© 2018 IJSRSET | Volume 4 | Issue 1 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Ambient Air Quality Monitoring at GIDC-Pandesara in Summer Season

Mitesh M. Page*[1], Kiran S. Nimavat[2], Sanyogita Sharma[1]
*[1]Department of Chemistry, Pacific Academy of Higher Education & Research University, Udaipur, Rajasthan, India
[2]Department of Chemistry, Government Science College, Gandhinagar, Gujarat, India

ABSTRACT
The rapid growth of cities and surroundings has a profound impact on the air by vehicular emissions. This is especially true in the developing world, mainly due to high proportion of old, poorly maintained vehicles and poor fuel quality. Different activities in the industrial areas or industrial zones also add a significant amount of pollutants in the air. The present research reports monitoring of $PM_{2.5}$, PM_{10}, SO_x and NO_x in ambient air for Summer season at GIDC-Pandesara, Surat. The concentrations of all four pollutants in ambient air in Summer season were compared with the National Ambient Air Quality Standards (NAAQS) limits.

Keywords: Ambient Air Quality Monitoring, GIDC-Pandesara, Summer Season, National Ambient Air Quality Standards

I. INTRODUCTION

With the increasing population, urbanization and industrialization; extent of urban air pollution and its effects on localized human health effects have been a great concern throughout the world. A study by WHO's International Agency for Research on Cancer (IARC) concluded that outdoor air pollution is carcinogenic. Exposure to particulate matter has been found to be causing amplified cancer incidence, particularly lung cancer & urinary tract/bladder cancer [1]. PM_{10} and $PM_{2.5}$ cause cardiovascular diseases, respiratory diseases, and cancers which were estimated to cause 3 million premature deaths worldwide per year in 2012.

While majority of developed & developing countries have introduced legislation for regular air quality monitoring of key urban pollutants such as SO_2, NOx or Ozone etc., few developing countries still have neither proper resources to control air pollution nor proper legislation in place.

In India, the Central Pollution Control Board has established the (Revised) fourth version of National Ambient Air Quality Standards (NAAQS) in 2009 under the provisions of Prevention & Control of Pollution Act, 1981 [2]. These revised national standards were established to offer consistent air quality for the whole country.

Under National Ambient air quality monitoring Program (NAAQMP), four air pollutants So_x, NO_x, PM_{10} and $PM_{2.5}$ have been identified for regular monitoring at all the locations in India.

In India, ambient air quality monitoring is done by Central Pollution Control Board (CPCB), Various State Pollution Control Boards (SPCBs), and National Environmental Engineering Research Institute (NEERI). CPCB has launched National Air Quality Monitoring Programme (NAMP), under which 683 air quality monitoring stations are established [3].

Although the ambient air quality monitoring network is expanding continuously, many areas and industrial

zones in India lack monitoring stations. CPCB publishes air pollutant status and trends at frequent intervals [4-9].

Number of studies by different researchers have been published reporting ambient air quality at different cities/towns/villages viz., Dehradun [10], Mumbai [11], Naubasta [12], Madurai [13], Delhi [14-20], Bangalore [21-23], Jaipur [24, 25], Lucknow [26, 27], Gwalior [28, 29] etc.

The present study deals with the Air Quality Monitoring (AQM) in the Summer season at the GIDC-Pandesara area in the Surat, Gujarat.

II. METHODS AND MATERIAL

Air quality was monitored in terms of concentration of four pollutants viz. $PM_{2.5}$, PM_{10}, SO_x and NO_x.

Site Description:

Location Name: GIDC Pandesara, District: Surat, State: Gujarat, Country: India.

Pandesara is an industrial area established located in the Surat district. The zone established by Gujarat Industrial Development Corporation in Pandesara (GIDC, Pandesara) was chosen as the location for air quality monitoring.

Sampling and Monitoring:

Before wind, Location specific and After wind air sampling was performed. Shree Balkishan Dyeing & Printing Pvt Ltd. was chosen as site for location specific air sampling.

Standard methods used for monitoring various pollutants have been summerized below:

A. Monitoring and Analysis of PM_{10} [Ambient]:

Reference Method: Monitoring and analysis of PM10 in the ambient air was performed using the method given in IS-5182 [part-23] 2006 [30], published by Bureau of Indian Standards (BIS).

