

# Atmospheric Heavy Metal Determination in Different Regions at Rajajinagar, Bangalore, Karnataka

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**ABSTRACT:** The ambient air contamination starts principally from industry, little size discharge sources and transport. Exposure to and uptake of such non-essential element have consequently increased in Bangalore city by affecting the people, environment. An examination was directed to look at the various pattern of heavy metal in ambient air in three different regions at rajajinagar, Bangalore for a period of 4months from December 2016 to march 2017. Three metals i.e., Pb, As, Cd concentrations was determined using Inductively Coupled Plasma-optical emission Spectrometry. The result obtained was compared with NAAQ and WHO standards. Commercial and industrial activity was the potential sources of heavy metal pollution in the city.

**KEYWORDS:** Ambient air, Heavy metals, ICP-OES, NAAQ, WHO.

## I. INTRODUCTION

Heavy metals are universal in the earth. Their essence happens in both natural and anthropogenic form. Air contamination is a standout amongst the most basic ecological issues in developing nations. It is the result of fast industrialization and urbanization; toxic heavy metals originate from anthropogenic sources such as fossil fuel combustion, metallurgical process, garbage incineration and windblown dust, vehicles emission. Exposures to dangerous air pollutants at certain concentrations levels and durations may result in chance of getting cancer or other serious health hazards. Pollution by metals like Lead, Cadmium, and Arsenic is affecting atmosphere quality and thereby threatening life and environment, its reduction in environment is an important issue. Bangalore the capital city of Karnataka is facing adverse air pollution in recent decades. Many studies have been carried out to reduce the pollution level and its effects on humans. The present study gives information about the concentration levels of heavy metals Lead, Arsenic, Cadmium in ambient air at various regions of Rajajinagar, Bangalore.

**Lead** is naturally present in the environment; most of the lead content found in the environment is result of human activities. Lead is the richest metal of the all heavy metals in the Earth's outside layer. It has been utilized since ancient days, and has turn out to be broadly appropriated and activated in the earth. Occupational and environmental exposures to lead are a serious problem in many developing, developed country and industrializing countries. Ecological lead pollution likewise causes genuine impacts in the biological communities. Human activities, such as fuel combustion, industrial processes and solid waste combustion results in lead contamination.

**Arsenic** is found naturally on earth in small concentrations, various sources like volcanoes, human activity like burning of fossil fuels etc releases arsenic into air. Copper producing industries, during lead and zinc production

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arsenic is released into environment, effluents from industries like phosphate, fertilizer, paints and textile contains arsenic metal, pesticides are the important sources of arsenic. In nature, arsenic and its mixes are versatile and can't be obliterated; exposure to arsenic has many effects on public such as hyper pigmentation, keratosis, cancer and other cardiovascular diseases. In many countries pollution by arsenic is considered as important issue.

**Cadmium** which is also found on earth's crust enters atmosphere from volcanic activities, waste incineration, production of nickel cadmium batteries, dust from cement industries, and combustion of fossil fuels, iron and steel plants, smelters, zinc mining activity. Inhalation of cadmium leads to diseases related to renal tract (kidney damages), lung disorders, abdominal pain etc.

These heavy or toxic metals entering into atmosphere results in disturbing the environment, human life, animal life as well making the ecosystem unfit for the further generation. WHO, US EPA has been taking many measures to reduce the pollution level by these elements, many studies / researches are also being carried out in developing and developed countries. Inductively coupled plasma – optical emission spectrometer, Atomic Absorption spectrophotometer and few other methods are used to determine the metals in the ambient air. In the present paper, ICP-OES method has been adopted to determine the concentration levels in ambience of rajajinagar from December 2016 to march 2017. The study will frame a standard that can be used for any management strategy to accomplish better natural quality and economical improvement in Bangalore city.

## II. RELATED WORK

1. Kabamba M, Basosila N et al., (2009) carried out a study in Kinshasa which was highly polluted due to high rate of urbanization. Ambient air samples were collected in that region for 4 months from July 2009 to October 2009 at five locations in Kinshasa. Four heavy metals i.e. As, Cd, Pb, Ni were analyzed using ICP-MS, evaluation was done for these metals collected from ambient air on roadsides i.e. at residential sites. They have selected sites in a view to reflect the impact the heavy population of Kinshasa, traffic and other sources. This study got the output with higher values of the toxic metals in the city.
2. Atef M.F. Mohammed, Essam A. Morsy et al., (2013) made a study on air quality status in areas of the Prophet's Mosque in Madinah during Ramadan from July 2013 to August 2013. 18 elements were analyzed and samples were collected on cellulose nitrate filter paper (0.45µm) using low volume sampler. Analysis of following metals Al, Ag, Ba, Co, Cr, Cu, Fe, Sb, As, Mn, Cd, Ni, Pb, Se, V, Be, Mo, and Zn was done using ICP-OES. The results showed the concentration levels in air, sources of origin of these metals in that region, Nature and quantity of the trace metals was also showed.

