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THE IMPACTS OF VEHICULAR EMISSION ON THE AIR QUALITY OF AKOLA CITY DURING COVID-19 PANDEMIC

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Abstract:

Vehicular emission is the major source of air pollution in urban areas, The rapid development in urban India has resulted in a tremendous increase in the number of motor vehicles and in some cities, this has doubled in the last decade. This is the main source of air pollution and poor ambient air quality impacting millions of dwellers. The vehicular emission is mainly caused due to the use of petrol, diesel kerosine and gasoline in the vehicles. This paper is a review of the impacts of vehicular emission of NOx, SO2, RSPM and SPM on the air quality of Akola city during Covid-19 Pandemic

Keywords: Vehicular emission, NOx, SO2, RSPM, Akola city, Covid-19 Pandemic.

INTRODUCTION

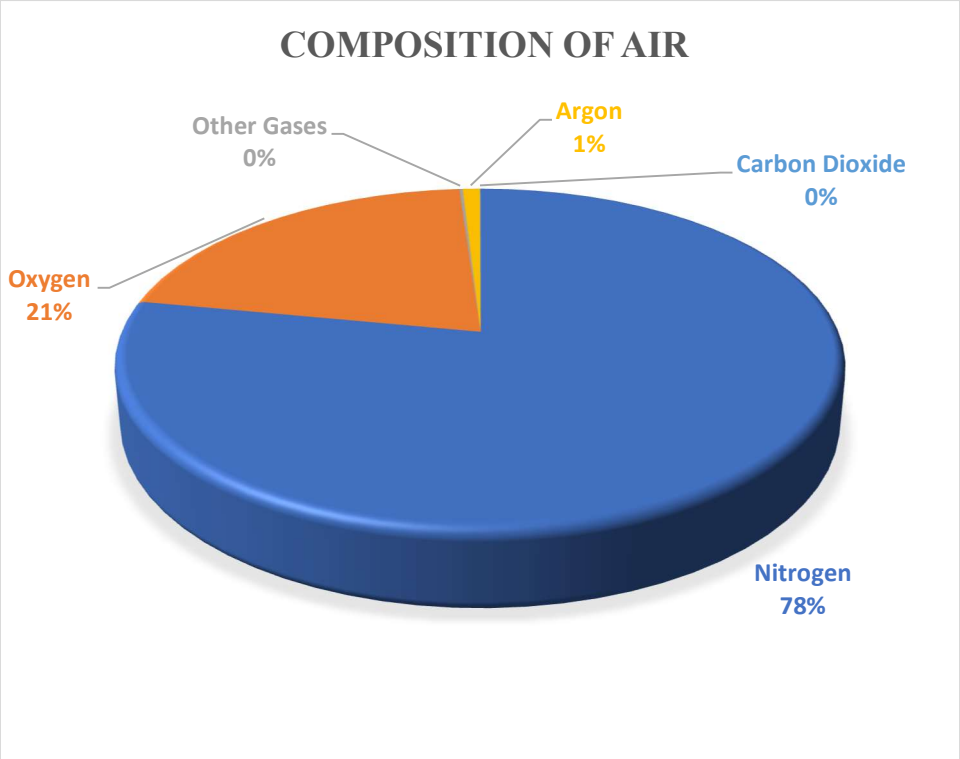
Akola city is located north-central of Maharashtra state, on the bank of river "Morna". although it is not considered a tourist destination, Akola is an important city due to its history, culture, politics and agriculture It also has a prominent road and rail junction that functions as a commercial treading centre the city is developing into a market centre and having 6,25,000 population. The air quality index of Akola city in the year 2020 up to May2021 shows the AQI value ranges from 101-200 which is a moderate value, which results breathing discomfort to the people with lung, heart disease, children and older adults.

Health problems reported to health facilities include cough and breathing impairments, Acute upper respiratory infection, Disease of upper respiratory tract, Chronic obstructive pulmonary disease with acute lower and Other Disorders of Lung

This unplanned urban and industrial development has led to the problem of air pollution. The major contributors to this widespread air pollution in urban areas is vehicular emission which is of great concern, as these are ground level sources and have maximum impact on the general population.

Two-wheelers, cars and the other vehicles in the city account for more than 80 percent of the vehicle population in the Akola city.

Chart 1: Composition of Ambient Air



Composition of Air	
Name of the Gases in air	Percentage
Nitrogen	78%
Oxygen	20.9%
Other Gases	0.17%
Argon	0.90%
Carbon Dioxide	0.03%

MATERIALS AND METHODS

Data collection and analysis:

Three locations as commercial, residential and industrial within the city were carefully selected for the collection of air samples during, Afternoon (12-1pm) and evening (6-7pm) twice in a week for the year 2020 and 2021

The sampling is done twice in a week. The sampling is done during afternoon and evening, Respirable Dust Sampler (Model- Envirotech APM 460NL) was used for the collection of air samples collected for the concentration of RSPM, SPM, NOx, & SO_2.

Questionnaire survey, Interview of Specialist Doctors, Cluster sampling from Hospitals,
was conducted to collect the information about risks and health problems of the peoples living in the city.

