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Short term Status of Particulate Matter and Carbon Monoxide in the Different Zones of Rajajinagar, Bangalore, Karnataka

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ABSTRACT: Urban air concentration is significantly increasing due to the effect of industrialization, vehicular emission and modern urbanization. The garden city, Bangalore is badly experiencing the worst quality of ambient air due to the various natural and anthropogenic activities. The present study is an attempt to estimate the concentration of particulate matter and carbon monoxide in Rajajinagar region, Bangalore. Three different zones are set namely Residential zone (Manjunath nagar), Traffic zone (Rajajinagar fire station) and Industrial zone (Vikranth hotel) for a sampling period from December 2016 to March 2017. Many meteorological parameter such as temperature, wind speed, wind direction, humidity are taken in to account for the status check of variation in the concentration level of pollutants present in the ambient air. All the obtained results were compared with NAAQS Standards.

KEYWORDS: Urban air concentration, ambient air, anthropogenic activities, Particulate Matter, NAAQS.

I. INTRODUCTION

The exposure of air pollution in the major metro cities of India is under a threat of health effects. In the recent decade rapid modernization and expansion of the fertile land converting in to industries have rendered the bad quality of air and made the nature to lose its beauty. The clean air is a basic essential need for all humans, animals and natural vegetations and it is being deprived by the unbalance in the ecosystem. In this study monitoring and analysis of Particulate matter and carbon monoxide are carried out which are the most common air pollutant present in the ambient air from the various activities such as forest fires, volcanoes, motor vehicles, burning of wood and from various industries. The particulate dust particle varies from courser to finer particle i.e. (PM₁₀, PM_{2.5}), Particulate matter are the liquid droplets or solid particles present in ambient air in which PM_{2.5} is lesser than or equal to 2.5µm size and PM₁₀ is 10micrometer or less in the particle size. Carbon monoxide causes green house effect which in turn affects ozone layer depletion and causes global warming because one of the major sources of CO is vehicular exhaust which majorly effects air quality. Major health issues both long term and short term diseases such as Asthma, respiratory tract problems, lungs inflammatory and cardio vascular problems arise from particulate matter and carbon monoxide. Carbon monoxide forms carboxyhaemoglobin when it enters blood thus decreases the oxygen content in the blood and it may also causes various other health issues .Atmospheric deterioration such as smog, acid rain, global warming and reduced solar radiation is caused by various ambient air pollutants.

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Many continuous monitoring stations have been adopted in many developing countries in order to determine the air concentration. WHO (World Health Organization) and US EPA (United States Environmental Protection Agency) are the various international organization made in order to set up the standards for different air pollutants and to reduce the pollutant concentration by remedial measures. In India various national and state pollution boards have set up in all the state for regular monitoring of air pollutants. National Ambient Air Quality Standards along Central pollution control board amended in 2009 with setting a particular standard for each parameter for ecologically sensitive areas and for Industrial, Residential, Rural and other Areas thus creating the awareness to public regarding the ambient air pollution. The particulate matter is sampled for twenty four hours and carbon monoxide is monitored two hours with active sampling devices along with laboratory analysis. Many advancement in the sampling instrument have come up in the recent days from manual to automatic and then to digital instruments

In this study, variation level of particulate matters (PM₁₀, PM_{2.5}) and carbon monoxide in Rajajinagar, Bangalore for each zone is completely studied and compared with NAAQS (National Ambient Air Quality Standards) which provides a baseline for the future assessment.

II. MATERIALS AND METHODOLOGY

Location details

In Bangalore, Rajajinagar area is taken for the study with three different zones.

Bangalore: The capital city Bangalore is situated south eastern part of Karnataka state. Bangalore is located between latitude 12°97'N and 77°56' longitude with the elevation 920m above sea level. The land locked city with area of about 1741km²with higher rate of expansion due to the effect of rapid urbanization, population growth and industrial set up.

- **Residential zone:** Residential zone (Manjunath nagar) with latitude 12°59'43'N and 77° 32' 54"E longitude. This zone includes all residential houses, temples and many grocery shops with variety of domestic activities.
- **Traffic zone:** Traffic zone (Rajajinagar fire station) with latitude 12° 97' 92"N and longitude 77°55'34"E. The zone comprises movement of wide variety of vehicles with enormous emission rate and it also includes many commercial shops nearby roadside.
- **Industrial zone:** Industrial zone (Vikranth hotel) with latitude and longitude 12°98'22"N and 77°54'36"E. Many small, medium and some large scale industries is being situated in this zone.

