MONITORING AND ASSESSMENT OF AIR QUALITY WITH REFERENCE TO DUST PARTICLES (PM_{10} AND $PM_{2.5}$) IN URBAN ENVIRONMENT

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Abstract

The rapid growth in population, urban and industrial activities resulted in deterioration of air quality in urban environments. The major air pollutants deteriorated air quality is fine particulate matter and gaseous aerosols. Fine particulate matter is respirable in nature and is considered as potential pollutant which causes economic loss and health implications on society. The present study is aimed to quantification of $PM_{2.5}$ and PM_{10} particulates from ambient environment in different environmental backdrops by using fine particulate sampler. The Exceedance Factor (EF) levels of both $PM_{2.5}$ and PM_{10} were within the limits in residential and moderate to high levels in commercial and industrial areas. Thus there is need for combating particulate matter in the study areas by implementing proper management measures such as enhanced public transport system and strengthening of green belt with suitable plant species.

Keywords: *Air pollution, Air quality, Exceedance Factor, Particulate matter.*

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1. INTRODUCTION

Air pollution is a major environmental problem in various parts of the world. The rapid growth of population is one of the main reasons for environmental concerns in the country. The major air pollutants are particulate matter (PM_{10} and $PM_{2.5}$) and gaseous aerosols. Particulate Matter is considered as potential pollutant which causes economic loss and health implications on society. The particulate matter of both $PM_{2.5}$ and PM_{10} are inhalable and penetrate into the thoracic region of the respiratory system. The chronic exposure to particulate matter causes respiratory and cardiovascular morbidity. The major sources of particulate matter in urban environment are combustion of solid waste, automobiles, power plants and industrial process. According to Economic Survey of India (2007-08) the total number of vehicles in India is more than 85 million in 2006 i.e. about 1% share of the world and creating pressure on urban transport which is one of the major challenges of this new millennium. TERI (2003) has projected the vehicular growth in India is about 300 million by 2026. The worst thing about vehicular pollution is that it cannot be avoided as the vehicular emissions are emitted at near-ground level. In urban environment the major contribution of particulate matter is mainly from on road vehicles and is considered to be a major source of air pollution in India. Delhi producing 9.7 tonns/day particulate matter from vehicular emissions (DPCC 2007) and in Hyderabad city the PM contribution from vehicular emissions is around 50% of total emission load (APPCB,2007). The industrial pollution along with vehicular pollution in urban environment can prove to be disastrous for the city. The present study is aimed to quantification of $PM_{2.5}$ and PM_{10} particulates from ambient environment in different environmental backdrops.

2. STUDY AREA AND METHODOLOGY

Visakhapatnam (extending from 82^0 57′ 37″ to 83^0 28′ 12″ E longitude and 17^0 30′ 15″ N latitude) is situated on the North Coast of Andhra Pradesh and is popularly known as the City of Destiny. Presently, it is the second largest city of Andhra Pradesh, and also considered as the industrial capital of the state. Keeping the importance of the present study, three environmental backdrops (Residential areas, Commercial areas and Industrial areas) were selected to conduct ambient air sampling. The sampling for particulate matter was carried out along the lateral roads connected to main traffic junctions. Location of sampling sites was shown in Figure-1.

PM_{10} and $PM_{2.5}$ were collected by using Ecotech-AAS 127 monitors for a period of one year. These stations were also equipped with temperature, wind and relative humidity monitors. The sampling was carried out during daytime on cloud free days for 24 hr basis in selected localities and calculations as per the CPCB guidelines. Particles above each cut size are collected on a 25 mm PTFE filter in the respective stage. Stage ‘A’ designed to collect particles less than 10 $\mu g/m^3$ size only i.e., size of particulates 2.5 µg/m to 10 $\mu g/m^3$. Particles below 0.25 µm collected on last stage of 37 mm PTFE after filter. Particle weight on the filter represents the percent less than the cut size of precious stage.

Fig: 1 Locations of sampling sites for measurement of Particulate Matter

3. RESULTS AND DISCUSSION

The average concentrations of $PM_{2.5}$ and PM_{10} at different environmental backdrops were given in Figure-2. The PM_{10} values were reported in the range of 52.39 - 79.45 µg/m^3 in residential, commercial and industrial areas. Regarding $PM_{2.5}$ the values in industrial, residential and commercial areas are reported in the range of 23 - 57 µg/m^3. The air quality of different study locations with respect to size has been compared with respected NAAQS and has been categorized into four categories based on Exceedance Factor (EF).

