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Contribution of wood combustion to PAH and PCDD/F concentrations in two urban sites in Northern Italy

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The use of residential wood combustion represents an important renewable energy source, but it contributes in a considerable way to atmospheric particulate matter (PM) concentration in urban as well as in rural sites. Moreover, recent studies (Belis (2010), Bari (2009)) pointed out wood burning as an important source of PAH.

In the present work, the contribution of wood combustion to benzo(a)pyrene (B[a]P) and Polychlorinated Dibenzop-dioxins and Dibenzofurans (PCDD/F) concentrations was investigated, using levoglucosan as a marker. To our knowledge, this was one of the first times that PCDD/F concentrations were determined in atmospheric particulate samples in Italy.

PM10 samples were collected daily for six months in two sites located in Piemonte (Northern Italy): Torino (900 000 inhabitants, 239 m asl), where the limit for atmospheric PM concentration is frequently exceeded; Susa (6 700 inhabitants, 503 m asl), characterized by very high B[a]P concentrations.

Composite monthly samples were chemically characterized, analyzing the concentrations of levoglucosan, B[a]P, PCDD/F, organic carbon (OC), elemental carbon, major anions and cations.

PM and OC concentrations were almost twice in Torino with respect to Susa, while levoglucosan and B[a]P concentrations were almost comparable in the two sites. Therefore, wood combustion affects more Susa than Torino. Concentrations of B[a]P and levoglucosan were highly correlated in both sites. Using the macro tracer method and the emission factors reported in literature, the wood combustion percentage contribution to B[a]P concentration was preliminary estimated and resulted as the main source in both sites. The levoglucosan : soluble potassium ratio was higher in Torino with respect to Susa, indicating that combustion plants with different efficiency are used in the two sites.

PCDD/F concentrations were higher in Torino (1.2 pg/m³ - 2.5 pg/m³) than in Susa (0.6 pg/m³ - 2.1pg/m³), but their ratio to OC concentration was comparable in the two sites and didn't show an increase in the colder months, as observed for B[a]P and levoglucosan concentrations. Some 2,3,7,8-substituted PCDF congeners showed a fair correlation with levoglucosan and were supposed to be representative of wood combustion source.

Belis CA et al. (2010) Geophysical Research Abstract, 12, 13018-2

Bari MA, Baumbach G, Kuch B et al. (2009) Atmospheric Environment, 43, 4722-4732