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Biological Monitoring Of Heavy Metals in Human

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Abstract: Air pollution in India is mainly caused by three sources, namely, vehicles, industrial and domestic sources. The objective of this paper is to provide an analysis of particulate metal emissions. The aim of this study was to investigate blood and urine levels of some heavy metals such as of chromium (Cr) and lead (Pb) in workers. These results have indicated that further studies are warranted for investigation of possible roles of heavy metals in industry workers. The majority of airborne metal emissions originate from metal industries and electric utility facilities, environmental and worker assessments of exposures as well as air pollution control research will be presented. The high morbidity and mortality among industry workers and dwellers in nearby industrial areas may be due to elevated levels of urinary and blood chromium and lead levels and resulting from increased air levels of chromium and lea.
Keywords: Heavy metals, Human serum, urine, AAS.

I. INTRODUCTION

WHO pointed out that air pollution is sixth-leading cause of death, causing over 2.4million premature deaths worldwide (WHO, 2002). The long-term effect of studies in several large cities predicts 60,000 deaths each year due to cardiac and respiratory problems which caused by air pollutants. It is generally accepted that geographical features of the study area may affect the concentrations of air pollutants and play an important role in the variation of meteorological conditions. Highly elevated concentrations of particulate matter with mean aerodynamic diameter less than 10 μm (PM_{10}) have been reported during low-level temperature inversion in the Utah Valley as a result of local emissions being trapped in a stagnant air mass near the valley floor (Pope, 1996). Some of the important heavy metals include lead (Pb), cadmium (Cd),zinc (Zn), mercury (Hg), arsenic (As), chromium(Cr), silver (Ag), iron (Fe),and copper(Cu).

The major findings of the study are: (1) Air pollutants can be classified as suspended particulate matter, gases and vapours that are present in the atmosphere in abnormally high concentrations. The main components of suspended particulate matter are coarse particles such as soil and mineral ash or fine particles found in wood smoke or coming from engine exhausts. Gaseous air pollutants are pricipally oxides of Nitrogen, Ozone, Carbon monoxide, Sulphur dioxide, Ammonia and Volatile organic compounds.

II. MATERIALS AND METHODS

A. Sample Collection

The blood samples were collected from chemical industry workers and patients from nearby industries in heparinized 5 mL, glass test-tubes containing 1 mg of sodium heparin[83]. . The hospital staff served as control group.

B. Detection of Chromium and Lead levels in Human blood and urine samples

The measurements of chromium and lead levels were performed using atomic absorption spectrophotometry. The urine samples were collected in 250 mL polyethylene bottles which were thoroughly washed and cleaned at the laboratory and to which 0.1 g of Na_4EDTA was added before used. New pyrex glass equipment and reagent –grade chemicals contained an acceptable amounts of chromium when we operated at the parts - per – billion level. The glass equipment was boiled twice in 1:1 aqua regia (and kept overnight in double – distilled reagent –grade nitric acid(1:1). Before use the glass equipment was thoroughly washed with distilled water. 50 mL of urine samples were added to 5 mL of double distilled nitric acid and evaporated in 100 mL glass beakers to an approximate volume of 7 mL, when nitrous gases appear. The beaker was then covered with a watch glass and the solution was evaporated to dryness. When the colour of the residue became yellowish white, the residue was dissolved in 2 mL of nitric acid and the glass equipment was rinsed with distilled water to a total volume of 10 mL. When the colour became brownish, 2 mL of acid was added, and the solution was evaporated a second time and then dissolved as described previously.

A series of urine specimens was analyzed with the standard addition method. From one sample to another the interferences seemed to be approximately constant, and a constant calibration factor could well be used. The data of chromium levels in urine samples of workers and dwellers were recorded.

