

INTRODUCTION

Air pollution is usually concentrated in densely populated metropolitan areas, where it may be a serious hazard for the inhabitants. In contrast to a wealth of information on air pollution in metropolitan areas, only a few studies considered pollutant levels in suburban areas. These are affected not only by local sources but also by emissions from neighbouring metropolitan areas, depending on local topology and wind regime.

Atmospheric particulate matter (PM) has various sources, both natural (crustal weathering, seawater aerosol evaporation, volcanism and natural forest fires) and anthropogenic (fossil fuel combustion, vehicular traffic, industrial activities, incineration and biomass burning). Particles generated by these processes are important carriers of various trace metals and organic pollutants. The chemical composition of PM can vary widely depending on the emitting source and chemical reactions taking place in the atmosphere. PM vehiculates a large number of organic and inorganic compounds, many of which are toxic and/or carcinogenic.

Polycyclic aromatic hydrocarbons (PAH) are ubiquitous environmental pollutants and some of them are among the strongest known carcinogens (IARC, 1984). It has been estimated that stationary sources contribute for approximately 90% of total PAH emission, but this is not true in urban and suburban areas, where the mobile sources are prevailing, due to the increasing vehicular traffic and the scarce dispersion of the atmospheric pollutants.

The major trace elements that typically are detected in particulate matter include aluminum, calcium, and iron, most of which tend to originate from terrestrial sources. The presence of significant levels of calcium in the particles is indicative of contamination from soil erosion and rock dust.

Here we report the results of an approximately 1-year-long sampling/analysis campaign for the determination of PM10 concentration in a suburban area of Caserta affected by relatively high traffic density in weekdays. Temporal variations of PM10 levels and their possible relationships with meteorological parameters were investigated. The results were employed in an attempt to identify the source of PM10.

EXPERIMENTAL

The sampling site (41°03'23"N, 14°20'29"E) was located in the suburb of Caserta, a city located in the South Italy, with a population of about 79000 inhabitants and a surface of 56 km². The determination of PM10 on daily samples was performed gravimetrically. Glass fiber filters, 47 mm diameter (Whatman, Germany) were used to collect aerosol for 24h. PM10 was sampled using a high-volume sampler (TCR Tecora Skypost) with a size selective inlet (LVS PM10). The flow was 2.3 m³/h.

PAH were determined using a gas chromatography (Agilent 7890) equipped with mass spectrometer (Agilent 5975C) in electron impact mode (70 eV).

Calcium were determined with a Varian SpectraAA 220 atomic absorption spectrometer (CA, USA) equipped with a MK7 burner.

Monitoring site was provided with several meteorological sensors for the determination of temperature, barometric pressure, relative humidity, solar radiation, wind speed and direction and rain if present (Vantage Pro, Davis Instruments).

RESULTS

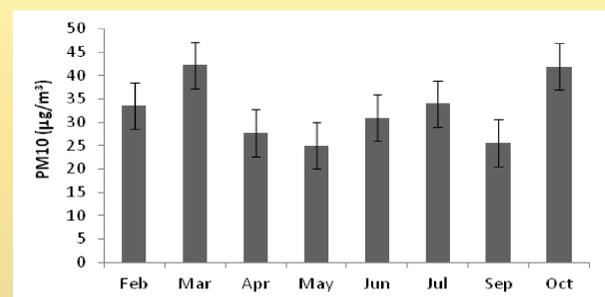


Fig. 1 Monthly dependence of average PM10 concentration in a suburban area of Caserta (Italy)

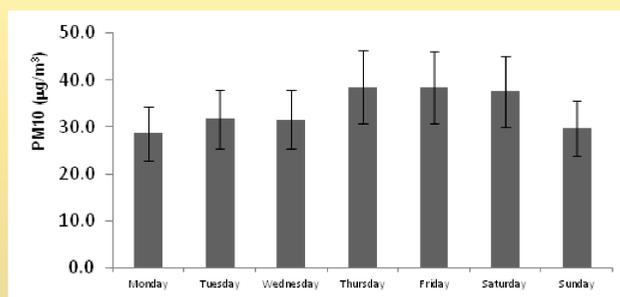


Fig. 2 Average fluctuation of PM10 during the week in a suburban area of Caserta (Italy)

