Biogenic Methane Production from Coal With Implications for Carbon Dioxide Sequestration

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ABSTRACT

Biogenic methane and carbon dioxide (CO_2) are the principle sources of coalbed gases in low rank coals and an important gas source in some high rank coals. In some coals it has been argued that ongoing biogenic methane production may contribute in real time to commercial gas production and that the associated bacterial degradation of coal may result in enhanced permeability. It has also been suggested that inoculation of coal seams in-situ with appropriate nutrients and bacterial consortia may promote coal gas generation and enhance permeability. The Alberta Research Council and its partners have been looking at a novel process to enhance methane recovery that involves injecting CO_2 or other effluent anthropogenic gases into deep unmineable coalbeds containing trapped methane. The CO_2 adsorbs onto the coal, displacing the methane, which can then be recovered. An extension to this process is the subsequent, in-situ microbial conversion of the sequestered CO_2 to methane. This would truly represent a “closed-loop” fossil fuel carbon cycle.

A long-term study was begun to assess whether methane production is ongoing in Alberta coals by attempting to culture indigenous microbial consortia from two cored coal samples. As well, medium and high volatile bituminous Alberta coals were tested as energy and carbon sources for methanogenic consortia from different environments. Initial studies showed that although enhanced methane production in the coal-based cultures over a 3-month period with different consortia was observed, no indigenous methanogenic activity was detected from the cored coal samples. Low microbial numbers and contamination could possibly have inhibited the culturing of any bacteria from the coal. Testing the biodegradability of coals of other ranks and investigating the growth conditions required for microorganisms in coalbeds is proposed for further studies.