Aminium salts in nanometer atmospheric particles

XIAOHONG YAO[1,2*], PEIRAN YU[1] AND HUIWANG GAO[1,2]

[1] Key Lab of Marine Environmental Science and Ecology (MoE), Ocean University of China, Qingdao 266100, China (correspondence: xhyao@ouc.edu.cn)

[2] Qingdao Collaborative Center of Marine Science and Technology, Qingdao 266100, China

Abstract

Concentration, size distribution and formation of dimethylaminium (DMA^+) and trimethylaminium (TMA^+) in atmospheric particles were investigated during four cruise campaigns performed over the marginal seas of China, two cruises mainly over the northwest Pacific Ocean (NWPO) in 2012-2015 and three campaigns at a semi-urban coastal site. An 14-stage Micro-Orifice Uniform Deposition Impactors (MOUDI) sampler was utilized for sampling atmospheric particles with aerodynamic diameter from 18 μm down to 0.010 μm in 2012-2013 and 2015 and an 11-stage MOUDI sampler was utilized in 2014. For all campaigns, DMA^+ and TMA^+ appeared to be two dominant aminium ions in atmsopheric particles. In the coasatl atmsophere, the measured particulate DMA^+ and TMA^+ dominantly existed in the size range of 0.18-1.8 μm and their concentrations were 0.2-0.3 nmol m^{-3} (on average). DMA^+ and TMA^+ also had a borad mode in the nanometer size range and were likely associated with formation and growth of these particles. In the remote marine atmospheres, e.g. in the Northwest Pacific Ocean, the obervational results of pariculate DMA^+ and TMA^+ were similar to those observed in the coastal atmospheres. However, much higher concentrations of DMA^+ and TMA^+ were observed in the marine atmospheres over the marginal seas of China in summer and the meaursed concentrations of DMA^+ and TMA^+ in the <0.056 μm particles were generally larger than those in the 0.18-1.8 μm particles. The unique observations were never reported before, but they strongly suggested that aminium salts likely played an important role in aerosol chemistry in nanometer sized particles. The unique results were also observed in some low concentration samples collected in other cruises. Atmospheric implications of the observations were presented.