Electronic Supplementary Material (ESI) for Analytical Methods.

Supporting Information

Real-time monitoring of atmospheric ammonia based on the modifier-enhanced vacuum ultraviolet photoionization ion mobility spectrometry

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S1. The mass fraction simulation of NH_3 in the ionization region in two drift tube structures.

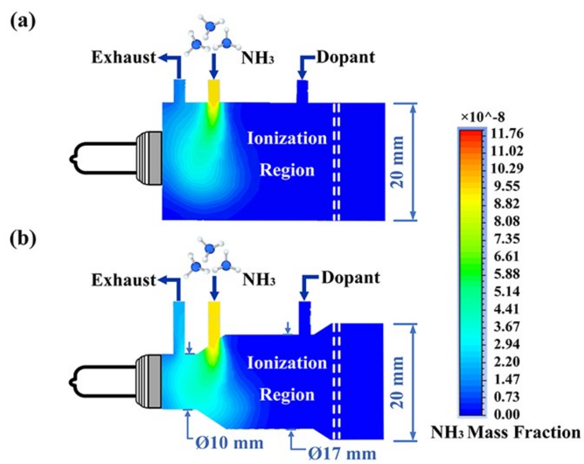

Fig. S1 The mass fraction simulation of NH_3 in the ionization region. (a) The inner diameter of the ionization region is 20 mm, which is the same as that of the drift region. (b) The inner diameter of the ionization region is gradually reduced to 17 mm and 10 mm in the direction close to the vacuum ultraviolet lamp.

S2. Schematic diagram of the online dilution system for obtaining different concentrations of NH_3.

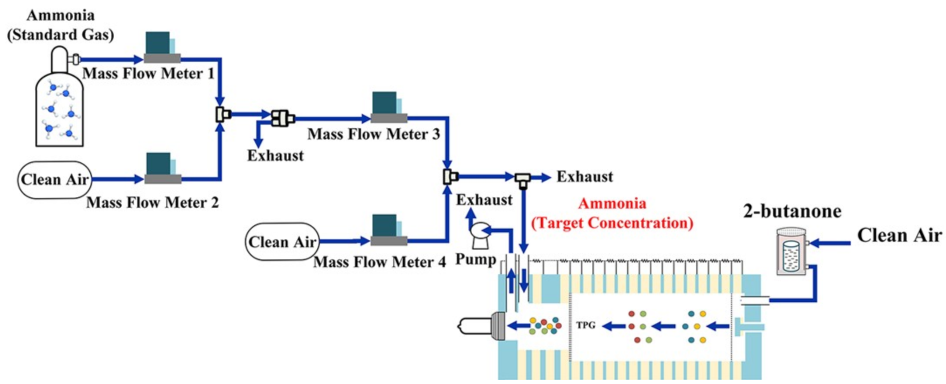

Fig. S2 Schematic diagram of the online dilution system.

As shown in Fig. S2, the online dilution system included four mass flow meters for two dilutions. Mass flow meter 1 was used to control the standard NH_3 gas flow rate. At the same time, mass flow meter 2 was used to control the flow rate of clean air as the dilution gas. By adjusting the two flow meters, a lower-concentration standard NH_3 gas was obtained after the first dilution. Then, mass flow meter 3 was used to control the NH_3 flow rate obtained after the first dilution and excess gas was discharged. The mass flow meter 4 was used to control the clean air flow rate for the second dilution, and the desired target concentration of NH_3 was obtained. Finally, a three-way valve was used to connect the VUV-PI-IMS for sampling and discharging of excess gas.

S3. The ion mobility spectra of NH_3 with concentration of 10 ppbv obtained using VUV-PI-IMS in mode A and mode B, respectively.

