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# COMPARATIVE STUDIES OF THE AIR POLLUTANTS IN THE INDUSTRIAL AREA OF BADLAPUR AND DOMBIVLI REGION OF THANE DISTRICT FOR THE PERIOD OF THREE YEARS FROM 2018 - 2020

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**ABSTRACT**

**The Industrial (MIDC) area of Badlapur and Dombivli have around 870 chemical and dyes manufacturing Industries, these industries release numerous air pollutants in surrounding environment. This air pollutant content is required to be below the standard norms given by NAAQS. Ambient air monitoring station of MPCB monitors the Sulfur dioxide ($SO_2$), Oxides of Nitrogen ($NO_x$), and Respirable Suspended Particulate Matter (RSPM) regularly in the area. The assessment was done at three sites, BIWA house Badlapur, CETP and MIDC Dombivli for the duration of three years from January 2018 – December 2020. Results obtained from the study have shown that RSPM level of all the stations were decreased several fold amidst lockdown compared to the previous years. The level of Sulfur dioxide and Oxides of Nitrogen were also drastically declined during the lockdown period. Hence the Air Quality Index (AQI) recorded at all three stations is satisfactory to moderate for the year 2020**

**KEY WORDS:** Air pollution, $SO_2$, NOx, RSPM, AQI

## INTRODUCTION

Air is an essential component of life. Ambient air is the atmospheric air in its natural state free of contaminants. But increasing population has led to increase in emissions from vehicles and industries leading to pollution. Pollution has led to deterioration of air quality day-by-day thus people are facing health hazards mainly related to the respiratory disorders (Maji *et al.*, 2016). $NO_x$, $SO_2$, ozone, $PM_{2.5}$, $PM_{10}$ are the most studied and are used as indicators of pollution (Manju *et al.*, 2018).

Oxides of nitrogen ($NO_x$)or nitrogen dioxide ($NO_2$) is released by combustion of fuel in vehicles (Khaniabadi *et al.*, 2017). Nitrogen dioxide being oxidative gas, oxidizes components of lung cells and results in influx of inflammatory cells to the site of injury. In absence of antioxidants, free radicles released by activated inflammatory cells attack local tissue and results in histological pulmonary inflammatory foci (Khafaie *et al.*, 2016). Sulfur dioxide ($SO_2$) is one of the major pollutants of air it is released mainly from industries due to consumption of fossil fuel, or from volcanic eruptions. $SO_2$ is mainly absorbed in upper respiratory tract where it can lead to bronchospasm and bronchoconstriction (Ghorani-Azam *et al.*, 2016). Long term exposure to sulfur dioxide is also associated with high blood pressure or also called as hypertension (Yang *et al.*, 2018). Particulate matter is one of major air pollutant generated by vehicular exhaust, soil dust, pavement work, etc. Most of the untimely deaths due to particulate matter have occurred by ischemic heart disease, chronic obstructive pulmonary disease, stroke, lower respiratory infection and lung cancer (Maji *et al.*, 2017). $PM_{10}$ can get easily settled in extra thoracic region of airways thus causing various respiratory

diseases (Bharti *et al.*, 2017).

This paper focuses on monitoring the air quality index (AQI) in MIDC areas of Badlapur and Dombivli region for aperiod of three years.

## MATERIALS AND METHODS

The air collected by the air samplers were analyzed for the presence of Nitrogen Dioxide, Sulfur Dioxide and RSPM. All the processes were carried out as per the guidelines for Measurement of Ambient Air Pollutants, by Central Pollution Control Board, Ministry of Environment and Forest (CPCB, 2013).

### Sampling

An automatic supreme quality dust sampler provided by Envirotech, APM 460 NL dust sampler for $PM_{10}$, was used along with thermoelectrically cooling box which is gaseous sampling attachment for sampling $SO_2$ and $NO_x$. A cycle of 24 hours is performed with automatic on and off, for two days a week. Manual sampling for RSPM and SPM was done every 8 hours and for $SO_2$ and $NO_x$ it was done every 4 hours. Liquid samples were stored at 5°C till analysis, whereas RSPM was kept inside desiccator till analysis. The samplers are located at 3 sites as follows: Dombivli Rotary Office MIDC (MIDC-D1) (Co ordinates :19.213333440035363, 73.10480403610761), Dombivli Common Effluent Treatment Plant (CETP-D2) (Coordinates: 19.20429826300443, 73.0985594985441), Badlapur Industrial Welfare Association House (BIWA) (Coordinates:19.156169456410723,73.23731220477706).

