

Dew occurrence and hydroxymethanesulfonate chemistry of dewwater in Yokohama, Japan

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Dewwater is an important source of water for animals and plants in arid regions though the amount of dewwater is lower compared to rainfall. On the other hand, it is also pointed out that the deposition velocity of air pollutants is increased on the surface of dew. In this study, we collected dewwater in Yokohama, Japan and analyzed for various chemical components so as to clarify the dew formation frequency and hydroxymethanesulfonate (HMSA) chemistry of dewwater in urban environments.

Dewwater was collected on the roofs of the five-story buildings on the campus of Kanagawa University in Yokohama, Japan. Dew-collector consisted of a 0.05 mm thick Teflon sheet (90 cm x 90 cm) mounted on a 10 cm thick slab of a styrofoam. The collector was set up after sunset and dewwater formed on the collector was collected with Teflon scraper in the following morning. The samples were weighted and filtrated with a 0.45 μm pore-size membrane filter. The electric conductivity, pH and ion components were measured using an electric conductivity meter, pH meter and ion chromatographs. The aldehydes in the samples were measured by means of a DNPH-HPLC method.

The average annual frequency of dew occurrence from 1997 to 2001 was about 24%, and was the highest during the winter. Although the relative humidity during the summer was the highest of all the seasons, the frequency of dew occurrence was the lowest during the summer because the summer included the rainy season. Precipitation resulting from dew was 7.7 mm/year in 1998 and corresponded to about 0.4% of annual rainfall (1901 mm in 1998). Considering both the events of dew and rain, the ground surface was wet state for approximately 60% of the night (days).

The reaction of formaldehyde (HCHO) with S(IV) forms the HMSA, which is one of the significant characteristics of dewwater. The volume-weighted mean concentrations of HCHO and HMSA from 1993 to 2001 were 109 μM and 18 μM , respectively. The formaldehyde concentration was high in summer and low in winter, whereas the HMSA concentration was high in winter, reflecting the difference in the concentration of atmospheric SO_2 , i.e. high in winter and low in summer.