Observation of hydrophobic organic compounds in fog water at the summit and on the foot of Mt. Fuji during the summer

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The presence of hydrophobic organic compounds (HOCs) such as PAHs, PCBs, and VOCs, which are considerably larger than expected from the surrounding gas-phase concentration and Henry’s law constants, has been reported in atmospheric droplets such as fog water, rainwater, and dew water. In recent years, decrease in surface tension with respect to pure water was observed in cloud/fog sample probably because of the presence of atmospheric humic-like substances (HULIS), which have been founded to account for a substantial amount of water-soluble organic compounds (WSOC) in fog droplets and fine aerosols. Lowering of surface tension of fog droplets may influence the gas-liquid distribution of HOCs, but the influences of HULIS on the dissolution of HOCs have never been investigated in the field observation.

We performed simultaneous sampling of volatile organic compounds (VOCs) such as chlorinated hydrocarbons (CHs), monocyclic aromatic hydrocarbons (MAHs), and dicyclic aromatic hydrocarbons (DAHs) in fog water and in the ambient air at the summit and on the mountainside (1300 m a.s.l.) in Mt. Fuji during the summer from 2006 to 2009. Dew water and rainwater were also collected although there were few samples during the period. The summit of Mt. Fuji is located in the free troposphere, while the foot is located in the forest area. VOCs in fog water were determined by Head Space-Solid Phase Micro Extraction (HS SPME) / GCMS, while VOCs in the gas phase were collected in adsorbent tube, then extracted with CS2, and analyzed by a GCMS. Dissolved HULIS in fog water were concentrated on anion exchangers, then extracted by sodium chloride, and measured with a UV/VIS spectrophotometer at 400 nm, which was proposed by Hiraide et al. (1994). Among the VOCs, MAHs were much contained in fog water collected both at the summit and on the foot of Mt. Fuji than CHs and DAHs. Toluene was abundant among the determined twenty-six VOCs in atmospheric water (fog, dew, and rain) as well as in the ambient air. We will discuss the influence of HULIS on the dissolution of VOCs into fog water.