### Method for assessment of Nitrogen Dioxide

Concentration of oxides of Nitrogen was analyzed by using Modified Jacob and Hochheiser Method. Samples were collected by $NO_x$ absorbing solution made up of sodium hydroxide and sodium arsenite. The concentration of nitrite ion ($NO_x$) is determined spectrophotometrically at 540 nm.

### Method for determination of Sulfur Dioxide

Sulfur dioxide is analyzed by Modified West & Gaeke Method. Sulphur dioxide is absorbed in potassium tetrachloromercurate (TCM) solution to form a complex. The concentration of complex is measured by UV-Spectrophotometer at 560 nm.

### Method for determination of Respirable Suspended Particulate Matter (RSPM):

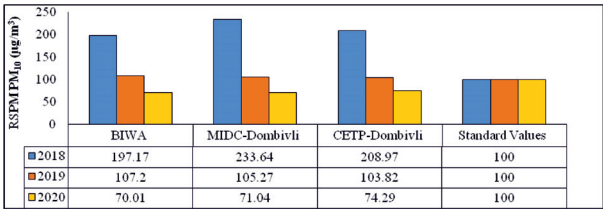
RSPM ($PM_{10}$) measured by the calculating the weight of pre-weighted glass microfiber filter paper in the laboratory after the 8hrs monitoring period.

## RESULTS AND DISCUSSION

In the above study monitoring of air pollution with 03 major parameters such as RSPM, $SO_2$, and $NO_2$ was done in two growing industrial cities of Maharashtra. Table 1 shows the Standard concentrations of pollutants as per National ambient air quality standards (NAAQS):

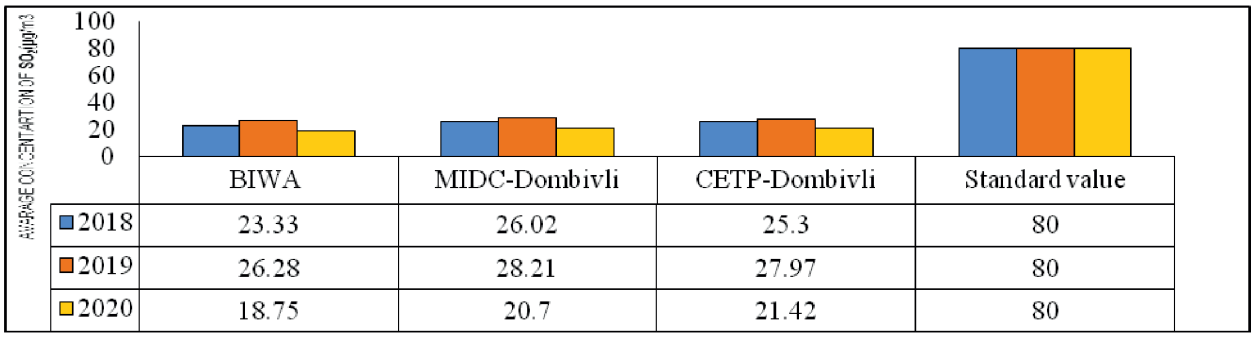
**Table 1.** Standard concentration of pollutants as per National ambient air quality standards (NAAQS).

| Pollutants | Concentration in ambient air of industrial area (24 hr average) |
|---|---|
| Sulfur Dioxide | 80 µg/m$^3$ |
| Oxides of Nitrogen | 80 µg/m$^3$ |
| RSPM $PM_{10}$ | 100 µg/m$^3$ |