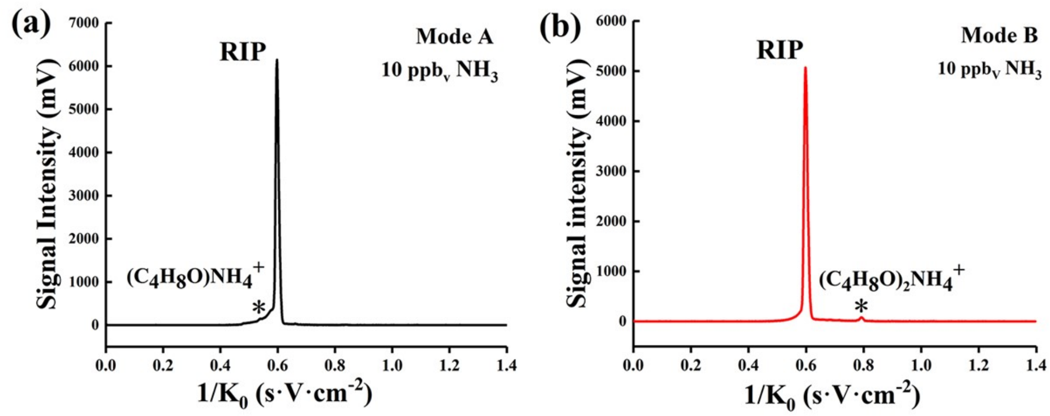

Fig. S3 The ion mobility spectra of NH_3 with concentration of 10 ppbv in mode A (a) and mode B (b), respectively.

S4. The ion mobility spectra of 100 ppbv NH_3 obtained by added different concentrations of 2-butanone to the drift gas.

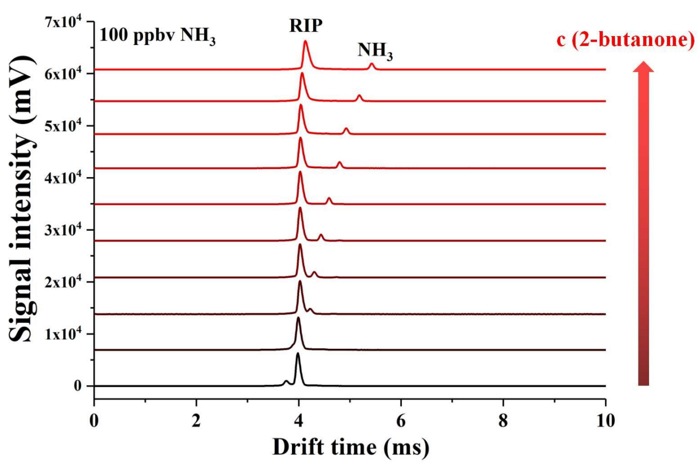

Fig. S4 The ion mobility spectra of 100 ppbv NH_3 obtained by added different concentrations of 2-butanone to the drift gas.

S5. The location of real-time concentration monitoring of atmospheric NH_3.

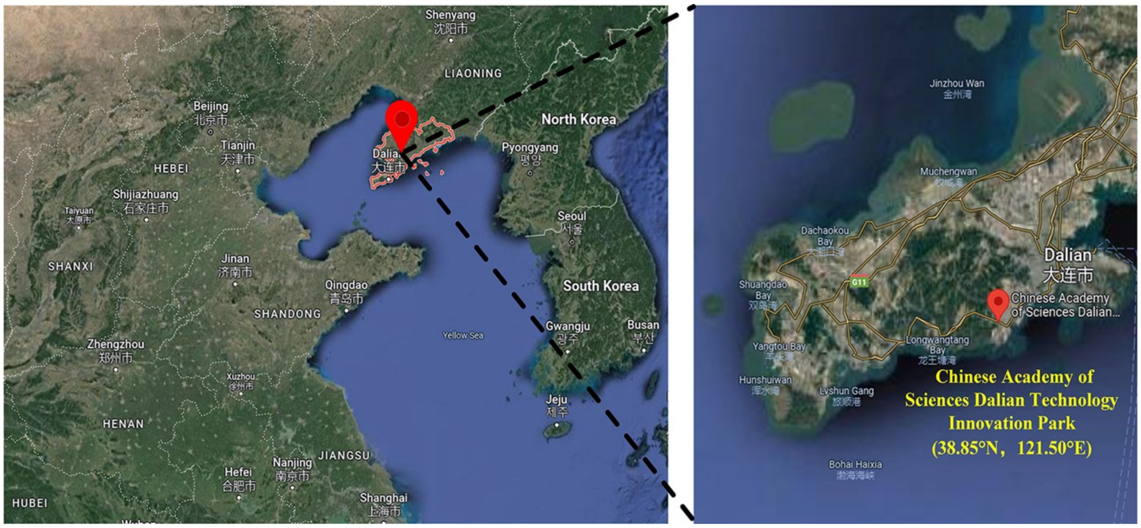

Fig. S5 The location of real-time concentration monitoring of atmospheric NH_3.