Sampling period and parameter undertaken

Particulate matters (PM₁₀, PM_{2.5}) and carbon monoxide (CO) are being monitored for four months from December 2016 to March 2017. The Particulate matters (PM₁₀, PM_{2.5}) is being sampled for 24 hours and carbon monoxide (CO) it is sampled and recorded for 2 hours (8 hours/1 hour time weighted average NAAQS). 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Instrument Used

The instrument Envirotech Respirable dust sampler (RDS APM 460NL) is used for monitoring Particulate matter (PM₁₀), Fine particulate Sampler (APM 550 MINI) for Particulate matter (PM_{2.5}) and Ecotech Carbon Monoxide Analyzer (Serinus 30) for monitoring the carbon monoxide (CO) pollutant concentration.

Sampling analysis and Method of measurement

Particulate matters (PM₁₀, PM_{2.5}) is using gravimetric method and analysis is done by collecting the sample (i.e. filter paper) for monitoring period for 24hrs. The filter paper collects the dust particles is being desiccated for 24 hours. The

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initial weight of the filter paper before sampling and final weight of the filter paper after sampling is noted .By using the relevant formula the concentration is found out.

Carbon monoxide (CO) is using Non dispersive Infrared (NDIR) Spectroscopy for the method of measurement, initial half an hour is left for the warm of instrument then it records the concentration of CO with the time span 5 minutes for 2hours, later it is connected to computer and the recorded value is obtained.

Meteorological data

Table No 1

MONTHS	TEMPERATURE (°C)	HUMIDITY (%)	WINDSPEED(m/sec)	WIND DIRECTION
December	22.61	62.51	6.64	137.89
January	21.78	60.35	2.28	189.52
February	25.11	44.47	2.68	130.94
March	28.18	48.32	2.36	141.01

In the above Table No 1, it gives the information of meteorological data in and around Rajajinagar, Bangalore. Variation in the different meteorological parameters from December 2016 to March 2017 is being mentioned which is responsible for variation in the concentration of air pollutants undertaken in the study.

III. EXPERIMENTAL RESULTS

Particulate matter (PM₁₀)

Table No 2

Zones	Concentration of PM ₁₀ µg/m ³ for different month			
	December	January	February	March
Residential zone(Manjunath nagar)	26.64	23.61	30.08	35.42
Industrial zone(Vikranth hotel)	40.73	44.95	47.40	52.71
Traffic zone(Rajajinagar fire station)	70.88	73.58	87.17	91.63

In the above Table No 2, it shows the values of Particulate matter (PM₁₀) in all three zones of Rajajinagar, Bangalore. Variation in the concentration of different from December 2016 to March 2017 is being mentioned which also indicates the maximum and minimum values for each zones.

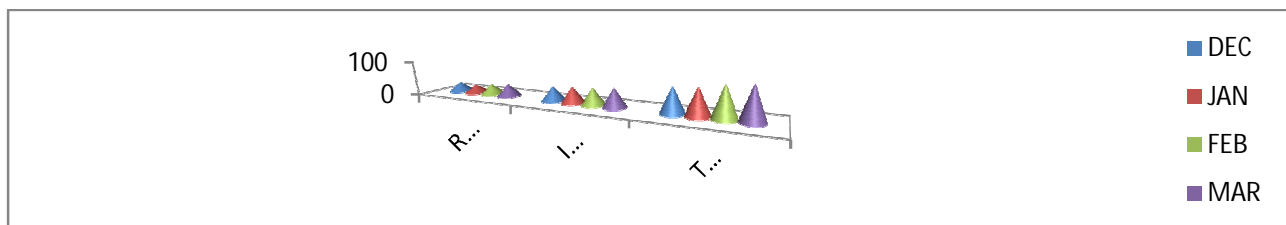


Fig No 1: Showing variations in concentration of Particulate matter (PM₁₀)

Out of three zones mentioned in the Fig No 1, the concentration level of PM₁₀ in Residential area (Manjunath nagar) is less in the month of January with range 23.61µg/m³ due to the less domestic activities, presence of residential houses and effect of meteorological parameters. In traffic zone (Rajajinagar fire station) it's found to be high in March with concentration 91.63 µg/m³ because of movement of vehicles, construction/repair activities of road/ metro station cal change in variations of meteorological parameter in march(Table No 1). In Industrial area (Vikranth hotel) the pollutant

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concentration is lesser than traffic zone and higher than residential zone because of the emission of particulate matter particles by small/medium scale industries and vehicular movements.

Particulate matter (PM_{2.5})

Table No 3

Zones	Concentration of PM _{2.5} µg/m ³ for different month			
	December	January	February	March
Residential zone(Manjunath nagar)	22.93	18.72	26.34	31.30
Industrial zone(Vikranth hotel)	27.55	33.19	39.63	45.61
Traffic zone(Rajajinagar fire station)	68.53	71.16	74.61	85.52

In the above Table No 3, it shows the values of PM_{2.5} all three zones of Rajajinagar, Bangalore. Variation in the concentration of values from December 2016 to March 2017 is being mentioned which also indicates the highest and lowest values for all zones.

