International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i04.029 ISSN: 2581-4621

AMBIENT AIR QUALITY MONITORING SYSTEM IN COIMBATORE CITY

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ABSTRACT
Air pollution is dispersion of the particulates, biological molecules, or other harmful materials into the Earth's atmosphere. Industrialization and urbanization are the two major causes of deteriorating air quality of the major cities in Tamil Nadu, India. Coimbatore is the second and most important commercial and industrial city in India. These industrial activities can add significant levels of heavy metals in the atmosphere. So, regular surveillance and consistent monitoring and modelling of the city would be much imperative. To evaluate the ambient air quality in Coimbatore city the pollutants such as PM10, Suspended Particulate Matter (SPM) and Heavy metals (Cd, Cr, Cu, Pb, Fe, Ni and Zn) were monitored at four locations of the city in this project. The concentration of PM10, SPM and seven heavy metals in the ambient air were estimated and the contributions of various sources were evaluated. The concentration of PM10 and SPM were found to be within the permissible limit. The aim of the project is to develop models, the concentration details of PM10 (Particulate mass). The quality analyzed parameter were compared with the values given by National Ambient Air Quality Standards (NAAQS) Nearly 8 Places in Coimbatore City.
Keywords - Air Quality , Particulate Matter ,ArcGIS ,Heavy Metals

1. Introduction

Air is one of the important constituents of nature, which is responsible for the survival of any form of life on this planet. It is also important for maintaining the ecological balance. Pollution, on the other hand is the contamination and deterioration of the ambient air by releasing undesirable constituents in the atmosphere, which are lethal to the various forms of life, and also disturbs the stability and the ecological balance of the surroundings. Air pollution is caused due to both gaseous (oxides of nitrogen, oxides of Sulphur, oxides of carbon etc.) and particulate pollutants (organic and inorganic). Heavy metals are particulate inorganic pollutants released in the atmosphere through natural and manmade processes such as metallurgical process, garbage incineration, combustion of fossil fuels, weathering of rocks, mining activities etc. Heavy metals are relatively dense and toxic at low concentrations as they can form complexes or ligands with organic compounds and alter them.These modified biological molecules lose their ability to function properly and resulting in malfunction or death of the affected cells. Heavy metals can be transported from one place to another and released in the ambient air through wind-blown dust. Studies in occupation and community settings have established the fact that the accumulation of heavy metals in the body by inhalation or ingestion can be responsible for a wide range of health effects such as cancer, neurotoxicity immune toxicity and cardio toxicity leading to increased morbidity/mortality in populations. As the toxic effects of heavy metals are now well recognized in urban places, the determination of their concentrations in the ambient air of major cities is significant. In India due to increasing traffic, unplanned urban and industrial development, growing energy consumption, and the high influx of population to urban areas, alarming levels of particulate matter are reported in urban atmospheres.

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Despite the increasing level of particulate matter associated with metals in Indian atmosphere is meagre. Suspended particulate matter (SPM) contains high concentrations of heavy metals of toxicological interest. About 75–90% of metals such as Cu, Cd, Ni, Zn, and Pb are found in the SPM. Although many metals are normal constituents of tissue, metals such as arsenic, antimony, lead, cadmium, mercury, and bismuth are known to be toxic even at low levels. For the past few decades, elevated levels of metals and their compounds, both inorganic and organic, have been released to the environment as a result of a variety of anthropogenic activities.

