FRAGMENTATION OF SULFURIC ACID-AMMONIA CLUSTERS INSIDE A CI-API-TOF

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New particle formation in the atmosphere is an important process that can influence the climate. The formed particles can scatter and absorb light and/or act as cloud condensation nuclei, impacting the Earth's radiative budget. The first steps in new particles formation involve atmospheric small clusters, and in particular sulfuric acids and ammonia (or amines) clusters [1]. The detection and quantification of these clusters, in the last years, has been possible thanks to the development of the chemical ionization atmospheric pressure interface mass spectrometers (CI-APi-TOF). This technique is highly powerful and can be used to detect clusters at environmental low concentration [2], however it is not completely clear the fate of atmospheric clusters inside the instrument. Indeed, atmospheric clusters can undergo fragmentation inside the instrument due to chemical ionization, low pressure and energetic collisions with neutral molecules. In the chemical ionization (CI) chamber the charging process could change the stability of the cluster, leading to its transformation; in the atmospheric pressure interface (APi) clusters could decompose by evaporation or through energetic collisions in the electric field; all these processes could lead to a misinterpretation of the data, in particular the measurement of the concentration and composition of clusters.
We tried to evaluate the effect of these conditions on the fragmentation of sulfuric acid-ammonia clusters. In particular we studied the consequences of the voltages applied to the quadrupoles and lenses that guide the charged clusters through the APi. We demonstrate that the tuning of the instrument significantly affects the sensibility of the instrument and the clusters fragmentation. In particular, the difference of voltages applied to the different sections of the APi could have an important impact on the fragmentation. This preliminary study allows to better understand the fate of clusters inside the CI-APi-TOF and could be useful to build a theoretical model to predict the fragmentation/evaporation processes inside the instrument.

[1] H. Vehkamäki and I. Riipinen, Chemical Society Reviews 41 (2012) 5160.
[2] T. Jokinen, M. Sipilä, H. Junninen, M. Ehn, G. Lönn, J. Hakala, T. Petäjä, R.L. Mauldin III, M. Kulmala and D.R. Worsnop, Atmospheric Chemistry Physics 12 (2012) 4117.