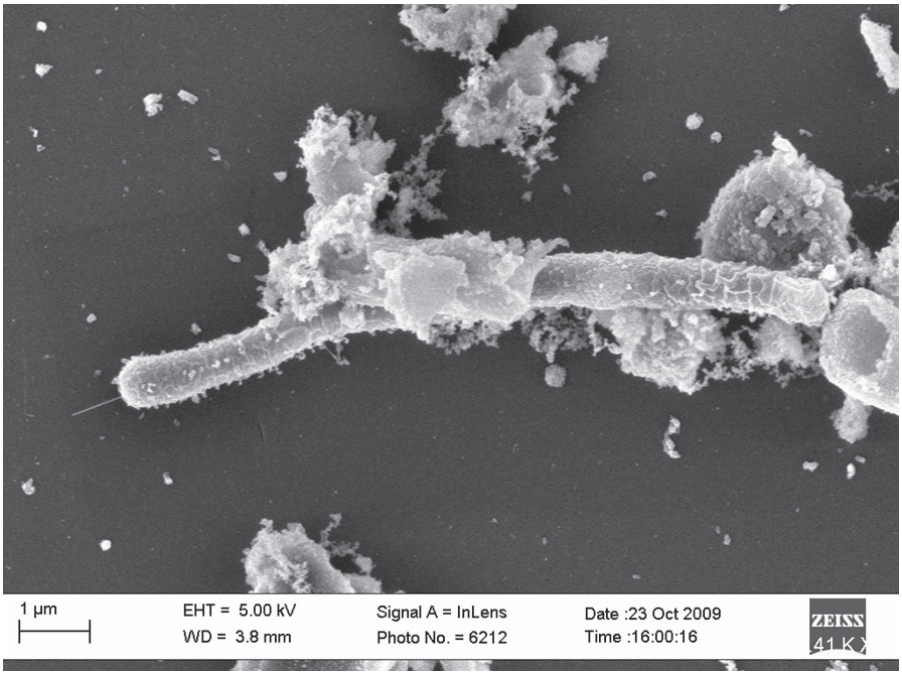
Coal seam methane (CSM), also known as coal seam gas (CSG), is becoming a widely-used energy source, particularly in eastern Australia. It already accounts for over 40 per cent of Queensland's natural gas consumption. It's use has several benefits, including:

- it is a cleaner-burning fuel than coal, generating fewer carbon dioxide (CO_2) emissions when used for the generation of electricity
- it can be considered a 'transition fuel' between coal and renewable sources of electicity
- by using microbial enhancement to prolong the life of individual production wells:
  - fewer wells are required, reducing the footprint required for CSM production
  - CSM reserves are increased thus increasing Australia's energy security.

Microbially enhanced coal seam methane

Indigenous microbes are present in coal reservoirs, and under the right conditions can produce biogenic methane. Many current high-methane production zones are confined to regions of microbial gas generation, and CSIRO research has shown that microbial activity enhances gas saturation levels of coal. This can lead to considerably higher production rates of CSM compared to areas containing only thermogenic gas.

Our team is now investigating whether methane gas production within coal seams can be further enhanced by the addition of nutrients to stimulate natural microbial activity.



Electron micrograph of coal culture.

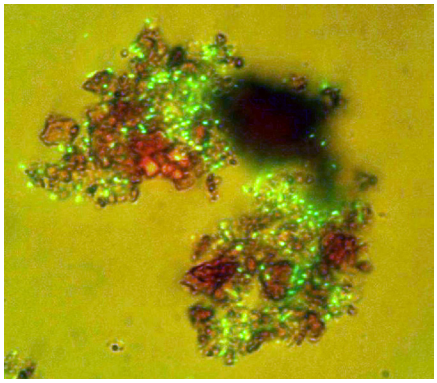
Discovery and characterisation

This program has demonstrated that most coals and coal seam-associated waters from active and prospective CSM-producing regions of eastern Australia contain active microbial populations that can produce methane using coal as sources of energy, carbon and hydrogen. The activity of these naturally occurring microbes to produce methane is stimulated in the laboratory by the addition of simple nutrients.

Predicting enhanced coal seam methane generation

The next phase of the program will focus on developing a more detailed and quantitative knowledge of methane biogenesis (interaction of microbes with the coal, nutrients and gaseous products) to optimise the process. This will then enable the development of a numerical model able to predict the rate of microbial methane generation in a coal seam.

The final phase of research will be the demonstration of the process in the field – injecting microbes and nutrients into a reservoir to improve the rate of CSM production.



Microbes stained with acridine orange growing on coal.

Project outcomes

The project aims to deliver a package of knowledge that enables the rapid regassing of depleted and/or under-saturated coal seams with methane for the Australian coal seam gas industry.

Benefits from the successful conclusion of this project include:

- reducing the need to continually drill new wells to maintain gas production
- a new field-tested technology to increase the methane content of coal seam gas reservoirs in a realistic time frame
- value-adding to existing CSM production
- increasing production of this energy source in Australia.

Ultimately, the technology may enable the conversion of some CO_2 stored in coal seams (naturally or artificially) to methane, delivering further environmental and economic benefits.

Core flooding facility to represent in situ conditions.

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