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Ambient Air Quality Status in Five Metropolitan Cities of Maharashtra before and After Diwali: A Case Study

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ABSTRACT

When comparing the twenty-first century to the previous one, it has been noted that the issue of air pollution is getting worse quite quickly. Several Maharashtra urban areas experienced this issue last year. The ambient air quality conditions in Pune, Nashik, Aurangabad, Nagpur, and Mumbai five major Maharashtra cities before and after Diwali will be analyzed in this essay.

Keywords: Particulate matter, ambient air, pollutants, and air quality index.

I. INTRODUCTION

This Air is an important natural resource furnishing the base of life on earth. The air in the atmosphere provides oxygen to shops and creatures by virtue of which they're suitable to live. It's thus important to have good- quality air for colorful conditioning. still, this is getting decreasingly delicate in view of large- scale pollution caused by the industrialization of society, the intensification of husbandry, the preface of motorized vehicles, and the explosion of the population. These conditioning induce primary and secondary air adulterants, which mainly change the composition of air. thus, it defined air pollution as the preface of chemicals, particulate matter(PM), or natural accoutrements that beget detriment or discomfort to humans or other living organisms, or beget damage to the natural terrain or erected terrain into the atmosphere(1). Adulterants from mortal conditioning are mischievous to mortal health. Primary anthropogenic sources include combustion of energies similar as wood and coal and the emigrations from vehicle exhausts. Assiduity has been suggested to be the primary source of sulfur dioxide(SO_2) and benzene(C_6H_6) in a number of studies, whilst nitrogen dioxide(NO_2) is primarily from vehicle combustion emigrations in a megacity terrain(2). Particulate matter with a periphery of $\leqslant$2.5 μm(PM 2.5) and $\leqslant$ 10 μm(PM10) will encompass both sources. Benzene may also be viewed as a deputy for other artificial adulterants similar as polycyclic sweet

hydrocarbons(PAHs) and other unpredictable organic composites, for which ambient situations are n't covered on a public scale(3). Air pollution is a major environmental threat factor for morbidity and mortality, leading to 4.2 million deaths every time encyclopedically, primarily from heart complaint, stroke, habitual obstructive pulmonary complaint(COPD), lung cancer, and acute respiratory infections(4). Diwali, or Deepawali, is a jubilee of " rows of light, " which is famed every time during October/ November in India. Celebrating with the brilliance and sparklers brings happiness, delight, and festivity. Firecrackers are associated with worldwide fests similar as New Year's Eve fests(5). The Lantern Festival in China, Bonfire Night in the UK, Tihar in Nepal, Day of Ashura in Morocco, Sky Fest in Ireland, Bastille Day in France, and Diwali in India(6). Firecrackers correspond of chemicals similar as potassium nitrate(KNO_3), potassium chlorate($KClO_3$), arsenic(Ar), sulfur(S), manganese(Mn), sodium oxalate($Na_2C_2O_4$), aluminum(Al), iron dust greasepaint($Fe_2O_3 . H_2O$), potassium perchlorate($KClO_4$), strontium nitrate($Sr(NO_3)_2$), barium nitrate($Ba(NO_3)$), and watercolor(5). Burning of firecrackers releases adulterants, like sulfur dioxide(SO_2 , 10), potassium nitrate(75), watercolor(15), carbon dioxide(CO_2), carbon monoxide(CO), suspended patches(including patches below 10 μm in periphery, i.e., PM_{10}), and several essence like aluminum, manganese, and cadmium, etc., which are accompanied by serious health pitfalls(7). In the Indian environment, studies have also been reported on the air quality declination for the firework conditioning during Diwali.Festivals are many, but studies are. In Thiruvananthapuram, India, a study about the effect of firework displays during Deepawali on the mass attention of atmospheric black carbon reveals over a 3 times increase compared to normal days. Studies have observed that there's a 2 to 3 times increase in PM10 and TSPM attention in Hisar megacity(India) that leads to short- term variation in air quality during the Diwali jubilee. Bursting crackers is turning into a competition and a status index. It's estimated that the periodic U.S. carbon dioxide emigrations from fireworks are 60,340 tons, or the same emigrations from 12,000 buses on the road for a time(8). Firecrackers during Diwali emit a large quantum of PM and toxic feasts in the air. They degrade the air quality, which causes air pollution in society, leading to serious health hazards and disturbance in the ecosystem. The present end of this paper is to study the status of ambient air pollution ahead and after Diwali by observing the attention of PM10 and trace feasts(SO_2 and NO_2) in four metropolitan metropolises of Maharashtra.

