

4.173 Determining Polarity Distribution of Organic Matters by the 1-octanol-water Partitioning Method.

Early Career Scientist

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Abstract:

Hygroscopic property of water-soluble organic matters (WSOM) has a crucial role in controlling cloud formation process and radiative balance in the atmosphere. Recently, the distribution of polarity, which regulates dissolution and phase partitioning processes in aerosol particles, has been regarded as one of the important properties of WSOM because it affects hygroscopic growth and cloud condensation nuclei activation. Techniques such as solid-phase extraction and high-performance liquid chromatography have been applied to classify WSOM by polarity. However, they only provide qualitative evaluations. To quantitatively conduct a liquid phase separation, we recently developed the 1-octanol-water partitioning method. Since 1-octanol-water partition coefficient is defined by polarity, the method is able to categorize organic compounds into different ranges of polarity by changing volume ratio of 1-octanol and aqueous phases ($V_{O/A}$).

We applied this method to WSOM in Indonesian biomass burning particles to quantitatively evaluate their polarity distribution. Sampled particles were dissolved in ultrapure water to extract WSOM. Subsequently, WSOM were classified into different ranges of polarity using the 1-octanol-water partitioning method with five sets of $V_{O/A}$ ranging from 0.01 to 10. The chemical composition of each fraction was measured by a Time-of-Flight Aerosol Chemical Speciation Monitor (ToF-ACSM) and a 3D fluorescence spectrometer. As the signal intensity of levoglucosan-like species derived from the ToF-ACSM mass spectra positively correlated with polarity, levoglucosan-like species were indicated to be highly polar. On the other hand, polarities of hydrocarbons and high molecular weight species were low. Regarding the fluorophores, humic-like substances and protein-like species were identified. The latter was classified into two types based on

the differences in polarity. In addition, polarity distribution of the Indonesian biomass burning particles was estimated by the established data inversion algorithm.