S6. The monitoring values of AQI, $PM_{2.5}$, PM_{10}, SO_2, CO, NO_2, O_3, temperature, humidity and windscale from the China Air Quality Online Monitoring and Analysis Platform from 12:00 on April 14th to 12:00 on April 19th, 2022 (https://www.aqistudy.cn/, last accessed on November 27, 2022).

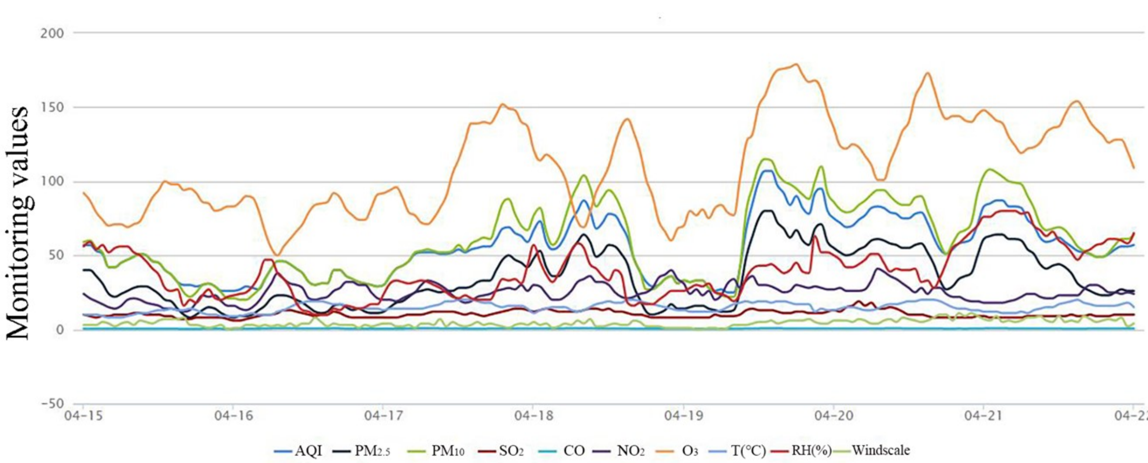

Fig. S6 The monitoring values of the AQI, $PM_{2.5}$, PM_{10}, SO_2, CO, NO_2, O_3, temperature, humidity and windscale from the China Air Quality Online Monitoring and Analysis Platform from 12:00 on April 14th to 12:00 on April 19th, 2022.

S7. The concentration variation and correlation curve of NH_3 and $PM_{2.5}$ from March 15th to 18th, 2022.

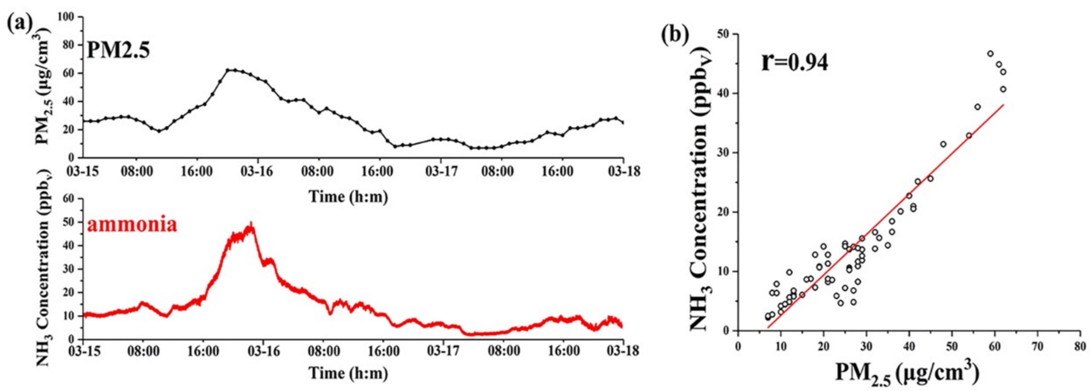

Fig. S7 (a) The concentration variation of atmospheric NH_3 and $PM_{2.5}$ from March 15th to 18th, 2022. (b) The concentration correlation curve between hourly NH_3 and $PM_{2.5}$ from March 15th to 18th, 2022.