III. RESULT AND DISCUSSION

An important health risk factor for the cement industry workers is occupational exposure to chromium, which is used as a basic tanning pigment. The workers on exposure to cement dust, which contains chromium and lead in the protein bound form, exhibited a higher mean concentration of urinary and blood chromium and lead than the reference values. The personal sampling conducted at different work sites exhibited higher levels of total chromium. The high morbidity (15%) observed in the workers and dwellers in comparison to the reference values (5 %) could be due to high levels of chromium and lead in the biological samples of the exposed workers and dwellers and air samples collected at the work site. The higher biological values of chromium and lead among the workers and dwellers could be explained by atmospheric pollution caused by the liberated cement dust at the work place and near the residential areas. In the literature that it is the metabolism distribution and transport of the chromium and lead in the blood that is a casual factor for increased respiratory morbidity. The hexavalent chromium is rapidly absorbed by the lungs into the blood and easily penetrates the cellular membranes and binds to the hemoglobin in the red blood cells thereby affecting the oxygen carrying capacity and impairing the lung function status. Our study confirmed the, earlier reports that the biological levels of chromium (in urine and blood) are good indicators of the exposure levels of chromium and lead at the work place.

We observed that blood chromium levels of the workers, nearby dwellers and controls were found to be 0.7248 mg/L, 0.7580mg/L, 0.6391 mg/L, and 0.5251mg/L respectively and the urine chromium levels were found to be 35 – 45 µg /L, and 25-35 µg /L, and 4.5 – 12.5 µg /L respectively. Similarly, we observed, the blood lead levels were found to be 20µg/dL, 62 µg/dL, 24 µg/dL, and 38 µg/dL respectively and the urine lead levels were found to be 32 µg /L, 25 µg/L and 1 – 5 µg /L respectively

Table – 1. Concentration of Chromium and Lead level in serum of Cement industry workers

Workers and dwellers Serum samples	Chromium in serum (µg /L)	Chromium in serum (µg /L) (Control)	Lead in serum (µg /L)	Lead in serum (µg /L) (Control)
01	0.5251	0.0119	0.2421	0.0124
02	0.5825	0.0138	0.2648	0.0148
03	0.6240	0.0145	0.3468	0.0119
04	0.6805	0.0128	0.2065	0.0105
05	0.7248	0.0153	0.3867	0.0128
06	0.4589	0.0110	0.4219	0.0135
07	0.7580	0.0147	0.4965	0.0139
08	0.6391	0.0142	0.5824	0.0126
09	0.7045	0.0141	0.5710	0.0117
10	0.6582	0.0124	0.6210	0.0145