II. DATA BASE AND METHODOLOGY

Data for this study were gathered from the authorized Central Pollution Control Board (CPCB) website and the Maharashtra Pollution Control Board (MPCB) website. This website has a live tracking of pollution levels. For this type of investigation, this is dependable and accurate data. Average air pollution data before Diwali was taken from 2nd November 2023 to 9th November 2023, and average air pollution data after Diwali was taken from 10th November 2023 to 17th November 2023. Census and district Gazetteer Data has been used.

III. STUDY AREA

For this study, unit, Nashik, Aurangabad, Nagpur and Mumbai were selected. Specific location silica DC Chikalthana, More Chowk Waluj, Chembur, Mindspace-Malad West, Mahal, Ram Nagar, Gangapur Road, Savitribai Phule Pune University for air data we wakens in into coconut frying stages of development and arranging cities. Mumbai is the largest metropolitan area. Pune is the ninth largest city in India and the leading metropolis. Nashik, Aurangabad, Nagpur are major million-person cities in the state, specifically

IV. RESULT AND DISCUSSION

The majority of Indian cities suffer from extremely high levels of urban air pollution, particularly in the form of suspended particulate matter, SO2 and NO2, Levels of all pollutants are increasing due to industrial processes, agricultural activities, building construction, and road traffic, as well as reductions in natural habitat and other natural sources [9]. This study shows how major pollutant level like Sulphur dioxide, Nitrogen oxide and particulate matters deteriorates air quality. The focus of this study is to compare air pollutants and there level in air before and after Diwali situation.

4.1. SULPHUR DIOXIDE

Sulphur dioxide major pollutant. It reacts with other substances and form hazardous compound like Sulphuric acid, Sulphurous acid and sulphate particles. Major sources of SO2 are fossil fuel like coal, oil and gas burning. Maximum SO2 comes from anthropogenic activities and Motor vehicle emission is also one of the prime sources of Sulphur Di oxide. It results cough, Shortness of breathing. Most of the people exposed to SO2 are resulted Asthma and respiratory Diseases. In 1953, Amdur and co-workers examined the responses of men breathing up to 8 ppm SO2 in one of the first controlled studies of humans exposed to air pollutants. They observed that SO2 caused a change in respiratory pattern and that the effect was concentration dependent. The tolerance level of inhalation was individually different [10].

4.2. NITROGEN DIOXIDE

Likewise others Nitrogen dioxide is a result of road traffic and other fossil fuel combustion processes.NO2 reduce immunity of lungs infection and bronchitis. The major health hazard that is associated with NO2 are increased incidence of lower respiratory tract infections in children and increased airway responsiveness in asthma patients. Study done by Neas, L. M et al shows Long-term exposure to NO2, typically in homes with gas burning appliances, appears to be associated with increased susceptibility to lower respiratory tract illness [11].

4.3. MATERIAL PARTICULATION

Particulate matter that is 10 micrometers in diameter or smaller is referred to as PM10. It might be breathable smoke, mist, or dust. If it is biological, the human body may become infected with bacteria or fungi. An allergy is the cause. Cancer is brought on by the body continuously absorbing substances like asbestos and chromates.

4.4. NATIONAL METRICS FOR AIR QUALITY:

Carbon monoxide, lead, industrial dust, and cycle pollution are the main pollutants in urban areas. Secondary sources on the CPCB website provided the data used in this investigation. As part of the Swachh Bharat Abhiyan, the National Air Quality Index (AQI), developed by IIT Kanpur, was introduced in Delhi in September 2014. The six AQI classifications are: Moderate, Poor, Good, Satisfactory, and Severe ,as well as eight contaminants groups .The central pollution control board approved of this.

