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Analysis of Air Pollution in India During Lockdown

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I. INTRODUCTION

Air pollution is a combination of different visible or diffusible gaseous and particulate pollutants from factories and various vehicles. Due to unusual covid situations that started in China in December 2019 has a drastic spread to the whole world. To reduce the widespread of the virus in India, the government has imposed a strict lockdown from march 24th 2020 for 21 days and was extended according to the highly affected areas. During the lockdown situations, many factories paused their production due to which the amount of pollution has deteriorated. The different types of pollutants in the air: PM2.5 and PM10, nitrogen oxide, sulfur dioxide, carbon monoxide, benzene, toluene and Xylene, ammonia, and ozone.

There were many restrictions related to mobility, workspace, entertainment and many more thereby an improvement in the quality of air has been increased as there was minimal use of vehicles additionally, most of the factories were shut to down for few months except the essential factories which include manufacturing of medicines, food, etc.

This project concerns different highly polluted cities in India and their respective pollution rate during and after the covid lockdown.

II. DATA SET

The data set contains 29532 records of different major cities of India Namely- Ahmedabad, Delhi, Patna, Gurugram, Lucknow, Talcher, Jorapokhar, Brajrajnagar, Kolkata, Guwahati, Jaipur, Bhopal, Amritsar, Visakhapatnam, Chennai, Hyderabad, Mumbai, Kochi, Chandigarh, Amaravati, Bengaluru, Ernakulam, Thiruvananthapuram, Coimbatore, Shillong, and Aizawa. Also, indicate the eminence air for five consecutive years from 2015 and a detailed view of the various impurities in exact composition. Including the classification of the extent, the city was affected by pollution.

Based on this information, analysis of air quality can be performed from Pre-lockdown and during the lockdown.

III. DATA REPRESENTATION

With the help of continuous monitoring systems maintained by the government, the data is represented on an hourly and daily basis. Initially, the packages like NumPy for scientific computing, pandas for data analysis, matplotlib used for plotting graphs, and seaborn for data visualization are imported, Including the data set with an extension .csv.

```
cities = city_day['City'].value_counts()
print(f'Total number of cities in the dataset : {len(cities)}')
print(cities.index)
```

```
Total number of cities in the dataset : 26
Index(['Chennai', 'Delhi', 'Lucknow', 'Mumbai', 'Bengaluru', 'Ahmedabad',
       'Hyderabad', 'Patna', 'Gurugram', 'Visakhapatnam', 'Amritsar',
       'Jorapokhar', 'Jaipur', 'Thiruvananthapuram', 'Amaravati',
       'Brajrajnagar', 'Talcher', 'Kolkata', 'Guwahati', 'Coimbatore',
       'Shillong', 'Chandigarh', 'Bhopal', 'Kochi', 'Ernakulam', 'Aizawl'],
      dtype='object')
```