## III. MATERIALS AND METHODOLOGY

### Area Study

For the study of concentration levels in Rajajinagar, Three regions were selected from the view of population influence, rapid industrialization, traffic flow source, windblown dust, construction activities.

- a. **Residential area:** Manjunathnagar Bangalore with latitude 12°59'43"N, 77°32'54" where construction sites, school zone, fuel banks, bakeries, low traffic flow, hotels and other activities were observed.
- b. **Traffic area:** Fire station premises, rajajinagar with 12.9845°N, 77.5482°E where construction activity, commercial buildings, high vehicular movement, marriage halls, road construction were observed surrounding to the place.
- c. **Industrial area:** Rajajinagar 6th block industrial town with latitude 12.9792°N, 77.5434°E rajajinagar where smelters, electroplating activity, restaurants, sweet factories, production of batteries, vehicular movement.

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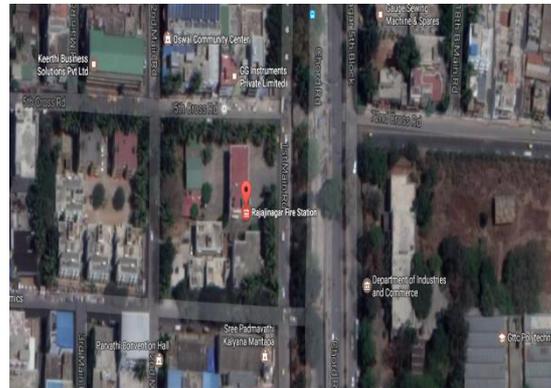
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**Fig A: Industrial town area**



**Fig B: Traffic area (Fire station, Rajajinagar)**



**Fig C: Manjunath Nagar (residential area)**

## Sampling and parameters undertaken

Lead, Arsenic, Cadmium are being monitored, Envirotech APM 460NL, High volume sampler installed with glass fiber filter paper, placed at an height of 3m above ground level was used to sample ambient dust in Manjunath nagar (residential area), Fire station premises (traffic area), industrial area. Sampling was done for 24hour for every 30days from December 2016 to march 2017. After the sample collection the filter paper is packed in plastic envelop and transported to laboratory for the analysis.

## Sampling Analysis

The filter paper exposed to dust is kept in desiccators for 24hours, 1/4<sup>th</sup> of filter paper was then cut into tiny pieces and it was digested in extraction solution (HNO<sub>3</sub>, HCL). The extraction fluid obtained was filtered through Whatman filter paper and was made up to 100ml using distilled water.

The filtrate is analyzed by ICP method – Inductively Coupled Plasma – Optical Emission Spectrometer.

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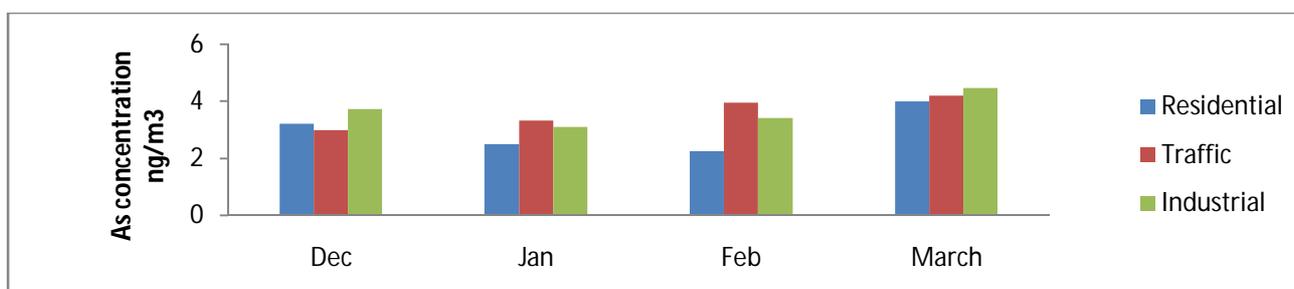
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## IV. EXPERIMENTAL RESULTS

### ARSENIC (As)

**Table No 1: concentration of Arsenic for all the four months in all 3 zones**

Zones	As concentration in ng/m <sup>3</sup>			
	December	January	February	March
Residential	3.22	2.49	2.25	3.99
Traffic	2.99	3.33	3.96	4.20
Industrial	3.72	3.11	3.41	4.47