Table No 1: AQI Codes

Sr No	Remark	Colour Code	Possible Health Impact
01	Good		Minimal impact

Sr No	Remark	Colour Code	Possible Health Impact
02	Satisfactory		Breathing discomfort to sensitive people
03	Moderate		Breathing discomfort to people with lungs, heart diseases
04	Poor		Breathing Discomfort To people with prolonged exposure
05	Very Poor		Respiratory illness of prolonged exposure
06	Severe		Affecthealthy people and serious impact on health

Source: Central Pollution Control Board

4.5. POLLUTION LEVEL BEFORE DIWALI PERIOD IN FIVE METRO CITIES:

Pollution level before Diwali among five major metro cities is as shown in following tables and figure. It is observed that at all the locations in Aurangabad, values of PM10, NO2, SO2 are within the permissible limits. For Nagpur values of PM10 at all the locations are very high than the permissible limits. Values of NO2 and SO2 are within the permissible limits. Maximum value of PM10 was 201.93 µg/m3 which is two times the limit given by CPCB. In Mumbai values of PM10 were observed higher than the permissible limits. Though NO2 and SO2 were within given limits permissible limits. Among all five metro cities values of gaseous pollutants are more in Mumbai. For Nashik and Pune also values of PM10 are more than the permissible limits. But NO2 and SO2 at both the locations are safe. It is observed from the graph that maximum value of particulate matter is at Nagpur followed by Nashik and Mumbai.

Table No 2: Pollution at Aurangabad before Diwali

Location	Aurangabad		
Pollutant	PM10	NO2	SO2
Station 1	95.2325	21.4875	4.96375
Station 2	99.665	16.465	16.82125
Average	97.44875	18.97625	10.8925

Table No 3: Pollution at Nagpur before Diwali

Location	Nagpur		
Pollutant	PM10	NO2	SO2
Station 1	201.93375	31.335	52.4175
Station 2	173.845	30.02875	22.68375
Average	187.889375	30.68188	37.55063

Table No 4: Pollution at Mumbai before Diwali

Location	Mumbai		
Pollutant	PM10	NO2	SO2
Station 1	166.3325	47.74625	6.11125
Station 2	117.4713	28.0775	12.72375
Average	141.9019	37.91188	9.4175

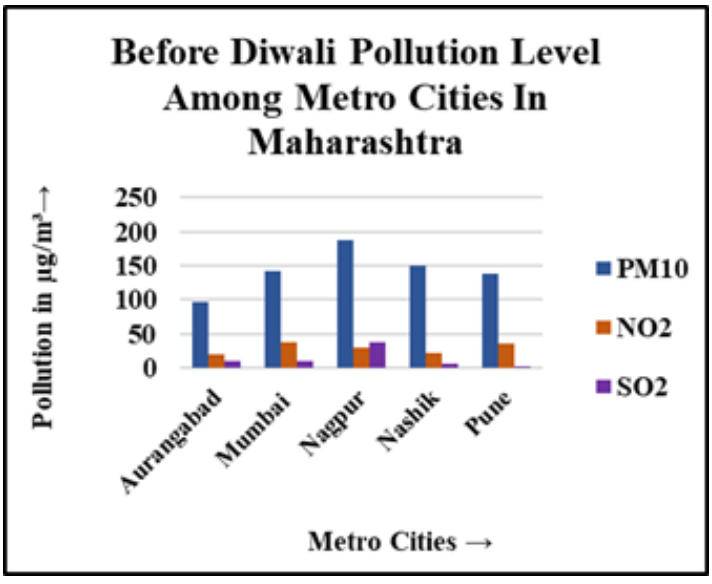
Table No 5: Pollution at Pune before Diwali

Location	Pune		
Pollutant	PM10	NO2	SO2
Station 1	139.2788	52.865	1.6625
Station 2	137.8913	18.40375	3.425
Average	138.585	35.63438	2.54375

Table No 6: Pollution at Nashik before Diwali

Location	Nashik		
Pollutant	PM10	NO2	SO2
Station 1	143.2243	9.721429	2.982857
Station 2	158.3175	35.3225	7.3575
Average	150.7709	22.52196	5.170179

Figure No 1: Pollution Before Diwali



4.6. POLLUTION LEVEL AFTER DIWALI PERIOD IN FIVE METRO CITIES:

Pollution level after Diwali among five major metro cities is as shown in following tables and graph. It has been observed that at all the locations values of PM10 is on higher side than permissible limit given by CPCB. It is alarming situation for all the metro cities in Maharashtra. In the Nagpur values of PM10 are two times more than the given limit. It has been also observed that there is rise in NO2 and SO2 also but they found within permissible limits. Maximum value of gaseous pollutant found at Mumbai. Maximum values of NO2 was around

46 µg/m3 and maximum value of SO2 was observed to be around 20 µg/m3. From the graph it is clear that maximum pollution of PM10 is at Nagpur. Nashik is at second position in terms of PM10 pollution and Mumbai is at third position. Pune and Aurangabad is at fourth and fifth position respectively.

