Air Pollution Monitoring in Pune City

Rohan S Towar[1], Keerthi Gurani[2], Renuka Binayake[3]
[1]*U.G Student Civil Department, JSPM's Imperial College of Engineering & Research, Pune, India*
[2,3]*Professor Civil Department, JSPM's Imperial College of Engineering & Research, Pune, India*

***Abstract*— The rapid growth in motor vehicles activity in India and other rapidly industrializing low-income countries is contributing to high levels of urban air pollution, among other adverse socio-economic, environmental, health and welfare impacts. Air Pollution in many of India's cities exceeds national and international standards, and effective pollution control strategies require knowledge of the sources that contribute to air pollution and their spatiotemporal variability. In this study, we examine the influence of a single pollution source, outdoor biomass burning, on particulate matter (PM) concentrations, So2, Nox, RSPM, SPM of locations in Pune such as PCMC, Nal Stop & Swargate. During COVID-19 Pandemic whole country is gone through Lock down and there were huge restrictions laid down on vehicular movement. In this lock down period National Highways, Indian railways were close historically. These pandemic has made the worst condition on entire Indian Subcontinent. Only good outcome from this pandemic is sharp decline in air pollution. In this study we will compare the pollution level in Pune City before lockdown & during lockdown. The results obtained from this study indicate the air quality index of Pune city is increasing day by day and this needs further assessment and application effort in order to control this growth.**

Index Terms: AQI, NOx, SO2, Covid-19, Air Pollution.

I.INTRODUCTION

Air Pollution is one of the serious problems in the world especially in urban areas of developing countries due rapid growth of population, increase in number of vehicle and industrialization. Motor vehicle have been regarded as the primary cause of air pollution in the urban areas and account for 60 to 70% of the pollution found in the urban environment. SO2, NO2, SPM and RSPM are major air pollutants in India. The studies on air pollution in large cities of India showed that ambient air pollution concentrations are at such levels where serious health effects are possible. Continuous rise of population along with the lack of suitable measures for air pollution control means that there is a great potential that conditions may worsen in future in Indian cities. These all pollutants may pose harmful effect on human health such as cardiovascular and respiratory disease, Neurological impairments, increased risk of preterm birth and even mortality and morbidity. Ambient air quality monitoring programme are needed to determine the existing quality of air, evaluation of the effectiveness of control programme and to develop new programme. Sources of air pollution include products of combustion such as nitrogen oxides (Nox), carbon oxides (Cox), sulphur oxides (Sox). In the city centre's especially on highly congested streets, traffic can be responsible for as much as 90-95% of the ambient CO levels, thereby posing a significant threat to human health and natural resources. Within Pune region air pollution monitoring shows that national air quality standards for particulate matter are regularly exceeded.

II. AIM & OBJECTIVES

The main aim of this project is to compare AQI (2020 & 2021) in few places in Pune City.

The Primary objectives are:

1 To check the quality of air in three locations of Pune City.
2 To compare PRE-lockdown & DURING-lockdown air pollution in Pune city.
3 To asses the effectiveness of pollution control programmes.

III. LITERATURE REVIEW

Milind R. Gidde, Pravin P.Sonawane (2012) [1] investigated the relation between air quality and traffic with respect to Pune city from Jan 2008 to Dec 2011. Vehicle count and air quality was analyzed. Analytical and statistical method was applied. It was

found that the strong correlation of increasing vehicles with nitrogen oxides (NOx), sulphur dioxide (SO2) and suspended particulate matters (SPM). Study shows that there is tremendous growth in vehicles from 2008 to 2011. Particulate matter (PM10), NOx concentrations levels were exceeding standards. Study found that there is increase in SO2 concentration levels. Air quality correlation also analyzed with the fuel types and it was observed that petrol vehicles contribute more pollution than diesel.

R. Gunasekaran (et al.2012) [2]the main objective of this study is to monitor the air quality of Salem Swadeswari College, Tamil Nadu area for the period of April 2011 to March 2011 and it has been shown that this area has no serious pollution issues related to the pollutants as Sulfur Dioxide, Oxides of Nitrogen and Suspended Particulate Matter because their annual average concentration are within the range of national standards. But the annual average concentration of the pollutant PM10 is slightly higher than the levels of national standard. Also the monthly 24- hour average concentration of PM10 in the same year were crossed the national standard level except during July to October.

R. E. Lamare and S. S. Chaturvedi (2014) [6]studied concentration of RSPM, NRSPM and TSPM Shillong, Meghalaya. Sampling was done in April, 2010. The concentration of RSPM, NRSPM and TSPM at Dhankheti Junction varies from 81.24 µg/m3 to 261.43 µg/m3 ; 73.17 µg/m3 to 265.54 µg/m3 and 212.49 µg/m3 to 467.94 µg/m3, respectively. Overall RSPM and TSPM concentrations were found to exceed the permissible limit. Based on the results obtained, the concentrations of particulate matter in the ambient air at Dhankheti Junction was mainly by vehicles. However, their concentrations at NEHU campus were found comparatively lower and are within the limit.

