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Air Quality Status at Selected Locations in Bangalore City, Karnataka, India

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Abstract:
Industrialization, urbanization and rapid growth in road transport sector leads to emissions resulting in air quality deterioration. Epidemiological studies over the past few decades, have demonstrated adverse health effects due to higher ambient levels of air pollution. Thus, to improve ambient air quality an efficient and effective approach for assessment and management of air pollution is necessary.
A study has been carried out at five selected pockets from all over Bangalore city covering Industrial, Commercial sensitive, Residential and Rural pockets: The pollutants namely Particulate Matter (PM_{10}) and Gaseous Pollutants (SO_2 and NO_2) were considered for study. Yearly average AQI values have also been presented.Based on the AQI values it is inferred that the industrial, commercial and sensitive areas are moderately polluted. However, the PM_{10} concentration in the sensitive hospital area was found to be exceeded National ambient air quality standards and NO_2 concentrations were found to be very near to permissible limits.

Keywords: *Air quality assessment, industrial particulate matter, gaseous pollutants, mitigation*

1. Introduction

Over the last few decades the ambient air composition has undergone several changes. Anthropogenic pollutants generated locally often have affected the regional air quality. Studies have showed adverse health effects due to repeated exposure to higher levels of pollutants in the ambient air over a prolonged period of time. Therefore, the need of the day is to monitor the ambient air quality continuously and thereby to propose measures to mitigate the same. Globally many cities continuously monitor air quality and record pollutant concentrations at critical pockets deemed to represent concentrations exposure of population to air pollutants. Also, Air Quality Index (AQI is commonly used to communicate the level of severity of pollution to public and policy makers and is found to be more sophisticated tool.
The study to assess the ambient air quality at selected pockets of Bangalore city was carried out as a part of research work during the year 2013. The observations of the study are presented in this paper and discussions are made.

2. Study Area

Bangalore - the study area once known was garden city of India, has over the years lost its reputation as the garden city. Bangalore is the capital of Karnataka and is one of the largest cities of India. It is situated at an altitude of 921 meters above the mean sea level. The rapid growth of the city in the last two decades has crippled its infrastructure and polluted all spheres of its environment specially the ambient air. Five pockets of Bangalore city selected for study are shown in Table 1.

Station Code	Sampling Station	Nature of the Sampling Station
A	Export Promotion Centre, Whitefield	Industrial
B	Central Silk Board	Commercial
C	Victoria Hospital	Sensitive
D	Banasavadi	Residential
E	Kazisummanahalli	Rural

Table 1: Sampling Stations Chosen for the Present Study

3. Materials and Methods

Three air pollutants, viz. particulate matter (PM_{10}), oxides of Nitrogen as NO_2 and Sulphur dioxide (SO_2) were monitored at all the selected locations with a frequency of once a week. High volume sampler was used for monitoring. As prescribed in NAAQM standard methods of sampling and analysis, sampling and analysis of samples was done. Atmospheric air was drawn for 8 hours' time intervals for a period of 24 hours at a flow rate of 0.8 to 1.2 m^3/min through glass fibre filter (Whatman GF/A). Then the amount of particulate matter per unit volume of air passed was calculated on the basis of the difference between initial and final weights of the filter paper and the total volume of the air drawn during sampling. For gaseous sampling, the impenger was exposed for 24 hours at an impingement rate of 1 l/min to get one sample in a day. NO_2 was analysed by employing the Jacob-Hocheiser method on a sepectrophoto meter at a wave length of 540 nm on the other hand SO_2 was analysed on a spectrophotometer at wave length of 560 nm by employing west-Greak method. Further IND-AQI was used for the calculation of AQI; which has been developed on the dose-response relationship of various pollutants (PrakashManatha and Basin: 2010). Based on National Air Quality Standard as prescribed by CPCB 1994 (Table 2) and standard AQI values (Table 3) air quality categories of the observed air samples are compared and inferred.

Pollutant	Time Weighted Average Per day	Concentration in µg/m^3		
		Industrial	Residential other areas	Sensitive
Particulate Matter	24 hrs	500	200	100
SO_2	24 hrs	120	80	30
NO_2	24 hrs	120	80	30

Table 2: National Ambient Air Quality Standards (CPCB 1994)

AQI Value	0-50	51-100	101-200	201-300	301-400	401-500
Category	Good	Satisfactory	Moderately polluted	Poor	Very poor	Severe

Table 3: Rating of Air Quality Index (AQI)

4. Results and Discussions

The variations in the average concentrations of particulate matter (PM_{10}) are depicted in Figure 1. The values of SO_2 and NO_2 during the study period (2013) at five pockets are shown in Figure 2 and Table 4 respectively. The AQI values calculated using IND-AQI for all the study stations are shown in Figure 3.