**Fig No 1: variations in Arsenic concentration in all zones**

The concentration of Arsenic metal was observed to be less in residential zone (Manjunath nagar) for all the months due to less activity, low traffic flow, effect of meteorological parameters. In traffic zone (fire station) there is increase in concentration level of arsenic from December to March because of heavy traffic sources, constructions of roads, other construction activities, climate changes. Industrial area (rajajinagar industrial town) also showed high values of arsenic due metallic industrial emissions, pharmaceutical industries, cement and paint production, vehicular movement, small scale industry activities, the arsenic values were less than traffic zone and more than residential zone (Table No .1) during January and February month due meteorological effects.

### LEAD (Pb)

**Table No 2: concentration of Lead for all the four months in all 3 zones**

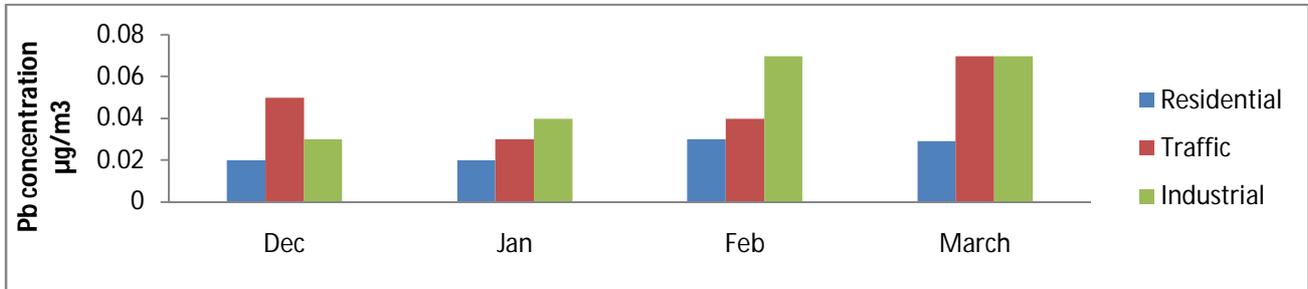
Zones	Pb concentration in µg/m <sup>3</sup>			
	December	January	February	March
Residential	0.02	0.02	0.03	0.029
Traffic	0.05	0.03	0.04	0.07
Industrial	0.03	0.04	0.07	0.07

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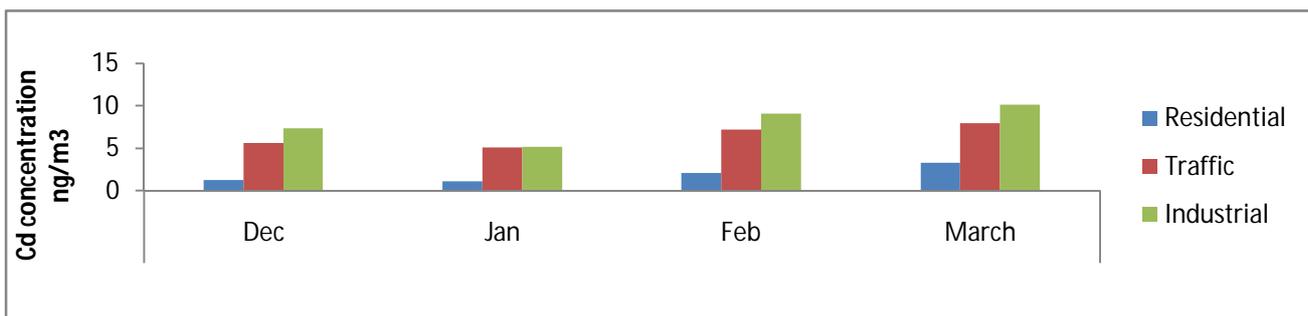
**Fig No 2: variations in Lead concentration in all zones**

According to Table No 2 and figure No 2 the concentration levels of Lead is low in Residential zone (Manjunath nagar) while in traffic zone (Fire station) the values were found to be higher in December month when compared to industrial and residential zone and in rest of months the value of arsenic in traffic zone was more than residential zone and had almost same values that obtained in industrial zone (Industrial town). Climatic changes, battery production industries, traffic sources, other anthropogenic activities were the main cause for variations in Lead concentration.

