Wood burning as source of Benzo(a)pyrene in PM

Belis C.A.[1], Piazzalunga A.[2], Larsen B.[1], Vecchi R.[3], Fermo P.[4], Colombi C.[5] and Gianelle V.[5]

[1] European Commission JRC - Institute for Environment and Sustainability - 21027, Ispra, Italy
[2] University of Milan-Bicocca Dept. of Environmental Sciences, Pza. della Scienza,1 20126, Milan, Italy
[3] University of Milan Dept. of Physics, via Celoria 16, 20133, Milan, Italy
[4] University of Milan Dept. of Organic, metal-organic and applied Chemistry
[5] Environmental Protection Agency of Lombardy Dept. of Milan, via Juvara, 22, 20122, Milan, Italy

Keywords: wood burning, benzo(a)pyrene, PM_{10}, factorial analysis, linear regression, Po Valley

Wood burning is a relevant source of PM in ambient air in many areas of the world. Recent studies have found that wood burning contributes between 7% and 20 % of PM_{10} mass in urban and rural sites in Austria (Caseiro et al., 2009). In particular, Bari et al. (2009) estimated that 20 to 60 % of the total PM_{10} organic loadings in the winter ambient air near Stuttgart (D) derive from wood burning. These authors observed that 93% of PAH in PM_{10} derive from combustion processes and 43% of them are carcionogenic. In the Po Valley emission inventories attribute 30% of primary PM_{10} to wood burning and the like (ARPA Lombardia). Source apportionment using CMB and PMF estimated a contribution of wood burning on annual basis ranging from 10 to 25 % (Colombi et al., 2008, Larsen et al., in prep.). In this area there are many locations where the levels of Benzo(a)pyrene (BaP) are near or above the annual target value set by European Directive 2004/107/EC (ARPA Lombardia).

This study points to estimate the contribution of wood burning (including burning of agricultural residues) to the levels of toxic PAHs in the PM_{10} by using BaP as marker.
The sources of BaP were estimated by computing multiple linear regression and non linear factorial regression. The model parameters were fitted using two independent datasets of PM_{10} samples collected between 2005 and 2007 in urban sites located in the Po Valley and in the southern Alps.
The explanatory variables used for estimating BaP were selected using forward selection based on F test from a pool of variables representing: biomass burning (levoglucosan), emissions from unspecified combustion processes (CO, NOx, EC, OC and trace elements) and atmospheric properties (wind speed, temperature, and height of the mixing layer).

In the background sites levoglucosan explained a considerable part of the BaP contribution to the PM_{10} mass. In a number of urban background sites, levoglucosan was the most important variable to explain BaP levels. Other variables explaining significant part of BaP variance were NOx, CO , OC, wind speed, and air temperature. In a kerbside site, the influence of levoglucosan on BaP variance decreased but was still relevant. Good agreement has been observed between these results and those obtained using PMF for source apportionment of BaP.
We conclude that biomass burning is one of the most important sources of toxic PAH in the particulate fraction in both the Po Valley and in Alpine areas where wood is widely use as fuel for heating.

ARPA Lombardia (Environmental Protection Agency of Lombardy) http://ita.arpalombardia.it/ITA/qaria/Home.asp

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