Airborne particulate matter (PM$_{2.5}$/PM$_{10}$) monitoring in urban site of Korea using instrumental neutron activation analysis

Han Rim Lee[1,*], Jiseok Kim[1], Jong-Hwa Moon[1], Do Hyun Kim[1], Bo-Young Han[1], Siwan Noh[1], Jae Chang Kim[2]

[1]Korea Atomic Energy Research Institute, Daejeon 34057, Republic of Korea
[2]Department of Nuclear Engineering, Hanyang University, Seoul 04763, Republic of Korea
[*]E-mail: leehr@kaeri.re.kr

Keywords: particulate material, neutron activation analysis, trace element, correlation matrix

Recently, an ambient concentration of particulate matter (PM) is one of the most important evironmetal issues because the PMs containing vairous toxic elements can be accumulated in human body and increase the incidence of respiratory and cardiovascular diseases. To address this social problem using the nuclear technology, we are performing the research project for the particulate material monitoring based on neutron activation analysis. To evaluate charicteristics of PM$_{10}$ and PM$_{2.5}$ in urban areas, we installed two monitoring stations in Seoul and Deajoen, and PM$_{10}$ and PM$_{2.5}$ samples are collected using two high volume air samplers (HiVol 3000, Ecotech, Australia) and two low volume air samplers with quartz filters (area: 8-inch × 10-inch) and PTFE (polymethylpentene) filters (diameter: 47 mm, pore size: 2 μm), respectively.   For the dates with low and high PM concentrations in the spring and summer season, the instrumental neutron activation analysis (INAA) was performed for the quantitative analysis of trace elements in 68 filter samples(17 samples for PM$_{10}$ and PM$_{2.5}$ at Seoul and Daejeon). Based on the results, it was confirmed that the concentration (ng/m^3) of 31 elements including toxic elements (As, Ba, Br, Cl, Cr, Fe, Mn, Sb, V and Zn) were determined, and these elemetal information will be used for the source apportionment of PM at Seoul and Daejeon using the receptor models. To eveluate the elemental correlation, the correlatation matrixs for PM composition were calucated. It was confirmed that Mn (0.87), V (0.72), Co (0.80), Fe (0.86), and Zn (0.80) had high degree of correlation (> 0.7) with the PM$_{10}$ concentration. In addiation, we obtined the high enrichment factor of Br (492), Zn (104) and, As (188) mainly emitted from the vehicles in PM samples.
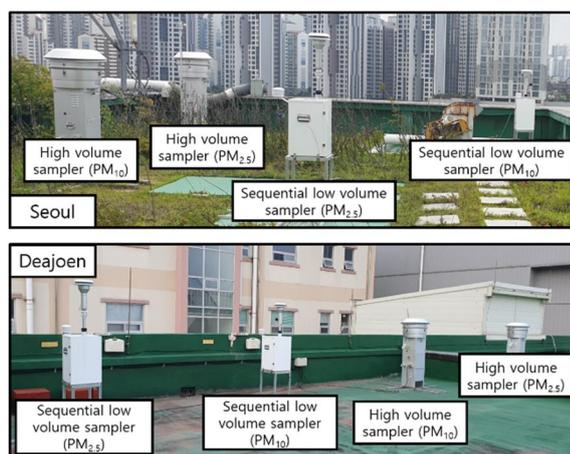
Fig. 1. Monitoring stations for aeroborne particulate materials (PM$_{2.5}$ and PM$_{10}$) in Seoul and Dajeon