A CONTRIBUTION TO THE CHARACTERIZATION OF THE AEROSOL SOURCES IN SAO PAULO - BRAZIL

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ABSTRACT

Atmospheric pollution is a world-wide problem whose importance has grown, mainly in urban areas like São Paulo, owing to the increasing effects of pollutants on human health.

The purpose of this paper is to contribute to the characterization of the atmospheric aerosol found in the city of Sao Paulo, which owing to the wide urban industrial area, is classified among the most complex in the world.

In order to study this aerosol, the particles in suspension in the atmosphere were collected on two teflon filters, using a dichotomous virtual impactor sampler, which separated them in two different aerodynamic size fractions, coarse (2.5 to 10 microns) and fine (less than 2.5 microns).

The concentration of elements Al, Br, Ca, Ce, Cl, Co, Cr, Fe, K, La, Mn, Na, P, Pb, S, Sb, Sc, Se, Si, Sm, Th, V and Zn was determined by Energy Dispersive X-Ray Fluorescence and Instrumental Neutron Activation Analysis and the mass of the particulate matter was determined gravimetrically.

The data sets were analyzed using linear correlation coefficients, enrichment factors and principal factor analysis.

The number of significant correlations was higher in the coarse particles than in the fine ones. Elements Al, Ce, Fe, La, Sc, Si, Sm and Th are clearly associated in the coarse particles, while in the fine fraction the elements most frequently associated are Br, Pb, S, Sb and V.

In order to evaluate the contribution of anthropogenic aerosol sources, the enrichment factors

(EF) were calculated using the average concentration of Earth crust and seawater reported by Mason and Moore[1] and Goldberg[2], respectively. The elements Fe and Na were used as reference elements to soil and seawater, respectively.The criterion established by Rahn[3], where elements with EF greater than 10 are anthropogenic and EF less than 7 are natural in relation to an investigated source, was utilized. It was observed that in relation to Earth crust elements Br, Cl, Cr, Pb, S, Sb, Se and Zn presented EF greater than 10, while the EFs for elements Al, Ca, Ce, Co, K, La, Mn, Na, Sc, Si and Th were less than 7 in both fine and coarse particulate matter. Only the element V presented a different behavior, with EF >10 in fine and EF < 7 in coarse particles. In relation to seawater, elements Br and Cl had EF < 7 while the others presented EF > 10, for both fine and coarse particulate matter.

Orthogonal varimax rotated factor analysis was applied to the coarse and fine elemental data. Six factors were responsible for 88.7% of the total data variance for coarse particulate matter, while for fine particles five factors explained 83.4% of the variance.

These factors were associated with the following major aerosol sources: soil (Al, Sc, Fe, Th, rare earths), phosphatic rocks (P, S, K, Ca, Si), marine (Na, Cl), fuel oil combustion (V, Br, rare earths), residual high temperature processes (Br, Sb), refuse burning incinerator (Zn, Mn) and residual industrial activities (Pb, Cr).

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