Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

HRE29-P11 Room:Convention Hall Time:May 22 18:15-19:30

Global underground gas winery absorbing air CO2 and reproducing methane gas reservoirs : underground carbon recycling

Hitoshi Koide[1*]

[1]AIST

A new counter-geoengineering scheme: leak-free air-CCS under hydrate sealing is proposed here to slash the artificially increased atmospheric CO2 level directly. The naturally most secure and extensive storages for CO2 are the deep aquifers in cold regions and beneath ocean floors. The high-pressure experiments suggest the precipitation of CO2-hydrate occurs in CO2-saturated aquifers at the pressures higher than about 3MPa. Huge volumes of secure CO2-storages under the CO2-hydrate autogenous sealing are expected in deep aquifers in the sub-permafrost regions throughout the world. Virtually limitless secure CO2-storages under the CO2-hydrate autogenous sealing are possible in worldwide marine sediments and oceanic basalts under sea floors deeper than about 300m. The conventional carbon capture and sequestration (CCS) scheme is not viable in the remote areas due to the large infrastructure investment and energy loss for long-distance transportation of huge amount of CO2. However, the air-CCS may be viable while CO2 is extracted directly from the atmosphere instead of the flue gas of fossil fuels. As the atmospheric CO2 concentration is very thin (about 390ppm), the excess energy is required to extract the CO2 from the atmosphere. CO2 is selectively injected into deep aquifers by the air microbubbles sequestration with the pre-concentration by micro-porous membranes. The unused natural energy (wind, solar, geothermal and natural gas) is used for the recovery of CO2 from the atmosphere and for the underground injection of CO2-rich gas. Energy penalty of air-CCS can be compensated by use of unused natural energy in the remote regions.

Carbon dioxide injection under gas-hydrate-filled layers or under permafrost layers may realize the greenhouse gas mitigation and recovery of unused natural gas. Autogenous sealing of carbon dioxide in deep and cool aquifers assures virtually complete and practically unlimited subsurface containment of carbon dioxide. Chemoautotrophs fix carbon dioxide in deep aquifers even in the absence of sunlight. Thermophile methanogens can convert the carbon dioxide into methane in anoxic aquifers. Biogenic restoration of subsurface hydrocarbon deposits is possible in CO2-injected aquifers probably after some ten of years. Microbiological recycling of carbon dioxide in aquifers brings the renewable hydrocarbon gas energy resources into reality.

Keywords: carbon recycling, CCS, hydrate, methanogen, renewable energy, natural energy