International Journal of Scientific Research in Science and Technology
Available online at : www.ijsrst.com
Print ISSN: 2395-6011 | Online ISSN: 2395-602X
doi : https://doi.org/10.32628/IJSRST52411164

The Examination of different Air Constituents to Ascertain Pune City's Air Quality

Dr. Nidhi Mishra

*[1]Electrical Engineering Department, S. P. P. U/JSPM's BSIOTR, Pune, Maharashtra, India

ARTICLEINFO

Article History:

Accepted: 01 Feb 2024
Published: 06 Feb 2024

Publication Issue :
Volume 11, Issue 1
January-February-2024
Page Number :
420-424

ABSTRACT

The city of Pune experiences poor air quality, leading to research of various air constituents in order to assess the overall quality of the air. Significant pollutants such as PM2.5, PM10 (RSPM), NO2, O3, SO2, and CO are addressed in this analysis, along with their causes and consequences. Exceeding WHO standards, levels of PM2.5 constitute a severe problem; NO2 and O3 levels constitute grounds for concern. In order to mitigate such pollutants and obtain cleaner air in Pune City, the research stresses the necessity for more difficult emission control measures, the promotion of public transportation and electric vehicles, and the supervision of industrial and construction activity.

The objective of this research is to evaluate Pune City's air quality and offer insights by thoroughly examining various air quality elements. An extensive tracking strategy is analyzed for three years (2022, 2023, and 2024), considering air quality components like RSPM (PM10), PM-2.5,NO2, O3, etc. Various graphs are analyzed for the above-mentioned years and observe the growth in air quality index for Pune city. In the last three years, data has been collected from government websites on a monthly basis, and various graphs have been plotted by considering their average value. All the graphs show an increase in the air quality index. The study's findings provide valuable new information on the present state of the air quality in Pune City and emphasize the urgent need for effective air quality management measures. To mitigate air pollution, maintain public health, and maintain environmental sustainability, initiatives must concentrate on emissions control, planning for cities, enhancing public transportation, and creating green infrastructure in Pune City.

Keywords: Pune air quality, PM-10, PM2.5, NO2, O3, air pollution sources, emission control

I. INTRODUCTION

Pune City, located in the Indian state of Maharashtra in the west, is an urban hub that is expanding quickly. It is distinguished by its developing industrialization, rising vehicle traffic, and quick urbanization. Air quality issues have become a major environmental challenge as the city's population and economic activity continue to grow. Pune City's declining air quality seriously jeopardizes the public's health, the sustainability of the environment, and the general standard of living of its citizens.

The main causes of air pollution in Pune City include several human activities, such as burning biomass, burning home fuels, industrial processes, construction, and vehicle emissions. Pollutants such as particulate matter (PM), nitrogen dioxide (NO2), sulfur dioxide (SO2), carbon monoxide (CO), volatile organic compounds (VOCs), and heavy metals are released into the atmosphere as a result of these operations. Numerous health issues have been connected to exposure to these pollutants, such as cardiovascular and respiratory conditions, as well as early mortality. Even though people are becoming more conscious of the negative effects of air pollution, there are still not many thorough studies looking at the dynamics, sources, and distribution of air pollutants in Pune City. As a result, rigorous evaluations are desperately needed to determine the priority areas for intervention and mitigation as well as to assess the current status of air quality. By carefully examining several air elements to determine Pune City's air quality, this study seeks to close this gap. Examining several components and their interactions is necessary to comprehend Pune's air quality.

Important Air Components:

PM2.5: Fine particulate particles less than 2.5 microns (μm) in diameter. extremely harmful to respiratory well-being.

PM10: Particulate particles with larger size (2.5 to 10 μm). continues to harm the lungs and exacerbate asthma.

Nitrogen Dioxide (NO2): Air pollution that damages lungs and adds to smog.

Ozone (O3): Irritating to the eyes and lungs, it is created when contaminants react chemically.

Sulfur Dioxide (SO2): Air pollution that harms plants and irritates the lungs.

Carbon Monoxide (CO): Partial combustion lowers the blood's ability to carry oxygen.

Methods of Examination:

1. Continuous data on key contaminants include PM2.5, NO2, O3, SO2, and CO can be obtained from air quality monitoring stations.
2. Chemical analysis is the thorough examination of particular pollutants and where they originate.
3. Identify the main sources of pollutants (e.g., automobiles, factories) using source allocating studies.
4. Satellite imaging: an in-depth review of the movement and distribution of pollutants.

