Jr. of Industrial Pollution Control 26 (2)(2010) pp 235-237

AIR QUALITY INDEX IN INDUSTRIAL AREAS OF BANGALORE CITY - A CASE STUDY, INDIA

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Key words : Air quality index, Ambient air quality, Air monitoring.

ABSTRACT

The ambient air quality survey was carried out at 12 monitoring stations with respect to SPM, SO_2 and NO_x. The pollutant concentrations were used to calculate the Air Quality Index. It is observed that most of the predicted pollutants are violating the permissible values.

INTRODUCTION

The degradation of air quality is a major environmental problem that affects many urban and industrial sites and the surrounding regions. There certainly exists a close relation between poor air and poor health, as pollution of air results in breathing difficulties, increased incidence of Asthma, Cancer and even death. Heavy industrialization and increased transportation has polluted the atmospheric air to such an extent that it is slowly loosing it's self cleaning capacity. Deteriorating air quality is posing serious threats, of changing, even the composition of atmosphere.

Indian metropolitan cities like Delhi, Mumbai, Kolkata, etc. have high emission of air pollutants, which is degrading the ambient air quality day by day. The degradation of air quality is a major environmental problem that affects many urban and industrial sites and the surrounding regions worldwide. Air pollution can reach levels, where it significantly influences human health, diminishes crop yield, and destroys infrastructure and patrimony. The phenomena involved in air pollution are complex. Once emitted into the atmosphere, primary pollutants are transported by wind, turbulence and diffusion, which can undergo chemical reaction, change phase and finally are removed from the atmosphere by dry and wet deposition.

Health and environmental impact of secondary pollutants, i.e., those formed in the atmosphere can be ore severe than their emitted precursor.

The Standards prescribed by C P C B (Central Pollution Control Board, India) has been tabulated in Table1.

Table1. Ambient air quality Indian standard ($\mu g/m^3$)

Area	SPM	SO_2	NO_x
Industrial	300	80	90
Residential,	140	60	60
Sensitive	70	20	20

MATERIALS AND METHODS

The present study is carried in Bommasandra industrial, Jigane industrial and Electronic Industrial areas in Bangalore. Each industrial area is divided

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into three zones to select sampling stations.

Location of sampling points

The method of random sampling was adopted to collect air pollution samples at three stations in and around industrial areas of Bommasandra industrial area, Jigane industrial area and Electronic City Industrial area. The location of sampling station should be such that it should be in the free atmosphere, without interferences from stagnant spaces or large buildings etc.

The selected parameters are SPM, SO_2, NO_x and CO. The high volume air sampler is used to collect the air samples at each sampling stations as standards, for each different parameters and chosen samples were analysed in the laboratory by following standard methods during the period of Feb 2008 to June 2008.

Site Description

The Bangalore urban and rural parts are located in the south eastern part of Karnataka state between the North latitude 12° 15′ and 13° 31′ and East longitude 77° 41′ and 77° 59 ′. The climate of the study area is seasonally dry tropical savannah with four Seasons. The dry Season with clear bright weather is from December to February. The summer Season from March to May is followed by the Southwest monsoon season from June to September, October and November Constitute the Post monsoon. The temperature ranges between 33° C in April to 14° C in January. The mean annual rainfall is 950 mm and number of rainy days is about 57, June to September is the principal rainy season.

Air Quality Management System (AQMS) is a strategy to overcome the problems of air pollution and is most effective towards continuous improvements of air quality. It includes the evaluation of various sets of emission control schedules to determine consequences to air quality and the formulation of alternative emission control schedules to meet air quality goals. In this paper the attempt has been made to collect data of air pollution at a number of stations industrial areas and then shown in the form of an Air

Quality Index

The air quality index (AQI) is calculated with the help of following equation concerning air quality rating with respect to each air quality rating parameters.

$$AQI = 1/4[SPM/SSPM + SO_2 /S\,SO_2 + NO_x/ S\,NO_x] \times 100$$

Where SPM, SO_2 and NO_x are observed values of air Quality parameters. SSPM, SSO_2 and SNO_x are Standard value of that very parameter recommended by CPCB. Based on the standard AQI values (Table 1), air quality categories of the observed air samples are compared and inferred.

Table 1. Rating of Air quality Index (AQI)

Category		AQI	Description
I		<10	Very clean
II	10 -25	Clean	
III	25 -50	Fairly clean	
IV	50- 75	yletarediM	
Polluted			
V	75 -100	Polluted	
VI	100-125	Heavily polluted	
VII	>125	Severely polluted	

RESULTS AND DISCUSSION

Most of the sampling stations exceed the residential standard limits of 140 µg/m³ but within the range of 300 µg/m³ for commercial areas in 24 hours. It is found that SPM values were very high in all directions. The maximum SPM was found near the close periphery of the highway line, which is due to the addition of ground dust by the moment of vehicles due to poor maintenance of roads. Table 2 shows the values of air quality index in different areas.

Table 2. Air Quality index at various sampling stations in the selected industrial areas.

Industrial area	Station	AQI	Remarks
Bommasandra	S1	176.62	Sever
	S2	135.65	
do			
	S3	177.98	do
Jigane	S1	162.89	Sever
	S2	151.79	do
	S3	174.53	do
Electronic city	S1	120.12	Sever
	S2	138.31	do
	S3	148.17	do

The table shows that station1 and 3 is higher than station 2 in Bommasandra industrial area due to industrial activities, traffic moment and constructional activities. In Electronic city industrial area the values

are very less compared to the other two industrial areas (Fig. 1), because of highway line effect and constructional activities.

The results of air quality monitoring indicates that the pollutants concentration were highly variable at

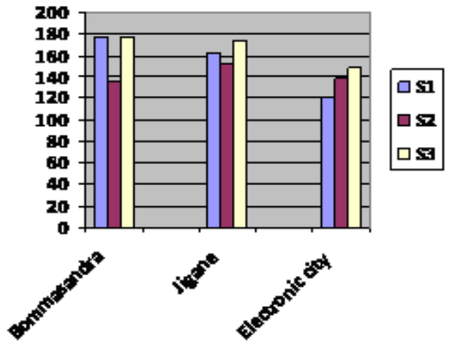

Fig 1. Variation of Air Quality Index

different sampling stations depending on stationary and density of mobile pollution sources. Particulate matter exceeded the permissible standard values due to stone cutting and stone polishing industries etc. and automobile effect where the national highway is passing and due to constructional activities in the vicinity of industrial areas. The present study shows that the value of SPM is on the threshold limit where as the other parameters in the atmosphere of the study area is not creating any hard threat to the civic life. It is found that sourrnding people of study area suffered from respiratory and other health problems.

CONCLUSION

The present study clearly indicates that particulate matter is the major air pollutant in the study area. In the entire study area, particulate pollutants exceeded the permissible standards, but gaseous pollutants were within the permissible limits. The industrial activities and transportation activities are mainly responsible for the high pollution load in the ambient air of the area. The present study further suggests that public awareness can play a major role in planning and developing innovative ways to solve health, transport and related air pollution problems and the strategic plan for the their implementation.

ACKNOWLEDGEMENT

The authors desire to express thanks to the authorities of Adhiyamaan collge of Engineering, Hosur, for their cooperatin during the work.

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