**Graph 1.** Average RSPM (PM10) concentration of BIWA, MIDC and CETP -Dombivli Sampling site.

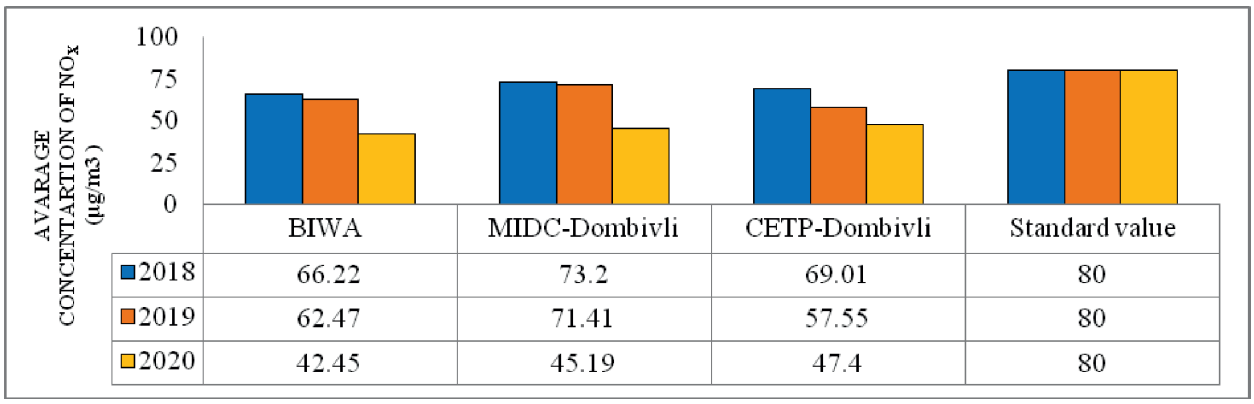
RSPM Level of all three stations was too high as compared to the standard of 100 g/m$^3$ in the industrial area in the year 2018 and 2019 than year 2020 (During lockdown). The percentage reduction of average RSPM values for in 2019 was 45.63%, 54.94% and 50.31% for sites BIWA, MIDC-Dombivli and CETP-Dombivli respectively. This reduction in RSPM values might be the result of revised action plan taken for Dombivli as well as Badlapur industrial area (MPCB, 2020 and MPCB, 2019). About 34.69% reduction of RSPM value was observed in year 2020 at BIWA site, followed by 32.51% and 28.44% reduction at MIDC-Dombivli and CETP-Dombivli site respectively. The one possible explanation for reduction of average RSPM values in year 2020 is implication of strict lockdown amidst Sars-Covid 19 pandemic. Similarly, reduction in RSPM values was observed by Saini *et al.*, in region of Nagpur, Maharashtra (Saini *et al.*, 2022). Robin *et al.*, observed 66.5% reduction in RSPM values within period of 24 hours of lockdown in industrial area of Alandur, Chennai (Robin *et al.*, 2021).




| | BIWA | MIDC-Dombivli | CETP-Dombivli | Standard value |
|---|---|---|---|---|
| 2018 | 23.33 | 26.02 | 25.3 | 80 |
| 2019 | 26.28 | 28.21 | 27.97 | 80 |
| 2020 | 18.75 | 20.7 | 21.42 | 80 |

**Graph 2.** Average concentration of SO2 for BIWA, MIDC and CETP Dombivli Sampling site.

Graph no. 2 and 3 depicts the average $SO_2$and $NO_x$ content of all three sites respectively. The standard/ permissible average concentration of $SO_2$ and $NO_x$ is 80µg/m$^3$ in industrial area. In the year 2020 the levels of $SO_2$ and $NO_x$ decreased because of the COVID-19 outbreak and immediate implication of lockdown throughout the country. In lockdown time there is gradual decrease in pollution level because all the industries, vehicles, constructions were shutdown. Similar trend was found by Bedi *et al.*, in four major cities namely, Mumbai, Chennai, Kolkata and Delhi (Bedi *et al.*, 2020). Singh and Tyagi, also observed reduction in $SO_2$ and $NO_x$ values during period of lockdown in Chennai (Singh and Tyagi, 2021). Reduction in tropospheric $NO_x$ levels over Mumbai and Kalyan-Dombivli region can be clearly seen from the images obtained from Copernicus Sentinel-5 Precursor Tropospheric Monitoring Instrument. Image no.1 shows troposphere $NO_2$ levels during period 2nd – 15th March 2020 whereas image no. 2 shows tropospheric $NO_2$ levels for period 1st – 14th June 2020, when unlock 1.0 was initiated by government.




| | BIWA | MIDC-Dombivli | CETP-Dombivli | Standard value |
|---|---|---|---|---|
| 2018 | 66.22 | 73.2 | 69.01 | 80 |
| 2019 | 62.47 | 71.41 | 57.55 | 80 |
| 2020 | 42.45 | 45.19 | 47.4 | 80 |

