USE OF BIOMONITORS FOR ASSESSMENT OF ENVIRONMENTAL POLLUTION USING NEUTRON ACTIVATION ANALYSIS AND ATOMIC ABSORPTION SPECTROMETRY

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The use of biological materials for monitoring heavy metal air pollution was introduced about 30 years ago. Since then, a variety of materials and organisms has been proposed for biomonitoring purposes. These include mosses, lichens, epiphytes, leaves, grass, or animal tissues such as hair and liver.

Plants as bioindicators are a good alternative to conventional pollution control instrumentation. Several advantages are observed, such as: different contaminant control in large areas; possibility of usage in different sites at the same time and low plant cultivation and maintenance cost. The lichen species *Canoparmelia texana*, the aerial epiphytic bromeliad *Tillandsia usneoides* and *Tradescantia pallida* plant were used to air pollution biomonitoring in São Paulo city, Brazil, by neutron activation analysis.. The samples of *Tillandsia usneoides* L. were collected in a non-polluted area, 80 km far from São Paulo city, and were transplanted to the monitoring sites. Samples were exposed for two months and after this period were substituted for new plants. This procedure was performed for 12 months, from June/02 to June/03. The exposed samples and a control sample (from the non-polluted area) were dried, homogenized, ground and analyzed by using Instrumental Neutron Activation Analysis (INAA). The concentrations of 25 elements were determined.

The results obtained showed a tendency of increasing concentration of elements As, Ba, Co, Sb and Zn in the samples of *Tillandsia usneoides* exposed in sites of São Paulo city increasing degrees of pollution. Seasonal and temporal variations in elemental concentrations were statistically evaluated and factor analysis was used to identify pollution sources. The *Canoparmelia texana* lichenized fungi has been used for passive biomonitoring and the samples collected in non-polluted sites of Atlantic Forest and in São Paulo city where the governmental air quality control agency, CETESB operates an automatic network with monitoring stations.

Samples were cleaned using adequate protocols and analysed for the determination of As, Br, Ba, Ca, Co, Cr, Cs, Fe, La, Na, Sb, Sc, Se, Zn and U. The cluster analysis applied to the analytical data obtained showed three main groups of area: non-pollute area and, areas affected by industrial and vehicular origin pollution. Distribution maps obtained for some elements such as Cd, Fe and Zn showed high concentrations of these elements in sites located near the industries.

These elements showed a very similar pattern because they probably have the same origin. In the case of T. pallida, this higher plant was rooted in vases containing soil from same lot.

These vases were distributed in sites of the Cerqueira Cesar and Congonhas districts as well as in Caucaia do Alto county, considered a non-polluted area. Analytical data obtained for T. *pallida* leaves were submitted to discriminant analysis using SPSS software to classify the samples according to their origins.

A graphic representation of the distribution indicated clearly three groups of results corresponding to the three sites of sample collection.