Calculation of Volume of air sampled:

$V = Qt$

Where,

V= volume of air sampled, m^3

Q=flow rate average in m^3/min

t= total sampling time in min

Calculation of PM_{10} in ambient air :

$$PM_{10} \text{ as } \mu g/m^3 = \frac{(W_2 - W_1) \text{ X } 1000000}{V}$$

Where, PM_{10}= mass concentration of particle matter having less than 10 micron diameter, $\mu g/m^3$.

W_1 = initial weight of filter paper, in g

W_2 = final weight of filter paper, in g

V= volume of air sampled, m^3

10^6 = gram to microgram conversion

B. Monitoring and Analysis of $PM_{2.5}$ [Ambient]:

Reference Method: Monitoring and analysis of $PM_{2.5}$ in the ambient air was performed using the method given in "Guidelines for Measurement of Ambient Air pollutants Vol-1" by Central Pollution Control Board, India [31].

Calculation:

1) Average flow rate=$\frac{\text{Initial flow rate} \pm \text{final flow rate}}{2}$

2) Total volume of air sampled (TVA) in m^3 = $\frac{\text{Average flow rate (lit/min)X sampling time (in hr) X 60}}{1000\ ^3/\text{lit}}$

3) Concentration of $PM_{2.5}$ ($\mu g/m^3$) :

$$PM_{2.5} = \frac{(W_f - W_i) \text{ X } 10^6}{\text{TVA } (m^3)}$$

Where, $PM_{2.5}$ = Total mass concentration during sampling

W_i = initial weight of filter paper, in g

W_f = final weight of filter paper, in g

TVA = total volume of air sampled, m^3

$PM_{2.5} = \frac{\text{difference X } 10^6}{\text{Duration in hrs.}}$

C. Monitoring and Analysis of SO_x [Ambient]:

Reference Method: Monitoring and analysis of SOx in the ambient air was performed using the Modified West & Gaeke Method given in IS-5182 Part-2, published by Bureau of Indian Standards (BIS) [32].

Calculation:

$$So_x \text{ (ambient)} = \frac{\text{Optical Density X Factor X 25 (System) X 25(Sample)}}{\text{ST X Air Gas Pass}}$$

D. Monitoring and Analysis of NO_x [Ambient]:

Reference Method: Monitoring and analysis of NOx in the ambient air was performed using the Modified Jacobs & Hochheiser Method given in IS-5182 Part-6, published by Bureau of Indian Standards (BIS) [33].

Calculation:

$$NOx \text{ (ambient)} = \frac{\text{Optical Density X Factor X 25 (System) X 25(Sample)}}{\text{ST X Air Gas Pass X 0.82 (efficiency factor)}}$$

III. RESULTS AND DISCUSSION

The results of the study have been presented in **Table 1**. The concentrations of all four pollutants in ambient air in Summer season have been compared with the National Ambient Air Quality Standards (NAAQS) limits.

Table 1. Concentration of PM_{10}, $PM_{2.5}$, SO_x, NO_x in Ambient Air in Summer Season at GIDC-Pandesara

	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_x (µg/m³)	NOx (µg/m³)
NAAQS	**60**	**40**	**50**	**40**
GIDC-Pandesara				
Before Wind Direction	98	36.25	6.05	9.58
Near Balkishan D & P Ltd.	213.5	45	17.47	25.76
After Wind Direction	284	91.3	34.94	43.6

Figure 1. Graphical Representation of Concentration of PM_{10} , $PM_{2.5}$, SO_x, NO_x in Ambient Air in Summer at GIDC- Pandesara:

