Supplement of

Mixing State of Refractory Black Carbon of the North China Plain Regional Aerosol Combining a Single Particle Soot Photometer and a Volatility Tandem Differential Mobility Analyzer

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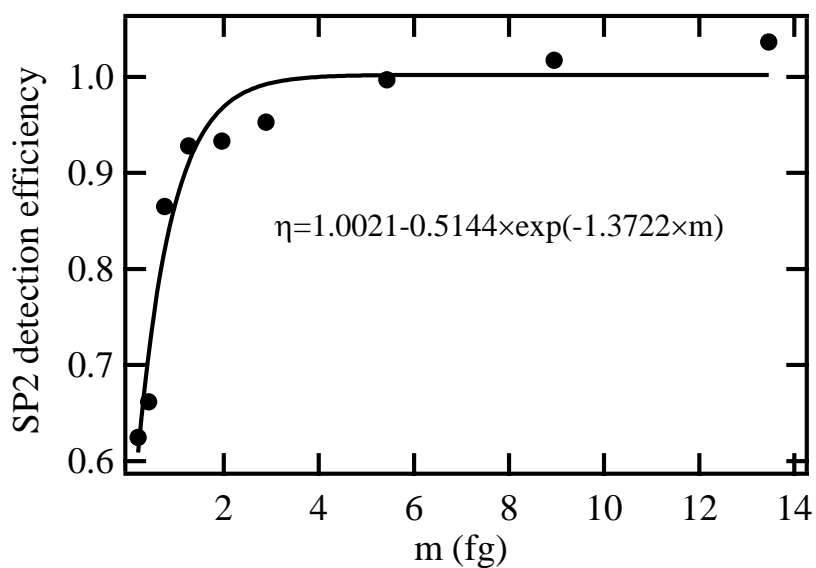
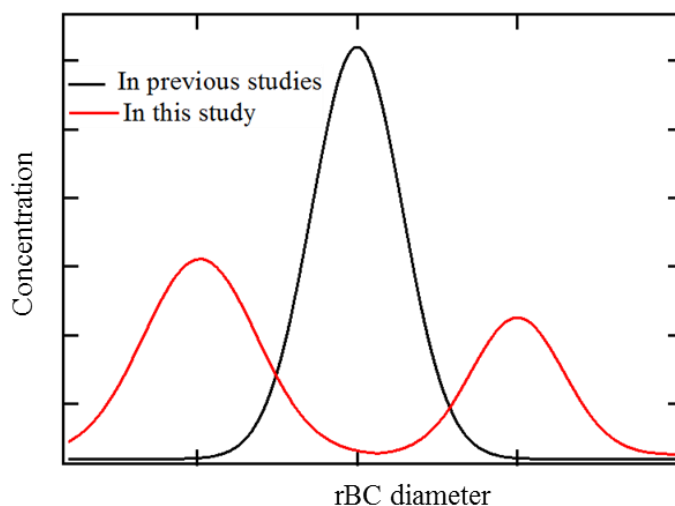
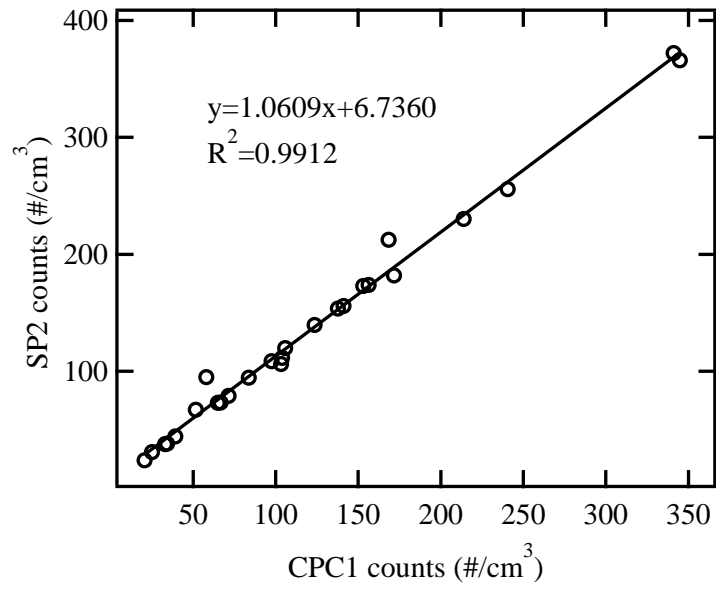
$$\eta = 1.0021 - 0.5144 \times \exp(-1.3722 \times m)$$

3   Figure S1. The SP2 detection efficiencies (η) in each rBC mass-bin.

4

5   Figure. S2. Example of rBC size distribution derived by SP2 measurement in previous

6   studies and in this study. In previous studies of SP2 measurement, the rBC diameter

7   were generally derived from BC material density (e.g. 1.8 g/cm^3) (black curve). In this

8   study, the rBC diameter was calculated by different effective densities for

9   externally-and internally-mixed particles (red curve).

2   Figure. S3. Comparison of the counting numbers using SP2 and CPC1 measurement

3   for total particles with mobility size of 200-350nm.