Study of deep subsurface microbial community under changing redox conditions using quantitative method

Y. SASAKI[1]*, T. ASANO[2], Y. AMANO[3], T. SATO[1], T. IWATSUKI[3] AND H. YOSHIKAWA[1]

[1]Geological Isolation Research and Development Directorate, Japan Atomic Energy Agency, Tokai, Ibaraki, Japan (*correspondence: sasaki.yoshito@jaea.go.jp)
[2]Environmental Business Division, Bio-Business Promotion Department, CHUGAI TECHNOS Corporation, Nishi-Ku, Hiroshima, Japan.
[3]Geological Isolation Research and Development Directorate, Japan Atomic Energy Agency, Horonobe, Hokkaido, Japan

Microbial activity is one of controlling factor for geochemical condition and the change during excavation and backfilling of underground facility. This study aims to evaluate the role of microbes on geochemical evolution around underground facility. We investigate microbial community and redox condition in the borehole drilled from 140m depth gallery of underground research laboratory (URL) in Horonobe area of Hokkaido, Japan.

Redox potential (ORP_{obs}) of groundwater changed from oxidized condition (+180mV) to reducing condition (-480mV) in 10 days. Total microbial count also decreases from $6.6x10^5$ cells/ml to $3.2x10^4$ cells/ml. Quantification analysis using both 16S rRNA and functional genes with real-time PCR shows that the biomass decreased constantly; domain bacteria (16S rRNA), Nitrate reducers (*nirS*), denitrifires (*nosZ*), Metal reducers (Geobacteraceae 16S rRNA) and Methane oxidizers (*pmoA*). On the other hand, the biomass increased in 5 days and then decreased or be maintained approximately-constant. ; domain archaea (16S rRNA), nitrate reducers (*nirK*), sulfate reducers (*dsr*), methanogens (*mcrA*). The change corresponded with redox potential change. These groups would have ecological relationship. Microbial community quickly changes according with redox condition change in deep subsurface.

This study was performed as a part of the 'Project for Assessment Methodology Development of Chemical Effects on Geological Disposal System' funded by the Ministry of Economy, Trade and Industry of Japan.

Air quality over India: Weekly periodicities and long term trends

S.K. SATHEESH[1,2]*, K. KRISHNA MOORTHY[3], S.S. BABU[3], N. SRIVASTAVA[1] AND V. VINOJ[4]

[1]Centre for Atmospheric and Oceanic Sciences, Indian Institute of Science, Bangalore-560012, India (*correspondence: profsks@gmail.com)
[2]Divecha Centre for Climate Change, Indian Institute of Science, Bangalore-560012, India
[3]Space Physics Laboratory, Vikram Sarabhai Space Centre, Thiruvananthapuram-695022, India
[4]Pacific Northwest National Laboratory, Richland, WA 99352, USA

Air quality degradation is emerging to be an issue of major concern in India. This is mainly attributed to unplanned urbanization and industrial growth. Central Pollution Control Board is executing a nation-wide programme of ambient air quality monitoring. This network consists of 342 monitoring stations covering 127 cities in India. In addition, Indian space Research Organisation (ISRO) is maintaining 33 climate observatories across the country namely ARFINET (Aerosol Radiative Forcing over India Network). In this study, we have used multi-year observations of particulate mass (PM) concentration, aerosol black carbon (BC) mass concentration and aerosol optical depth (AOD) from these network observatories to make assessment of ambient air quality over India and its radiative impact. It has been observed that both column AOD and ground-level measurements (BC and PM) exhibit a weekly cycle with low aerosol concentrations on weekends. In comparison to the weekdays, the weekend reductions of AOD, BC and PM were ~15%, 25% and 24%, respectively. Aerosol trends indicates conflicting trends at different regions of India, thereby reflecting the complex factors behind the impact of growth on environment. While an increasing trend in aerosol has been observed in many cities, some cities show a decreasing trend during the last few years. Aerosol radiative impact assessment was made using ground-based radiometers and is compared with that simulated by radiative transfer models (which employ measured aerosol microphysics). One striking inference from this effort is the large discrepancy between observed and modelled aerosol surface radiative impact. Potential sources of such discrepancies are discussed in this presentation. The CHIMERE chemistry-transport model was used to simulate PM, BC and AOD over India and are compared with measurements. Evaluation of CHIMERE output shows that while diurnal and seasonal trends are captured reasonably by the model, absolute magnitudes differ substantially.