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DATA COLLECTION AND TABULATION

Air Quality Index AQI **Air Samples collected at Akola, from January to December in the year 2020.** **Location: COE&T (Architecture Building), Commercial Area. Sampling Frequency: Twice in a week**					
Sr. No.	Monthly Average	SO2 µg/m3	NOx µg/m3	RSPM µg/m3	SPM µg/m3
	Standards →	80.00	80.00	100.00	---
1	January	14.60	15.20	67.50	66.90
2	February	15.25	16.00	68.25	67.50
3	March	11.87	12.37	50.62	50.62
4	April	8.80	9.50	33.50	32.60
5	May	9.87	10.00	39.12	36.62
6	June	12.40	13.00	42.20	42.00
7	July	12.57	13.43	41.71	41.14
8	August	13.20	13.20	40.20	39.60
9	September	13.22	13.67	55.56	55.00
10	October	13.22	13.67	55.56	55.00
11	November	17.31	17.46	72.46	71.31
12	December	15.10	15.70	66.10	66.30
	Annual Average	**13.12**	**13.60**	**52.73**	**52.05**

Air Samples collected at Akola, from January to December in the year 2020. **Location: Ranpise Nagar, professor Colony, Residential. Sampling Frequency: Twice in a week**					
Sr. No.	Monthly Average	SO2 µg/m3	NOx µg/m3	RSPM µg/m3	SPM µg/m3
	Standards →	80.00	80.00	100.00	---
1	January	12.87	13.25	65.75	66.50
2	February	13.50	13.87	66.37	66.25
3	March	10.70	11.60	51.10	50.80
4	April	8.11	8.33	34.55	33.11
5	May	10.75	11.37	40.37	37.50

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6	June	11.86	12.57	41.57	40.86
7	July	12.80	13.00	41.40	40.40
8	August	12.25	12.87	38.00	36.37
9	September	12.25	12.87	38.00	36.37
10	October	12.50	13.50	55.75	53.25
11	November	15.57	17.43	69.79	70.79
12	December	13.22	13.78	67.33	65.44
	Annual Average	**12.20**	**12.87**	**50.83**	**49.80**

Air Samples collected at Akola, from January to December in the year 2020.

Location: Phase II, MIDC Water Work Industrial. Sampling Frequency: Twice in a week

Sr. No.	Monthly Average	SO2 μg/m3	NOx μg/m3	RSPM μg/m3	SPM μg/m3
	Standards →	80.00	80.00	100.00	---
1	January	15.20	16.30	69.60	68.60
2	February	16.87	17.12	70.75	70.62
3	March	12.00	12.22	50.00	49.78
4	April	8.86	9.14	34.14	33.29
5	May	12.87	13.53	43.13	42.00
6	June	14.00	14.67	41.67	40.78
7	July	14.00	14.67	41.67	40.78
8	August	13.67	14.67	43.00	40.00
9	September	13.67	14.67	43.00	40.00
10	October	15.50	15.00	64.80	64.10
11	November	21.00	20.75	74.625	75.50
12	December	16.90	16.60	71.50	69.70
	Annual Average	**14.54**	**14.95**	**53.99**	**52.93**

Air Samples collected at Akola, from January to May in the year 2021.

Location: COE&T (Architecture Bldg.), Commercial Area. Sampling Frequency: Twice in a week

Sr. No.	Monthly Average	SO2 μg/m3	NOx μg/m3	RSPM μg/m3	SPM μg/m3
	Standards →	80.00	80.00	100.00	---

1	January	18.00	18.87	70.12	69.12
2	February	17.37	17.50	69.62	69.87
3	March	17.00	16.12	67.62	70.62
4	April	15.22	15.78	66.11	68.44
5	May	15.22	15.78	66.11	68.44
	Annual Average	**16.90**	**17.07**	**68.37**	**69.51**

Air Samples collected at Akola, from January to May in the year 2021.
Location: Ranpise Nagar, professor Colony, Residential. Sampling Frequency: Twice in a week

Sr. No.	Monthly Average	SO2 μg/m3	NOx μg/m3	RSPM μg/m3	SPM μg/m3
	Standards →	80.00	80.00	100.00	---
1	January	15.37	16.12	65.62	70.25
2	February	15.87	16.62	70.50	70.50
3	March	15.22	15.11	68.89	68.56
4	April	15.22	15.11	68.89	68.56
5	May	13.50	15.00	64.75	66.25
	Annual Average	**15.04**	**15.60**	**67.73**	**68.82**

Air Samples collected at Akola, from January to May in the year 2021.
Location: Phase II, MIDC Water Work Industrial. Sampling Frequency: Twice in a week

Sr. No.	Monthly Average	SO2 μg/m3	NOx μg/m3	RSPM μg/m3	SPM μg/m3
	Standards →	80.00	80.00	100.00	---
1	January	19.50	19.80	77.30	76.50
2	February	18.87	20.12	77.62	75.75
3	March	18.87	20.12	77.62	75.75
4	April	17.22	18.11	71.44	71.00
5	May	16.78	17.67	67.56	67.11
	Annual Average	**18.25**	**19.17**	**74.31**	**73.22**

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RESULTS AND DISCUSSION

The concentrations of SO_2, ranged between 8-20 $\mu g/m^3$. The obtained values for SO_2 are below the permissible value because of the lock down during the covid -19 pandemic. The permissible standard value for sulphur dioxide (SO_2) in the ambient air is 80 $\mu g/m^3$ (micrograms per cubic meter) There is significant variation in the concentrations of the sampled gases between the periods of the day at the selected locations.

The value of SO2 dropped to 8.8 $\mu g/m^3$ in the month of April 2020 and then gradually increase up to 17.31 $\mu g/m^3$ at the month of November 2020 as shown in fig. 1