Table I represents AQI and their respective concentration ranges:

TABLE I

Pollutant	**Concentration Range (micrograms per cubic meter or parts per million)**
Particulate Matter (PM10)	0-50 Good 101-150 Moderate 151-200 Unhealthy 201-300 Very Unhealthy 301-500 Hazardous
Particulate Matter (PM2.5)	0-50 Good 101-150 Moderate 151-200 Unhealthy 201-300 Very Unhealthy 301-500 Hazardous
Ground-level Ozone	0-50 Good 101-150 Moderate

O3	151-200 Unhealthy 201-300 Very Unhealthy 301-500 Hazardous
Nitrogen Dioxide (NO2)	0-50 Good 101-150 Moderate 151-200 Unhealthy 201-300 Very Unhealthy 301-500 Hazardous
Carbon Monoxide (CO)	0-50 Good 101-150 Moderate 151-200 Unhealthy 201-300 Very Unhealthy

TABLE III

AQI Category	AQI Range	Health Implications
0-50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.
51-100	Satisfactory	Air quality is acceptable; may be of concern for some, but overall, air quality poses little or no risk.
101-200	Moderate	Unhealthy for sensitive individuals. Members of sensitive groups may experience. health effects, but the general public is less likely to be affected.
201-300	Poor	Everyone may begin to experience health. effects; members of sensitive groups may experience more serious health effects.
301-400	Very Poor	Health alert: everyone may experience. More serious health effects.
401 and above	Severe	Health warnings of emergency conditions: the entire population is likely to be affected.

Table II shows range of air quality index and their impact on health.

II. LITERATURE REVIEW

1. Air Quality Trends and Health Impacts in Indian Cities

Numerous studies have brought attention to how rapidly increasing industrialization, urbanization, and vehicle emissions are causing air quality in Indian cities—including Pune—to deteriorate. High levels of nitrogen dioxide (NO2) and particulate matter (PM10 and PM2.5) have been associated with higher mortality rates in urban populations as well as cardiovascular and respiratory disorders (Gurjar et al., 2016; Khare & Kulkarni, 2018).

2. Review of air quality in Pune city

Pune's air pollution has gotten worse, according to a July 2010 Environment Status Report (ESR) research. There is more respiratory suspended particle matter (PM10) in the air than is considered safe for the country. Approximately 93,000 commercial buildings, such as hotels, shopping centers, and hospitals, release 204 tons of PM10 annually. Pune's transportation sector is the main source of pollution. In the last three years, there has been a 12.15% growth in its emissions. Maharashtra currently has 31 National Ambient Air Quality Monitoring Stations (NAQMS).There are four in Pune: Bhosari, Nal Stop, Karve Road, Pimpari-Chinchwad, and Swarget. Every day, SO2, NOx, and RSPM are measured .(Jaising gadekar,2017).

3. Spatial and Temporal Variability of Air Quality Parameters:

Research examining the temporal and spatial variability of air quality measures has shown that there is a great deal of variation in the amounts of

pollutants in metropolitan areas. The spatial distribution of air pollutants is influenced by factors like land use patterns, meteorological conditions, and proximity to pollution sources; long-term, seasonal, and diurnal trends show how emissions, atmospheric processes, and environmental factors interact (Kumar & Gupta, 2017; Sonawane et al., 2021).

4. Air Quality Monitoring and Modeling Techniques:

Developments in satellite remote sensing, low-cost sensor networks, and ground-based stations have made it easier to conduct thorough evaluations of air quality at different time and space scales. Furthermore, our capacity to simulate and forecast air pollution levels has improved due to the integration of dispersion models, chemical transport models, and machine learning algorithms; this has supported decision-making for air quality management (Singh et al., 2018; Mandal et al., 2020).

5. Policy Interventions and Mitigation Strategies:

At local, national, and worldwide levels, policy interventions aimed at improving air quality have been put into practice. These interventions have included public awareness campaigns, technology advancements, regulatory measures, and sustainable urban design projects. However, stakeholder participation, enforcement procedures, resource allocation, and integration with larger environmental and public health agendas are all necessary for these measures to be effective in reducing air pollution (Jain et al., 2019; Chakrabarty et al., 2021).

Image of Dataset for year 2022

r.No.	Date	SO2 µg/m3	NOx µg/m3	RSPM µg/m3	AQI
1	01-01-2022	17	78	144	129
2	03-01-2022	19	59	132	121
3	14-01-2022	15	73	105	103
4	15-01-2022	19	51	144	129
5	17-01-2022	17	36	176	151
6	18-01-2022	16	65	121	114
7	19-01-2022	16	71	116	111
8	20-01-2022	8	39	207	171
9	22-01-2022	11	86	59	106
10	24-01-2022	9	39	199	166
11	25-01-2022	8	91	182	155
12	28-01-2022	11	101	145	130
13	29-01-2022	36	104	177	151

