Use of risk-based remediaiton strategy and concept of attainable clean-up level in management of groundwater contaminated sites in Korea

HUN-MI KIM[1]*, SEONGSUN LEE[1], DUGIN KAOWN[1] AND KANG-KUN LEE[1]

[1]School of Earth Environmental Science, Seoul National University, Seoul 151-747, Korea (*correspondence : tweety1@snu.ac.kr), soon3311@snu.ac.kr, dugin1@snu.ac.kr, kklee@snu.ac.kr

There are recognized needs to establish a reliable and effective remediation strategy as groundwater and soil protection from DNAPL(dense non-aqueous phase liquid) contamination is one of the critical issues in Korea. Remediation performance results at DNAPL contaminated field sites have shown that achieving groundwater clean-up is very difficult due to the complexity of site characterization and contaminants (DNAPL). Therefore, a new approach is now necessary to determine the reachable clean-up level and control the groundwater contaminated sites with DNAPLs. Our research team initiated a 5-year GAIA(Geo-Advanced Innovative Action) project to intensively monitor the DNAPL contaminated site with a focus on developing clean-up options under support of Korea Ministry of Environment (KMOE). Woosan industrial complex was chosen as our field site and 16 rounds of groundwater sampling at about 90 monitoring wells were performed from 2009 to 2013. The highest concentration of trichloroethylene (TCE) which was the main pollutant in the source area of this site was 15 mg/L. According to field mornitoring data and hydrogeologic condition, Risk Based Corrective Action (RBCA) program and variable remediation technologies such as soil vapor extraction, pump-and-treat, surfactant enhanced in-situ remediation, in-situ bioaugmentation and Monitoring Natural Attenuation (MNA) were performed. As a result of our field site application, we propose the following step by step- remediation strategy. The 1st step is implementation of site-specific characterization and risk-based site assessment and 2nd step is application of the chosen remediation technologies to enhance the attenuation, plume capture and mass reduction in source zone based on the 1st step result. The 3rd step is establishment of an attainable clean-up level considering the reulsts of mass reduction when there is no further contaminant exposures and plume migration and the final step is application of the MNA until the final clean-up level of groundwater remediation is achieved.

Combined use of ED-EPMA and ATR-FTIR imaging for characterization of individual aged Asian Dust particles

HYEKYEONG KIM, HAE-JIN JUNG, HYO-JIN EOM, XUE LI AND CHUL-UN RO

Department of Chemistry, Inha University, 253 Yonghyun-dong, Nam-gu, Incheon, 402-751, KOREA and curo@inha.ac.kr

In our previous works, it was demonstrated that the combined use of quantitative energy-dispersive electron probe X-ray microanalysis (ED-EPMA), which is also known as low-*Z* particle EPMA, and attenuated total reflectance FTIR (ATR-FTIR) imaging has great potential for a detailed characterization of individual aerosol particles. In this study, extensively chemically modified (aged) individual Asian Dust particles collected during an Asian Dust storm event on November 11, 2002 in Korea were characterized by the combined use of low-*Z* particle EPMA and ATR-FTIR imaging. Overall, 109 individual particles were classified into four particle types based on their morphology, elemental concentrations, and molecular species and/or functional groups of individual particles available from the two analytical techniques: Ca-containing (38%); $NaNO_3$-containing (30%); silicate (22%); and miscellaneous particles (10%). Among the 41 Ca-containing particles, 10, 8, and 14 particles contained nitrate, sulfate, and both, respectively, whereas only two particles contained unreacted $CaCO_3$. Airborne amorphous calcium carbonate (ACC) particles were observed in this Asian Dust sample for the first time, where their IR peaks for the insufficient symmetric environment of CO_3^{2-} ions of ACC were clearly differentiated from those of crystalline $CaCO_3$. This paper also reports the first inland field observation of $CaCl_2$ particles probably converted from $CaCO_3$ through the reaction with HCl(g). HCl(g) was likely released from the reaction of sea salt with NO_x/HNO_3, as all 33 particles of marine origin contained $NaNO_3$ (no genuine sea salt particles were encountered). Some silicate particles with minor amounts of calcium were observed to be mixed with nitrate, sulfate, and water. Among 24 silicate particles, 10 particles are mixed with water, the presence of which could facilitate atmospheric heterogeneous reactions of silicate particles including swelling minerals and non-swelling ones. Using the combined use of the two single particle analytical techniques, this work clearly shows that internal mixing states of the aged Asian Dust particles are highly complicated.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.11