4.7. Level of Pollution in Five Metro Cities Prior to Diwali:

Before Diwali, the following tables and figures depict the pollution levels in five major metro areas. It is noted that the levels of PM10, NO2, and SO2 at every location in Aurangabad are within acceptable bounds. The PM10 levels in Nagpur are significantly higher than the allowable limits at every location. The acceptable ranges for NO_2 and SO_2 values are met. Two times the CPCB-provided limit, or 201.93 µg/m³, was the highest measurement of PM10. PM10 levels were found to be over the allowable limits in Mumbai. NO_2 and SO_2 , however, were within the allowed ranges. Out of the five metropolitan areas, the levels of gaseous pollutants are greater in.

Table No 7 : Pollution at Aurangabad after Diwali

Location	Aurangabad		
Pollutant	PM10	NO2	SO2
Station 1	162.0083333	18.64333333	5.535
Station 2	104.88125	23.08875	11.9675
Average	133.4447917	20.86604167	8.75125

Table No 8: Pollution at Nagpur after Diwali

Location	Nagpur		
Pollutant	PM10	NO2	SO2
Station 1	226.62625	30.0375	32.6025
Station 2	189.4475	26.075	16.09875
Average	208.036875	28.05625	24.35063

Table No 9: Pollution at Mumbai after Diwali

Location	Mumbai		
Pollutant	PM10	NO2	SO2
Station 1	178.59125	43.24875	4
Station 2	151.6025	45.60625	19.95
Average	165.096875	44.4275	11.975

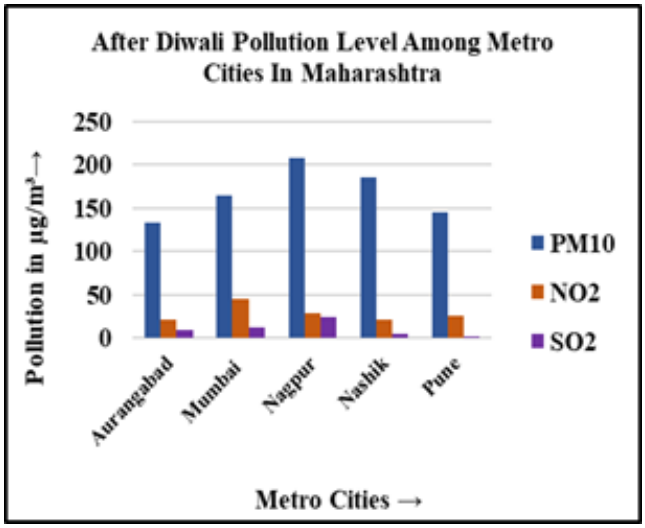
Table No 10: Pollution at Pune after Diwali

Location	Pune		
Pollutant	PM10	NO2	SO2
Station 1	124.72875	41.545	2.9225
Station 2	164.715	9.96125	1.24
Average	144.721875	25.753125	2.08125

Table No 11: Pollution at Nashik after Diwali

Location	Nashik		
Pollutant	PM10	NO2	SO2
Station 1	158.16375	11.51375	3.1075
Station 2	213.3275	31.54375	7.58875
Average	185.745625	21.52875	5.348125