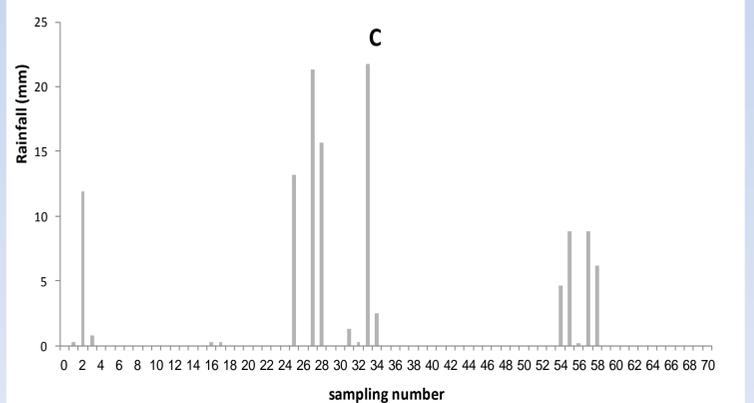
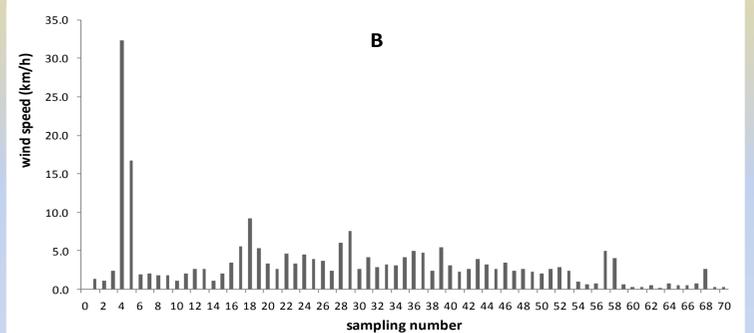
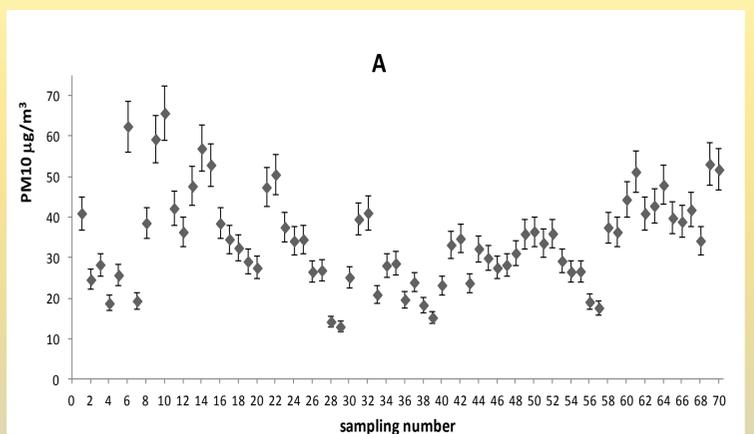


Fig. 3 Daily records of PM10 (a), wind speed (b) and rainfall (c) over the whole study period in a suburban area of Caserta (Italy)

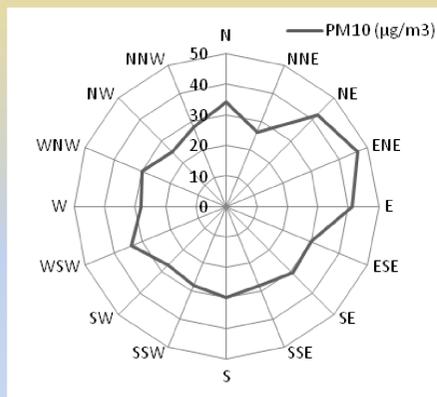


Fig. 4 Average concentration of PM10 (bold line) for different wind directions in a suburban area of Caserta (Italy)



Fig. 5 - Satellite photo of the sampling site

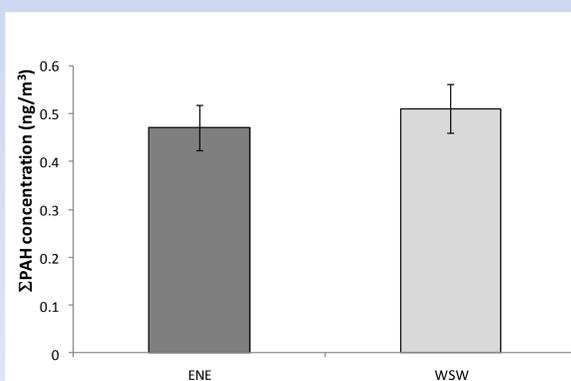


Fig. 6 Average PAH concentrations measured with east-north east (ENE) wind and wind with opposite direction (west-south west, WSW) in a suburban area of Caserta

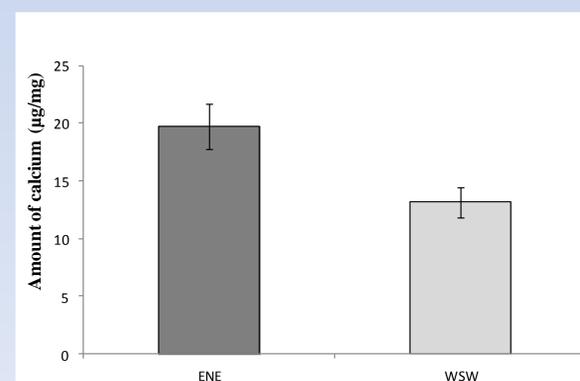


Fig. 7 Influence of wind direction on calcium concentration in particulate matter in a suburban area of Caserta

CONCLUSIONS

The daily level of PM10 in the suburban area of Caserta city, together with the analysis of the wind intensity and direction, as well as of the chemical composition of the particulate matter, strongly suggest that the major source of local dust pollution is not vehicular traffic but industrial facilities located a few kilometers ENE of the investigated area. In particular, the pattern of calcium distribution in function of wind direction pinpoints a large limestone quarry and associated cement factory about 2.8 km ENE of the monitoring site as the most likely cause for the relatively high PM10 levels recorded in the present analysis. The daily limit of 50 mg/m³ was exceeded in 9 over 70 days. In our opinion this demands a careful assessment of air healthiness to be carried out by the public administration in order to evaluate the need for protection measures.

REFERENCES

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