Geophysical Research Abstracts
Vol. 18, EGU2016-10970, 2016
EGU General Assembly 2016

Volatility of NH_3 from internally mixed sodium succinate-$(NH_4)_2SO_4$ particles

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Contributing the complicacy of atmospheric constituents, aerosol particles may undergo complicated heterogeneous reactions that have profound consequences on their hygroscopic properties and volatility. Ammonia (NH_3) is a ubiquitous trace atmospheric gas in the troposphere and has negative effects on human health and climate forcing of ambient aerosols. In addition, atmospheric cycle of NH_3 is complex in atmosphere, therefore it necessary to get insights to the complexity of gas-to-aerosol NH_3 partitioning, which results in large uncertainties in the sources and distributions of NH_3. By using in-situ Fourier transform infrared spectroscopy and attenuated total reflection (FTIR-ATR), we report here the volatility of NH_3 from the laboratory generated sodium succinate with ammonium sulfate ($(NH_4)_2SO_4$) at a 1:1 molar ratio as well as its effect on the hygroscopicity of the mixtures. The loss of the NH_4^+ peak at 1451cm^{-1} and the formation of peaks at 1718 and 1134 cm^{-1} due to C = O stretching asymmetric vibration of -COOH and ν_3 (SO_4^{2-}) stretching of sodium sulfate indicate that sodium succinate reacts with $(NH_4)_2SO_4$, releasing NH_3 and forming succinic acid and sodium sulfate on dehydration process. The formation of less hygroscopic succinic acid and volatility of NH_3 in mixtures leads to a significant decrease in the total water content. To the best of our knowledge, this is the first report of the reaction between $(NH_4)_2SO_4$ and dicarboxylate salts, which may represent an important particle-gas partitioning for ammonia and thus elucidate another underlying ammonia cycle in atmosphere. These results could be helpful to understand the mutual transformation process of dicarboxylic acids and dicarboxylate salts.