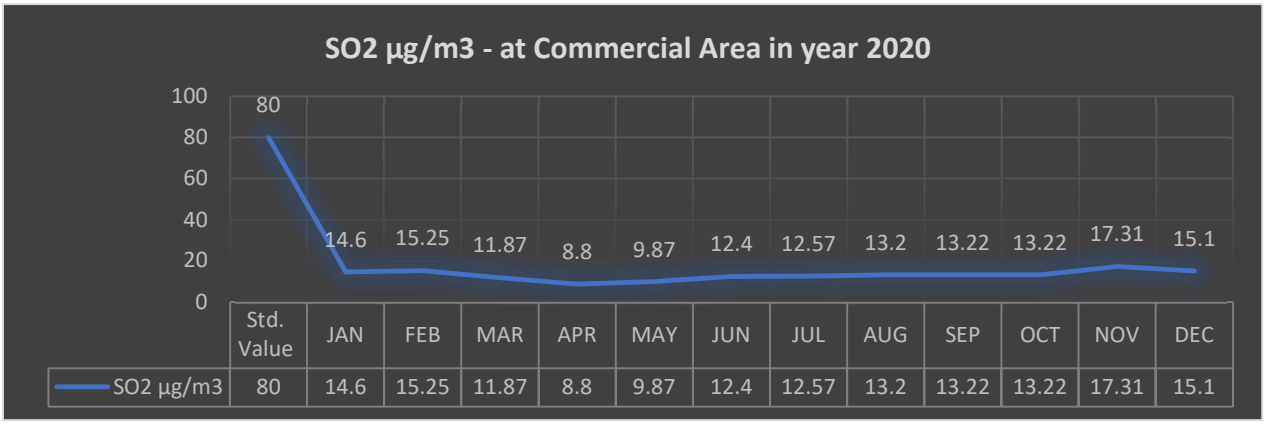

Figure 1: Value of SO_2 $\mu g/m^3$ at The Commercial Area in Year 2020

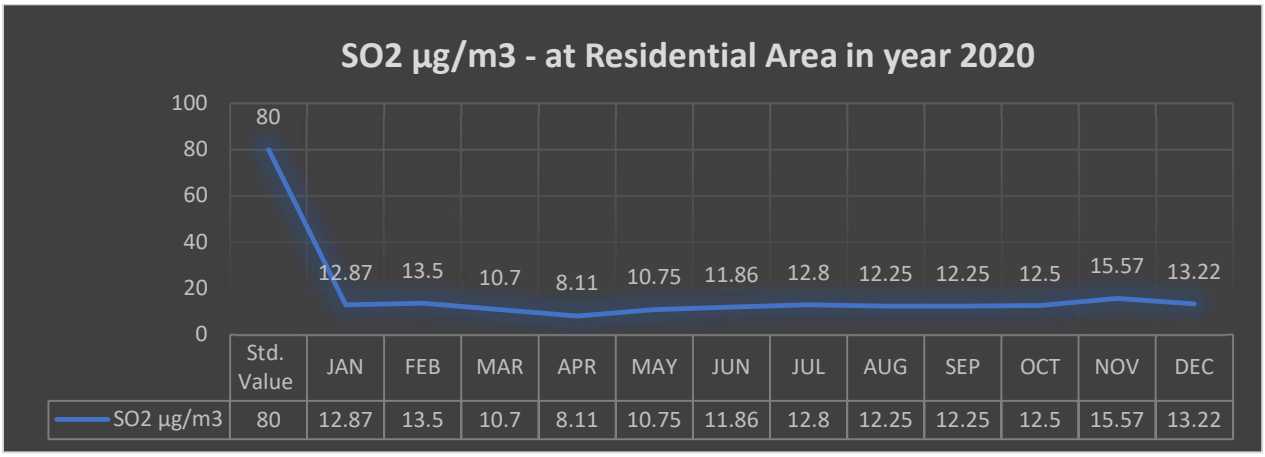

Figure 1: Value of SO2 µg/m3 at The Residential Area in Year 2020

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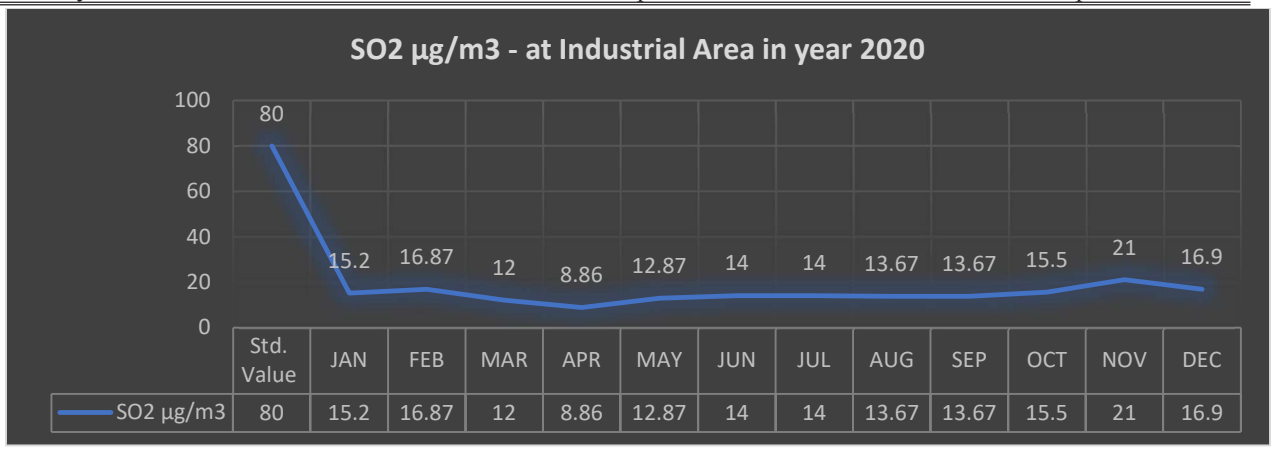

