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Seasonal and daily source apportionment of polycyclic aromatic hydrocarbons in PM10 in a semi-rural European area by TD-GC-MS

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Polycyclic aromatic hydrocarbons (PAH) make up an important part of the toxic fraction of the particulate matter in ambient air. They were analysed from ambient air PM10 by direct-sample-introduction thermal desorption GC-MS. This method needs small samples volumes (1-7 m3) allowing shorter sampling times (3 h) in comparison to 24 h which is beneficial for source apportionment applications and human exposure estimates. Filter samples were collected in a semi-rural area in Northern Italy from August 2008 to January 2009, using 24-hour and 3-hour sampling resolutions. Highest individual PAH concentrations ranged from 0.05 ng/m3 during mid-days in summer to about 6 ng/m3 during the nights of the coldest period. A multivariate experimental regression model for the estimation of PAH concentrations was developed to apportion the identified local sources of PAH. This model included specific markers (i.e., levoglucosan for wood combustion and hopanes for traffic emission) and meteorological parameters (i.e., ambient air temperature and atmospheric mixing layer heights). In autumn and winter, wood combustion on a daily average contributed from 30 to 70% to the PAH. In this period, the contribution of the wood combustion was less than 30% during mid-day and increasing many times to more than 80% during the evenings and nights. In the samples taken during the summer period, traffic contribution to PAH concentrations was about 30%, while wood combustion was insignificant. The experimental regression model reveals the exposure of the population to toxic levels of polycyclic aromatic hydrocarbons from especially biomass burning at certain moments of the day during an extended period of the year which could provoke adverse health effect on the long-term.