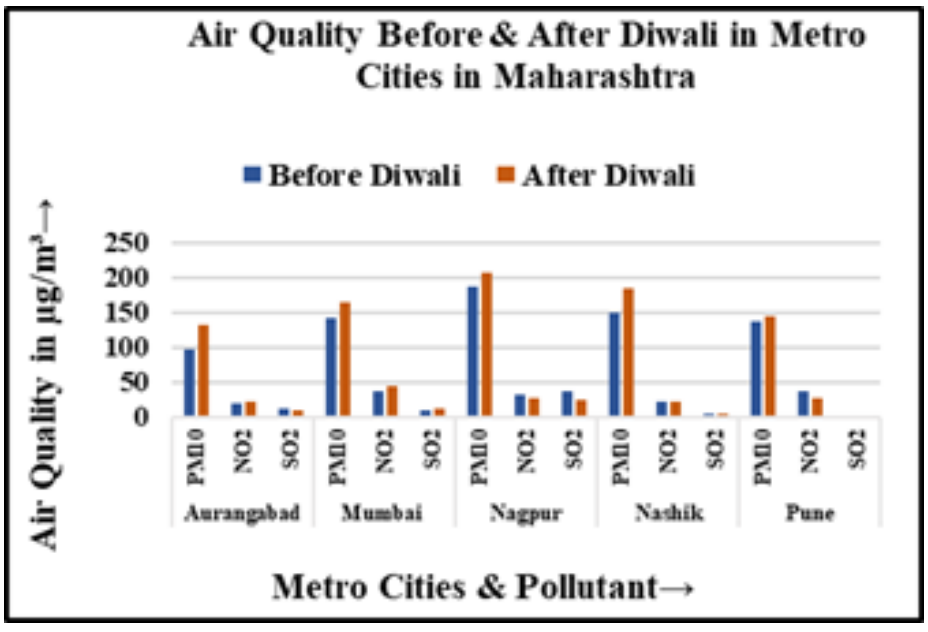
Figure No 2: Pollution after Diwali



4.8. COMPARISON OF POLLUTION LEVEL BEFORE AND AFTER DIWALI PERIOD IN FIVE METRO CITIES:

Pollution before and after Diwali is given in the following figure. It is clear from the graph that pollution of PM10 increases after Diwali. Maximum increased pollution of PM10 was observed at Nashik, followed by Nagpur and Aurangabad. Already at all the locations except Aurangabad, values of PM10 were more than the permissible limits after Diwali. It is concerned that these values may be set as a new benchmark for the new values in the next Diwali.

Figure No. 2: Pollution before and after Diwali



V. CONCLUSION

It is observed that there has been a rise in the pollution of particulate matter over the last 10 years, and we are putting in a new benchmark every year. Diwali is a festival of lights where the entire nation enjoys fireworks, and pollution increases. We treat this as a new benchmark for the next Diwali. According to our study, the approximate rise in PM10 pollution is an increase of 50 $\mu g/m^3$ this year. Already all the cities have a high value of PM10 pollution except Aurangabad before Diwali. And after Diwali, all the locations are having PM10 pollution more than the permissible limit. If this continues, it will be a threatening situation for us and the coming generation. It is also observed from the study that gaseous pollutants are also increasing, but fortunately they are within the permissible limit for all metro cities. Finally, it is concluded from the studies that individual and authorities should take care of the cities during Diwali with less use of fire crackers. Otherwise next generation will blame us for the worse conditions of the environment.

VI. REFERENCES

[1]. Peter Osei Boamah, Jacqueline Onumah, Mohammed Takase, Prince Osei Bonsu & Tayari Salifu. Air Pollution Control Techniques, Global journal of bioscience and bio technology, vol.1 (2) 2012: 124-131

[2]. Carlos E. Restrepo. Nitrogen Dioxide, Greenhouse Gas Emissions and Transportation in Urban Areas: Lessons From the Covid-19 Pandemic, Frontiers in Environmental Science, vol.9 2021.

[3]. Calvin Jephcote, Alice Mah. Regional inequalities in benzene exposures across the European petrochemical industry: A Bayesian multilevel modelling approach, Elsevier Journal 2019.

[4]. https://www.who.int/publications/i/item/9789240 034228.

[5]. Balram Ambade, The air pollution during Diwali festival by the burning of fireworks in Jamshedpur city, India, Urban Climate, Elsevier, 2018: 149-160.

[6]. Babu and Moorthy, 2001; Ravindra et al., 2003; Kulshrestha et al., Emissions and accumulation of metals in the atmosphere due to crackers and sparkles during Diwali festival in India, 2004: 4421-4425.

[7]. Roberts. S, Have the short-term mortality effects of particulate matter air pollution changed in Australia over the period 1993-2007. Environ. Pollut, 2013, 182, 9–14.

[8]. Babu, S.S., Moorthy, K.K., Anthropogenic impact on aerosol black carbon mass concentration at a tropical coastal station: a case study. Curr. Sci, 2001, 81, 1208–1214.

[9]. A. K. Singh, H. K. Gupta, K. Gupta, P. Singh, V.B. Gupta, R. C. Sharma, A Comparative Study of Air Pollution in Indian Cities, Springer, 2007: 411- 416.

[10]. Mary O. Amdur, Walter W. Melvin, Jun., Philip Drinker, Effects of Inhalation of Sulphur Dioxide by Man, The Lancet, 758-759.

[11]. Sam J. Silva, Avelino F. Arellano, and Helen M. Worden, Toward anthropogenic combustion emission constraints from space-based analysis of urban CO2/CO sensitivity, Vol 40, 4971-4976.