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Primary sugars in the aerosol from background sites at a West-East transect in Europe

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Introduction

Primary sugars have been identified as constituents of the particulate matter at tropical (e.g. Decesari et al., 2006) as well as in samples from temperate climates (e.g. Carvalho et al., 2003). The major primary saccharides glucose and fructose have been related with the natural background aerosol in the Amazonian forest (Graham et al., 2002), and it was suggested that their predominance in the coarse fraction was linked with the primary biological aerosol particles (PBAPs) (Graham et al., 2004), such as pollen grains, fern spores, bacteria, viruses, fungal spores, fragments and excretions of plants and animals. Simoneit et al. (2004) proposed soil biota, through the resuspension of soil dust, as the source for primary sugars.

Experimental

Aerosol samples were collected at six different sampling sites forming a West-East transect across Europe for two years. Three are low altitude sites: the Azores (oceanic background), Aveiro (Portuguese coast, rural site with maritime influence), and K-puszta (rural continental site in the central European plain). Three are high level sites: Puy de Dôme (continental background mountain site, France), Schauinsland (rural mountain site, Germany) and Sonnblick (continental background mountain site). Glucose, fructose and levoglucosan, a tracer for biomass burning, present in the monthly pools of sample aliquots, were analysed using a technique optimized for the determination of saccharidic compounds in atmospheric aerosols (Caseiro et al., 2007).

Results and discussion

Glucose followed an annual cycle, with higher concentrations in the warm season and lower in the colder months. The ecosystem's aerosol production was the major driving force of the cycle at the high-level sites. At Aveiro, higher glucose concentrations in winter than in summer originated with the emissions due to biomass burning. Though showing a different annual pattern, K-puszta also exhibits an annual cycle influenced by biomass burning during winter. At that site, soil dust resuspension was also a source of particulate primary sugars. Thus, continental sites show a large warm season biological contribution, while oceanic sites do not, and low level sites show a winter biomass burning contribution, whereas mountain sites do not.

For the low altitude sites where biomass burning was identified as a winter source of primary sugars, it was possible to calculate a glucose emission factor from biomass burning. This was done relating glucose and levoglucosan. In that fashion, an emission factor range of 2.5×10^{-3} - 5.4×10^{-3} ng Glucose/ng $PM_{2.5}$ at Aveiro and of 1.1×10^{-3} - 7.7×10^{-3} ng Glucose/ng PM_2 at K-puszta were calculated. For the other four sites, the methodology used was not applicable, either because its assumptions were inappropriate or because the biomass burned at those sites was not quantitatively significant and/or different in its emissions so that the methodology could not be applied.

Except for Aveiro where the biomass burning contribution to the PM load was most stressed, fructose concentrations were in phase with glucose. Fructose levels confirm that the biological aerosol has a greater contribution to the global aerosol budget in continental sites, being not so important in maritime sites.

Decesari, S., Fuzzi, S., Facchini, M. C., Mircea, M., Emblico, L., Cavalli, F., Maenhaut, W., Chi, X., Schkolnik, G., Falkovich, A., Rudich, Y., Claeys, M., Pashynska, V., Vas, G., Kourtchev, I., Vermeylen, R., Hoffer, A.„reae, M. O., Tagliavini, E., Moretti, F. and Artaxo, P. *Characterization of the organic composition of aerosols from Rondônia, Brazil, during the LBA-SMOCC 2002 experiment and its representation through model compounds*. Atmos. Chem. Phys.6:375-402 (2006).

Carvalho, Abel, Pio, Casimiro and Santos, Carla *Water-soluble hydroxylated organic compounds in German and Finnish aerosols*. Atmos.Environ.37: 1775-1783 (2003).

Graham, Bim, Mayol-Bracero, Olga L., Guyon, Pascal, Roberts, Gregory C., Decesari, Stefano, Facchini, M. Cristina, Artaxo, Paulo, Maenhaut, Willy, Koll, Peter and Andreae, Meinrat O. *Water-soluble organic compounds in biomass burning aerosols over Amazonia 1. Characterization by NMR and GC-MS*. Journal of Geophysical Research, doi:10.1029/2001JD000336 (2002).

Graham, Bim, Falkovitch, Alla H., Rudich, Yinon, Maenhaut, Willy, Guyon, Pascal and Andreae, Meinrat O. *Local and regional contributions to the atmospheric aerosol over Tel Aviv, Israel: a case study using elemental, ionic and organic tracers*. Atmos.Environ.38: 1593-1604 (2004).

Simoneit, Bernd R.T., Elias, Vladimir O., Kobayashi, Minoru, Kawamura, Kimitaka, Rushdi, Ahmed I., Medeiros, Patrícia M., Rogge, Wolfgang F. and Didyk, Borys M. *Sugars-Dominant Water-Soluble Organic Compounds and Characterization as Tracers in Atmospheric Particulate Matter* Environ.Sci.Technol.38: 5939-5949 (2004).

Alexandre Caseiro, Iain L. Marr, Magda Claeys, Anne Kasper-Giebl, Hans Puxbaum and Casimiro A. Pio *Determination of saccharides in atmospheric aerosol using anion-exchange high-performance liquid chromatography and pulsed-amperometric detection* Journal of Chromatography A 1171:37-45 (2007).