

Wood combustion contribution to PM: results of three winter campaigns (2005-2007) in Lombardy (Italy)

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Recent studies identify wood burning as an important source of particulate matter (PM). In Lombardy Region (Northern Italy), where PM₁₀ concentration frequently exceed the EU daily limit of 50 µg/m³, emission inventories estimate that on average 28% of primary PM₁₀ and 31% of primary PM_{2.5} are due to wood burning (INEMAR 2005).

Levoglucosan has been identified as a marker for biomass burning emissions and contribution to PM in ambient air (Simoneit et al., 1999, Schmidl et al., 2008).

In this study two different urban sites in Northern Italy were investigated: a site in Milan (about 1.500.000 inhabitants), which is located in the Po Valley, and a site in Sondrio (22.000 inhabitants), which is a small alpine city. PM₁₀ samplings were carried out in parallel in Milan and Sondrio (70 samples in total) during three winter periods (years 2005-2006-2007). Moreover, PM_{2.5} samples were collected in Milan.

Levoglucosan together with other anhydrosugar compounds, including mannosan and galactosan, quantification was carried out using HPAEC-PAD method (Engling et al., 2006, Caseiro et al., 2007). Using this method levoglucosan analysis can be interfered by the presence of arabitol, which is a typical summer species coming from fungal spores and lichens (Puxbaum et al., 2007). In our case, this interference was overcome hydrolysing some samples by extraction with 0.1M HCl (Dixon et Baltzell 2006) in order to convert levoglucosan to glucose. The result was that the arabitol signal was not detected in the chromatogram, as expected because this species is typically found in summer samples.

OC and EC were also quantified by TOT method (Birch and Cary 1996, Fermo et al., 2006).

PM₁₀ average mass during the investigated periods was about 50 µg m⁻³ in Sondrio and 70 µg m⁻³ in Milan. OC concentrations were on average 10 µg m⁻³ in Milan and 12 µg m⁻³ in Sondrio, accounting respectively for 15% and 20% of the PM₁₀ mass measured at the two sites. The levoglucosan concentration was 400 ng m⁻³ in Milan (15% of OC) and 700 ng m⁻³ in Sondrio (23% of OC).

The quantification of wood burning contribution to the measured OC levels requires the

knowledge of levoglucosan/OC emission ratio. In this study we used an emission ratio of 0.15 in accordance with Puxbaum et al. (2007). Wood burning contribution to the OC measured in PM₁₀ samples is estimated to be about 25% in Milan and 50% in Sondrio, indicating that wood burning was the main OC source in the alpine city during wintertime.

In Milan, the PM_{2.5}/PM₁₀ levoglucosan ratio was also assessed (0.85) suggesting that wood burning mainly contributes to the fine fraction.

According to Schmidl et al. (2008), the levoglucosan to mannosan ratio gives information about the predominant use of softwood or hardwood. In Milan the 80% of the wood used for domestic heating is softwood, while in Bormio this percentage is about 90%.

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