Cite abstract as Author(s) (2007), Title, European Aerosol Conference 2007, Salzburg, Abstract T13A070

# Wood smoke contribution to aerosol concentrations in Northern Italy: levoglucosan determination by GC-MS and HPAEC-PAD

P. Fermo[1], A. Piazzalunga[1], R. Vecchi[2], G. Valli[2], M. A. De Gregorio[3], S. Marengo[4]

[1]Dep. Inorganic, Metallorganic and Analitical Chem., University of Milan, Via Venezian 21, 20133, Milan, Italy
[2]Institute of General Applied Physic , University of Milan ,Via Celoria 16 20133, Milan, Italy
[3]ARPA Lombardia-U.O.lab., Via Juvara 22, 20122, Milan, Italy
[4]Stazione Sperimentale per i Combustibili, Viale A. De Gasperi 3, 20097, S. Donato M., Milan, Italy

Keywords: levoglucosan, biomass burning, particulate matter, emission factor, HPAEC-PAD.

Very scarce data on the possible contribution of particles emitted by residential wood combustion in Italy are available. To achieve more information on this source of particulate matter, a study was carried out on wood smoke contribution by means of the chemical characterization of aerosol samples collected at different locations in Lombardy (Northern, Italy). It is noteworthy that in the literature potassium, oxalate and levoglucosan are regarded as good signatures of biomass/wood combustion in the atmosphere (Simoneit et al., 1999).

Measurement of collected samples included organic and elemental carbon analysis together with the wood smoke tracer levoglucosan. Levoglucosan arises from the pyrolysis of cellulose, the main building material of wood, at temperature higher than 300°C. It is emitted in large amounts, sufficiently stable and specific to cellulose-containing substances.

PM10 aerosol samples were collected in Milan and in other five cities in the Lombardy region in the frame of the ParFiL project (Particolato Fine in Lombardia). The sampling sites have been chosen according to the different contributions estimated for wood combustion to particulate matter emissions. The samples examined were collected during winter 2005, summer 2005 and winter 2006 using low volume EPA- samplers (flow rate: 1 $m^3$/h) equipped with PM10 inlets. OC (organic carbon) and EC (elemental carbon) were measured by Thermal Optical Transmission method (TOT). Levoglucosan was quantified by two different techniques: Gas Chromatography coupled with Mass Spectroscopy (GC/MS) and High Performance Anion Exchange Chromatography (HPAEC) coupled with Pulsed Amperometric Detection (PAD). The two methods show fairly good agreement in mass concentration of levoglucosan ($R^2$ = 0.95 for the linear regression between the two methods). Up to now GC/MS was the most commonly applied technique for levoglucosan quantification (Wang et al., 2005). Nevertheless, HPAEC-PAD is sensitive, precise and accurate (Gorin et al., 2006; Engling et al., 2006) and doesn't require any complex extraction procedure followed by derivatization such as those needed by for GC-MS analyses.

Emission factors for levoglucosan were determined as percentage of tracer on OC. In the examined sites it ranged from 3.6% (in a typical urban site) to 5.7% (at an Alpine town where per head consumption of wood for residential combustion is estimated to be the highest in Lombardy).

Using the correlation between levoglucosan and OC (i.e. extrapolating the least-square fit to zero levoglucosan) it is possible to quantify a "background" or "non-woodsmoke" contribution to OC, as reported in figure 1 for two of the examined sites during wintertime when levoglucosan concentrations are expected to be higher.

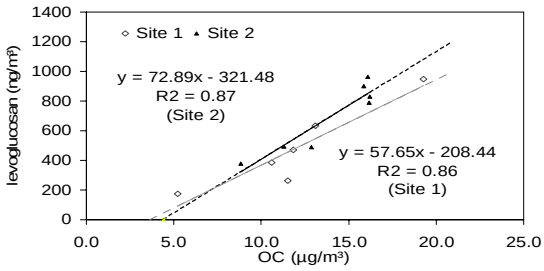


figure 1 – levoglucosan vs. OC concentrations for two of the examined sites during winter

More appropriate emission factors typical for the wood species present in Lombardy were also evaluated in order to make a correct assessment of wood burning contribution to OC. Through the analysis of the source test samples we estimated the contribution of levoglucosan to OC for different combustion systems (fireplaces and stoves) and different wood types.

**Acknowledgements**
The authors are grateful to ParFiL Project for their financial support. We are thankful to all the people who have taken part to the collaboration.

Engling G., et al. (2006). *Atmos. Environ.*, 40, S299-S311
Gorin C. A., J. L. Collett (2006). *J. Air & Waste Manage. Assoc*., 56, 1584-1590
Simoneit et al. (1999). *Atmos. Environ.*, 33, 173-182
Wang W. et al. (2005). *Mass. Spectrom*., 19, 1343-1351