Assessment of Air quality index of Visakhapantam urban area Andhrapradesh

Boni.Anil Kumar
Department of Environmental sciences
AU College of Science and Technology, Andhra University
Visakhapantam, India

B.Vinay Sagar
Department of Environmental sciences
AU College of Science and Technology, Andhra University
Visakhapantam, India

B.Prasanna Kumar
Department of Environmental sciences
AU College of Science and Technology, Andhra University
Visakhapantam, India

***Abstract*—The impact of air pollution on living beings as well as on the environment surrounding them is being increasing every day. The potentiality of air pollution can be calculated using air quality index (AQI). This present study illustrated the trends of air pollutants like PM, RSPM, SOX and Nox in 5 different locations of the bowl city and there by calculating the air quality index of five areas in Visakhapatnam city for a period of five years between 2010 to 2014. The results revealed that the quality of air varied from being good to unhealthy.**

Keywords*— *Air quality, Air Pollution index (AQI), ,Visakhapatnam

I. INTRODUCTION

With the ever expanding cities and rapid industrialization, the urban environment is facing a severe crisis of deteriorating air quality. Around 7 million people died that is one in eight of total global deaths, as a result of air pollution exposure (11). The association between healths was established in the 20th century during occurrence of air pollution episodes, which were followed by important increases in morbidity and mortality (4). India which is considered as developing countries is facing a major crisis of air pollution, as some of its major cities have very poor urban air quality. The determination of quality is a very important factor in determining the area's suitability for inhabitation by humans. Evaluating air quality index (AQI) is one such method in determining the quality of air An air quality index (AQI) was defined as a numerical rating system that reflects the composite influences on the overall quality of a number of air quality parameters, which will be helpful not only for advising the public, but can also be used for urban planning (4)(5)(6)(7) Globally the US-based system is in use to estimate AQI where Pollutant concentrations for each pollutant are transformed onto a normalized numerical scale of 0 to 500, with an index value of 100 corresponding to their primary National Ambient Air Quality Standards (NAAQS) for each pollutant (10). The current study focuses on evaluating the air quality index in five areas of Visakhapatnam city.

II. STUDY AREA

Visakhapatnam ,located to North east corner of Andhra Pradesh lies between the coordinates17o - 15' and 18o-32' Northern latitude and 18o - 54' and 83o - 30' in Eastern longitude ,(17°42 N; 82°18 E) . The city geographically is considered as bowl area as it is surrounded by Eastern Ghats on three sides and Bay of Bengal on the other side. The city is considered as a hub to various government and private industries. Major Industries such as Vizag steel plant, HPCL, Visakhapatnam port are a reflection of the measure of industrialization of the city.

TABLE I. STUDY LOCATIONS

S.No	Name of the Location	G.P.S point
1	Mindi	N17 41 53.1 E 08312 52.3
2	Police Barracks	N 17 42 64.3 E 083 11 28.8
3	Industrial Estate	N 17 41 55.5 E 083 11 28.8
4	E.S.I Hospital	N 17 44 20.9 E 083 15 42.3
5	Gannapuram	N 17 4318.11 E083 17 07.4

These above five samplings locations were selected for the study of air quality.

III. METHODOLOGY

A. *Materials and Methods*

Air quality monitoring in the selected sites of the Visakhapatnam using High volume air sampler the frequency of the sampling was twice a week and 104 samples in a year this was carried out for the four years the collected samples were analyzed using the standard methods prescribed by CPCB and APHA (1).The pollutants which are considered while calculating AQI are RSPM, TSPM, SOx, NOx.

B. *Calculating AQI*

Let there be n air quality parameters Pi (i= 1, 2, 3... n), which are to be taken into account for calculating the AQI. Let Vi be the observed value of the ith parameter in the ambient air and let Vsi be the standard value recommended for this

parameter. Then the quality rating Qi for this parameter is given by

$$Qi = 100 (Vi/Vsi) \quad (1)$$

If Qi < 100, it is to be noted that the given parameter is within the prescribed limit. On the other hand, if Qi > 100, it implies that the ith parameter exceeds the prescribed standard and the ambient air is harmful for breathing by human beings. It is assumed here that all the parameters have the equal importance and so only the unweighted air quality indices are calculated. The geometric unweighted AQI may be calculated from the quality ratings Qi by taking their geometric mean.

$$AQI= (Qi)\ 1/n \quad (2)$$

This relation is simplified and hence

$$AQI = \text{Antilog} (\Sigma \log Qi)/n \quad (3)$$

n=1

The ambient AQI can be calculated using equations 1 and 3 [8].

C. Categorization of AQI

The ambient air quality can be categories like good, moderate, poor, very poor and critical based on the values of air quality index (3).

