Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

MAG021-03 Room: 201A Time: May 26 09:30-09:45

Effects of ingredients in formation water on a microbial process for methane production from carbon dioxide sequestered

Takahiro Sakuma[1*], Hideo Kawaguchi[1], Kozo Sato[1]

[1]School of Engineering, The U. of Tokyo

Carbon dioxide capture and storage (CCS) is one of the feasible technological options for reducing net CO_2emissions to the atmosphere, those are considered to be a major factor of global warming. In order to establish a sustainable carbon cycle, development of carbon conversion processes capable of converting CO_2stored in subsurface by CCS into reusable sources of energy is required. Although biological production were observed in oil fields under various environmental conditions, microbial methane production under CCS conditions have not been proposed.
We reported that we achieved producing methane in virtual CCS conditions, such as high-CO_2, low pH, and nutrient-depleted employing formation water obtained from petroleum reservoir as growth medium using thermophilic hydrogenotrophic methanogens, Methanothermobacter thermautotrophicus. We analyzed the composition of formation water, and examined the methane production in formation water. As a result, methane production rate in formation water is 60% of that in standard media (Nakata. et al.).
Comparing to standard media, formation water contains less nitrogenous compounds, phosphorus compounds, and minerals, all of which are necessary substances for growth of microorganisms. Thus, we suggested that adding these substances into formation water would improve methane production. And, formation water contains various substances, so we also suggested that various substances in formation water would suppress methane production. The objective of this study is examining these two possibilities respectively, in order to know the reason of the difference between methane production in formation water and standard media.
To examine the former possibility, we evaluated the methane production in two formation waters (formation water A, B) added the same amount of nitrogenous compounds, phosphorus compounds, and minerals to standard media. As a result, methane production increased about 100 % in formation water A, and about 150% in formation water B respectively, comparing to that in pure formation waters.
To examine the latter possibility, we evaluated the methane production in standard media added 1 0% or 50% of formation water A or B. As a result, methane production decreased corresponding to added amount of formation water. Methane production in standard media added 50% formation water A was 14% of that of standard media.
In conclusion, formation waters do not contain sufficient nitrogenous compounds, or phosphorus compounds, or minerals for methane production, and that can suppress the growth of microorganisms, and formation water can contains some substances those can suppress the methane production.

Keywords: Carbon dioxide capture and storage, methane production, microorganisms, formation water, carbon cycle