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A PRELIMINARY STUDY OF LEAD DEPOSITION ON PLANT LEAVES IN TEHRAN

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KEY WORDS: *Lead Aerosol, Plant Leaves, Tehran*

ABSTRACT

Fifty-nine samples of washed and unwashed leaves of 4 species of plants in Tehran and 24 similar samples of the suburb (as control) were analysed for Pb content.

A significant difference was seen between Pb contents of washed and unwashed urban samples, while no signficant difference was observed between the control samples.

The mean Pb contents of the urban suburb samples were also singificantly different. Washing removed 40% of lead from the surface of urban samples. Lead content was highest in fall and lowest at spring time.

Results of this study showed that contamination of plant leaves with Pb aerosol in the city of Tehran is mainly a surface deposition and is due to the exhausts of the motor vehicles and low rainfall

INTRODUCTION

Exhaust products of leaded gasoline are one of the major sources of environmental contamination by lead. Plant and soil surfaces are the major sink for airborn lead in the environment and may make a contribution to dietary lead intake. Lead in soil and vegetation has been the subject of many studies from various aspects(1,3,6,10,17). Most

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of these investigations deal with the effect of lead on the roadside vegetation; urban vegetation has received less attention.

This perliminary study deals with the depositon of airborn lead on plant leaves in Tehran, a city with a high traffic volume and a low rate of rainfall.

MATERIALS AND METHODS

The area of study was keshavarz Boulevard in the city of Tehran (capital of Iran)with a traffic flow about 200000 cars /24h. Five points were chosen and leaves were collected at a height of 2-3 meters(except for lollium FPP) in three different seasons from spring to winter.

Fourty-six sample of leaves from 4 species were collected at least 10 doys after a raining period, Thirteen of which were washed thoroughly with deionized water. Another twenty-four samples of the same species were obtained from a remote area in the suburbs of the city (control samples). Half of these samples were also washed in the same manner. All samples were dried in an air oven at 75-80 C to constant weight, ground to a fine powder and stored in tightly stoppered containers. One gram of each sample was washed in a muffle furnace at 500C for 8 hours. The washed sample were dissovle in 10 ml of concentrated nitric acid, filtered and made up to 25 ml with distilled water.

Lead content of the samples was determined by flameless atomic absorption spectrophotometry (FAAS) according to the method of Dokya et. at.(5) with a slight modificiation in CRA parmaters (8). The dithizone method (7) was used as a supportive techinque of analysis

RESULTS AND DISCUSSION

Results obtained by the two different methods of analysis showed a good correlation, whith $r=0.98$, therefore the mean values obtained by the two methods were used for calculations.

The mean values of lead content of unwashed and washed samples are given in Table 1. Table 2 displays the mean lead content of unwashed urban and suburb samples in different seasons. Analysis of variance of lead in different leaf species and variation of lead with each species due to season are given in Tables 3 and 4.

The mean Pb contents of urban samples within the year were 27.33 ± 12.04 and 16.30 ± 7.42 $\mu g/g$ dry wt. for unwashed and washed samples respectively (Table 1), which indicates a significant difference ($P < 0.05$). The average Pb values for unwashed and washed samples collected from urban samples, while it had no noticeable effect in the suburb samples. This may be attributed to the surface contamination of urban leaves with the lead- containing exhaust emissions of the automobiles at the studied area, as well as to the low rate of rainfall in the city (about 320 mm/yr). Some studies have reported that about 50% of the Pb is susceptible to removal by water washing (11,13,15,16), which is approximately in agreement with the findings of this study. The difference may be due to the washing procedures and characteristics of the leaves and lead particles (2,9,16,18). As stated by Wedding (18), the Pb accumulation on leaf surfaces may cause adverse physiological effects, either by physical blocking of stomata or by disturbing plant metabolism after being adsorbed into the leaf.

The mean Pb contents of the urban and suburb samplse showed a significant differnce ($P<0.01$), which confirms the surface deposition of lead from motor vehicles.

Lead content was highest in fall and lowest in spring. In addition, older leaves showed a higher content than the younger ones. Since the traffic flow was aproximately the same within the year, the higher lead values of the older leaves may have been due to the longer exposure to pollution. Of course, shape, size and surface texture of the leaves must also be considered as reported in some studies (2,16).

