

NOTE

**Assessment of Toxic Heavy Metal Pollution in
Urban Atmosphere in Tehran**

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This work describes the methodological and experimental problems arising from toxic heavy metals constitute at Greater Tehran. Environmental monitoring for trace metal like lead, cadmium, zinc and copper in air, water, surface soil and food to assess the exposure of these heavy metals to population. The annual geometric mean concentration of these heavy metals show an increase in atmosphere and concentration of them were found to be higher in higher vehicular traffic areas but concentration of these heavy metals constitute in blood within the tolerance limits while teeth provide an index of cumulative exposure to heavy metals.

Key Words: Heavy metals, Atmosphere, Toxicity.

Toxic heavy metals constitute a class of environmental pollutants which require particular attention in the management of the environment due to their toxicity to man and general ecosystem. Elevated levels of heavy metals have been observed in soil, vegetation and ambient air in urban areas due to burning of fossil fuel, automobile exhaust and industrial emission. It has been observed that pollution living in industrial areas has relatively higher concentration of metals like lead and cadmium in their blood.

Environmental monitoring for toxic heavy metals like lead, cadmium along with zinc and copper has been carried out at Greater Tehran in air, water, surface soil and food to assess the exposure of these metals to population. This study is further supplemented by biological monitoring, where levels of lead, cadmium, zinc and copper were measured in blood and teeth of Tehran residents to assess the current and integrated to these metals.

The methodological and experimental problems in trace metal analysis of environmental samples arise mainly from the fact that the concentrations of these metals are low as compared to other constituents. Consequently their analysis requires either an ultra sensitive method of detection and measurement or relatively large quantities of sample are to be processed from which the heavy metals may be concentrated by some process prior to the measurement.

The details of several techniques used for collection of environmental samples are described elsewhere^{1,2}. The analysis was carried out by differential pulse anodic stripping voltametry. The reliability of procedures has been checked by analyzing the standard reference materials such as soil and sediment (SL-1, S-5) and blood obtained from IBO and orchard leaves (SRM7571). The results obtained are very close to the certified values. The replicate analysis of the samples agreed within $\pm 10\%$.

The mean concentration of atmospheric lead, cadmium, copper and zinc at different locations in Tehran³ are shown in Table-1. The geometric mean concentration of lead, cadmium and zinc in surface soil at two places in Tehran^{4,5} is given in Table-2. Table-3 shows mean concentration of heavy metals in blood and tooth of Tehran residents⁶.

TABLE-1
GEOMETRIC MEAN CONCENTRATIONS OF LEAD, COPPER,
CADMIUM AND ZINC IN ATMOSPHERE OF TEHRAN AREA

Place	Concentration			
	Lead	Cadmium	Zinc	Copper
Shush	0.700	0.010	1.900	0.495
Emam Hosein	0.900	0.010	1.230	0.300
Engelab square	1.100	0.013	2.110	0.555
Sanaat square	0.205	0.003	0.355	0.085

TABLE-2
CONCENTRATIONS OF LEAD, COPPER AND ZINC IN SURFACE SOIL OF TEHRAN

Place	Concentration ($\mu\text{g/g}$)		
	Lead	Zinc	Copper
Shush	62.0	221	139
Emam Hosein	52.5	250	158

As compared to other three locations in Tehran, Sanaat square has lower vehicular traffic. The lead levels are lower at Sanaat square ($0.191 \mu\text{g m}^{-3}$) and higher by a factor of three to give at Shush ($0.74 \mu\text{g m}^{-3}$), Emam Hosein ($0.94 \mu\text{g m}^{-3}$) and Engelab ($1.05 \mu\text{g m}^{-3}$). Similar trends have also been observed for air borne zinc, cadmium and copper. The annual geometric mean concentrations of lead, cadmium, zinc and copper show an increase over our earlier data of 2005-6.

Table-2 shows the mean concentrations are lower in residential areas compared to industrial areas. The concentrations of copper and zinc at Shush are higher by an order of magnitude than that of Emam Hosein in Tehran. Particle size distribution study was also carried out at Tehran. The percentage of fine particle is more at Sanaat square than that of Shush. The mean concentration level of heavy metals in surface soil at different places in Tehran is given in Table-2.

Concentrations of metals are much higher at shush than the concentration of that at Emam Hosein. Concentration of lead, copper and zinc were found to be higher in higher vehicular traffic areas. Toxic metal levels in blood are generally considered to be an index of biologically active metals in the body. Blood is considered to be a good indicator of current exposure while teeth provide an index of cumulative exposure to heavy metals. Table-3 shows the mean concentrations of lead, copper, cadmium and zinc in blood ($\mu\text{g}/\text{dl}$) and tooth ($\mu\text{g}/\text{g}$) of Tehran residents. The concentrations level of these metals in blood is within the tolerance limits.

TABLE-3
MEAN CONCENTRATIONS OF LEAD, CADMIUM, ZINC AND
COPPER IN BLOOD AND TOOTH OF TEHRAN RESIDENTS

Type of tissue	Population	No. of patients	Mean concentration			
			Lead	Cadmium	Zinc	Copper
Blood	Adult	80	14.00	0.185	580.00	68.2
	Children	181	11.00	0.205	450.00	94.0
Tooth	Adult	74	8.27	0.035	118.90	–
	Children	181	2.90	0.115	108.02	–

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REFERENCES

1. NCCLS Analytical Procedures for the Determination of lead in Blood, Document C40-A, Vol. 21, No. 9 (2000).
2. R.N. Khandekar, R. Radha and U.C. Mishra, *Sci. Total Environ.*, **66**, 185 (1987).
3. D. Schwela, *Rev. Environ. Health*, **15**, 13 (2005).
4. R.M. Harrison and C.R. Williams, *Atmos. Environ.*, **16**, 2669 (1982).
5. M.J. Duggan, *Water, Air, Soil, Pollut.*, **14**, 309 (1980).
6. N. Künzli, R. Kaiser, S. Medina, M. Studnicka, O. Chanel, P. Filliger, M. Herry, F. Horak Jr, V. Puybonnieux-Texier, P. Quénel, J. Schneider, R. Seethaler, J-C Vergnaud, H. Sommer, *The Lancet*, **356**, 795 (2000).

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