EGU21-15866
https://doi.org/10.5194/egusphere-egu21-15866
EGU General Assembly 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Distinct diurnal formation processes of organic aerosols in winter in Beijing, China

Tao Ma, Hiroshi Furutani, Fengkui Duan, Takashi Kimoto, Yongliang Ma, Lidan Zhu, Tao Huang, Michisato Toyoda, and Kebin He
School of Environment, Tsinghua University, Beijing, China (mt911206@163.com)

Organic aerosols (OA) are major components of fine particulate matter, yet their formation mechanism remains unclear, especially in polluted environments. Laboratory studies have shown that the OA formation processes may be different under irradiated and dark conditions, but few studies have explored this aspect in ambient air. Here we investigate the diurnal chemical composition and formation processes of OA in carbonaceous particles during winter in Beijing using aerosol time-of-flight mass spectrometry. Our results show that 84.5% of carbonaceous particles undergo aging processes, characterized with larger size and more secondary species compared to fresh carbonaceous particles, and present different chemical compositions of OA in the daytime and nighttime. During the day, organosulfates and oligomers exist in the aged carbonaceous particles, which are mixed with a higher abundance of nitrate compared with sulfate. At night, distinct spectral signatures of hydroxymethanesulfonate and organic nitrogen compounds, and a minor abundance of other hydroxyalkylsulfonates and high molecular weight organic compounds are present in the aged carbonaceous particles, which are mixed with a higher abundance of sulfate compared with nitrate. Our results indicate that photochemistry dominates the formation of OA under high oxidant concentrations in the daytime, while aqueous chemistry plays an important role in the formation of OA under high relative humidity in the nighttime. The findings can help improve the performance of air quality and climate models on OA simulation.