Analysis of variance of the Pb content of leaf species in different seasons showed no sigificant difference. Analysis of variance of the Pb content among the species indicated a significant difference, with $F=6.12$. No significant difference was found within the species.

The overall results of this study show that the major causes of plant contamination by Pb in Tehran are leaded gasoline (automobiles) and low rainfall. This contamination

may have direct or indirect effects upon the health and hygienic standards of the environment and deteriorate the quality of human diet.

Fortuntely, the surface contamination can be completely removed by careful washing of edible crops before consumption.

Table 1: Average lead concentration (g/g dry wt.) of urban and suburb leaves.

Leaf Species	n		Mean Pb Cone	
	Unwashed	Washed	Unwashed	Washed
Platanus orientalis				
U[a]	8	2	49.60±21.70	30.70±7.65
S[b]	3	3	9.93±2.08	9.70±1.17
Ulmus campestris				
U	8	2	35.70±15.20	17.30±5.10
S	3	3	10.90±2.18	9.30±1.15
Lolium FPP				
U	10	3	23.90±16.05	16.10±13.9
S	-	-	- -	- -
Magnolia grandiflora A[c]				
U	10	3	11.70±3.85	9.25±2.4
S	3	3	6.40±1.17	6.3±1.20
Magnolia grandiflora B[d]				
U	10	3	21.90±6.10	13.30±2.10
S	3	3	11.40±3.13	9.80±1.48
Total				
U	46	13	27.33±12.04	16.30±7.42
S	12	12	9.50±2.02	8.79±1.25

a: Urban samples b: Suburb samples c: Young leaves d: Old leaves

Table 2: Average lead concentration (μg/g dry wt.) of urban and suburb leaves according to season.

Leaf species	Mean Pb conc		
	Spring	Summer	Autumn
Plantanus orientalis			
U[a]	28.80±12.10	53.40±22.60	60.00±23.84
S[b]	9.85±2.11	10.00±2.21	9.95±2.17
Ulmus cimpestris			
U	42.82±19.81	31.40±16.02	34.70±16.30
S	10.40±2.25	10.30±2.31	10.45±3.02
Lolium FPP			
U	16.25±10.70	12.70±8.70	38.10±15.5
S	-	-	-
Magnolia grandiflora A[c]			
U	7.40±2.70	13.10±3.81	12.20±3.70
S	6.25±1.16	6.55±1.25	6.50±1.18
Magnolia grlndiflora B[d]			
U	17.60±5.30	23.30±6.40	22.00±5.80
S	11.50±3.13	11.25±3.11	11.65±3.14
Total			
U	22.60±10.12	24.50±11.50	33.40±13.02
S	9.50±2.16	9.52±2.22	9.60±2.22

a: Urban samples b: Suburb samples c: Young leaves d: Old leaves

Table 3: Analysis of variance of lead in the leaf species.

Sources of Variation	SS	df	MS	F
Among species	5430.99	4	1357.67	6.12
Within species	9089.07	41	221.68	

SS: Sum of Squares; df: degree of freedom; MS: Mean Square

Table 4: Analysis of variance of lead of leaf species in different seasons.

Leaf species	Sources of Variation	SS	df	MS	F
Plantanus orientalis	Aomng seasons	1428.65	2	714.32	1.62
	Within seasons	2142.94	5	428.59	
	Total	3571.59	7		
Ulmus capestris	Among seaons	143.16	2	71.580	0.25
	Within seasons	1450.58	5	290.12	
	Total	1593.74	7		
Lolium FPP	Among seasons	1530.04	3	510.01	3.26
	Within seasons	930.56	6	155.09	
	Total	2460.60	9		
Magnolia grandiflora	Among seasons	67.22	3	22.41	1.65
(Young leaves)	Within seasons	81.60	6	13.60	
	Total	148.83	9		
Magnolia grandiflora	Among seasons	68.66	3	22.89	0.46
(Old leaves)	Within seasons	301.33	6	50.22	
	Total	369.99	9		

SS: Sum of Squares; df: degree of freedom; MS: Mean Square

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