PA26) Theoretical Calculation of Ionic Mass Resolved in Each Size of Raindrop

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1. Introduction

The natural scavenging of aerosol particles has been subjected to numerous studies. Since the analysis of rain as bulk phase will lead to a loss of detailed information, the sampling and analysis of individual and size-classified raindrops must be performed (Ma et al., 2006).

In this study, to study wet-scavenging of air pollutants, size-resolved raindrops were collected and analyzed. Also the calculated and measured elemental masses in size-classified raindrops were compared. Moreover, the chemical components of individual solid particles separated from sizeclassified raindrops were determined.

2. Methods

For the purpose of size-classified raindrop sampling, the unique raindrop-sampling device designed and made in the laboratory of environmental inorganic chemistry was employed. Samplings of ambient particles and size-resolved raindrops were conducted on a four-story building of Fukuoka Women's University during rainfall events in 2007 and 2008. The elemental components retained in size-classified raindrop samples were analyzed by the PIXE installed at the Cyclotron Research Center of Iwate Medical University (Ma, 2006). Model calculation (see Fig. 1) of wet scavenging was also performed to determine the pollutant mass concentration as a function of raindrop size.

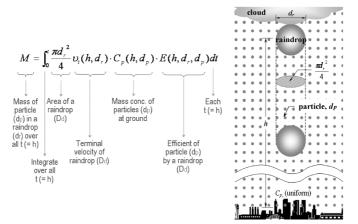


Fig. 1. Schematic of the model used for the calculating each elemental mass concentration as a function of raindrop size at ground.

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3. Results and Discussion

Even though the tendency of the continuous decreasing of elemental mass concentration across the raindrop size spectrum was also shown in the model calculation, to improve the results of modeling calculation, the sampling of atmospheric particles with good time-resolved sampling duration is desirable. A combination of model calculation and field measurement performed in the present study makes certain of the truth that the wet removal processes is one of final dissipation mechanisms of ambient particles. In order to fully understand the wet scavenging properties of air pollutants and those wet deposition amounts according to rainfall amount, a field measurement during continuous rainfall event is planning.

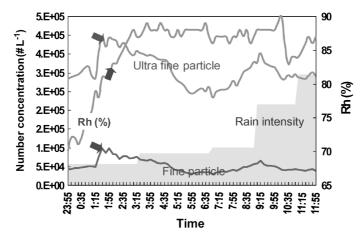


Fig. 2. Time series variation of particle number concentration, intensity of rainfall amount and humidity.

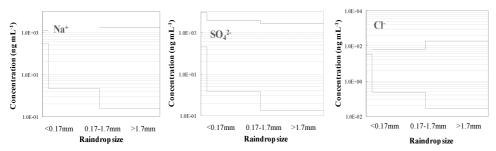


Fig. 3. The plot of calculated vs. measured mass concentration for three major elements as a function of raindrop size (upper line: measured, lower line: calculated).

References

- Ma, C.-J. (2006) Chemical composition of a yellowish rainfall by the application of PIXE and micro-PIXE technique, Nuclear Inst. & Methods in Physics Res. B., 251, 501-506.
- Ma, C.-J., S. Tohno, M. Kasahara, and S. Hayakawa (2006) Elemental distribution in individual rain droplets determined by a combination of the replication method and Synchrotoron radiation X-ray fluorescence microprobe technique, Analytical Sciences, 22, 415–419.