2. Methodology

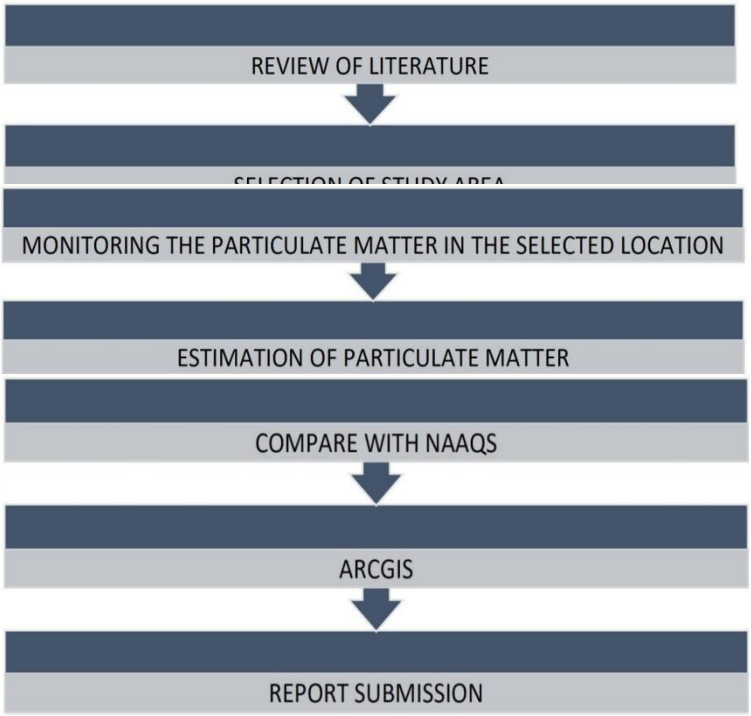

Fig 1. Flow Chart

3.Study Area Description

Coimbatore District is located in the western part of Tamil Nadu. The district is spread out in an area of 246 sq.km. The average annual rainfall in the plan is around 700 mm. Coimbatore city is located at 11° 1' 6" N and 76° 58' 21" E, at about 411.2 meters above mean sea level. The city is also known as Manchester of South India.

3.1 Ambient air quality monitoring location

Industrial Zone - Ferrexo Machinery unit 2, Annur
Institution Zone - Kumaraguru college, Saravanampatti
High Traffic Zone - Ganapathy, Coimbatore
Agriculture Zone - Mettupalayam
School Zone- SRSI school
Bus stop Zone- Gandhipuram Bus stop
Residential Zone- HR residency
Hospital Zone-KMCH

3.2 Sampling period

The Sampling was done on 8 hours basis on the selected location during the month of February and March of 2023.

3.3 Sampling Equipment and Methods

The Concentration of PM10 were measured with the help of Respirable Dust Sampler and PM2.5 was measured with the help of APM 550 air Sampler.

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3.4 Extraction and Quantification of Heavy Metals

Sample filter and control (blank filters) filter paper were processed separately to extract the heavy metal present in particulate matter by acid digestion.

3.5 Acid Digestion

A Portion of filter paper was cut in to small pieces and placed in 100 ml beaker 50 ml of aqua regia was added and the beaker was covered with watch glass then mixture was heated with about 140˚C to near dryness. The sample was then filtered off rinsing the beaker with 10% HNO_3 and 50 ml of concentrated HNO3 was added (second digestion) and the beaker was covered with watch glass then the mixture was heated with at about 140˚C to near dryness. The sample was then filtered off, rinsing the beaker with 10% HNO_3 . The solution was then heated again near dryness. About 50 ml of 10% HNO_3 was added and then allowed to cool to room temperature then transferred into a 100ml volumetric flask and diluted to volume with 10% HNO_3.

Blank filter was prepared by digesting clean glass filter paper with the same digestion method for the samples.

3.5.1 Atomic Absorption Spectroscopy (AAS)

Atomic absorption spectroscopy (AAS) is a spectra analytical procedure for the quantitative determination of chemical elements using the absorption of optical radiation (light) by free atoms in the gaseous state. Atomic absorption spectroscopy is based on absorption of light by free metallic ions. Atomic absorption spectrometry has many uses in different areas of chemistry such as: clinical analysis of metals in biological fluids and tissues such as whole blood, plasma, urine, saliva, brain tissue, liver, hair, muscle tissue, atomic absorption spectrometry can be used in qualitative and quantitative analysis. The technique makes use of the atomic absorption spectrum of a sample in order to assess the concentration of specific analyses within it. It requires standards with known analyze content to establish the relation between the measured absorbance and the analyze concentration and relies therefore on the Beer-Lambert law. In order to analyse a sample for its atomic constituents, it has to be atomized.

The atomizers most commonly used nowadays are flames and electro thermal atomizers. The atoms should then be irradiated by optical radiation, and the radiation source could be an element-specific line radiation source or a continuum radiation source. The radiation then passes through a monochromatic in order to separate the element-specific radiation from any other radiation emitted by the radiation source, which is finally measured by a detector.

4.Results and Discussion

The result obtained from the sampling stations were compared with **National Ambient air India National Ambient Air Quality Standards (NAAQS)-18th November,2009**. GIS used in this project.