Stations Code	NO_2Concentration, µg/m^3		
	Max	Min	Average
A	33	26	29.7
B	32.3	29	29.8
C	30.2	26.1	28.6
D	27.2	22.4	20.3
E	29.9	27.2	28.7

Table 4: Concentrations of NO_2 in the Study Pockets

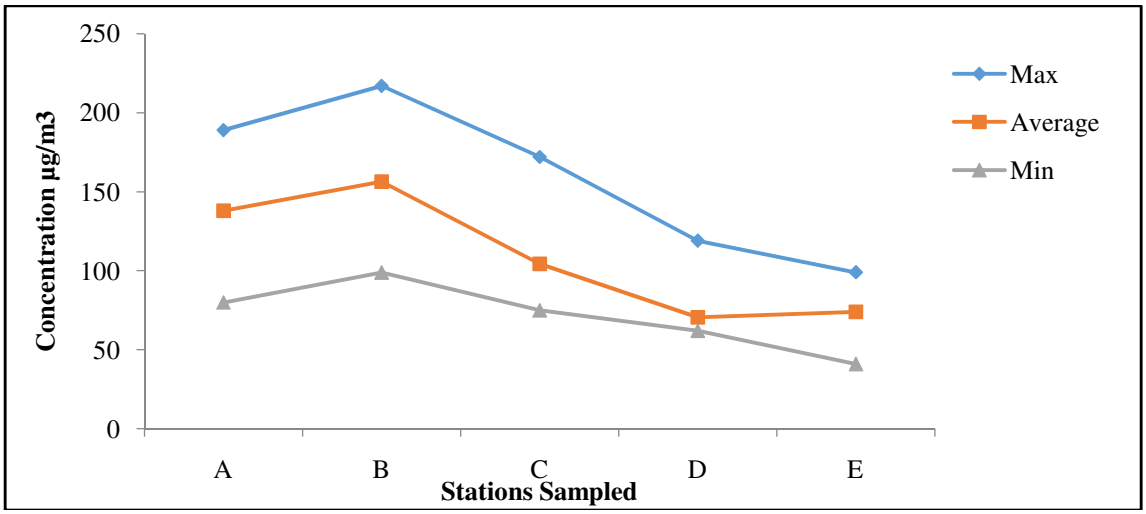

Figure 1: Concentration of PM_{10} in the Study Area

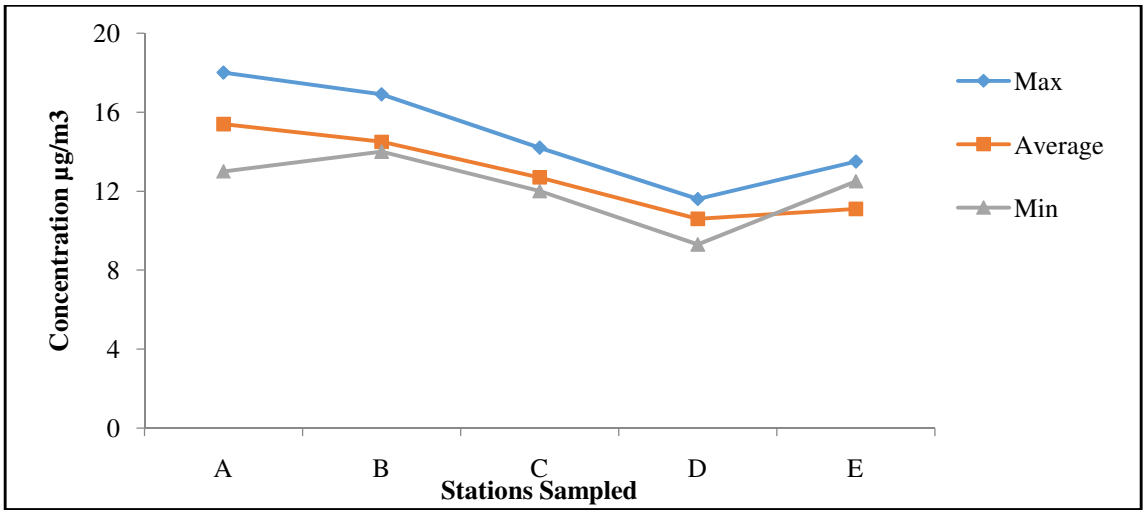

Figure 2: Concentration of SO_2 in the Study Area

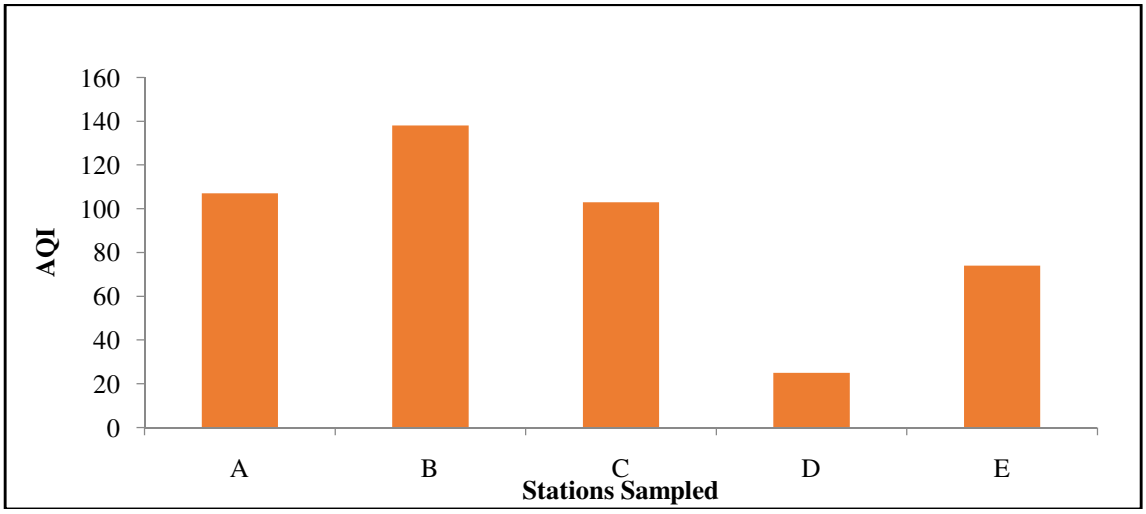

Figure 3: AQI in the Study Area

Maximum concentration of particulate matter at all the stations sampled was found to vary from 99 to 217 µg/m^3. The higher concentrations being recorded at industrial and commercial areas. Same trends have been observed with reference to SO_2 and NO_2 concentrations. The ranges of these pollutants observed were between 11.6 to 18 µg/m^3 (max) and 27.2 to 33 µg/m^3 (max) respectively. On the other hand, AQI values for residential, commercial, sensitive, residential and rural areas were respectively 107, 138, 103, 25, and 74. Comparison of concentrations of PM_{10} recorded at various sampling stations with national ambient air quality standards (Table 2) indicated that, except at sensitive area (Victoria Hospital), the values are within the acceptable limits. For sensitive area standard for particulate matter is 100, but at sensitive area (Station C), in the study area, for more than 42% of the months in a year, the PM_{10} concentration of more than 100 µg/m^{3}has been recorded (Max: 172, average 104.4). On the other hand, at all the stations sampled during the study period, the NO_2 (except at station C) and SO_2 concentrations were within the National ambient air quality standards. However, NO_2 concentrations recorded at sensitive area (Station C) during all the months of study period were found to be (Max: 30.2 µg/m^3 and min: 28.6 µg/m^3) very near to national ambient air quality standard of 30 µg/m^3.
