Relation between anhydrosugars and organic carbon in the PM_1 particle fraction

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Levoglucosan is a very specific and unique biomass burning marker as it is formed only by cellulose decomposition, which is why it can unambiguously confirm the presence of biomass burning in air pollution contribution studies. Besides levoglucosan, mannosan and galactosan are also formed but are associated with hemicellulose degradation so generally their levels greatly depend on the type of biomass. Our previous studies in Zagreb, Croatia, showed more than 80 % of levoglucosan in the PM_{10} fraction is bound to the PM_1 fraction. This study aimed to determine the levels of anhydrosugars; levoglucosan, mannosan, and galactosan in the PM_1 fraction in different seasons, as well as the content of organic carbon to investigate the impact of biomass burning on organic carbon and PM_1 levels. The ratio between different anhydrosugars was determined for biomass type identification.

The daily samples of the PM_1 fraction were collected by a low-volume sampler onto quartz fiber filters at an urban background monitoring station. The analysis of anhydrosugars was performed by high-performance anion-exchange chromatography with pulsed amperometric detection, while organic carbon and water-soluble organic carbon were measured by thermal-optical transmittance.

Results showed a domination of levoglucosan levels compared to mannosan, and galactosan levels. A pronounced seasonal cycle was observed for anhydrosugars, organic carbon, water-soluble organic carbon, and PM_1 mass concentrations. Levoglucosan, organic carbon, water-soluble organic carbon, and PM_1 reached the highest levels in the winter season, while the levels of mannosan, and galactosan were highest during the spring season. Depending on the season, the average contribution of anhydrosugars to the organic carbon ranged between 1.7 and 22.0 %, while the ratio of anhydrosugars in the PM_1 fraction ranged from 0.3 to 7.1%

The strong correlation between anhydrosugars and organic carbon was observed in winter and autumn (r= 0.89 and 0.85, respectively) suggesting that biomass burning in the colder part of the year is an important source of organic carbon.

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