Figure 2 : Value of SO2 µg/m3 at The Industrial Area in Year 2020

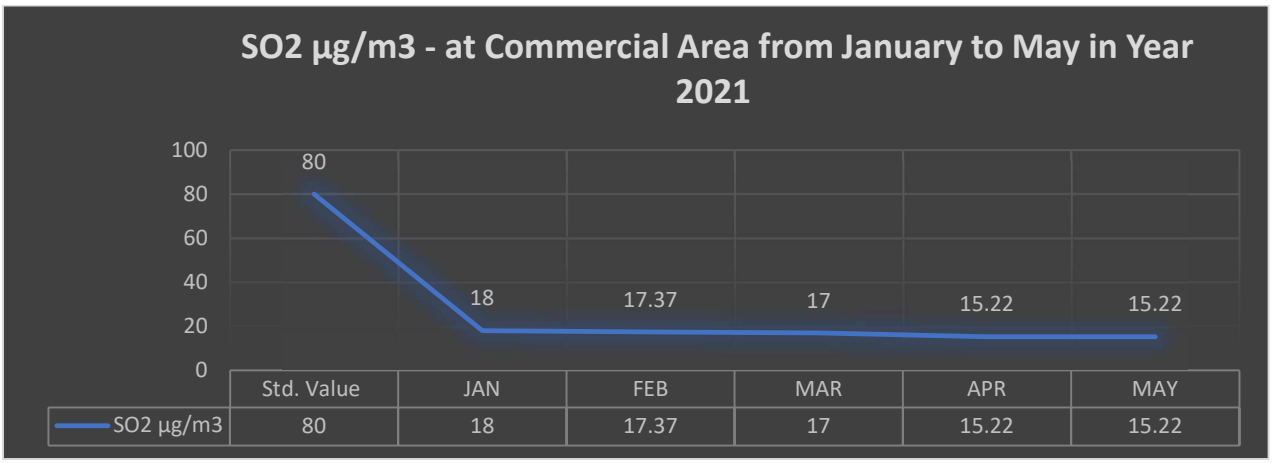

Figure 3: Value of SO2 µg/m3 at The Commercial Area from January to May in Year 2021

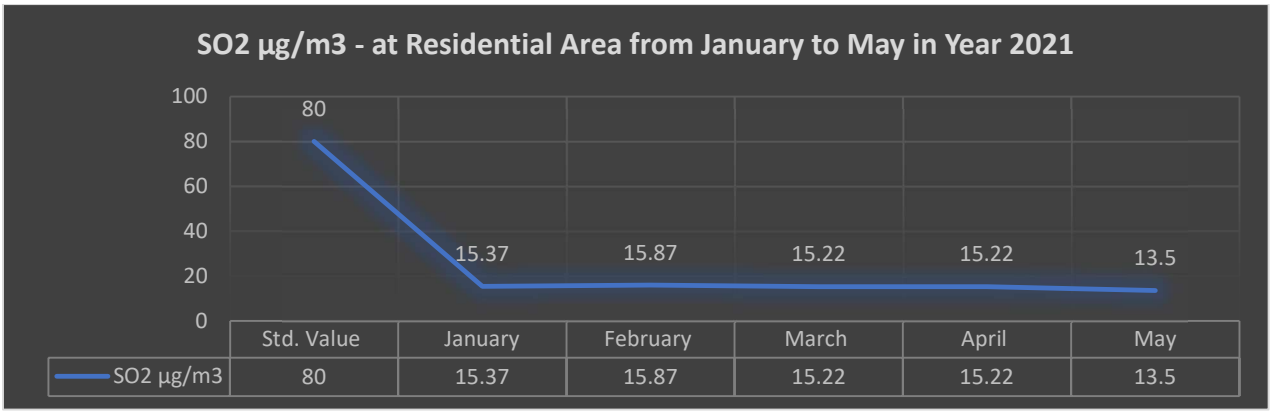

Figure 4: Value of SO2 µg/m3 at The Residential Area from January to May in Year 2021

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Figure 5: Value of SO2 µg/m3 at The Industrial Area from January to May in Year 2021

The concentrations of NOx were similar to the value of SO2 which was ranged between 8-20 $\mu g/m^3$. There is significant variation in the concentrations of the sampled gases between the periods of the day at the selected locations. The permissible standard value for Oxides of Nitrogen (NO_X) in the ambient air is 80 $\mu g/m^3$ (micrograms per cubic meter).

Nitrogen released during fuel combustion it combines with oxygen atom to create nitric oxide (NO)

The reaction of NO2 and NO are referred together as oxides of nitrogen NOx and its hazardous to the human health. NOx is produced during combustion of fuel in vehicles at high temperature.

