2.072 Chemical characterization of submicron aerosols during the coal ban winter at Dezhou in the North China Plain.

Early Career Scientist

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Abstract:

A severe regional haze problem in the North China Plain has attracted much attention in recent years. In the winter of 2017, Beijing and surrounding areas banned the use of coal to switch to gas for heating to reduce pollution. An intensive campaign was conducted during that winter at Dezhou site (116.465°E, 37.146°N), 300 km south away from Beijing, to investigate the secondary formation and aging process of atmospheric aerosols in response to the coal ban. An aerosol chemical speciation monitor (ACSM) was used to measure chemical components of non-refractory submicron particulate matter (NR-PM_1) from 4 November to 4 December 2017. The results show that NR-PM_1 was mainly composed of organics (38%), nitrate (27%) and sulfate (18%). Compared to previous winters, NR-PM_1 was at a quite low level (42 mg m^{-3}) and nitrate was more predominant in secondary inorganics, indicating that the coal ban was effective to alleviate air pollution to a certain extent, in addition to favorable meteorological conditions. Three primary organic aerosol (POA) factors from biomass burning (BBOA), coal combustion (CCOA) and traffic (HOA) emissions and one secondary OA (oxygenated OA) factor were resolved by positive matrix factorization of organic mass spectra. POA dominated OA (65% on average), with BBOA being the largest contributor (30%). The ratio of OOA to O_x (O_3+NO_2) largely increased under high humidity, implying that aqueous-phase process can enhance SOA production and oxidation states of OA in winter. In total, secondary inorganic and organic formation contributed the majority (~70%) of NR-PM_1, indicating that reducing regional emissions of secondary aerosol precursors is still needed.