

1.220 Characterization of a Thermal Denuder for the Estimation of Volatility Parameters of Laboratory Generated Aerosols.

Early Career Scientist

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Abstract:

In this study, a new KNU thermal denuder was developed and characterized in detail. The temperature profile was uniform with relatively higher exit temperatures as compared to previous studies. Temperature ramping rate was $\sim 14.3^{\circ}\text{C min}^{-1}$ for a set value in the range of 25°C - 250°C . Particle losses in thermal denuder were due to diffusional and thermophoretic losses at room and higher temperatures, respectively. Furthermore, integrated volume method was used to determine saturation pressure (P_{sat}^0) at 25°C and enthalpy of vaporization (ΔH_v) of organic aerosols (single component and binary mixtures) using volatility profile data generated by coupling thermal denuder and scanning mobility particle sizer. For cis-pinonic acid, (1S)-(+)-ketopinonic acid, (1R)-(+)-nopinone, phthalic acid, catechol, benzoic acid, and o-cresol determined ΔH_v and P_{sat}^0 were 81.5 kJ mol^{-1} , 41.2 kJ mol^{-1} , 36.4 kJ mol^{-1} , 45.1 kJ mol^{-1} , 58.8 kJ mol^{-1} , 75.2 kJ mol^{-1} , and 39.8 kJ mol^{-1} and $0.24 \times 10^{-5} \text{ Pa}$, $0.65 \times 10^{-5} \text{ Pa}$, $1.67 \times 10^{-5} \text{ Pa}$, $1.15 \times 10^{-4} \text{ Pa}$, 6.55 Pa , 0.18 Pa , and 12.47 Pa , respectively. For the case of binary mixtures of benzoic acid and o-cresol, catechol and phthalic acid, cis-pinonic acid and nopinone, and ketopinonic acid and nopinone, the values of $P_{\text{sat},1}^0$ and $\Delta H_{v,1}$ and $P_{\text{sat},2}^0$ and $\Delta H_{v,2}$ for high and low volatile components were estimated using two product model and were within 10% to 38% of single component values. In addition, estimated ΔH_v and P_{sat}^0 using Thermal Denuder were also compared with those determined using Thermogravimetric Analysis.