**Graph 3.** Average concentration of NO2 for BIWA, MIDC and CETP Dombivli Sampling site

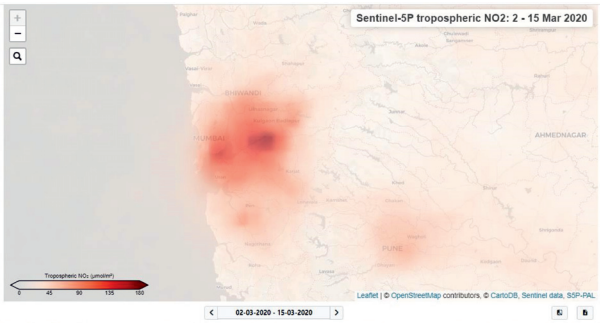



**Image 1.** Tropospheric NO2 levels during period 2nd – 15th March 2020.

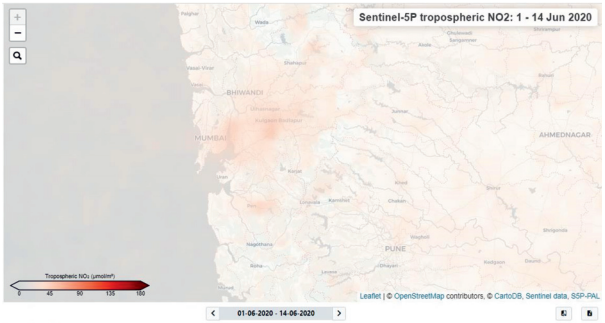



**Image 2.** Tropospheric NO2 levels for period 1st – 14th June 2020.

## AIR QUALITY INDEX (AQI)

AQI is one of the important parameters which give us information about quality of air we breathe in or live in. Table 2 shows reference values of AQI. AQI for three consecutive years was obtained for above mentioned sampling sites. It shows that the AQI of BIWA, MIDC and CETP Dombivli in 2018 was moderate, but during winter season, i.e. year ending and year starting months shows very poor quality of air. In last two years quality of air shows satisfactory results. In the year 2020 air quality of all sites show good quality of air because of COVID-19 pandemic outbreak. During lockdown all industrialization, vehicles and construction line was shut down and therefore lead to reduction of all air pollutants. The results are cumulated in Table 3.

## CONCLUSION

The Central Pollution Control Board (CPCB) and National Research Council (NRC) declared that there needs to be more research on the long-term health effects of air pollution exposure in two areas: first the effects of PM in combination with gaseous pollutants and the effects on potentially susceptible groups from the exposure to air pollution than others. In the year of 2018-2019 during winter season due to dry air poor quality of air was observed. But in the lockdown period the air quality was very good and this type of quality air is of immense importance for all living beings. Thus, care should be taken by people to protect them from polluted air. Also, policies should be drawn with respect to industries to reduce the release of untreated pollutants in the air as well as to reduce the use of vehicles to minimize emissions.

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**Table 2.** Air Quality Index (AQI) reference chart (Motghare, *et al.*, 2020).

| | | | |
|---|---|---|---|
| Good (0-50) | Minimal impact | Poor (201-300) | Breathing discomfort to people on prolonged exposure |
| Satisfactory (51-100) | Minor breathing discomfort to sensitive people | Very poor (301-400) | Respiratory illness to people on prolongs exposure |
| Moderate (101-200) | Breathing discomfort to people with lung, heart disease, children and older adults | Severe (≥401) | Respiratory effects on healthy people |

**Table 3.** AQI of BIWA, MIDC and CETP Dombivli for the years 2018, 2019 & 2020.

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2018** | BIWA | 485 | 378 | 160 | 157 | 160 | 104 | 90 | 90 | 97 | 141 | 154 | 201 |
| **2019** | | 171 | 151 | 122 | 113 | 98 | 79 | 79 | 51 | 79 | 75 | 105 | 100 |
| **2020** | | 90 | 102 | 76 | 84 | 98 | 43 | 45 | 47 | 51 | 50 | 82 | 70 |
| **2018** | MIDC-Dombivli | 693 | 588 | 195 | 145 | 121 | 108 | 100 | 90 | 104 | 168 | 180 | 198 |
| **2019** | | 137 | 134 | 120 | 106 | 91 | 106 | 85 | 79 | 93 | 100 | 104 | 114 |
| **2020** | | 93 | 108 | 84 | 88 | 91 | 43 | 48 | 42 | 45 | 54 | 84 | 72 |
| **2018** | CETP-Dombivli | 647 | 456 | 156 | 155 | 146 | 130 | 100 | 129 | 101 | 115 | 135 | 140 |
| **2019** | | 135 | 146 | 120 | 106 | 113 | 77 | 79 | 79 | 43 | 98 | 102 | 102 |
| **2020** | | 96 | 109 | 83 | 96 | 113 | 45 | 44 | 47 | 53 | 65 | 90 | 74 |

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