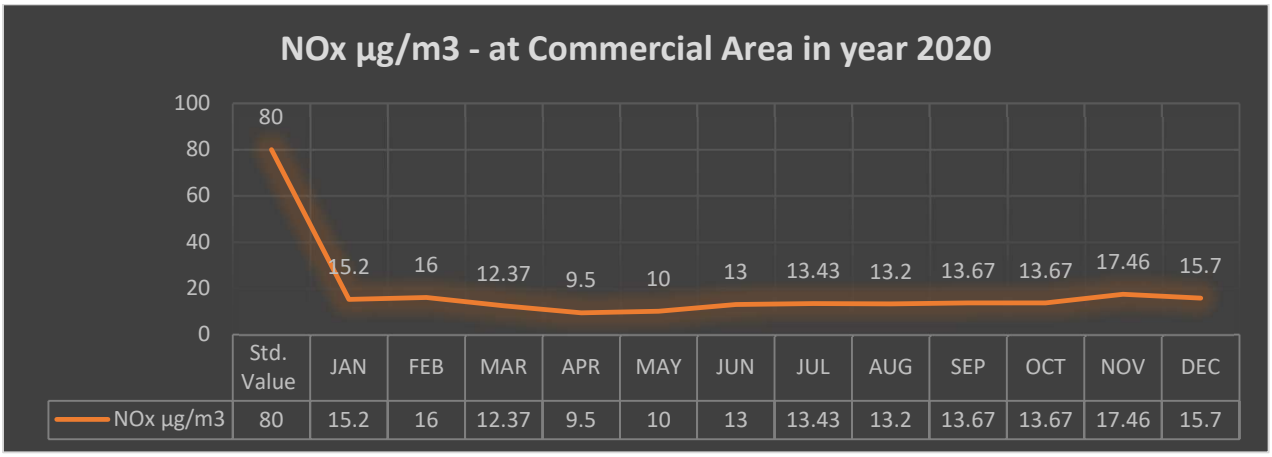

Figure 6: Value of NOx µg/m3 at The Commercial Area in Year 2020

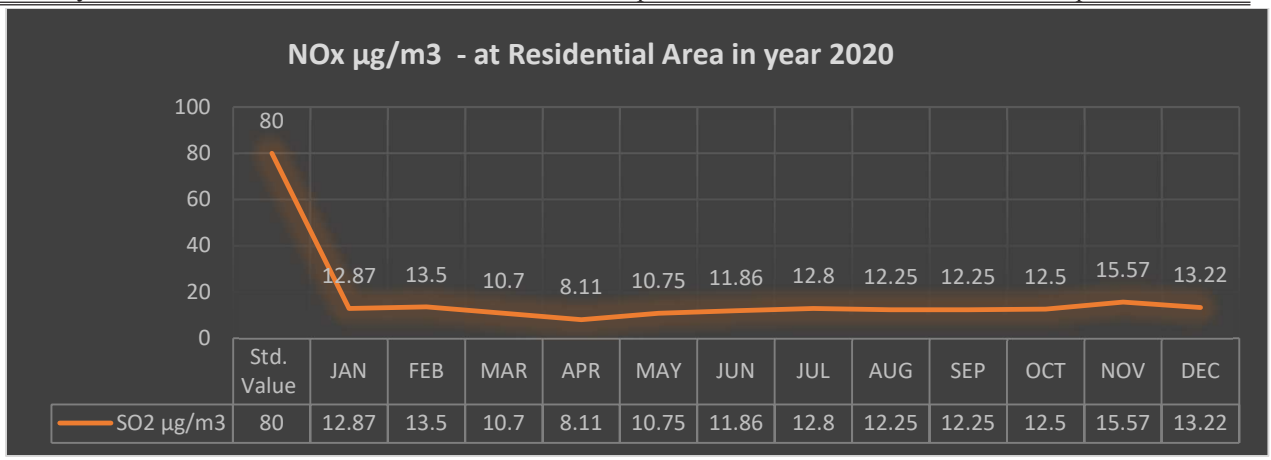

Figure 7: Value of NOx µg/m3 at The Residential Area in Year 2020

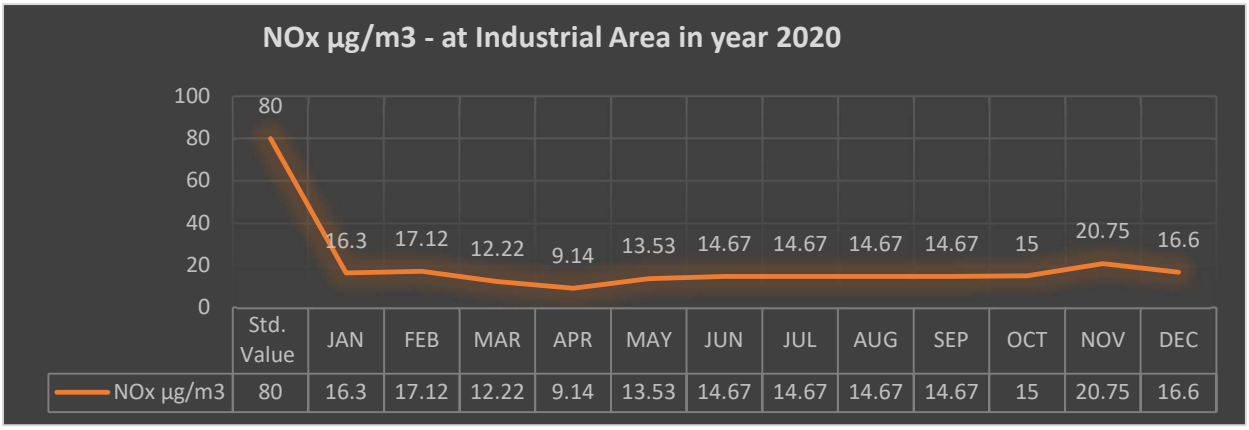

Figure 8: Value of NOx µg/m3 at The Industrial Area in Year 2020

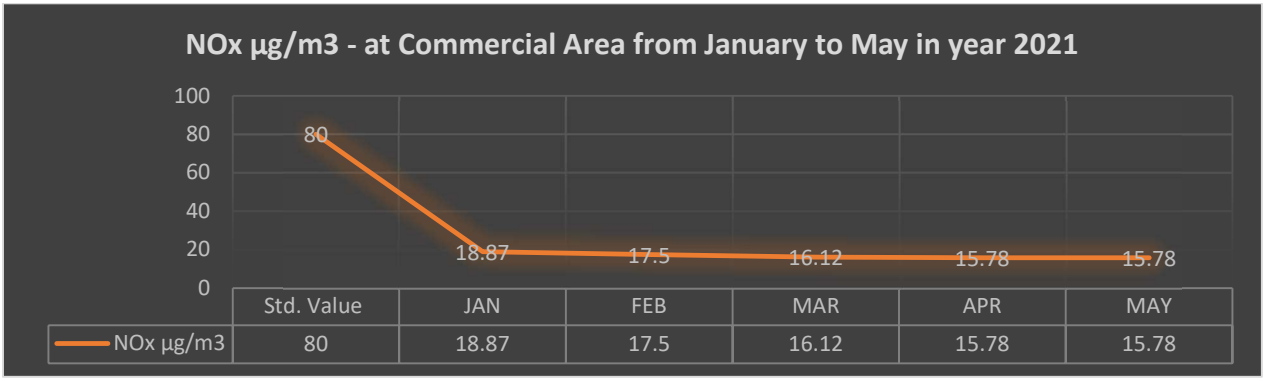

Figure 9: Value of NOx µg/m3 at The Commercial Area from January to May in Year 2021

