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

Early Career Scientist

Presenting Author:
Wei Hu, Institute of Surface-Earth System Science, Tianjin University, Tianjin 300072, China; State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China, huwei3621405@126.com

Co-Authors:
Song Guo, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Wenfei Zhu, State Environmental Protection Key Laboratory of Formation of Urban Air Pollution Complex, Shanghai Academy of Environmental Sciences, Shanghai 200233, China
Xin Fang, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Xuena Yu, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Jialong Jiang, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Weizhao Xu, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Shiyi Chen, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Huabin Dong, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Min Hu, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Limin Zeng, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China
Yuanhang Zhang, State Key Joint Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China

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.