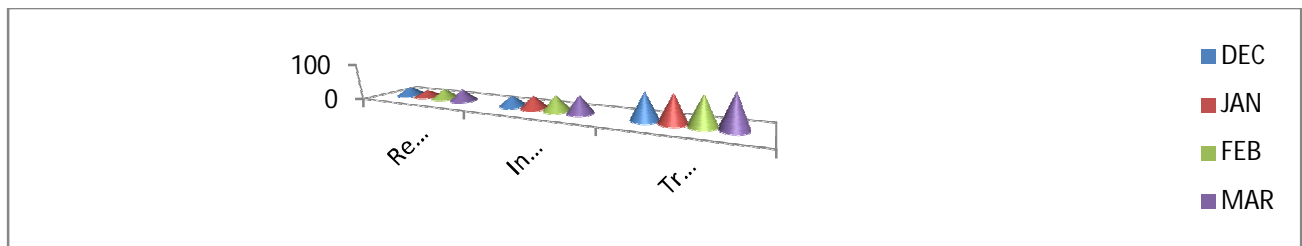


Fig No 2: Showing variations in concentration of Particulate matter (PM_{2.5})

From Fig No 2, the Particulate matter (PM_{2.5}) is minimum in January for Residential zone (Manjunath nagar) with range 18.72 µg/m³ and found maximum in Traffic zone (Rajajinagar fire station) in March during sampling period with concentration of 85.52 µg/m³. Consideration of meteorological data (Table No 1), vehicular emission, constructional activities, industrial emission and domestic activities made a significant effect in variations of concentration in each zone.

Carbon monoxide (CO)

Table No 4

Zones	Concentration of CO mg/m ³ for different month			
	December	January	February	March
Residential zone(Manjunath nagar)	0.45	0.51	0.56	0.59
Industrial zone(Vikranth hotel)	1.07	1.25	1.82	1.47
Traffic zone(Rajajinagar fire station)	1.82	2.03	1.91	2.24

In the above Table No 4, it gives the information of all three zones of Rajajinagar, Bangalore. Variation in the values of concentration of CO from December 2016 to March 2017 is being mentioned which also indicates the maximum and minimum values for all zones.

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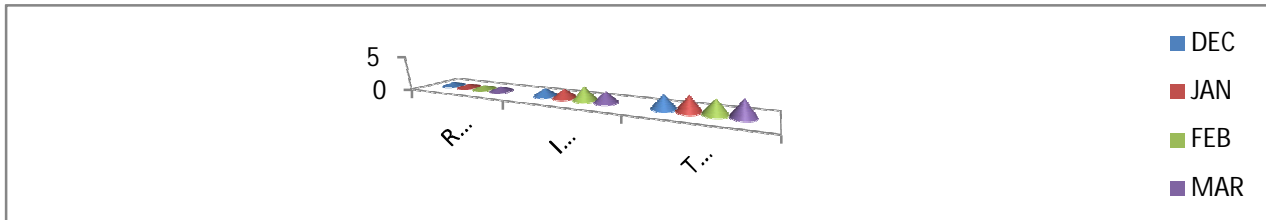


Fig No 3: Showing variations in concentration of Carbon monoxide (CO)

Carbon monoxide (CO) from and Fig No 3 is found to higher in Traffic zone (Rajajinagar fire station) with faster and higher rate of vehicle movements mainly at traffic zone point which releases carbon monoxide in a huge amount through vehicle exhaust. It is found to be least at the residential site due lesser sources of CO. The Industrial zone (Vikranth hotel) is experiencing medium rate of emissions through the sources of CO emitting from the industries to the ambient air.

National Ambient Air Quality Standard

NAAQS has set a limit for all air pollutants for the Particulate matter (PM_{2.5}) its 40-60µg/m³, Particulate matter (PM₁₀) its 60-100µg/m³ and Carbon monoxide (CO) 2-4 mg/m³.

Particulate matter (PM₁₀), Particulate matter (PM_{2.5}), Carbon monoxide (CO) are within the NAAQS permissible limit.

IV. CONCLUSION

In the short term monitoring campaign it covers substantial portion of Rajajinagar, Bangalore and concludes that the Residential zone (Manjunath nagar) is having low levels of air pollution followed by Industrial zone (Vikranth hotel) and Traffic zone (Rajajinagar fire station) is having high levels of air pollution concentration for all air parameter taken in study. It is found that the Particulate matter (PM₁₀), Particulate matter (PM_{2.5}), Carbon monoxide (CO) are within the NAAQS permissible limit, but continuously monitoring ambient air should be adopted in future due to the increase in the urbanization, industries and vehicles especially at the traffic and industrial zone. It is noted that there were significant differences in the concentrations of air pollution parameters at different months.

V. ACKNOWLEDGMENT

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