Pollutants concentration – **INDUSTRIAL ZONE FERREXO MACHINERY UNIT2, ANNU**

S.No	Parameters	*Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours*	Standard Limits Asper NAAQS (µg/M3)
1	PM10	54.31	100
2	SPM	98.24	500

Pollutants concentration – **INSTITUTION ZONE KUMAGURU COLLEGE, SARAVANAMPATTI**

S.No	Parameters	*Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours*	Standard Limits Asper NAAQS (µg/M3)

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1	PM10	26.72	100
2	SPM	62.45	500

Pollutants concentration **– HIGH TRAFFIC ZONE ,GANAPATHY**

S.No	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	PM10	102.01	100
2	SPM	343.45	500

Pollutants concentration – **AGRICULTURE ZONE METUPALAYAM**

S.No	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	PM10	28.41	100
2	SPM	84.45	500

Pollutants concentration – **SCHOOL ZONE SRSI SCHOOL**

S.No	**Parameters**	***Pollutant concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	PM10	23.31	100
2	SPM	84.45	500

Pollutants concentration – **BUSSTOP ZONE GANDHIPURAM BUSSTOP**

S.No	**Parameters**	***Pollutant concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	PM10	99.41	100
2	SPM	56.24	500

Pollutants concentration – **RESIDIENTIAL ZONE HR RESIDIENTIAL**

S.No	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	PM10	21.40	100

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2	SPM	65.36	500

Pollutants concentration – **HOSPITAL ZONE KMCH , AVINASHI ROAD**

S.No	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	PM10	54.41	100
2	SPM	105.65	500

Heavy Metal concentration **– INDUSTRIAL ZONE FERREXO MACHINERY UNIT2, ANNUR**

S.No	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	COPPER	0.97	1.1
2	NICKEL	16.24	20
3	ZINC	88.23	100
4	IRON	8.91	10
5	KLEAD	0.56	1.5

Heavy Metal concentration – **INSTITUTION KUMARAGURU COLLRGE, SARAVAMPATTI**

S.No	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	COPPER	0.0071	1.1
2	NICKEL	7.12	20
3	ZINC	79.98	100
4	IRON	8.12	10
5	KLEAD	0.05292	1.5

Heavy Metal concentration – **HIGH TRAFFIC ZONE GANAPATHY, COIMBATORE**

S.No	**Parameters**	**Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours**	**Standard Limits Asper NAAQS (µg/M3)**
1	COPPER	0.52	1.1
2	NICKEL	15.22	20
3	ZINC	76.98	100
4	IRON	9.52	10
5	KLEAD	1.2	1.5

Heavy Metal concentration – **AGRICULTURE ZONE METTYPALAYAM**

S.No	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**

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1	COPPER	0.0065	1.1
2	NICKEL	4.45	20
3	ZINC	22.28	100
4	IRON	6.12	10
5	KLEAD	0.41	1.5

Heavy Metal concentration – **SCHOOL ZONE SRSI SCHOOL**

S.NO	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	COPPER	0.61	1.1
2	NICKEL	5.56	20
3	ZINC	55.22	100
4	IRON	6.12	10
5	KLEAD	0.41	1.5

Heavy Metal concentration – **BUSSTOP GANDHIOURAM BUS STOP**

S.NO	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	COPPER	0.95	1.1
2	NICKEL	13.69	20
3	ZINC	82.14	100
4	IRON	6.42	10
5	KLEAD	1.05	1.5

Heavy Metal concentration – **RESIDENCY ZONE HR RESIDENCY**

S.NO	**Parameters**	**Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours**	**Standard Limits Asper NAAQS (µg/M3)**
1	COPPER	0.0068	1.1
2	NICKEL	5.0068	20
3	ZINC	33.95	100
4	IRON	1.27	10
5	KLEAD	0.512	1.5

Heavy Metal concentration – **HOSPITAL ZONE KMCH,SAKTHI ROAD**

S.NO	**Parameters**	***Pollutant Concentration (µg/M3) 24 Hours Or 8 Hours***	**Standard Limits Asper NAAQS (µg/M3)**
1	COPPER	0.96	1.1
2	NICKEL	12.16	20
3	ZINC	88.20	100
4	IRON	9.52	10
5	KLEAD	0.62	1.5