TABLE II. CATEGORIZATION OF AQI

Category	AQI	Descriptions of ambient air quality
I	0-50	Good
II	51-100	Marginally Polluted
III	101-200	Unhealthy
IV	201-300	Very Unhealthy
V	>300	Critical

IV. RESULTS AND DISCUSSION

Using the data the air quality indices were calculated for the five mentioned areas for the period between 2010 to 2014, using the standard formula.

TABLE III. CALCULATED AQI

Location	2010	2011	2012	2013	2014
Mindi	55.98	84.01	42.69	49.60	55.66
Police baracks	65.82	114.52	90.31	96.41	83.59
Industrial estate	47.20	65.87	54.67	55.58	55.64
E.s.i hospital	45.46	66.18	43.27	48.42	53.63
seethamadhara	49.92	63.57	56.51	56.54	56.20
Ganapuram	69.69	115.13	81.82	89.35	76.41

The AQI for the mindi area ranged between 42.69 to 84.1. Based on the table given above, in the years 2010, 2011 and 2014, the area can be considered as marginally polluted. However the AQI data for the years 2012 and 2013 show that the quality of air is good.

The AQI data in the police barracks indicated that the air quality can be considered as unhealthy in the year 2011 with an AQI of 114.52. The quality of air in the respective years 2010,2012,2013,2014 can be considered as marginally polluted with AQI in the areas being 65.82, 90.31, 96.41and 83.59. The deteriorating air quality of this area may be attributed to the presence of Visakhapatnam port which is very nearby.

The AQI values of industrial estate indicated that the quality of air in the area in the year 2010 was good with value of 47.20. But the indices obtained in the respective years 2011, 2012, 2013, 2014 indicated that the area was marginally polluted.

The AQI analysis in the E.S.I hospital area revealed that the area was marginally polluted in the year 2011 with an AQI of 65.87. The quality of air in the respective years 2010,2012,2013,2014 can be considered of good quality as the values were below 50.

The AQI values obtained for Seethammadhara indicated that the quality of air was good in the year 2010 with AQI of 49.92. In the respective years 2011,2012,2013,2014 the area can be considered as marginally polluted with reference to air quality as the values were above 50.

The air quality index in the Gnanapuram area for the year 2011 was 115.13 which belongs to the unhealthy category. The AQI index for the years 2010, 2012, 2013, 2014 was ranged between 69.69 to89.35 which indicated that the area was marginally polluted.

CONCLUSION

The current study revealed that the majority of the study locations fall under, marginally polluted category, while the areas like gnanapuram and police barracks reported high AQI values, when compared to remaining areas. In the year 2011 all the sites reported high AQI from their normal trend, both gnanapuram and police barracks showed AQI values of above 100 which falls under unhealthy category, showing alarming levels of pollution trends in the city. So the study recommends that necessary steps such as installation of air pollution abatement devices and stringent environmental policies must be initiated by authorities to confine the pollution levels under AQI of 50 so as to maintain a healthy urban air quality.

REFERENCES

[1] APHA(American public Health association) 1977.Standard methods of Air sampling and analysis “second edition” morris katz.APHA inter society committee,18th street NW Washington DC.20036.

[2] Anderson H, Ponce de Leon A, Bland J, Bower JS, Strachan DP: Air pollution and daily mortality in London: 1987–92.

[3] Avinash kumar (2005). Air pollution studies at Tughlakabad environmentally sensitive area in New Delhi. Indian Journal of air pollution control 1, 85-93.

[4] Bell and davis (2001), Reassessment of the Lethal London Fog of 1952: Novel Indicators of Acute and Chronic Consequences of Acute Exposure to Air Pollution. Environmental Health Perspectives • VOLUME 109 | SUPPLEMENT 3 | June 2001

[5] Inhaber.H. (1975). A set of suggested air quality indices for Canada. Atmospheric Environment 9, 353- 364.

[6] Kassomenos, P., Skouloudis, A.N., Lykoudis, S., Flocas, H.A., 1999 : Air quality indicators for uniform indexing of atmospheric pollution over large metropolitan areas. Atmospheric Environment 33, 1861-1879.

[7] Srivastava, R.K., Rajasree Sarkar (2006). Air quality Index: A Brief review. Indian Journal of Environmental Protection 26,344-347.

[8] Tiwari, Manzoor Ali, 1987. Air quality index for Calcutta and its monthly variations for various localities. Indian Journal of Environmental Protection 7,172-176.

[9] USEPA (2006), revised air quality standards for particle pollution and updates to the air quality index (AQI).

[10] WHO (2012) report , Burden of disease from Household Air Pollution for 2012.