Molecular characteristics and seasonal differences of urban organic aerosols from Chennai: A case study of a mega-city in tropical India

PINGQING FU, KIMITAKA KAWAMURA AND CHANDRA MOULI PAVULURI

Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan (pqfu@pop.lowtem.hokudai.ac.jp)

India has experienced a serious air pollution problem owing to the rapid economic growth in the past decade. Major contributors to the Indo-Asian haze (or "brown cloud") are considered to be caused by biomass burning and fossil-fuel combustion. However, little is known about the molecular characteristics and seasonal differences of organic aerosols in South Asia. In this study, we collected day/night PM_{10} samples (n=49) using quartz fibre filters in Chennai, Southeast India during winter and summer 2007. Filter aliquots were extracted with dichloromethane/methanol, derivatized with BSTFA and then analyzed using a capillary gas chromatography/mass spectrometry.

Twelve organic compound classes were detected in the aerosols, including aliphatic lipids, sugars, phthalate esters, isoprene/monoterpene oxidation products, and polycyclic aromatic hydrocarbons. In winter, fatty acids (302±179 ng m^{-3}) were found to be the most abundant compound class, followed by sugars and phthalate esters. In summer, phthalate esters (553±140 ng m^{-3}) were the most abundant compound class, followed by fatty acids and *n*-alkanes. Bis(2-ethylhexyl) phthalate, C_{16} fatty acid and levoglucosan, a pyrolysis product of cellulose, were found as the most abundant single compounds. Malic acid was found to be more abundant in summer than in winter, suggesting an enhanced photochemical production of secondary organic aerosols during summer. This is consistent with higher abundances of biogenic secondary oxidation products (e.g., 2-methyltetrols and pinic acid) in summer. Interestingly, a good correlation (R^2=0.72, n=49) was found between terephthalic acid and 1,3,5-triphenylbenzene (a tracer for plastics burning), suggesting that field burning of municipal solid wastes including plastics is a significant source of terephthalic acid in South India.

Based on the grouping of organic source tracers, we found that in winter, plastic emission was the most important source of organic aerosols in South Asia, followed by terrestrial plant waxes, biomass burning, marine/microbial source and fossil fuel combustion. However, contributions of marine/microbial source and secondary oxidation products to organic aerosol masses were significantly enhanced in summer.

Carbonate mineralogy in bottom sediment response to paleoenvironment in Lake Hovsgol (Mongolia)

H. FUKUMOTO[1]*, K. FUKUSHI[1], S. OCHIAI[2] AND K. KASHIWAYA[1]

[1]Kanazawa Univ., Kanazawa, Ishikawa 920-1192 Japan (fukumoto@stu.kanazawa-u.ac.jp)
[2]Taiwan National Univ., Taipei, Taiwan

Lake Hovsgol is the semi-closed and second largest freshwater lake after Lake Baikal in Central Asia area where is most sensitive to solar insolation [1]. There have been reported the variability of carbonate minerals in long drilling cores from Lake Hovsgol with depth. In this study, HDP04 core was investigated to reveal the paleoenvironment which lead to the variability of carbonate mineralogy in Lake Hovsgol. The high smectite/illite ratios (S/I) coincident with the high organic matter contents, indicating smectite had been predominantly produced by weathering during warm periods. The carbonate mineral assemblages with depth were closely related to the climatic conditions inferred from the S/I ratio. There were three major carbonate minerals in the core. They were dolomite, calcite and monohydrocalcite (MHC). Occurrences of carbonate minerals and the differences of solubility among the carbonate minerals indicate that the differences of the carbonate mineral assemblies are explained by changes of the saturation state of water when the sediments were deposited. The lake level of Lake Hovsgol was lower during the glacial period than present level [2]. The changes of lake level must lead to changes of saturation states of lake water. Therefore, the absences or presences of these minerals with depth are also related to climatic conditions. The formation of MHC indicates the extremely low lake level during the severely cold periods. The reconstruction of climate conditions by the sediment mineralogy at Lake Hovsgol indicated that the HDP04 cores preserve the global and local climatic changes.

[1] Kashiwaya (2001) *Nature* **410**, 71-74. [2] Prokopenko (2005) *Quaternary International* **136**, 59-69.