"AIR QUALITY INDEX OF BHOPAL CITY"

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Abstract: This study was carried out between 2017 and 2018 to evaluate the Ambient Air Quality Index of the city of Bhopal in Madhya Pradesh, India. In all, 18 locations in the city of Bhopal were chosen for ambient air quality monitoring of seven pollutants, including lead (Pb), nitrogen dioxide (NO2), sulphur dioxide (SO2), ozone (O3), and the following: PM10, PM2.5, SO2, NO2, and NH3. The study found that, while PM10 and PM2.5 levels were consistently found to be higher than the National Ambient Air Quality Standards 2009 at all monitoring locations, average concentrations of gaseous pollutants, such as NOx, SO2, O3, and NH3, were found to be well within standard limits at all chosen locations. In the city of Bhopal, the Air Quality Index ranged from excellent (63.90–96.38) at two locations to bad (202.26–218.05) at two locations. During the research period, the overall ambient Air QualityIndex of the city of Bhopal was found to be moderate.

Keywords: Gaseous Pollutants, Pb, Air Quality Index, Ambient Air Pollution, PM10, PM2.5

I. INTRODUCTION

Due to a variety of factors, including urbanization, transportation, industrialization, power generation, and human activities, ambient air pollution in metropolitan areas is a major global problem. According to Bortnick et al. (2002), an "Air Quality Index" is a single number used to report theair quality in relation to its impacts on human health. The effects of air pollution on human health, agriculture, ecology, construction, and climate are now well established. It can cause cancer and has an impact on the reproductive, cardiovascular, cardiopulmonary, and respiratory systems. The Air Quality Index is a mechanism for clearly explaining the state of the air to the general public. It simplifies the complicated information about different contaminants in the air into a single number (index value), nomenclature, and colour. Six AQI classifications exist: excellent, acceptable, moderately contaminated, poor, extremely poor, and severe. Each of these categories is chosen based on the levels of air pollutants found in the ambient environment and their predicted effects on human health, or "health breakpoints." Although the air quality is good, a very small percentage of people may have moderate health concerns from some contaminants. AQI levels between 15 and 200 are unhealthy. 201-300 is the VeryUnhealthy AQI range. A dangerous AQI isone that is higher than 300 and can range between extremely bad (300–400) and severe (401–500 and >500). Particulates area broad term for any atmospheric material that is not a gas, including suspended droplets, solid particles, and mixtures of the two. Oxides of nitrogen contribute to pneumonia, asthma, and other respiratory ailments. Bronchitis, acid rain, sulfurous smog, and decreased vision are all caused by increased levels of sulfur oxides, in addition to bronchitis. According to Balasanmugam et al. (2012), the combination of particulate matter and sulfuroxides is more damaging than each one by itself. By solar reaction, ozone is created in the upper atmosphere. This gas diffuses downward in small concentrations, where it becomes the main source of concern for airpollution.

II. METHODOLOGY

Study Area The capital of Madhya Pradesh, Bhopal, is located in the center of India between N-latitude 23o07' and 23o20'and E-longitude 77o19' and 77o31'. It is well linked to all parts of the nation. Due toits numerous man-made and natural lakes, Bhopal is sometimes referred to as the "Lake City" and is one of India's greenest cities. Bhopal is a growing city that is home to a number of marketplaces, parks, schools, hospitals, and malls, among other amenities. The study took place in a total of 18 locations in 2017–2018. Table 1 and Figure 1 indicate the specifics of every monitoring station.

Table1: Selected Ambient Air Monitoring Locations in Bhopal City

S.N.	Code	Monitoring locations
1	A1	Bairagharh
2	A2	Chhola Road
3	A3	Sultania Road
4	A4	Karod
5	A5	BHEL Area
6	A6	Govindpura
7	A7	Anand Nagar
8	A8	Arera Colony
9	A9	Saket Nagar
10	A10	Katara Hills
11	A11	Vidhya Nagar
12	A12	Babdiya Kalan
13	A13	Misrod
14	A14	Gehun Kheda Kolar
15	A15	WALMI Kolar
16	A16	Kotra
17	A17	T T Nagar
18	A18	VanVihar Colony

2.1 Monitoring and Analysis

The ambient air sampler Envirotech APM-460 BL and APM-540 machines drew ambient air through a size-selective intake. Particulate matter less than 10 m (PM10), particulate matter less than 2.5 m (PM2.5), sulfur dioxide (SO2), and nitrogen dioxide (NO2) were examined on a four-hourly basis during a 24-hour air monitoring period in eight hours at selected sites. Throughout the whole monitoring period, ozone (O3) and ammonia (NH3) were observed on an hourly basis. Various parameters were examined in the samples that had been obtained using conventional techniques advised by the Central Pollution Control Board of India (Guidelines, CPCB, 2011). By using a gravimetric approach, particulate matter (PM10 and PM2.5) in ambient air was evaluated. The ambient air was examined for nitrogen dioxide and sulfur dioxide using the West & Geake and Jacob & Hochheiser methods, respectively. By using chemical, indophenol blue, and atomic absorption spectroscopy techniques, the ambient air's concentrations of ozone, ammonia, and the heavy metal lead were evaluated, respectively.

