Contribution of anthropogenic and biogenic aerosol sources in three Austrian cities

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Keywords: PAHs, n-alkanes, PM10, source identification.

The EU short term limit for the PM10 concentration is 50 \( \mu g/m^3 \) daily mean and for years 2005-2009 it may not be exceeded more than 30 times a year. In fact, at many urban sites the EU PM10 daily mean is exceeded many more times in the year, which raises the questions, what is this PM and where does it come from? Knowing what the sources are could help to reduce air pollution by more effective regulation of emission sources.

The primary sources are either connected with human activity or they have natural origin and the estimation of individual source contribution to the PM10 fraction is based on utilization of a specific species, markers. The aim of this study was to evaluate some sources contribution via determination of non-polar and semi-polar organic compounds.

The atmospheric aerosols were collected at urban, urban-fringe and rural sites in Vienna, Graz, and Salzburg during the year 2004. Selected polyaromatic hydrocarbons (PAHs) and their derivates were determined, which serve as tracers of vehicle exhaust, wood combustion, natural gas combustion. Furthermore, normal alkanes \( C_{24}-C_{33} \) were quantified to differentiate vegetative detritus.

The yearly mean concentrations of selected 5-7 rings PAHs at Vienna sampling sites in year 2004.

The yearly mean concentrations of selected PAHs were only slightly higher at urban sites than at the rural sites, suggesting that long range transport plays the main role in distribution of PAHs in the atmosphere. A little bit higher urban impact was found for retene and benzo(de)anthracene-7-one, what indicates contribution of local sources as well as role of transport, probably at regional level.

As the main source of selected 5-7 rings PAHs is considered vehicle exhaust. Other sources are also anthropogenic and are connected with combustion. The differentiation of sources is possible via known PAHs ratios in source emissions. Thus, it was found out, that non-traffic sources have higher input to polyaromatic hydrocarbons in winter season and that the traffic emissions come predominantly form diesel engines.

The specific marker for natural gas burning, benzo(de)anthracene-7-one, showed high concentrations in January-February and in November-December 2004 (up 5 ng/m³ in Vienna and Salzburg, up to 16 ng/m³ in Graz), while in summer it was often below the detection limit of 0.1 ng/m³. This is in keeping with the suggestion that it can be used as a marker for natural gas combustion. The wood combustion is reported to be identified via retene. However, the concentrations did not always show the expected yearly trend. So, the usage of retene as wood smoke marker is questionable.

The relatively high value of urban impact for total n-alkanes \( C_{24}-C_{33} \) (e.g. 30% for Vienna) suggests that a high proportion of them come from local sources. Among normal alkanes sources, traffic emissions and vegetative detritus are proposed to be the strongest. Basically on their composition differences, the origin of n-alkanes can be assign. The strong contribution of vegetative detritus was identified summer according carbon preference index (CPI) values higher than 2.0, typical for urban areas, and via higher plant wax number (% WAX). The plant wax contribution to total n-alkanes is in winter usually less than 15%, but in summer it can be over 40%. Although CPI and % WAX numbers were higher at not inner city sampling sites, it was found out that relative composition of total n-alkanes varied more with time than with a location.

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