

Aerosol Composition in Three South American Cities

P. VASCONCELLOS¹, G. PEREIRA¹, S. SOARES¹, S. CAUMO¹, N. ALVES¹, W. MAENHAUT², M. CLAEYS³, R. HILLAMO⁴, K. TEINILÄ⁴, ODON SANCHEZ-CCCOYLLO⁵, NESTOR ROJAS⁶.

¹ University of São Paulo, Institute of Chemistry, São Paulo – SP, Brazil.

² Ghent University (UGent), Department of Analytical Chemistry, Gent, Belgium.

³ University of Antwerp (UA), Department of Pharmaceutical Sciences, Antwerpen, Belgium

⁴ Finnish Meteorological Institute, Air Quality Research, Helsinki, Finland.

⁵ National Service of Hydrology and Meteorology of Peru, Lima, Peru

⁶ National University of Colombia, Bogota, Colombia

To investigate the impact of biomass-burning and other sources (industrial and vehicular emissions) in the air quality, the concentrations of levoglucosan, mannosan, galactosan, soluble ions (Cl^- , NO_3^- , SO_4^{2-} , MSA^- , Oxalate, Na^+ , NH_4^+ and Nss-K^+) and organic and elemental carbon (OC and EC) were determined at the cities of São Paulo (SPA - Brazil), Lima (LIM - Peru) and Medellin (MED - Colombia). The sampling was carried out during the dry season at SPA (2013), when the sugarcane burning occurs in the northwest of São Paulo state. This aerosol is often transported to São Paulo city by air masses. Lima and Medellin samples were collected in high traffic spots, during the wet season. Particulate matter (PM_{10}) average mass concentration at SPA site was $105 \mu\text{g m}^{-3}$ and the Organic and Elemental Carbon (OC and EC) average concentrations for this site were, respectively 11.4 and $5.3 \mu\text{g m}^{-3}$. Levoglucosan was the most abundant of all monosaccharides in SPA. Its concentrations ranged from 179 to $1,086 \text{ ng m}^{-3}$. The average for this campaign for SPA was 471 ng m^{-3} , more than double that in the 2008 previous winter campaign (201 ng m^{-3}). The average concentrations for LIM and MED were considerably lower (respectively, 16 and 95 ng m^{-3}). The levoglucosan/mannosan ratio was 12 at SPA, close to other studies for sugarcane biomass burning. Backward trajectories showed air masses coming from the north-west of the state and fires were observed.

SO_4^{2-} , NO_3^- and NH_4^+ were the most abundant ions at SPA. Non-sea-salt potassium (Nss-K^+) concentrations ranged from 494 to 922 ng m^{-3} . As expected, levoglucosan was highly correlated to mannosan and galactosan. The correlation between Nss-K^+ and levoglucosan showed a moderate correlation ($R^2 = 0.46$). A part of the potassium may be related to biomass burning. Correlations between monosaccharides and potassium tend to be different depending on the site. Organic and elemental carbon also correlated strongly with levoglucosan ($R^2 = 0.8705$ and 0.744) at SPA site. These correlations suggest that a fraction of organic and elemental carbon in SPA may come from air mass transported from biomass burning areas. NH_4^+ had a strong correlation with SO_4^{2-} (0.787) and moderate with Cl^- (0.686). The results obtained in this study suggest that biomass burning was an important anthropogenic source of aerosol for SPA site in this period, apart from the industrial and vehicular emissions. Water-soluble concentrations ions found at Lima and Medellín were lower than at SPA and different emissions sources are suggested.