Assessment of the role of saltingout effect on the hygroscopicity of urban atmospheric aerosol

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Atmospheric aerosols are complex mixtures consisting of inorganic and organic compounds [Jing et al., 2017], where water-soluble matter accounts for a large portion of the total mass [Wang et al., 2003; Almeida et al., 2005]. For cloud condensation nucleus (CCN) activation ofaerosol particles, inorganic salts could influence on the surface tension and thus the CCN activation by so-called salting out effect [Prisle et al., 2010]. In this study, the surface tension of water-soluble matter collected in Nagoya, with and without addition of ammonium sulfate, was investigated to assess whether salting out effect should be taken into account for the prediction of the CCN activation of aerosol particles.

Water soluble matter in aerosol samples collected using a high volume sampler with a cascade impactor was extracted using water, and the extract solutions were concentrated. The solutions and those diluted from the original solutions were subjected to the surface tension measurements using a pendant drop tensiometer (DM-301, Kyowa Interface Science Co., Ltd). The surface tension of the extract solutions with addition of ammonium sulfate was also measured in the same manner.

When the concentrations of water-soluble organic matter were relatively low (0.004 and 0.010 mol-C L^{-1}), the reduction in surface tension by adding ammonium sulfate was found to be small regardless of up to 0.1 M ammonium sulphate. By contrast, the clear decrease in surface tension was found for a higher concentration of water-soluble organic matter with the higher concentration of ammonium sulfate. The surface tension lowered gradually during 2 min of measurements for all samples. The result suggests that the surface tension of atmospheric aerosol particles could be lower than prediction if longer residence times in the real atmosphereis not considered appropriately. The cloud-forming potential of inorganic/organic mixed particles should be further investigated by taking into account the possible importance of the salting out effect by inorganic salts.

References

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