The contribution of biomass burning to PAH levels in PM10

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The objective of the present study is to identify the contribution of wood burning and biomass burning to the levels of toxic polycyclic aromatic hydrocarbons (PAH) in the atmospheric particulate matter.

Benzo(a)pyrene has been selected as a marker of PAHs since it is predominantly present in the solid phase and is the only isomer having a target value for its atmospheric concentrations in the European Union.

The levels of BaP have been evaluated both as ambient air concentration (ng/m3) as required by directive 2007/104/EC and as mass fraction of PM10 (mg/g). The levels of BaP were estimated by computing multiple linear regression and non linear factorial regression. The model parameters were fitted using two independent datasets of PM10 samples collected between 2005 and 2007 in 3 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).

The uncertainty of the model was estimated by propagating the standard uncertainties of the corresponding variables. An analysis of sensitivity was conducted by evaluating the influence of the variation of the measured variables along a range comparable to their standard deviations on the model outputs.

In the background sites levoglucosan explained between 55% (s.e. 16%) and 87% (s.e. 8 %) of the BaP contribution to the PM10 mass and between 53% (s.e.16%) and 84% (s.e.10%) of the BaP concentration. Levoglucosan was the most important single variable to explain BaP levels. Other variables explaning 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 (44%; s.e 18%) while NOx and OC were the most important variables.

These results indicate that biomass burning is an important source 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.