Exceedance Factor (EF) (AAQ Report, 2007) is calculated by:

$$EF = \frac{\text{Observed annual mean conc. of criteria pollutant}}{\text{Annual standard for the respective pollutant and area class}}$$

The four air quality categories are

1. Critical pollution (C) – when EF is more than 1.5
2. High pollution (H) – when EF is between 1.0 to 1.5
3. Moderate pollution (M) – when EF is between 0.5 to 1.0
4. Low pollution (L) – when FE is less than 0.5

The EF values in different study areas are given in Table -1. From the table it is noticed that in residential areas both $PM_{2.5}$ and PM_{10} were reported air quality is moderate. Whereas in commercial and industrial area represented the mixture trend of both moderate and high pollution levels. The results has shown that particulate matter will play a significant role in near future keeping in view of urban and industrial development of Visakhapatnam. In residential and commercial areas the particulate matter mainly from massive constructional activities followed by vehicular and road shoulders. In industrial areas the emissions from large scale and small scale industries contributing major portion of particulates. In addition, heavy tonnage vehicles, automobiles and poor maintenance of roads have worsening the situation.

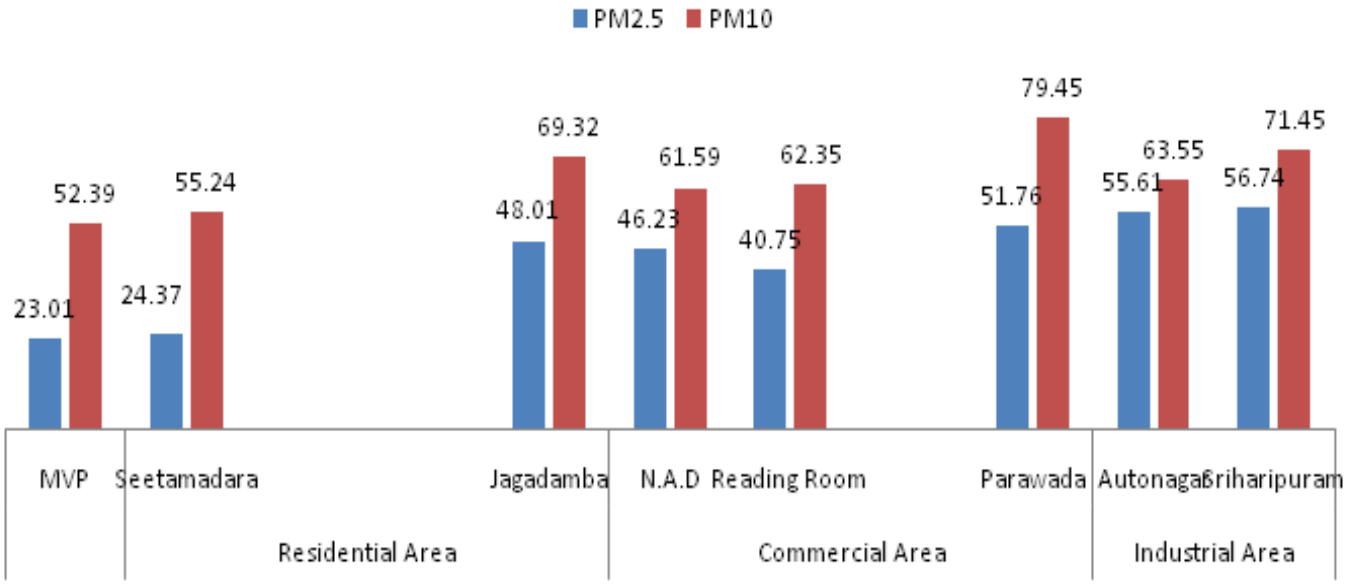

Fig-2: PM_{10} and $PM_{2.5}$ (Avg.) concentrations from October-2013 to August-2014 in different study areas

Table: 1. Exceedance Factor (EF) of particulate matter in the study areas

S. No	Study areas	$PM_{2.5}$	PM_{10}	EF
01	**Residential**			
	MVP Colony	0.5	0.8	Moderate
	Seetammadhara	0.6	0.9	Moderate
02	**Commercial areas**			
	Jagadamba junction	1.2	1.1	High
	NAD Junction	1.1	1.0	High and Moderate
	Reading Room	1.0	1.0	Moderate
03	**Industrial areas**			
	Parawada	1.2	1.3	High
	Auto nagar	1.3	1.0	High and Moderate
	Sri Hari Puram	1.4	1.1	High

4. CONCLUSION

It is concluded that the average respirable dust levels of both $PM_{2.5}$ and PM_{10} were within the limits in residential and moderate to high levels in commercial and industrial areas. Thus there is need for combating particulate matter concentrations in the study areas by implementing proper management measures such as increase of public transport system, improvement in road maintenance, traffic management and strengthening of green belt with suitable plant species.

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REFERENCES

[1] Economic survey of India (2007-08) Ministry of finance, Government of India, New Delhi.

[2] TERI (2003). Transportation economics and environmental issues that influence product of strategy. Tata Energy Research Institute, New Delhi.

[3] DPCC (2007) Delhi Pollution control Committee report. New Delhi.

[4] APPCB (2007). Status of Ambient Air Quality in Andhra Pradesh -2007, Andhra Pradesh Pollution Control Board, Hyderabad (http//appcb.ap.nic.in/air%20quality/air-data/finalreport%20of%20AA…)