



## Chemical stability of levoglucosan: an isotopic perspective

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Levoglucosan, used in receptor models as a specific tracer of biomass burning aerosols, has long been considered chemically stable in the atmosphere. Recent laboratory investigations found significant chemical degradation of levoglucosan when exposed to OH radicals (Hennigan et al., 2010). Stable carbon isotopic analyses, complementarily to concentration measurements, can provide additional evidence for physical and chemical processing in the atmosphere, since chemical processing causes changes in the relative abundance between heavy and light isotopes due to kinetic isotope effect (KIE).

In this study, the chemical stability of levoglucosan was studied by exploring the isotopic fractionation of the reactant during the oxidation by OH. Mixed particles with levoglucosan and ammonium sulfate were generated in a continuous-stirred flow reactor and exposed to different levels of OH. Levoglucosan chemical degradation as function of OH exposure was derived from the decrease of levoglucosan/(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> concentration ratios using aerosol mass spectrometry (AMS). Filter samples were collected for off-line isotopic analyses. Liquid extraction - Gas Chromatography - Isotope Ratio Mass Spectrometry (LE-GC-IRMS) was applied to measure stable carbon isotope ratios of levoglucosan. The observed  $\delta^{13}\text{C}$  became more positive with increasing OH exposure, showing isotopic fractionations up to 3 ‰ at a reactant conversion of 45%. From the dependence of levoglucosan  $\delta^{13}\text{C}$  on the OH exposure, a KIE of 1.00451 was derived, being within the range of predicted values for alkanes and alkenes with the same number of carbon atoms. With known source isotopic composition of levoglucosan in biomass burning aerosol (Sang et al., 2012), ambient measurements of levoglucosan  $\delta^{13}\text{C}$  composition can therefore be used to determine the extent of chemical processing at the observation site.

### Reference:

- Hennigan, C. J., et al. 2010. Levoglucosan stability in biomass burning particles exposed to hydroxyl radicals. *Geophysical Research Letters* 37, L09806, doi:09810.01029/02010GL043088.
- Sang, X. F., et al., 2012. Stable carbon isotope ratio analysis of anhydrosugars in biomass burning aerosol particles from source samples. *Environmental Science & Technology* 46 (6): 3312-3318.