Fig.1.1

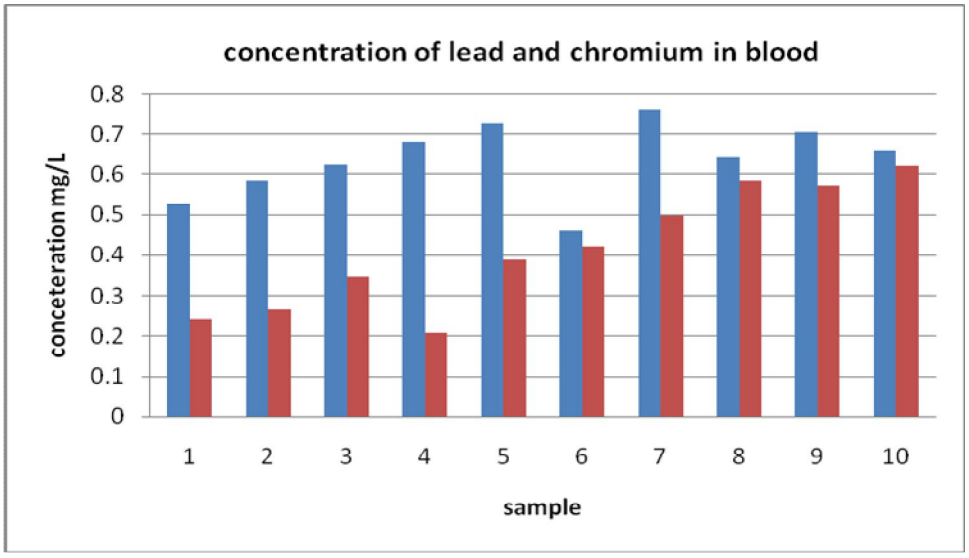
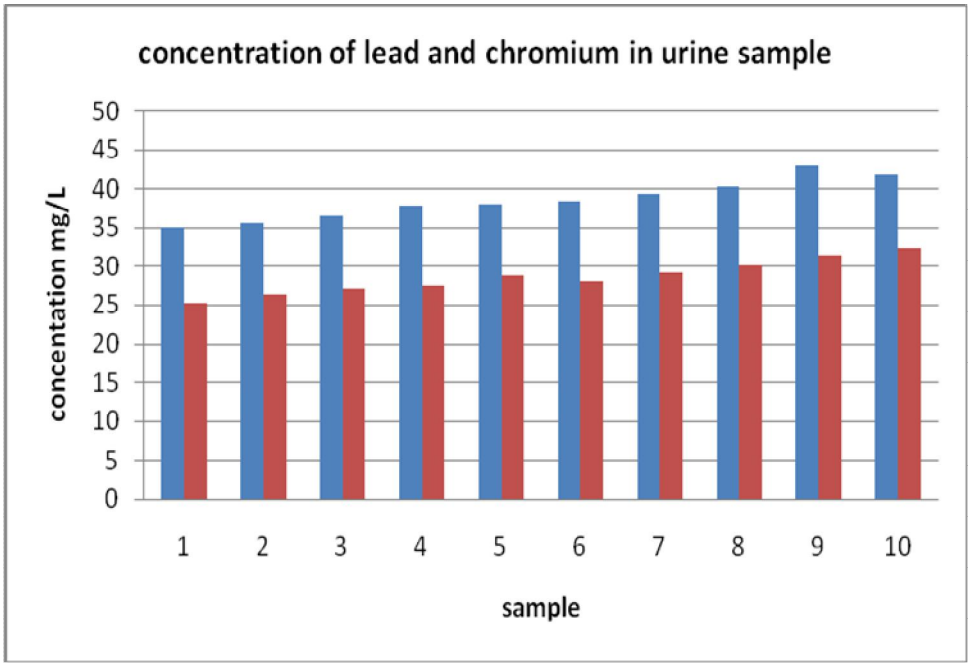


Table – 2. Concentration of Chromium and Lead level in urine of Cement industry workers

Workers and dwellers Urine samples	Chromium in blood (µg/L)	Chromium in blood (µg/L) (Control)	Lead in urine (µg /L)	Lead in urine (µg /L) (Control)
01	35.0	4.5	25.2	1.0
02	35.5	5.2	26.3	2.2.
03	36.4	7.4	27.1	2.0
04	37.8	8.2	27.5	2.5
05	38.0	9.5	28.7	2.4
06	38.4	10.0	28.0	2.7
07	39.2	10.3	29.2	3.0
08	40.3	10.6	30.1	3.2
09	42.9	9.4	31.3	3.5
10	41.8	9.8	32.4	4.0

Fig.2.1



IV. CONCLUSION

Health hazards associated with chronic exposures to urban air pollution are now well recognized. Although air pollution affects the population in general, children are particularly vulnerable to toxiceffects of air pollution because of more outdoor exposures, greater intake of air in relation to bodyweight, lower breathing zone where particulate concentration is higher and, most importantly, a child's underdeveloped immunity. Air pollution-related health effects ranged from low birth weight, reduced lung development and lung function to behavioral alterations. Compared with the developed nations, however, very little is known about the health effects of urban air pollution on children's health in developing countries including India. The result showed that Chromium and lead concentration is higher than standard.One of the main objectives of Air Act is to protect. Those who were having higher concentration of chromium and lead levels in blood and urine were having severe form of COPD and asthma and there were no neurological deficit as the leaf levels were below the toxic levels. This study recommends that the biomonitoring of air levels of chromium, PM and other organic pollutants levels at the work place and the nearby surroundings that can be used as a tool for mitigating health hazards and risk factors in the exposed community capacity. The result showed that Chromium and lead concentration is higher than standard.