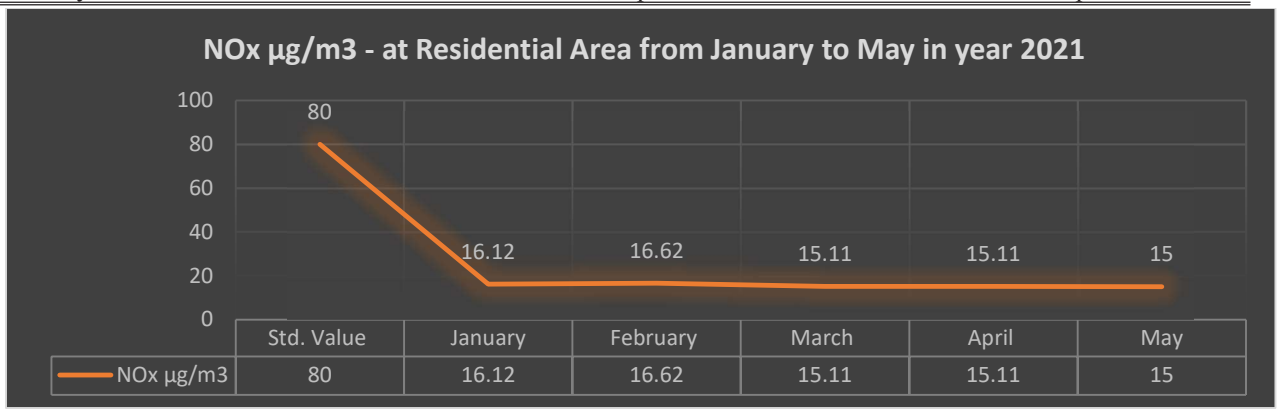

Figure 10: Value of NOx µg/m3 at The Residential Area from January to May in Year 2021

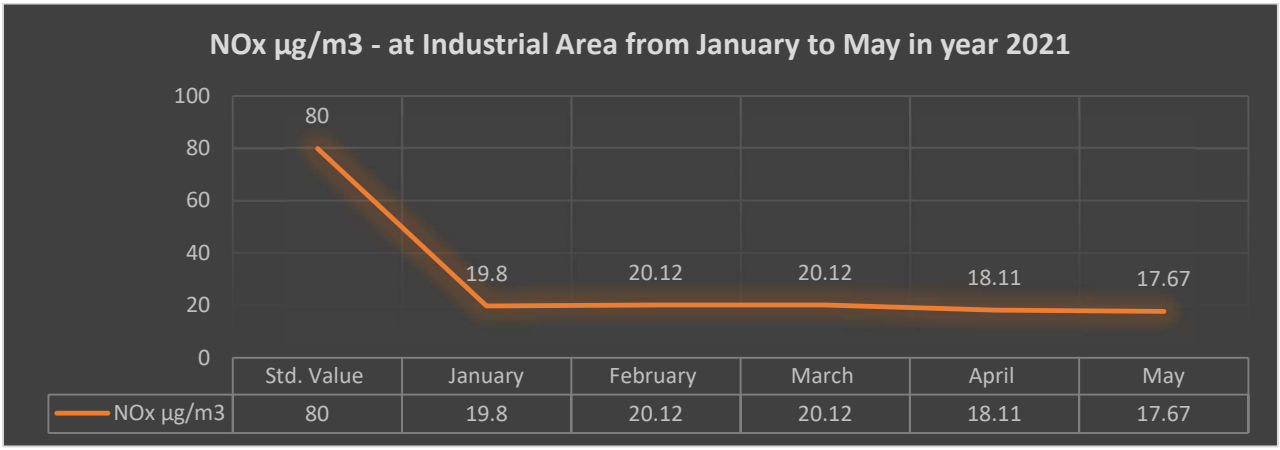

Figure 11: Value of NOx µg/m3 at The Industrial Area from January to May in Year 2021

The permissible standard value for Respirable Suspended Particulate Matter (RSPM) in the ambient air is 100 µg/m^3 (micrograms per cubic meter). The RSPM can penetrate deep into the lungs and cause serious damage to the respiratory system.

RSPM refers to particulate matter with diameter of less than or equal to 10 microns. They are produced from combustion process, vehicles and industrial sources. In Akola city vehicles are the main source for the RSPM in the ambient air. The RSPM obtained from ambient air of Akola is ranged between 30 µg/m^3 - 75 µg/m^3

Figure 12: Value of RSPM µg/m3 at The Commercial Area in Year 2020

The RSPM during the first lock down (April 2020- Sep 2020) was observed between 33 $\mu g/m^3$ to 50 $\mu g/m^3$ at all the selected locations.
the observed value was less during the lock down but after month of November the RSPM Value increases to 60 $\mu g/m^3$ and above, it also remains constant up to 70 $\mu g/m^3$ after the first lockdown and in year 2021 because of the vehicular movement on the roads of Akola.