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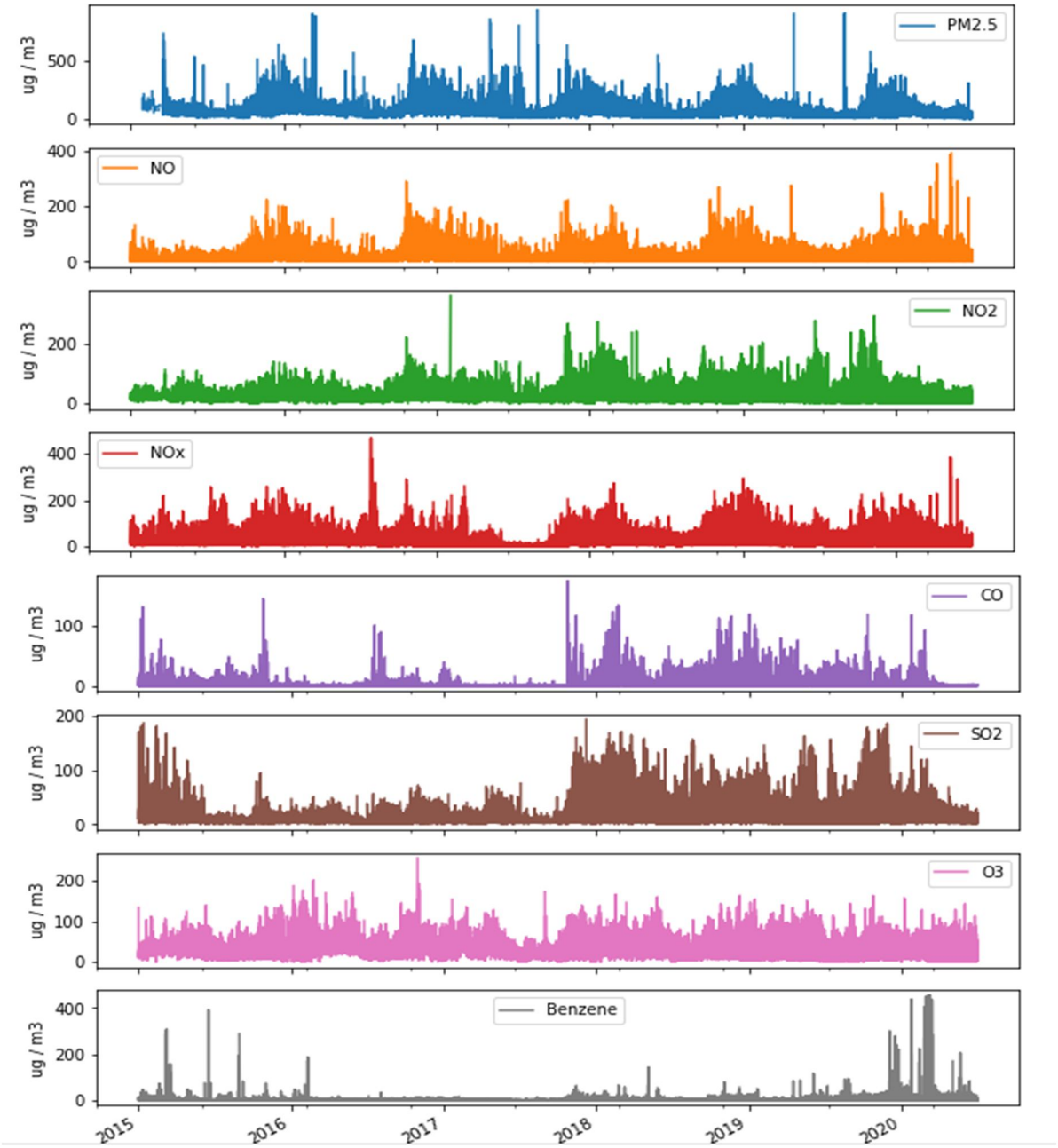
Data of a few pollutants are unfastened as the data contains many null values thereby, indicating the pollution by those gases is minimal.

```
In [9]: print(f"The available data is between {city_day['Date'].min()} and {city_day['Date'].max()}")

The available data is between 2015-01-01 00:00:00 and 2020-07-01 00:00:00
```

The yearly and monthly effects of individual pollutants are visualized through which the number of pollutants present is represented graphically.



Through these graphs, it is evident that the number of pollutants is reduced in the months of April - August, by these recent unusual covid lockdown situations.

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IV. EFFECT AFTER LOCK DOWN

Due to intense lockdown situations that have arrived in India, the air presence has become clear**.** Additionally, the sources of poor air quality were temporarily paused thereby, reducing the effect of pollutants in the air. Here in this project, we are comparing the AQI index. AQI index is the measure of harmful pollutants and the quality of the air that is present in that particular location, which is under the control of the government. Greater the value of the AQI index, the amount of pollution in that area is higher.

The levels have been separated according to the effect that may impact the environment:
0-50 -- GOOD (usually indicated by green colour)
50-100 -- MODERATE (usually indicated by yellow colour)
100-150 -- UNHEALTHY FOR SOME SENSITIVE GROUPS (usually indicated by orange colour)
150-200 -- UNHEALTHY (usually indicated by red colour)
200-300 -- VERY UNHEALTHY (usually indicated by purple colour)
300-500 -- HAZARDOUS (usually indicated by maroon colour)

The AQI for some major cities is protracted and compared between the original values stated by the government to the values before and after a lockdown in descending order.