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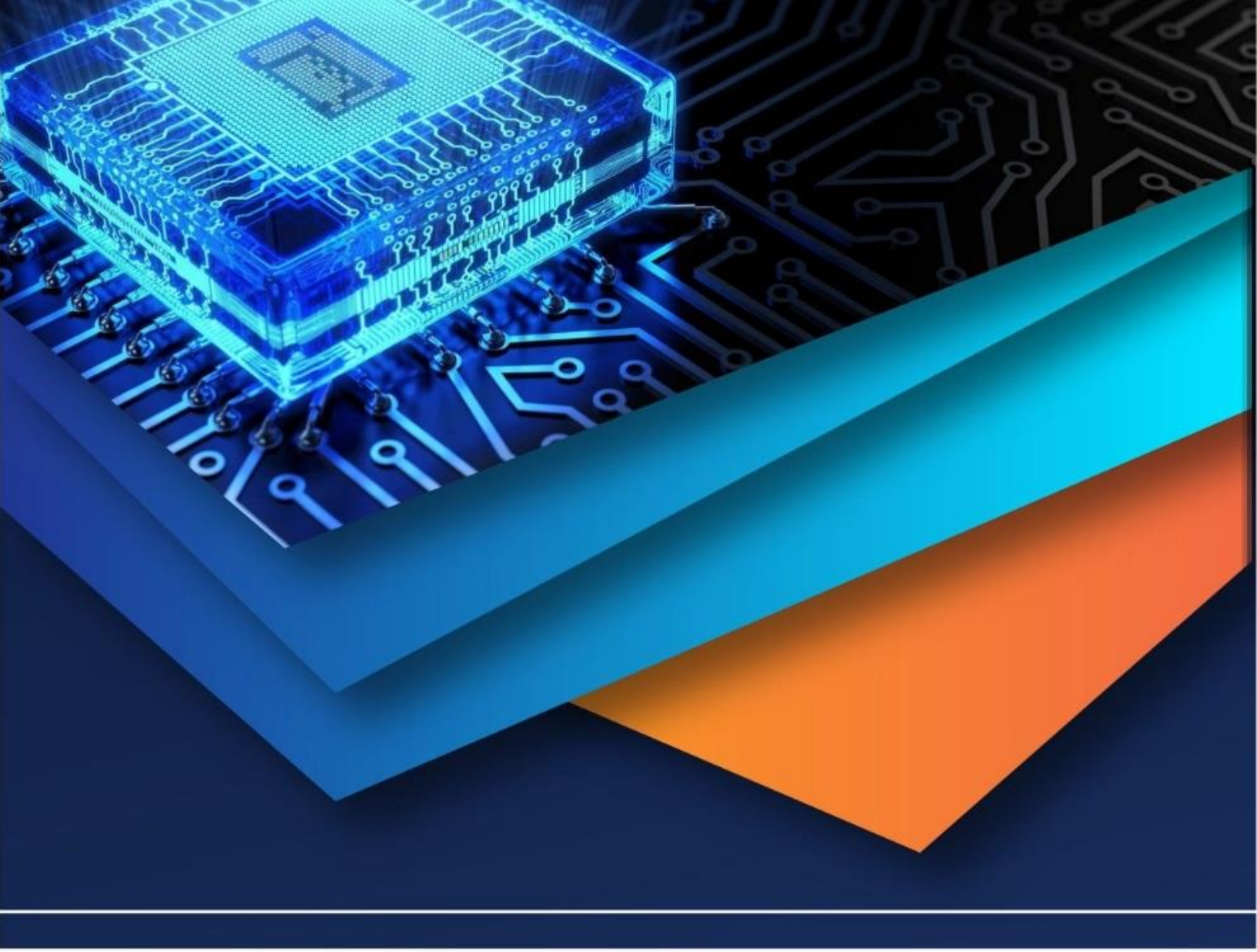

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