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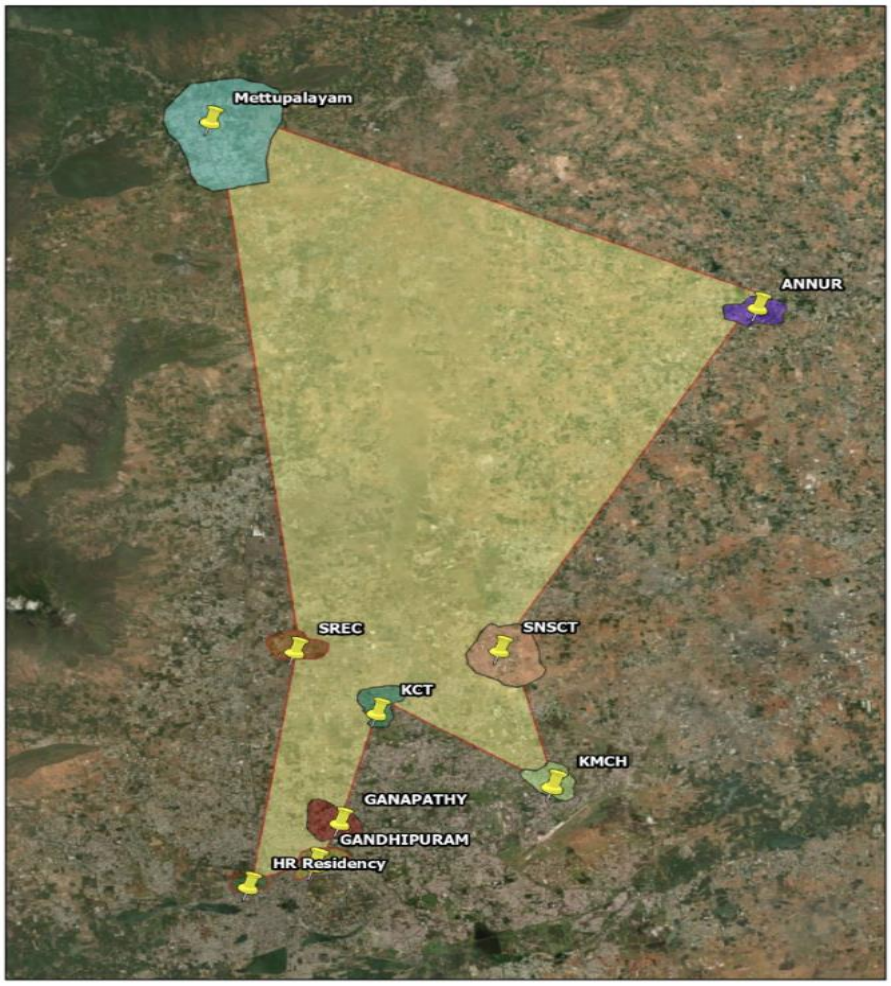

REPRESENTATION OF THE AREAS USING ARCGIS

CONCLUSION

➢ The concentration of various heavy metals in particulate matter of ambient air in Coimbatore city were identified in the traffic area (Gandhipuram and Ganapathy) withhigh levels of SPM, PM10 and PM2.5. Nevertheless, it was found to have low concentrations of heavy metals.

➢ At Industrial sampling stations, concentrations of Fe and Zn were found to be maximum than other heavy metals.

➢ The order of average concentrations of heavy metals in Coimbatore atmospheric air was Fe > Zn > Pb > Cu > Ni >Cr > Cd. The usage of Fe and Zn for protective coatingon iron, steel etc. by the industries in Coimbatore city could be the major reason for the higher concentration of this heavy metal in this region. Toxicity is a function of solubility.

➢ Insolubility compounds as well as the metallic form often exhibit negligible toxicity.

➢ The heavy metals are extremely dangerous for all living beings in the world.

➢ Maintain the automobiles in a good condition can be reduces these types of

➢ problems.

➢ As well as industries can also cause pollution to control or minimized that by installing air pollution control equipment’s like filters etc. This can help to reduce the pollution in the surrounding.

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DOI:10.46647/ijetms.2023.v07i04.029 ISSN: 2581-4621

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