III. RESULT AND DISCUSSION

In the form of the Air Quality Index (AQI),the cumulative impact of the concentration of distinct contaminants in ambient air is frequently reported as a single number. At every monitoring station in the city of Bhopal, the air pollution index was determined for each parameter. Table 2 andFigure 2 show the detected levels of seven air contaminants.

AQ sub-index also evaluated for seven pollutants (PM10, PM2.5, NO2, SO2, O3, NH3, and Pb)are depicted in table 3.

At two monitoring stations (A2 and A6), PM2.5 was found to be in the bad category(200–300), which denotes air quality that is hazardous and potentially harmful to human health.

Aside from sites A8 and A10, all locations had moderate levels of PM10 (100–200). The SO2, NO2, O3, NH4, and Pb air pollution indexes were determined to be in the acceptable range (0–100), suggesting that the air is clean and not detrimental to human health. Table 4 shows the range and distribution of air quality at all the chosen Bhopal city monitoring stations.

Table 2: Concentration of air pollutants of Bhopal city

S.N	Sampling Locations	NO_2 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	Pb ($\mu g/m^3$)
1	A1	23.2	0	109	51	27.6	0	0.001
2	A2	47.6	0	137	91	21.0	0	0.001
3	A3	16.9	0	197	84	36.0	0	0.001
4	A4	16.9	0	193	72	12.0	0	0.001
5	A5	45.5	0	164	59	23.5	0	0.001
6	A6	17.8	0	215	96	12.9	0	0.002
7	A7	13.7	0	153	66	19.0	0	0
8	A8	9.8	0	64	25	14.1	10.5	0
9	A9	43.9	0	174	44	34.8	0	0
10	A10	33.6	0	96	25	43.1	3.3	0
11	A11	18.9	0	142	54	19.0	1.55	0.001
12	A12	12	0	194	86	24.0	3.54	0.001
13	A13	19.4	0	114	56	25.4	0.25	0.001
14	A14	16	0	163	47	21.3	20.6	0
15	A15	19.9	0	187	41	11.0	0	0
16	A16	8.3	0	169	68	16.0	2.35	0
17	A17	33.9	0	125	56	17.0	0	0
18	A18	21.1	0	119	30	9.0	0	0

