2.045 Characterization and source apportionment of water-soluble organic aerosol with high resolution aerosol mass spectrometry in Beijing, China.

Early Career Scientist

Presenting Author:
Yanmei Qiu, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China, ymqiu_bnu@163.com

Co-Authors:
Linjie Li, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
Qiaorong Shi, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
Weiqi Xu, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
Jian Zhao, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
Yuntao Chen, Jiangsu Key Laboratory of Atmospheric Environment Monitoring and Pollution Control, Jiangsu Engineering Technology Research Center of Environmental Cleaning Materials, Collaborative Innovation Center of Atmospheric Environment and Equipment Technology, School of Environmental Science and Engineering, Nanjing University of Information Science & Technology, Nanjing 210044, China
Yanfang Chen, Jiangsu Key Laboratory of Atmospheric Environment Monitoring and Pollution Control, Jiangsu Engineering Technology Research Center of Environmental Cleaning Materials, Collaborative Innovation Center of Atmospheric Environment and Equipment Technology, School of Environmental Science and Engineering, Nanjing University of Information Science & Technology, Nanjing 210044, China
Junfeng Wang, Jiangsu Key Laboratory of Atmospheric Environment Monitoring and Pollution Control, Jiangsu Engineering Technology Research Center of Environmental Cleaning Materials, Collaborative Innovation Center of Atmospheric Environment and Equipment Technology, School of Environmental Science and Engineering, Nanjing University of Information Science & Technology, Nanjing 210044, China
Qingqing Wang, State Key Laboratory of Atmospheric Boundary Layer Physics

and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
Xinlei Ge, Jiangsu Key Laboratory of Atmospheric Environment Monitoring and Pollution Control, Jiangsu Engineering Technology Research Center of Environmental Cleaning Materials, Collaborative Innovation Center of Atmospheric Environment and Equipment Technology, School of Environmental Science and Engineering, Nanjing University of Information Science & Technology, Nanjing 210044, China
Pingqing Fu, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
Yele Sun, State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China

Abstract:

Water-soluble organic aerosol (WSOA) constitutes a major fraction of organic aerosol (OA), and plays an important role in affecting aerosol hygroscopicity and cloud condensation nuclei formation. While real-time characterization of OA with Aerodyne aerosol mass spectrometer (AMS) has been widely conducted in Beijing during the past decade, our knowledge of the characteristics and sources of WSOA remains less understood. Here we analyzed filter extracts of fine particles using high resolution AMS that were collected at ground level and 260 m on the Beijing 325 m meteorological tower in winter 2016. The mass concentrations of WSOA were quantified and the sources were analyzed with positive matrix factorization (PMF).
Our results show that WSOA on average contributed 47% and 52% to the total OA at ground and 260 m, respectively. PMF analysis identified five sources for WSOA, including three primary factors (coal combustion, biomass burning, and oxidized POA) and two secondary factors with different oxidation states. Our results suggest that WSOA in winter has considerable contribution from primary emissions which accounted for 44% and 42% at ground and 260 m, respectively. The sources and properties of WSOA also show some differences between ground and 260 m. For example, the average oxygen-to-carbon (O/C) ratio of WSOA at 260 m is 0.68, higher than that at ground (0.62), and the contribution of secondary sources is also higher (58% vs. 56%), especially the fraction of more oxidized organic OA account for 34% in 260m and 28% in ground level. These results indicate that WSOA at higher heights in the city is more oxidized. The offline source apportionment results were further compared with those of AMS online measurements, which provides more insights into the water solubility of OA from different sources.