Particulate organic compounds in the atmosphere surrounding a waste water treatment plant (Agliana-Pistoia, Italy)

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Organic compounds of anthropogenic or biogenic origin often represent a large fraction of particulate matter. Anthropogenic emissions generally include motor vehicles, industrial processes, waste incineration and tobacco smoke (Mandalakis et al., 2002); on the other hand, wind erosion of leaf epicuticular waxes, vegetation debris and microbial degradation are considered as the most important biogenic sources of organic compounds (Rogge et al., 1993). Organic compounds exist in ambient air as gases and adsorbed to airborne particulate matter; the distribution between gas-phase and particulate matter depends on the chemical-physical properties of the investigated organic compounds. Meteorological parameters (such as temperature, wind direction, wind speed, etc.) could also influence the distribution of the pollutants from the source in the ambient air so these parameters were also measured in this study.

A sampling field was performed in Agliana, near the city of Pistoia (Italy), during the period from May to July 2006. Aerosol samples were collected at 4 different sites located around a sewage treatment plant, because waste water treatment processes are considered responsible of the emissions of PM10 and associated pollutants (e.g. PAHs, alkyl phenols, etc.) (Cincinelli et al., 2003). The investigated area is also characterised by the presence of main arterial roads such as A11 and A1 highways, whose traffic is extremely high, and a residential area. The aims of this study were to evaluate the sources of organic pollutants and the impact of these on the surrounding area the waste water treatment plant.

To this aim the particulate matter amount and the aerosol-associated alkyl phenol mono and di-ethoxylates (waste water treatment plant markers), n-alkanes and PAHs were determined. Gas phase, total suspended particle (PTS), PM10 and VOCs (i.e. alkyl benzenes and tetrachloroethylene in particular). Sampling and analytical methods are described elsewhere (Cincinelli et al., 2003 – Cincinelli et al., 2007).

N-alkane concentrations varied from 13 to 165 ng/m³ in the gas phase and from 16 to 101 ng/m³ in the particulate matter. In figure 1 representative gas chromatographic profiles for the aliphatic hydrocarbons fraction are reported. N-alkanes origin were evaluated by specific parameters such as CPI, UCM, pristine and phytane, %WNA, Cmax.

Alkyl phenols were also found in all samples, except for the PTS and PM10 of sample 1. These compounds are not produced naturally so their presence in the ambient might be due to anthropogenic activities such as the waste water treatment plant.

Total PAH concentrations ranged from 0.638 to 5 ng/m³ for the gas phase and from 0.055 to 1.010 ng/m³ for the particulate phase. Significant compositional differences were observed between gas and particulate phase. The gas phase percentage, generally, decreased with increasing molecular weight.

High concentrations of tetrachloroethylene were found in samples down wind to the plant. This result, together with the presence of alkylphenols in the same samples, evidences the impact of the plant in the surrounding area.


Mandalakis M., Tsapakis M., Tsoga A., Stephanou E.G., 2002 – Gas- particle concentrations and distribution of aliphatic hydrocarbons, PAHs, PCBs and PCDD/Fs in the atmosphere of Athens (Greece). Atmospheric Environment 36, 4023-4035