### CADMIUM (Cd)

**Table No 3: concentration of Cadmium for all the four months in all 3 zones**

Zones	Cd concentration in ng/m <sup>3</sup>			
	December	January	February	March
Residential	1.24	1.06	2.0	3.26
Traffic	5.55	5.02	7.17	7.9
Industrial	7.34	5.11	9.04	10.1



**Fig No 3: variations in Cadmium concentration in all zones**

The concentration of Cadmium level was high in March in all the three zones, while least value of cadmium level was observed in January month. In December and February the value was more in industrial zone than in traffic and residential zone. Production of Ni-Cd batteries, other metal industries, waste incineration, cement production, sudden climate change resulted in significant variation in the cadmium level.

### National Ambient Air Quality Standard and WHO (World Health Organization) Standard

According to NAAQ and WHO standard the permissible limit for:

Lead: 0.5 µg/m<sup>3</sup> – 1.0 µg/m<sup>3</sup>

Arsenic: 6.0 ng/m<sup>3</sup>

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Cadmium: 2 – 15 ng/m<sup>3</sup> (urban areas), 15 -150 ng/m<sup>3</sup> (industrial areas) (WHO limits)

## V.CONCLUSION

The rapid speed of urbanization of Bangalore has resulted in high pressure on the environment with severe impacts. The results of analysis showed that the average Lead (Pb), Cadmium (Cd), Arsenic (As) concentrations determined at Manjunath nagar (residential area), Industrial town (industrial area), Fire station (traffic area) over the period of study were below NAAQ and WHO standards. Overall the air pollution was high in industry and traffic zone with vehicular and industrial emission as main source of pollution while pollution level was minimum in residential zone. From the data obtained for the study showed that the distribution of metals were resulted from anthropogenic influence. Further to maintain air quality and to protect our environment continuous monitoring, awareness regarding air pollution among people is necessary.

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## REFERENCES

- [1] Manju Mahurpawar “EFFECTS OF HEAVY METALS ON HUMAN HEALTH “International Journal of Research – Granthalaayah ISSN-2350-0530(0) – ISSN – 2394-3629(P).
- [2] Mahadevappa Harish “A STUDY ON AIR POLLUTION BY AUTOMOBILES IN BANGALORE CITY “Management Research and Practice Vol...4, Issue 3 (2012).
- [3] Radin Maya Saphira Radin Mohammed<sup>1</sup>, Farah Hanim Binti Che Aziz<sup>2</sup>, Amir Hashim Mohammed Kassim<sup>3</sup> “ AN ASSESSMENT OF SELECTED HEAVY METAL CONCENTRATIONS IN UNIVERSITY CAMPUS LOCATED IN INDUSTRIAL AREA “ ARPJ Journal of Engineering and Applied Sciences Vol..9 ISSN 1819 – 6608.
- [4] Down to Earth: 1999, “ANALYSIS; DEADLY PARTICLES, RELEVANCE TO INDIA”
- [5] P. S Khillare<sup>1</sup>, S. Balachandran<sup>2</sup>, Bharat Raj Meena<sup>3</sup>, “ SPATIAL AND TEMPORAL VARIATION OF HEAVY METALS IN ATMOSPHERE AEROSOL OF DELHI “ Jawaharlal Nehru University, New Delhi, India. Issue 19 November (2002).
- [6] Amit Kumar Mishra<sup>1</sup>, Subodh Kumar Maiti<sup>2</sup>, Asim Kumar Pal<sup>3</sup> “ STATUS OF PM<sub>10</sub> BOUND HEAVY METALS IN AMBIENT AIR IN CERTAIN PARTS OF JHARIA COAL FIELD, JHARKHAND, INDIA “. International Journal of Environmental Science, Vol.4, No 2 – 2013, ISSN 0976 – 4402.
- [7] CPCB: 2009, “NATIONAL AMBIENT AIR QUALITY STANDARDS”.
- [8] Pramod R Chaudhari<sup>1</sup>, D. G Gajghate<sup>2</sup>, Dheeraj Kumar Singh<sup>3</sup>, “ STUDIES ON RESPIRABLE PARTICULATE MATTER AND HEAVY METAL POLLUTION OF AMBIENT AIR IN DELHI, INDIA “ AJER : American journal of engineering Research, Vol..4, Issue – 12 e-ISSN: 2320-0847, p-ISSN: 2320-0936
- [9] Xiandeng Hou<sup>1</sup>, Bradley T.Jones<sup>2</sup>, “INDUCTIVELY COUPLED PLASMA OPTICAL EMISSION SPECTROMETER “Wake Forest University, USA.
- [10] “ASSESSMENT REPORT ON MANGANESE FOR DEVELOPING AN AMBIENT AIR QUALITY OBJECTIVES” WBK & Associates inc., November 2004.