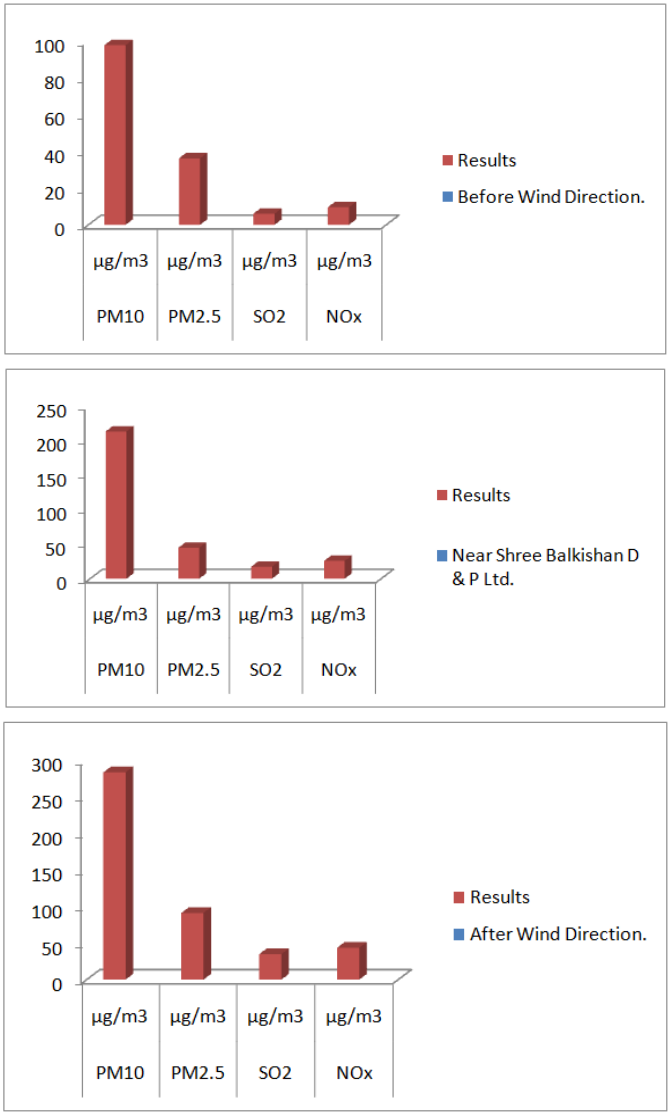
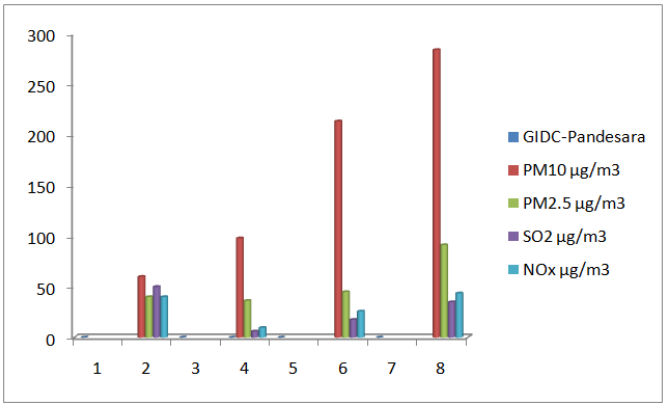


Figure 2. Comparison of Concentration of PM_{10}, $PM_{2.5}$, SO_x, NO_x in Ambient Air in Summer at GIDC-Pandesara with the NAAQS limits:



In the **Figure 2**; series 2, series 4, series 6 and series 8 on X-axis represent NAAQS, Before wind, Location specific (i.e., at Shree Balkishan D&P) and After wind concentrations of four pollutants respectively. It was found that PM_{10} and $PM_{2.5}$ were in higher concentration than the NAAQS limit for the after wind measurements, while SO_x and NO_x were below the limit.

As seen from the results, concentration of ambient air pollutants is higher for the after wind direction.

Thus, sampling from various types of industries located in various locations with wind direction (such as middle, left side of periphery and right side of periphery) was necessary to get the proper assessment.

IV. CONCLUSION

Comparison of concentrations of all the four pollutants viz. $PM_{2.5}$, PM_{10}, SO_x and NO_x with the National Ambient Air Quality Standards (NAAQS) limits revealed that PM_{10} and $PM_{2.5}$ were found to be higher in concentration especially for after wind direction measurements than the NAAQS while SO_x and NO_x were found to be lower than the NAAQS limit.

V. REFERENCES

[1]. World Health Organization, Ambient (outdoor) air quality and health-Fact Sheet, September-2016. [apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf]

[2]. Harikrishnan S., Pradeep S., Ramalingam M., Prasanna. N., Manivasagan V. 2012. Universal Journal of Environmental Research and Technology, Volume 2, Issue 4: 254-260.

[3]. Central Pollution Control Board, 2017. [http://cpcb.nic.in/air.php]\

[4]. Central Pollution Control Board Report, 2012. National ambient air quality status & trends in India-2010.