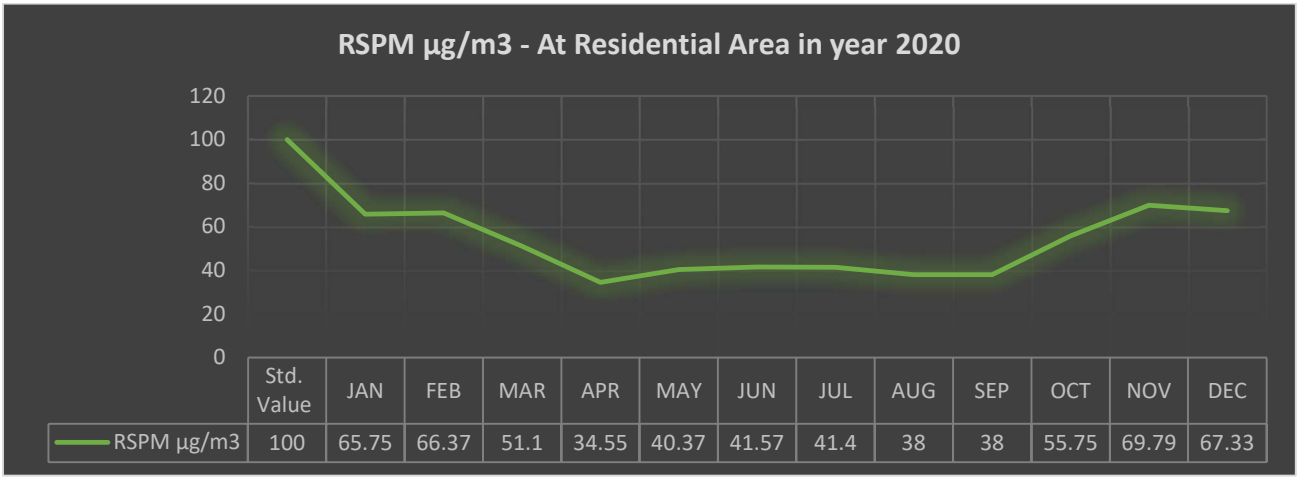

Figure 13: Value of RSPM µg/m3 at The Residential Area in Year 2020

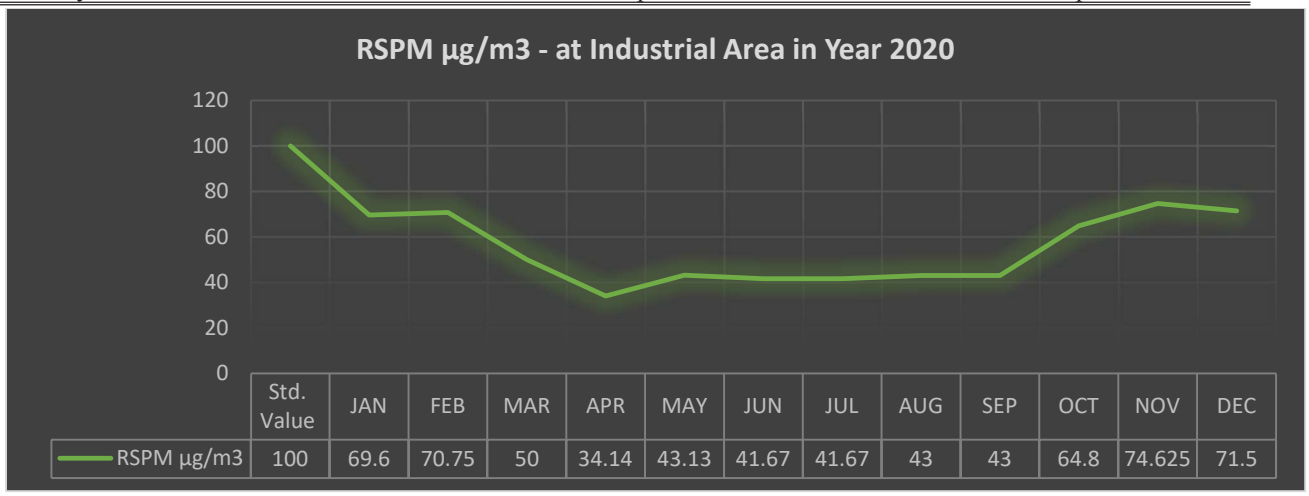

Figure 14: Value of RSPM µg/m3 at The Industrial Area in Year 2020

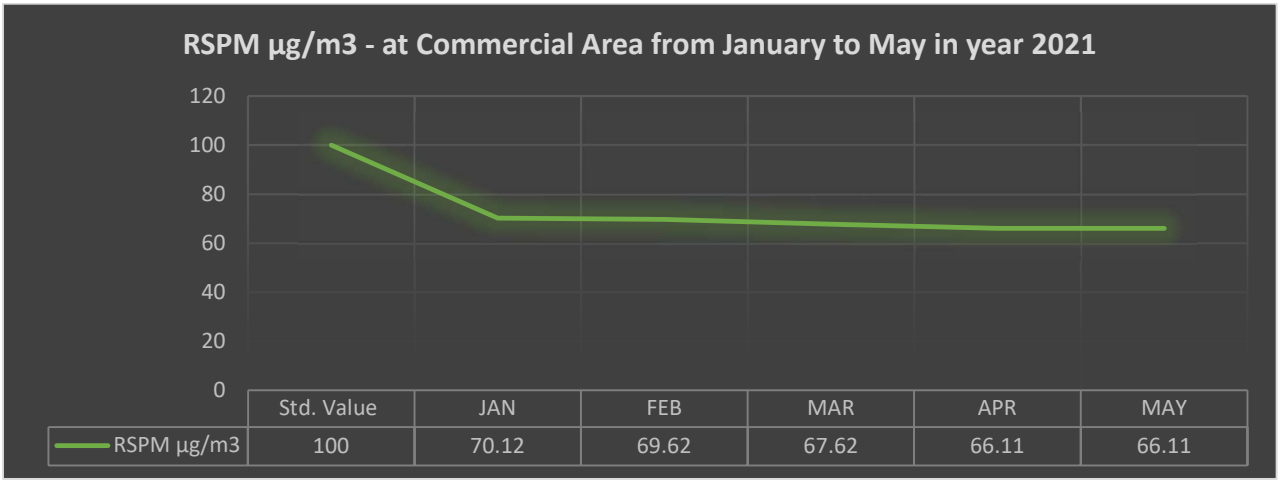

Figure 15: Value of RSPM µg/m3 at The Commercial Area from January to May in Year 2021