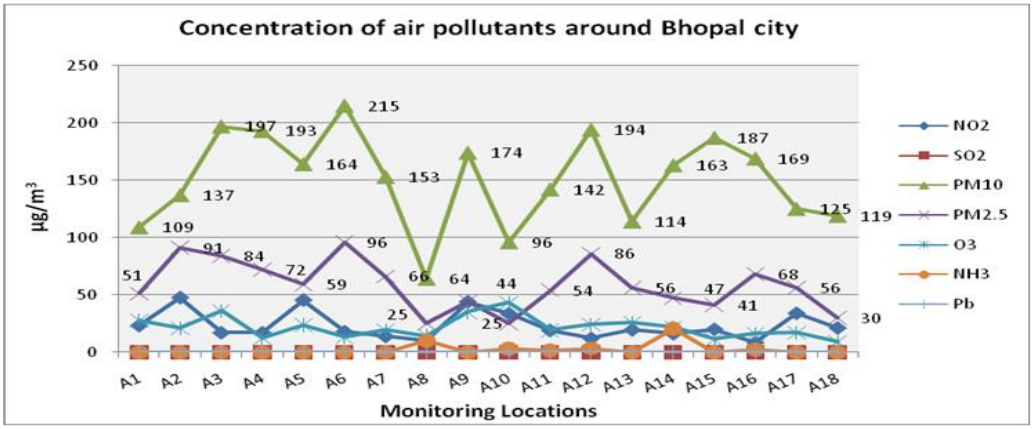

Figure 1: Concentration of air pollutants of Bhopal city

Table 3: Sub Index and Air Quality Index of air pollutants in Bhopal city

S.N.	Monitoring Locations	NO_2	SO_2	PM_{10}	$PM_{2.5}$	O_3	NH_3	Pb	AQI	Category
1	A1	29.00	0.00	106.08	84.44	27.60	0.00	0.10	106.08	MODERATE
2	A2	59.25	0.00	124.58	202.26	21.00	0.00	0.10	202.26	POOR
3	A3	21.13	0.00	164.36	179.43	36.00	0.00	0.10	179.43	MODERATE
4	A4	21.13	0.00	161.72	138.51	12.00	0.00	0.10	161.72	MODERATE
5	A5	56.63	0.00	142.91	98.29	23.54	0.00	0.10	142.91	MODERATE
6	A6	22.25	0.00	176.24	218.05	12.90	0.00	0.20	218.05	POOR
7	A7	17.13	0.00	135.59	117.06	19.00	0.00	0.00	135.59	MODERATE
8	A8	12.25	0.00	63.90	41.50	14.05	2.63	0.00	63.90	SATISFACTORY
9	A9	54.63	0.00	149.18	72.97	34.82	0.00	0.00	149.18	MODERATE
10	A10	42.00	0.00	96.38	41.14	43.15	0.83	0.00	96.38	SATISFACTORY
11	A11	23.63	0.00	127.86	89.85	19.00	0.39	0.10	127.86	MODERATE
12	A12	15.00	0.00	162.15	184.75	24.00	0.89	0.10	184.75	MODERATE
13	A13	24.25	0.00	109.49	93.23	25.42	0.06	0.10	109.49	MODERATE
14	A14	20.00	0.00	141.59	78.02	21.30	5.15	0.00	141.59	MODERATE
15	A15	24.88	0.00	157.76	67.14	11.00	0.00	0.00	157.76	MODERATE
16	A16	10.38	0.00	145.88	124.87	16.00	0.59	0.00	145.88	MODERATE
17	A17	42.38	0.00	116.79	93.23	17.00	0.00	0.00	116.79	MODERATE
18	A18	26.38	0.00	112.88	49.32	9.00	0.00	0.00	112.88	MODERATE

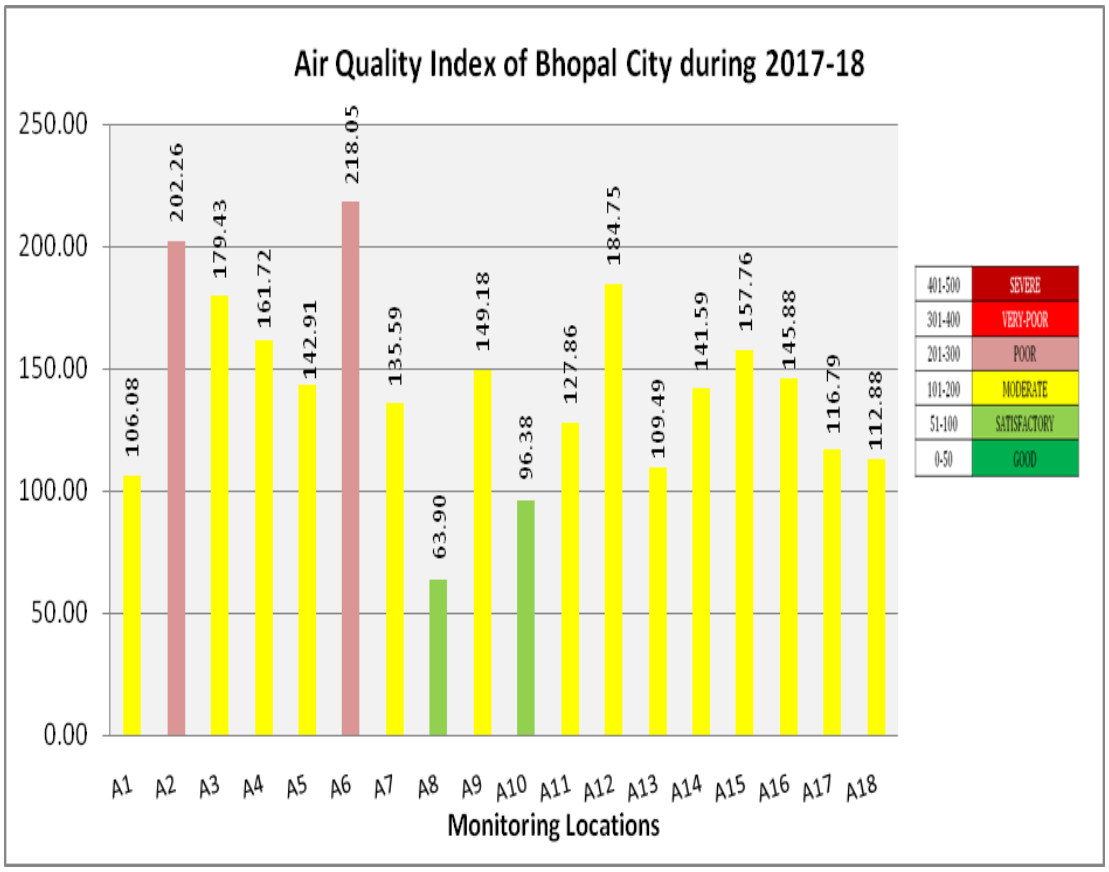

Figure 2: Air Quality Index of Bhopal City during year 2017-18

IV. CONCLUSION

It showed that during the research period, Bhopal's ambient air quality index was generally considered moderate. At two places in Bhopal city, the air quality index was bad (202.26-218.05), at fourteen locations it was moderate (106.08-184.75), and at two locations it was good (63.90- 96.38). A moderate level of air pollution is tolerable, but for a very small number of people who are exceptionally sensitive to it, certain contaminants may pose a moderate health risk. While the general population is unlikely to be affected by this AQI range, individuals with lung disease, older adults, and children are more at risk from ozone exposure than individuals with heart and lung disease, older adults, and children are from airborne particle exposure.

V. REFERENCES

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