Atmospheric behavior of sea salt components and its environmental effects.

Manabu Igawa and Hiroshi Okochi
Faculty of Engineering, Kanagawa University

Summary

Sea salt components are abundant in the atmosphere as aerosol and gas (hydrogen chloride) and deposited as dry deposition and wet deposition. The atmospheric sea salt components are formed not only from sea water but also from the exhaust of the anthropogenic sources, which is the waste of the industrial products made from sea salt components. For example, hydrogen chloride is exhausted as the components of the combustion gases of polyvinyl chloride. Hydrogen chloride was also formed from the reaction of sea salt with acidic substances in the atmosphere as follows: $NaCl + HNO_3 = NaNO_3 + HCl$ or $2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl$.

We have been studied about the acidification mechanism of rain, fog, and dew water. In 1994, we observed acid fog of pH 1.95, whose major component was hydrochloric acid. Then, we analyzed major elements of sea salt components, sodium and chlorine, in the aerosol, gas, rain water, fog water, and dew water to study the atmospheric behavior of sea salt components. Chloride ion in aerosol is abundant in winter in fine particles as ammonium chloride. Sodium chloride is present as coarse particles but changes to be sodium nitrate in summer by the reaction of sodium chloride with nitric acid gas which is abundant in summer. Hydrogen chloride gas is abundant in summer but its concentration is low in winter because it reacts with ammonia gas to be ammonium chloride. In rain and dew water, the concentration of the non sea salt chloride ion is low and its contribution to the acidification of rain and dew water is low. Hydrogen chloride sometimes contributes primarily to the acidification of fog water. The ion loading of hydrogen chloride of the very acidic fog water was corresponding to the atmospheric concentration of 4 to 5 ppb, whose concentration level was often observed in Yokohama, although the pollution of hydrogen chloride is local and just temporal. Then, the pollution of hydrogen chloride may become an important factor of the acidification of the precipitation.