Further from the AQI values it is inferred that, Industrial, Commercial and Sensitive areas are moderately polluted, and air quality at residential and rural areas is satisfactory and good respectively.

5. Conclusions

The pollutants in the ambient air at all the study pockets except at sensitive area are within the permissible limits. The AQI values indicated that, there is a threat to ambient air quality at Industrial, Commercial and Sensitive areas studied. Further the authors strongly opine that, for the development of any region, industrialization and urbanization play a vital role, however these activities bring with them the adverse effects which have to be effectively mitigated.

6. References

i. APHA, Standard methods of air Sampling and Analysis, 2nd Edn. 1977, Washington DC.
ii. CPCB, Air Quality Status and Trends in India. 2000.

iii. GowthamSarella and Anjali K. Khambete, Ambient Air Quality Analysis using Air Quality Index – A case study of VAPI IJIRST, 2015,1(1), 68-71.
iv. Harinath S. and Usha N. Murthy, Air Quality Index in Industrial Areas of Bangalore City – A case study, India, Jr of Industrial Pollution Control, 2010,26(2), 235-237.
v. Mahendra and Krishnamurthy, Assessment of Carbon Monoxide Levels at selected Traffic Intersections in Urban Area of Banglaore, J. Ecotoxicol Environ Mont, 2004,14(2):101-104.
vi. PrakashMamta and Bassin J.K., Analysis of Ambient Air Quality using Air Quality Index – A case study, IJAET, 2010,1(11), 106-114.
vii. Sastry M.S., SuneelaM.,. Shashidhar Kumar N.P. and Hussain S.K. Air Quality status at selected locations in Hyderabad city, Jr. of Environ. ScienteEngg., 2004,46(2), 86-91.
viii. Senthilnathan T., Urban Air Quality in Chennai city based on Exceeding Factor Criteria During 1999-2003, IJEP, 2007,27(7), 638-644.
ix. Sharma M., Maheshwari M., Sengupta B. and Shukla B.P., Design of website for dissemination of an air quality Index in India, Env Mod & Software, 2003,18, 405-411.