IV. METHODOLOGY

We have collected data from previous research papers & literature papers. The various aspects of air quality monitoring network such as, which pollutants should be monitored, location of monitoring station and the various techniques of monitoring. The legal requirements in Pune for carrying out ambient air quality monitoring are also discussed. These requirements serve as basis on which objectives of ambient air quality monitoring are determined. The ambient air quality monitoring network involves measurement of a number of air pollutants at number of locations in the country so as to meet objectives of the monitoring.

Site Selection:-Three locations PCMC, Nal Stop and Swargate were selected for the analysis of air pollutants.

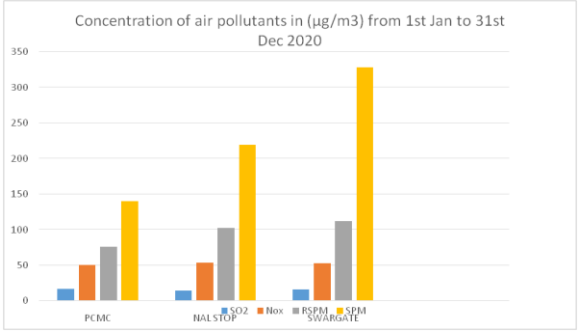
Data Collection:- Secondary data was collected from MPCB(Maharashtra Pollution Control Board), PMC.

V. OBSERVATION & RESULTS

Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour. There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe.

AQI	Remark	Color Code	Health Impacts
00 To 50	Good		Minimal Impact
51 To 100	Satisfactory		Minor Breathing Discomfort to Sensitive People
101 To 200	Moderate		Breathing Discomfort to people with Lungs, Asthama and Heart diseases.
201 To 300	Poor		Breathing Discomfort to most people on prolong exposure
301 To 400	Very Poor		Respiratory illness on prolong exposure
401 To 500	Severe		Affect healthy people and seriously impact those with existing diseases

Table 1: Air Quality Standards of CPCB

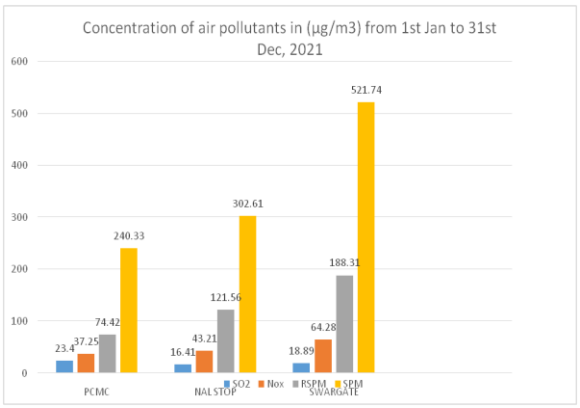


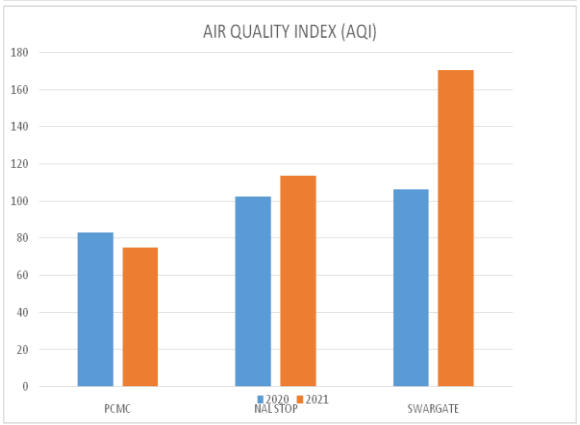
It was found that SO2 concentration in PCMC was found to be 16.57 µg/m3 in 2020 & 23.40 µg/m3 in 2021. Nal Stop showed SO2 concentration of 14.24 µg/m3 in 2020 & 16.41 µg/m3 in 2021 whereas the concentration of SO2 was found to be 15.68 µg/m3 in 2020 & 18.89 µg/m3 in 2021.

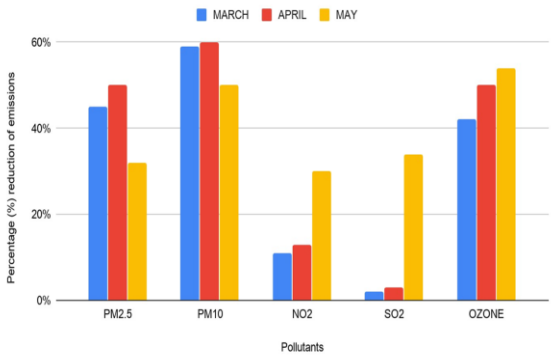
NOx concentration in PCMC is found to be 50.48 µg/m3 in 2020 & 37.25 µg/m3 in 2021. NOx in Nal Stop was found to be 53.55 µg/m3 in 2020 & 43.21 µg/m3 in 2021. At swargate NOx comcentration was showed 53.12 µg/m3 in 2020 & 64,28 µg/m3 in 2021.

