COMPARISON OF METAL ACCUMULATION IN TREE BARK AND SOIL FROM URBAN PARKS IN SÃO PAULO CITY, BRAZIL

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INTRODUCTION

The main sources of air pollution in the São Paulo megacity are gases and particulate matter released by the ever increasing fleet of light and heavy vehicles (more than 7 million) as well as industrial process emissions. The increase of motor vehicles in the urban environment make it unavoidable that people in big cities, especially those living near high density traffic areas, breathe toxic emissions. These emissions are of great concern due to their effects on human health, causing lung cancer and respiratory problems, since they contain a wide range of potentially toxic metals and organic contaminants. In the present paper, the concentration levels of the metals Ba, Co, Cr, Cu, Pb and Zn in superficial soil and tree bark samples collected in urban parks of São Paulo city were determined and compared.

MATERIALS AND METHODS

Ibirapuera Park

Trianon Park

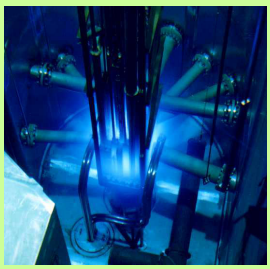
Soil sampling

Top soil samples (0-5cm) were composed by sub-samples collected in lines across the park every 30m. Tree bark samples were collected from adult tree species (*Eucaliptus* sp and *Tipuanatipu*) in 4 urban parks in São Paulo City, Brazil. The bark tree samples were collected at 1.20m above the soil, cleaned with a dry tooth brush and only the outerlayer (5mm) was ground in a titanium grater and sieved.

EXPERIMENTAL

Instrumental neutron activation analysis (INAA) was employed to analyse soil samples. The samples and geological reference materials were irradiated for 8 hours at a thermal neutron flux of 10^{13} n cm^{-2} s^{-1} at the IEA-R1 nuclear reactor of IPEN. The measurements of the induced gamma-ray activity were carried out in gamma-ray spectrometer with a GX20190 hyperpure Ge detector (Canberra). The accuracy and precision of the results were verified by the analysis of the reference materials Soil-7 (IAEA). The results showed good accuracy (relative errors to certified values < 5%) and good precision (relative standard deviations < 10%).

The tree bark samples were analyzed by energy dispersive X-ray fluorescence spectrometry (EDXRF-720 HS-Shimadzu, Japan). The results accuracy (relative errors ≤10%) and precision (relative standard deviations ≤10%) were verified by the reference material analysis –Peach Leaves (NIST-1547) and Mixed Polish Herbs (INCT-MPH-2).



IEA-R1 reactor

Pellets for EDXRF

RESULTS AND DISCUSSION

Metal Concentration in park soil and tree bark samples (mg kg^{-1})

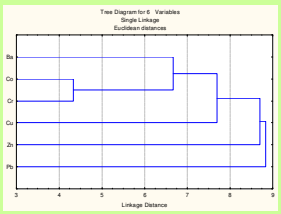
PARK SOILS (0-5cm)	Co	Ba	Cr	Cu	Pb	Zn
Aclimação	3.2-6.2	143-361	82-94	32-58	47-89	107-174
Ibirapuera	2.3-3.1	85-251	61-102	24-54	31-83	73-225
Luz	2.5-2.8	140-185	71-86	81-94	154-162	152-168
Trianon	2.4-3.1	247-271	49-72	68-86	125-145	99-100
Quality Reference Values (VRQ)	13	75	40	35	17	60
Prevention Values (VP)	25	150	75	60	72	300

CETESB, Decisão de Diretoria No. 195-2005-E, de 23 de novembro de 2005, Dispõe sobre a aprovação dos Valores Orientadores para Solos e Águas Subterrâneas no Estado de São Paulo – 2005, em substituição aos Valores Orientadores de 2001.

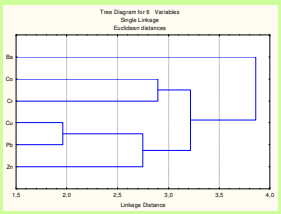
TREE BARKS	Co	Ba	Cr	Cu	Pb	Zn
Aclimação	0.8-1.1	263-374	2.2-2.9	45.3-51.2	2.5-3.6	43.2-82.6
Ibirapuera	0.7-1.4	234-855	2.3-2.9	40.9-50.6	2.6-4.3	50.9-106.9
Luz	0.7-1.5	470 - 654	2.4 -4.1	37.1-76.8	2.9-4.0	78.4-195
Trianon	0.4 -2.5	149- 1059	1.6-5.2	32.1-83.5	2.0-4.4	86.5-199
Reference Values (control area)	0.5	225	1.6	21.7	2.0	21.8

Higher concentrations were obtained both in the soil and bark trees samples in relation to reference values (Environmental Protection Agency of the State of São Paulo - CETESB - guidelines), in the case of soils, and to a control area, in the case of the tree barks, indicating the influence of anthropogenic sources.

CLUSTER ANALYSIS



Tree Barks



Soils

It can be seen that the studied elements presented similar correlations in the soil and in the tree barks, indicating that they may be from the same origin.

There was an association between the traffic-related metals Cu, Zn and Pb. The studied parks are located near high density traffic avenues, suggesting that these three metals originate from vehicular emissions.

CONCLUSIONS

Metal determination in urban soils and trees may contribute to evaluate the impact of traffic on urban air and soil quality, which are very important to human health.

The utilization of these two different environmental compartments for pollution monitoring may improve the comprehension of metal pollution in megacities, in order to identify the emission sources and to implement pollution-control strategies.

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