Individual particle analyses of biomass burning aerosol particles from wild fires

*Kouji Adachi[1]

1. Meteorological Research Institute

Biomass burning (BB) is one of the most important aerosol particle sources in the atmosphere and has a significant influence on the climate. Contributions of BB aerosol particles on the global radiation budget depend on their optical and chemical properties. However, particles emitted from BB rapidly change their properties within smoke and have a large uncertainty. To reveal these uncertainties of biomass burning aerosol particles especially tar balls (TBs), which are characteristic spherical organic aerosol particles from BB smoke, an aircraft measurement campaign was conducted; biomass burning observation project (BBOP) campaign in 2013 at North West of United States using a Gulfstream-1 (G-1) aircraft. During the campaign, we collected samples from various ages (approximately 0-4 hour aged) of BB smoke as well as on-line measurements to measure the composition, concentrations, size, and optical properties of aerosol particles. This study especially focuses on morphology and compositions of individual particles using a transmission electron microscopy (TEM; JEM-1400, JEOL) with EDS (X-max 80mm, Oxford) (Adachi et al., 2018).

The results indicate that TBs formed through increasing of viscosity on the substrates, where liquid organic matters spread over the substrate and solid ones remain their spherical shapes. Chemical compositions of inorganic components such as N, K, S, and Cl within individual particles were measured. Increase or decrease of these elements as well as changes of their occurrences within BB particles as aged were observed. Sizes of TB particles were around 200 nm and did not largely change as aged (Sedlacek et al. 2018). Refractive index of TB was estimated as 1.56-0.02i at 550 nm wavelength, which suggests TBs are weak light absorbance (Sedlacek, et al., 2018).

This study shows chemical, physical, and optical properties of BB aerosol particles including TBs. The findings will improve climate influences of BB smoke as well as aerosol chemistry within near-emission particles.

Acknowledgements: The author acknowledges Sedlacek III, A.J., Kleinman, L., Onasch, T. B., Chand, D., Hubbe, J.M., and Buseck, P.R. for their supports during and after the campaign; the DOE Atmospheric Radiation Measurement (ARM) Climate Research program and facility, and the Atmospheric System Research (ASR) for the support to carry out the BBOP campaign and for use of the G-1 research aircraft; and the support of the Global Environment Research Fund of the Japanese Ministry of the Environment (2-1403, 5-1605, and 2-1703) and JSPS KAKENHI (grant numbers JP25740008, JP16K16188, JP16H05620, JP15H02811, and JP16H01772).

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Keywords: aerosol, transmission electron microscope, biomass burning

