CITY DUST (PM10) COMPOSITION AS AN IMPORTANT TOOL OF PLANING A TOWNS ENVIRONMENT: MINERALOGY, LEAD-ISOTOPE AND PAH-COMPOSITION IN VIENNA

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The air and the fine dispersed dust particles, with major contributions of the geological environment, are important for the well being and the prosper development of inhabitants of major cities. The knowledge about sources and composition of emitted fine dust are important for planing and sustainable development of larger towns.

Due to improved filtering techniques industry reduced the coarse dust emission considerably in Central Europe, the very fine grained (< 10 µm) and more dangerous dust emission stayed constant or has even increased. Because of their small size as well as their shape, dust particles may be particular harmful to the human respiratory system.

High concentrations of some minerals themselves (asbestos, quartz etc.) or the high heavy metal content as well as carcinogenic organic compounds (PAH's) frequently attached to them have noxious effects.

The most important natural and manmade particle sources in urban environments are materials eroded by wind (soils, construction materials), as well as industrial and traffic emissions. Speculation about their sources has mostly been on the basis of chemical information only. Very little is known about their mineral and organic phases. In order to interpret the physical properties of particles, their environmental behaviour and the health risks they may pose in future, the combined information of chemistry and mineralogy is essential.

Methods

The very fine-grained particles have been collected on "low blank" cellulose nitrate and glassfibre filters in a high volume sampler (Stroehlein) or in a cascade impactor (CMI).

In order to observe long term changes samples have been taken from the filter of an air condition in intervals of 3-5 month from 1991-1995. These samples have been dry-screened < 20 µm in order to make them comparable to the PM10 filter samples. Mineralogical composition was analysed by x-ray diffraction, FTIR and SEM. The trace element and Pb-isotope composition was obtained by dissolving parts of the filters and subsequent analysis with ICP-MS. Glassfibre filters were extracted with supercritical CO_2 and the PAH were analysed with GC-MS.

Results

The dust samples consist of calcite, dolomite, quartz, organic matter (+ soot), and gypsum as major phases, whereas illite-mica, chlorite and feldspar are minor phases (<5%). Magnetite, goethite, brushite and epsomite were detected as well. Winter samples are more enriched in calcite, dolomite and gypsum compared to samples collected during summer. The considerable enrichment in As, Cd, Pb and Zn, compared with the mean crustal composition, as well as the lead isotope-ratios (207/026) indicate a fair mixture of emissions from heating and gasoline combustion during winter and a dominance of the latter during summer. The PAH-pattern support the conclusion drawn from the heavy metal analysis.

The most prominent change during 1991-1995 is the considerable decrease in lead content, due the stop of leaded gasoline during this period.