RSPM concentration in PCMC was found 76 µg/m3 in 2020 & 74.42 µg/m3 in 2021 whereas concentration of RSPM at Nal stop was found 102.86 µg/m3 & 121.56 µg/m3 in 2020 & 2021 respectively. At Swargate concentration of RSPM was to be found 112.17 µg/m3 in 2020 & 188.31 µg/m3 in 2021.

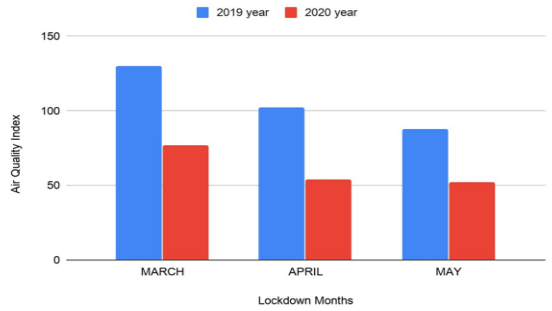
SPM concentration at PCMC was found to be 140.18 µg/m3 in 2020 & 240.33 µg/m3 in 2021. At Nal stop concentration of SPM was found 219.60 µg/m3 in 2020 & 302.61 µg/m3 in 2021.Swargate showed SPM concentration of 328.35 µg/m3 & 521.74 µg/m3 in 2020 & 2021 respectively.







Percentage Reduction (%) in Emissions in 2020 as Compared to 2019



Air Quality Index (AQI) Comparison in 2019 & 2020 in lockdown months

VI. CONCLUSION

At PCMC, Nal Stop & Swargate Air Quality Index was observed for year 2020 & 2021. Swargate area was found to be having higher concentration of pollutants as compared to PCMC & Nal Stop. The air pollution at Swargate & Nal Stop in 2021 is more than year 2020.

The observations in this study are very helpful to understand the lowest limit of all criteria pollutants during lockdown while all activities are restricted, the results are very promising and give hope to reduce pollutant concentrations to some extent by taking a few precautions in the future. PM2.5, PM10, NO2, and ozone concentrations are at their lowest level in the last few decades, while the variation in SO2 concentration is not very significant. The emission of CO is noticed significantly high during the lockdown period.

REFERENCE

[1] Milind R. Gidde, Pravin Sonawane(2012). "Assesement of Traffic Related air pollution &

ambient air quality of Pune City" IOSR Journal of engineering, 2250-3021.

[2] Lamare RE and Chaturvedi SS (2014). Suspended Particulate Matter In Ambient Air Of Shillong , Meghalaya submitted to Indian Journal Of Scientific Research And Technology Vol 2(6): 37-41.

[3] Heidar Malek, Armin Sorooshian, Gholamreza Goudarzi, Zeynab Baboli, Yaser Tahmasebi Birgani, Mojtaba Rahmati, "Air pollution prediction by using an artifcial neural network model", Clean Technologies and Environmental Policy, (2019) 21:1341–1352.

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

[5] Kamath and Lokeshappa (2014). Air Quality Indexing for Selected Areas inBangalore City, Karnataka, India submitted to International Journal of Innovative Research in Science, Engineering and Technology Vol. 3, Issue 8.

[6] R. Gunasekaran, K. Kumaraswamy, P.P. Chandrasekaran, R. Elanchezhian, "MONITORING OF AMBIENT AIR QUALITY IN SALEM CITY, TAMIL NADU", International Journal of Current Research, ISSN: 0975-833X, Vol. 4, Issue, 03, pp.275- 280, March, 2012.

[7] Mohamed Shakir, N. Rakesh, "Investigation on Air Pollutant Data Sets using Data Mining Tool", IEEE Xplore Part Number:CFP18OZV-ART; ISBN:978-1- 5386-1442-6.

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

[9] Times of India, "Pune's Air Quality Continues to Worsen Over the Years", https://timesofindia. indiatimes.com/city/pune/air-qualitycontinues-to -worsen-over-the-years/article show/68086 815. cms.

[10] World Health Organization. "Air Quality Guideline Values," 2018. https://www.who .int/ news-room/fact- sheets/detail/ambient- (outdoor) -air-quality-and-health.

[11] Pune Municipal Corporation, "PMC's efforts for Air Quality and Climate Resilience" Press Note (2019) https://www.pmc.gov.in/en/ pmc-mou-air-pollution-control.

[12] Indian Institute of Tropical Meteorology. "SAFAR - India (Pune Observational Network)," 2019. http://safar.tropmet.res.in/ MONITORING %20SYSTEM-10-3-Details