Image of Dataset for year 2023

r.No.	Date	SO2 µg/m3	NOx µg/m3	RSPM µg/m3	AQI
247	02-01-2023	6	60	95	95
248	03-01-2023	10	64	103	102
249	04-01-2023	10	72	129	119
250	06-01-2023	14	54	154	136
251	07-01-2023	13	62	158	139
252	09-01-2023	39	63	202	168
253	10-01-2023	18	216	217	236
254	11-01-2023	46	85	141	127
255	12-01-2023	33	66	120	113
256	13-01-2023	32	54	88	88
257	14-01-2023	43	95	146	131
258	16-01-2023	6	85	168	145
259	17-01-2023	34	97	121	117
260	18-01-2023	8	88	162	141
261	19-01-2023	9	95	159	139

The above dataset is obtained from source: https://www.aqi.in/in/dashboard/india/maharashtra/pune

TABLE IIIII

Year	SO2	Nox	RSPM	AQI
2022	16.68	44.68	88.99	87.79
2023	12.07	56.07	98.8	103.35
2024	30	55.6	148	155

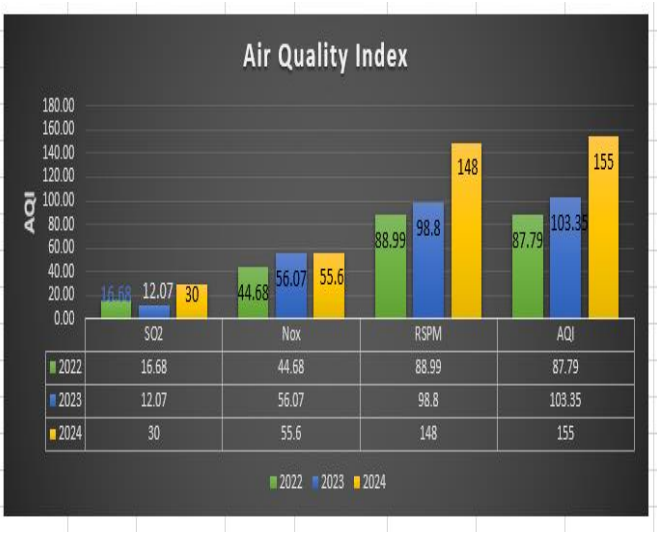

Figure 1 Average value of SO2,NOx ,RSPM and AQI

Table III shows show the average values of SO2, NOx, and RSPM for three years i.e 2022,2023 and 2024. Values of SO2, NOx, RSPM and AQI are recorded for the year of 2022,2023 ,and 2024.Fig:1 shows the year wise variations in air quality constituents.

