2.135 Degradation of levoglucosan in atmosphere during transportation from West Siberia to northern Japan.

Presenting Author:
Daichi Asakawa, Osaka City Research Center of Environmental Science, d-asakawa@city.osaka.lg.jp

Co-Authors:
Aya Muneta, School of Human Science and Environment, University of Hyogo
Yuichiro Oku, School of Human Science and Environment, University of Hyogo

Abstract:

Stability and degradability of levoglucosan, which is biomass burning tracer, in aerosols are key information for estimation of contribution of biomass burning aerosols. Degradation of levoglucosan in atmosphere is suggested by chamber experiment and chemical reaction studies. Validation of degradability of levoglucosan by different approach is necessary for better understanding the dynamics of levoglucosan in actual atmospheric conditions. We, therefore, investigated the degradation of levoglucosan during long transportation using combination of chemical analysis and model simulation techniques.

We measured hourly concentrations of levoglucosan at 7 stations located in northern part of Japan during July 25–August 1, 2014, when forest fire aerosols transported from West Siberia to Japan. Levoglucosan was quantified using high performance anion exchange chromatography with positive electrospray ionization mass spectrometry. The hourly concentrations of levoglucosan ranged from below method detection limit (0.48 ng m^{-3}) to 1120 ng m^{-3}. Backward trajectory analysis indicated that air mass was transported from West Siberia, when the levoglucosan concentration was remarkably high.

The measured concentrations of levoglucosan were compared with concentrations estimated by simulation model. Preliminary simulation was conducted by Weather Research and Forecasting (WRF, Ver. 3.7.1) model using NCEP Final Analysis (NCEP-FNL) data and Global Fire Emissions Database (GFED, Ver. 3.1) as boundary conditions and burned area, respectively. We hypothesized that degradation of levoglucosan is first-order kinetics with a half-life, and then the half-life was estimated by minimization of residues between measured and simulated concentrations of levoglucosan. We obtained half-life of 31–35 hour by preliminary analysis. Our result was within the atmospheric life time of levoglucosan estimated from previous experimental studies (0.9–3.5 day). In the future, chemical transport model and flux of wild fire emission database will improve our research.

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