

Abstract

24-hour concentrations of atmospheric particulate matter (PM₁₀, PM_{2.5} a BS) were measured during two winter (heating) periods (12/1997–4/1998 a 11/1998–3/99), one summer period (4-10/1998) and during a separate measuring campaign (3.-21.4.2003) performed in a central part and at a nearby background location of a selected small settlement (163 inhabitants), where brown coal is a dominant fuel for domestic heating. PM₁₀ and PM_{2.5} samples were mineralized and concentrations of selected elements (Al, Ti, V, Cr, Mn, Co, Ni, Zn, Cu, As, Se, Sr, Cd a Pb) were determined by ICP-MS technique. Average PM₁₀ winter (38 a 41 µg.m⁻³) and summer (27 µg.m⁻³) concentrations were comparable with PM₁₀ concentrations in neighbouring towns, including Prague. Average PM₁₀, PM_{2.5} and BS concentrations were higher in the central part of the village (38, 28 a 27 µg.m⁻³) than at the nearby background location (31, 24 a 13 µg.m⁻³). Concentrations of BS, PM₁₀ and elements (As, Pb, Ni, Se a V) demonstrated a considerable seasonal variability with high concentrations in winter and lower in summer. This phenomenon indicates a good relation between sources of air pollution and local heating. In comparison with other places in the Czech Republic very high winter concentration of As, that originates first of all from brown coal combustion, was found in this settlement. PM₁₀ concentrations in the village were highly correlated with PM₁₀ concentrations in neighbouring towns. Both PM₁₀ and PM_{2.5} were reasonably correlated in the central part of the village and also at the nearby background location (0,804 a 0,853), however, correlation between same fractions from the two monitoring sites was even higher (for PM₁₀ 0,917 and for PM_{2.5} 0,929). The most considerable differences of elemental composition were found between PM₁₀ and PM_{2.5} for crustal elements (Al, Mn, Ti) in both places. Elemental composition of PM_{2.5} in the central part of the village and PM_{2.5} at the nearby background location were not found very different. These results indicate that most of the aerosol in both locations is influenced by similar sources. In addition PM_{2.5} concentrations in both places were highly correlated with PM₁₀ concentrations in Beroun, the nearest larger town, (0,929 for the central part of a village and 0,932 for the nearby background location). It supports the idea that long range transport of fine particles can play an important role in regional aerosol concentration. Special events of increased air particulate matter concentrations recorded during the 2003 measuring campaign at the nearby background location influenced PM concentrations not only in the village but also in Beroun. 24-h limit for

PM₁₀ (50 µg.m⁻³) was exceeded in 27 and 32% of days during the two winter periods, in 4% of days during the summer period and in 26 and 11% of days during the last measuring campaign in the central part of the village and at the nearby background location.

The results of the present study show that aerosol pollution may not necessarily be restricted to larger cities but is also common in villages. Considering relatively dense distribution of small and mid-sized settlements over the Czech territory, local heating may be considered namely in winter a large-scale non-point air pollution source which may in some instance substantially increase the overall background levels of ambient particulate matter. Small particles containing various health hazardous substances can play a large role in affecting human health of inhabitants living in small settlements in the Czech Republic, where coal combustion for domestic heating is still widely used.