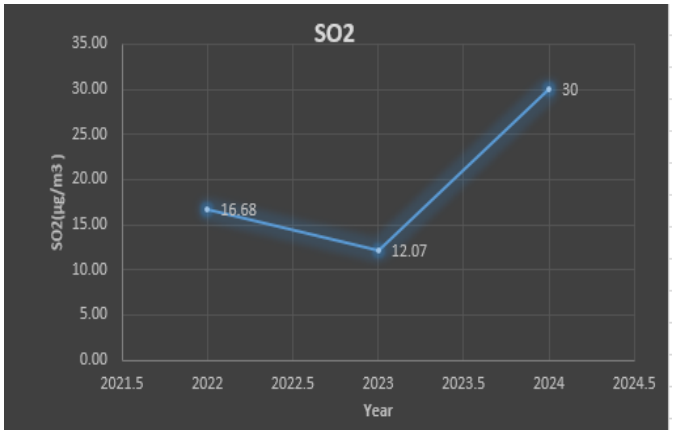

Figure 2 Average value of SO2 vs Year

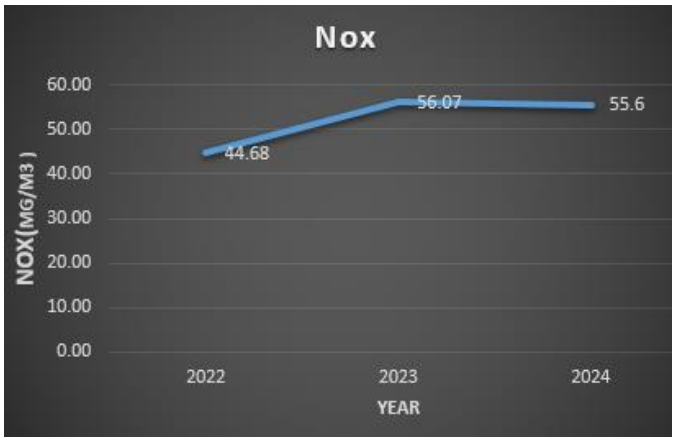

Figure 3 Average value of NOx vs Year

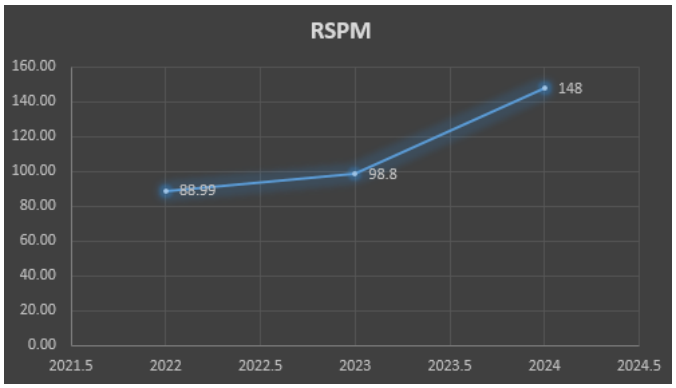

Figure 4 Average value of RSPM vs Year

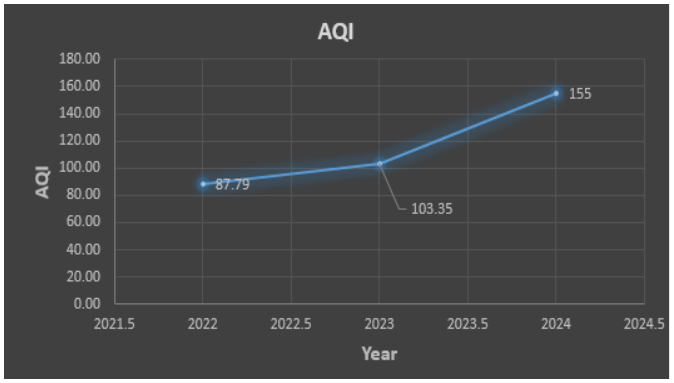

Figure 5 Average value of AQI vs Year

From the above figures we can observe that there are continuous growth in AQI as the year passes due to growth in air constituents like SO2, NOX, RSPM etc. Prolonged heart disease, asthma issues, and other adverse health effects may arise from excessive amounts of RSPM in the air. In Pune, vehicle emissions lead the way in terms of RSPM emissions, followed by industrial processes, dust from building projects, and other sources such as burning biomass.

III. CONCLUSION

It can be seen that the levels of NOx, SO2 and RSPM are increasing drastically. AQI is also increasing due to increase in its constituents that are NOx, SO2 ,RSPM .This is very serious issue .The main and very dangerous concern is RSPM (respirable suspended particulate matter. They are nearly twice the normal range. The examination of different air constituents indicates that high PM2.5 levels are the primary cause of Pune's current bad air quality. People face serious health hazards as a result of this. To understand Pune City's air quality and its impact on the environment and public health, it is crucial to look into various air aspects.

We may discover more about the causes of air pollution and the potential threats to health associated with exposure to multiple pollutants through analysis of particulate matter (PM10 and PM2.5), ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2).

The findings show the need it is to take action on Pune City's air quality problems in order to maintain citizens' health and welfare. Significant risks to health, including as asthma, heart disease, and other adverse health effects have been associated with high levels of pollution in the air. Pune may contribute toward improved air quality, healthier communities, and a more environmentally friendly future through strengthening public health services, reducing emissions from various sources, and providing priority to sustainable development approaches.

REFERENCES

[1] Indian Institute of Tropical Meteorology. "SAFAR - India (Pune Observational Network)," 2019. http://safar.tropmet.res.in/

[2] MONITORING %20SYSTEM-10-3-Details.

[3] Times of India, "Pune's Air Quality Continues to Worsen Over the Years", https://timesofindia.

[4] indiatimes.com/city/pune/air-qualitycontinues-to -worsen-over-the-years/article show/68086 815. cms.

[5] World Health Organization. "Air Quality Guideline Values," 2018. https://www.who .int/ news-room/fact-

[6] sheets/detail/ambient- (outdoor) -air-quality-and-health.

[7] Pune Municipal Corporation, "PMC's efforts for Air Quality and Climate Resilience" Press Note (2019)

[8] https://www.pmc.gov.in/en/ pmc-mouair-pollution-control.

[9] CPCB, Air Quality: "National Air Quality Monitoring Program", https://cpcb.nic.in/list-ofnon-attainment-cities/.

[10] https://punemirror.com/pune/cover-story/gasping-for-fresh-air/cid1697835274.htm

[11] Nidhi Sharma , "Forecasting air pollution load in Delhi using data analysis tools", ScienceDirect, 132 (2018) 1077–1085.

[12] Kazi Erum , Kulkarni S. D," Study of Air quality in different areas of Pune City", IJCRT | Volume 8, Issue 3 March 2020 | ISSN: 2320-2882

Cite this article as :

Dr. Nidhi Mishra , "The Examination of different Air Constituents to Ascertain Pune City's Air Quality", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 11 Issue 1, pp. 420-424, January-February 2024. Available at doi : https://doi.org/10.32628/IJSRST52411164

Journal URL : https://ijsrst.com/IJSRST52411164