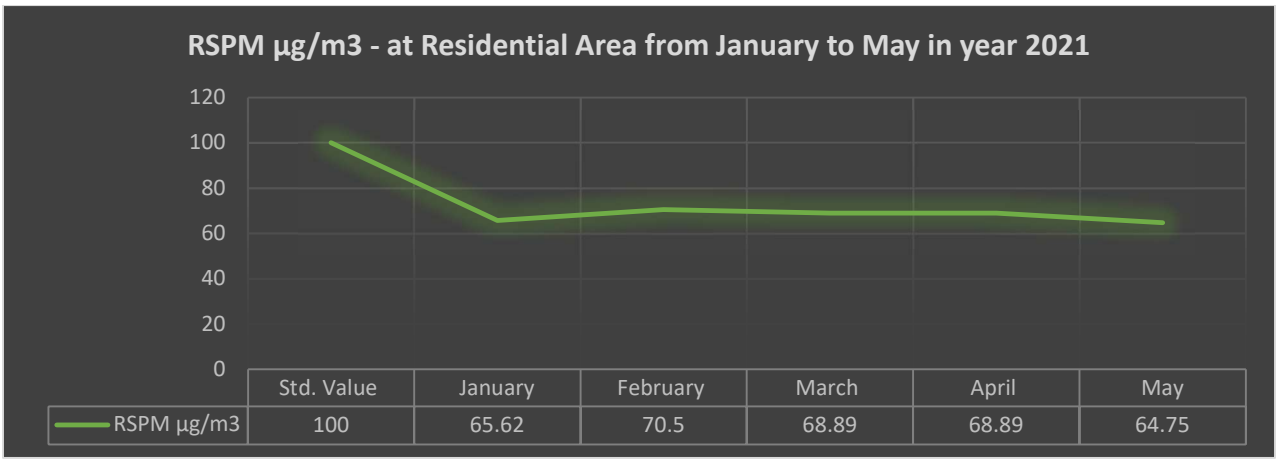

Figure 16: Value of RSPM µg/m3 at The Residential Area from January to May in Year 2021

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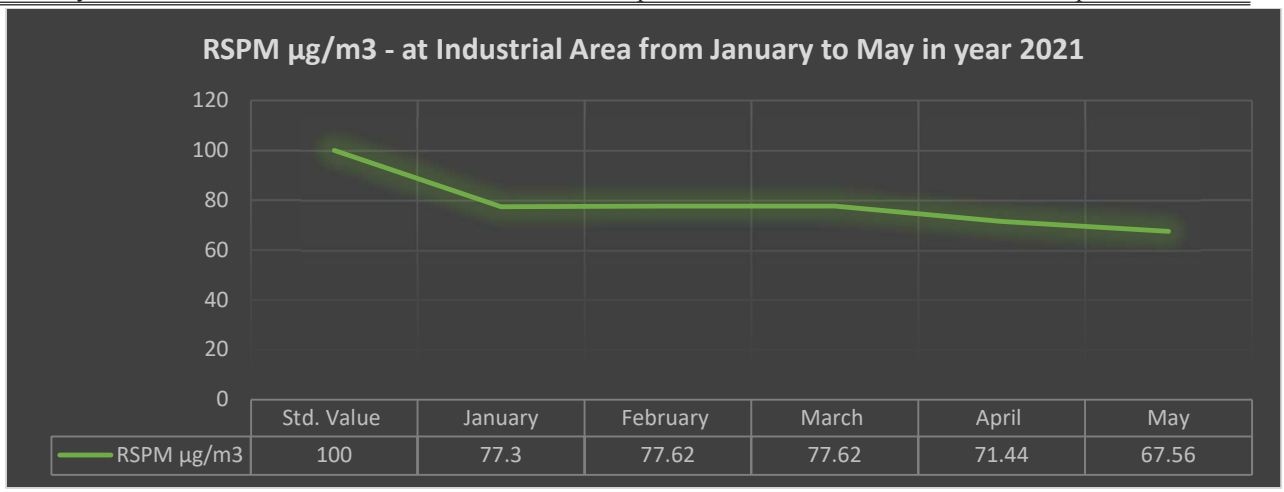

Figure 17: Value of RSPM µg/m3 at The Industrial Area from January to May in Year 2021

CONCLUSION AND RECOMMENDATIONS

As demonstrated by the findings of this study, vehicular emissions contribute significantly to urban air quality. Health risks associated with continuous exposure of humans to gaseous pollutants emanating from vehicle exhaust are largely impairment of respiratory system. In order to minimize the problems of noxious gases emitted by automobiles, the developing countries should ensure that imported vehicles and those locally assembled meet emission standards. Moreover, programme should be put in place to establish enforceable standards for permissible levels of vehicle emissions. Such standard will be used to screen vehicles already in use to determine their road worthiness and check emission level. Functional and effective public-mass transportation programme/ scheme must be pursued with high sense of commitment so as to reduce the volume of private cars in urban centres. To make this achieve the desired result, subsidies should be introduced in the operation of the mass transport system while fees will be charged from private car owners plying some selected routes at certain periods of the day. Traffic volume in some busy zones within the city should be minimized through the introduction of toll fees so as to discourage the use of private vehicles in such area.

As it is clearly observed during the lock down period that because of various rule and regulation adopt by the governing authorities there was restrictions on the vehicle movement in the city and thus the obtained values of SO2, NOx, and RSPM are below the permissible standards.

the ambient air quality in the Akola city was found good in the year 2020 and up to May 2021

Measures that seek to minimize emission of pollutants from automobile are required in the city.

Recommendations

1.Civic education.

Many people do not care about the effects of pollution because they are not aware of them. This can be done through community organizers or by having it taught in schools as part of the curriculum.

2.Adoption of Progressive policies

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Lawmakers should draft legislations that will make people do the necessary as far as bringing down the levels of vehicle pollution is concerned. Such laws can include placing a cap on the age of vehicles that can be imported, setting out guidelines on the conditions of roadworthy vehicles, and creating agencies that will look into alternative fuels such as green energy.

3.Regular Vehicle maintenance

Regular car maintenance can help in repairing or replacing worn out parts. When this is done, the vehicle performs optimally and less amount of pollutants are released into the air.

4.Discard old vehicles

Old vehicles should be discarded or returned to the manufacturing company so that new ones can be acquired. They contribute highly to environmental pollution and can also cause accidents on the roads.

5.To wear Protective Mask

In order to reduce the amount of pollutant inhaled, a person can consider putting on pollution masks.

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