[5]. CPCB, 1999. Annual Report. [cpcbenvis.nic.in/annual_report/AnnualReport_4_annualreport1999-00.pdf]

[6]. CPCB, 2002. National Ambient Air Quality Status-2002. [cpcb.nic.in/upload/Publications/Publication_365_sec8_22.pdf

[7]. CPCB, 2009. National Ambient Air Quality Status-2009. [cpcb.nic.in/upload/Publications/Publication_514_airqualitystatus2009.pdf]

[8]. CPCB, 2011. National Ambient Air Quality Status & Trends-2011.[cpcb.nic.in/divisionsofheadoffice/pams/NAAQStatus_Trend_Report_2011.pdf]

[9]. CPCB, 2012. National Ambient Air Quality Status & Trends-2012.[www.cpcb.nic.in/divisionsofheadoffice/pams/NAAQStatus_Trend_Report_2012.pdf]

[10]. Chauhan, A., Pawar, M., Kumar R. and Joshi, P. 2010. Journal of American Science 6(9), 4-8.

[11]. Kumar Rakesh and Joseph Abba Elizabeth. 2006. . Environmental Monitoring and Assessment 176, 191-199.

[12]. Mahendra Kumar Tiwari, Mishra, R.M., Dwivedi, S. 2011. International Journal of Pharmacy and Life Sciences 2(12), 17.

[13]. Meenakshi, T., Mahadevan, A. 1991. Poll. Res. 10, 161-164.

[14]. Boralker, D.B., Tyagi, S.K., Singh, S.D. 1992. J. Ind. Air Environ. Monit. 19, 21-27.

[15]. Indrani Gupta. 2003. Indian J. Environ. Hlth. 45(3), 169-182.

[16]. Goyal, P. and Sidhartha. 2003. Atmospheric Environ. 37, 5423-5431.

[17]. Gurjar, B.R., Aadenne, J.A., Van Lelieveld, J. and M. Mohan. 2006. Atmospheric Environ. 40, 5663-5681.

[18]. Chelani, A.B. and S. Devotta. 2007. Environ. Monit. Assess. 125, 257-263.

[19]. Jayaraman, G. 2007. 135, 313-325.

[20]. Sharma, Pandey, R., Maheswari, M., Sengupta, B., Shukla, B.P. and Mishra, A. 2003b.

International Journal on Energy for a Clean Environment 4, 83-98.
[21]. Chandrashekar, G.E., Ravichandran and Neetha Shetty. 1996. International Journal of Environment and Pollution 17(3), 184-188.
[22]. Karnataka State Pollution Control Board, Report, 2006-2013. [kspcb.gov.in/Website%20Air%20and%20Noise%2quality.pdf]
[23]. Karnataka State Pollution Control Board, Report, 2015-2016. [kspcb.kar.nic.in/AAQ-NOISE-Bangalore%20City.pdf]
[24]. Kumar, A., Garg, A., Pandel, U. 2011. Nature and Science 9(6), 56.
[25]. Sharma, S., Sharma, K. 2016. International Research Journal of Environment Sciences 5(1), 43-48.
[26]. Shukla, A., Mishra, R., Farida, M. 2010. Institute of Town Planers, India, Journal 7(4), 45-56.
[27]. Verma A. K., Saxena A., 2015, J. Environ. Res. Develop. 9(4), 1176-1188.
[28]. Ahmad, I., Sharma, H. K. 2016. Oct. Jour. Env. Res. 2(3), 227-238.
[29]. Sharma, H. K., Ahmad, I., Tantry, I. A., Jadon, N. 2016. Res J. Chem. Environ. Sci. 4 (3), 79-87.
[30]. Bureau of Indian Standards (BIS), IS-5182 [part-23] 2006.https://archive.org/details/gov.law.is.5182.23.2006
[31]. Central Pollution Control Board, India, Guidelines for Measurement of Ambient Air pollutants Vol-1. [www.cpcb.nic.in/NAAQSManualVolumeI.pdf]
[32]. Bureau of Indian Standards (BIS), 2001. IS 5182 Part 2, Method of Measurement of Air Pollution: Sulphur Dioxide. [https://archive.org/details/gov.in.is.5182.02.2001]
[33]. Bureau of Indian Standards (BIS), 2006. IS 5182 Part 6, Method of Measurement of Air Pollution: Oxides of Nitrogen. https://archive.org/details/gov.in.is.5182.06.2006