V. VALUES BEFORE LOCKDOWN

```
print(avg_AQI_beforeLockdown.sort_values(ascending=False))
```

```
City
Ahmedabad             386.023810
Guwahati              252.785714
Delhi                 248.142857
Lucknow               216.380952
Patna                 214.500000
Talcher               209.476190
Gurugram              196.535714
Kolkata               185.142857
Jorapokhar            161.952381
Brajrajnagar          150.345238
Mumbai                149.464286
Bhopal                136.964286
Kochi                 122.714286
Jaipur                116.488095
Ernakulam             114.369048
Amritsar              108.095238
Visakhapatnam         104.428571
Bengaluru              96.333333
Hyderabad              94.845238
Chandigarh             84.523810
Thiruvananthapuram     81.440476
Chennai                80.583333
Coimbatore             79.440476
Shillong               72.595238
Amaravati              69.011905
Aizawl                 53.250000
dtype: float64
```

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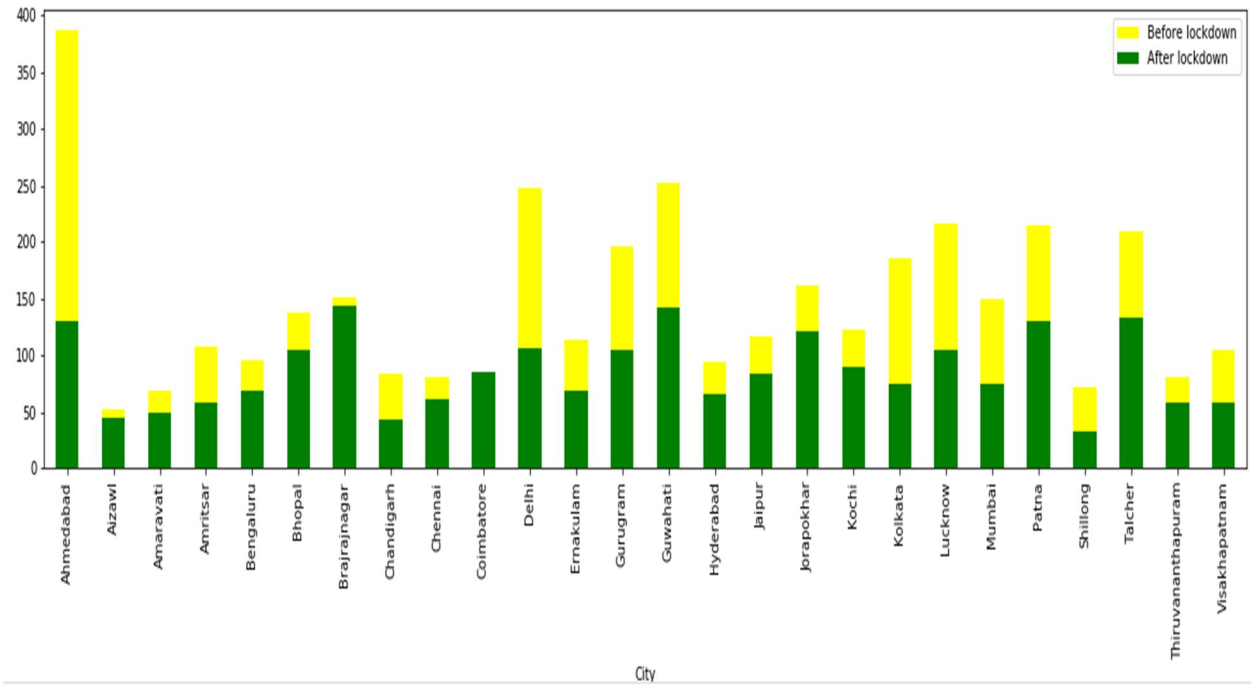
VI. VALUES DURING LOCKDOWN

```
print(avg_AQI_afterLockdown.sort_values(ascending=False))
```

```
City
Brajrajnagar          144.315789
Guwahati              142.842105
Talcher               132.578947
Patna                 130.000000
Ahmedabad             129.578947
Jorapokhar            121.684211
Delhi                 106.868421
Bhopal                105.578947
Lucknow               105.184211
Gurugram              105.000000
Kochi                  90.263158
Coimbatore             85.473684
Jaipur                 83.342105
Kolkata                75.710526
Mumbai                 74.342105
Ernakulam              69.157895
Bengaluru              68.526316
Hyderabad              65.421053
Chennai                62.236842
Visakhapatnam          59.236842
Amritsar               59.157895
Thiruvananthapuram     58.894737
Amaravati              49.736842
Aizawl                 45.342105
Chandigarh             43.421053
Shillong               33.921053
dtype: float64
```

Moreover, for clear depiction of the abrupt increase in the quality of air after lockdown is indicated by a bar graph.



This bar graph depicts the quality of air after the serious decision taken by our government. The quality of air has been escalated after shut out of the country.

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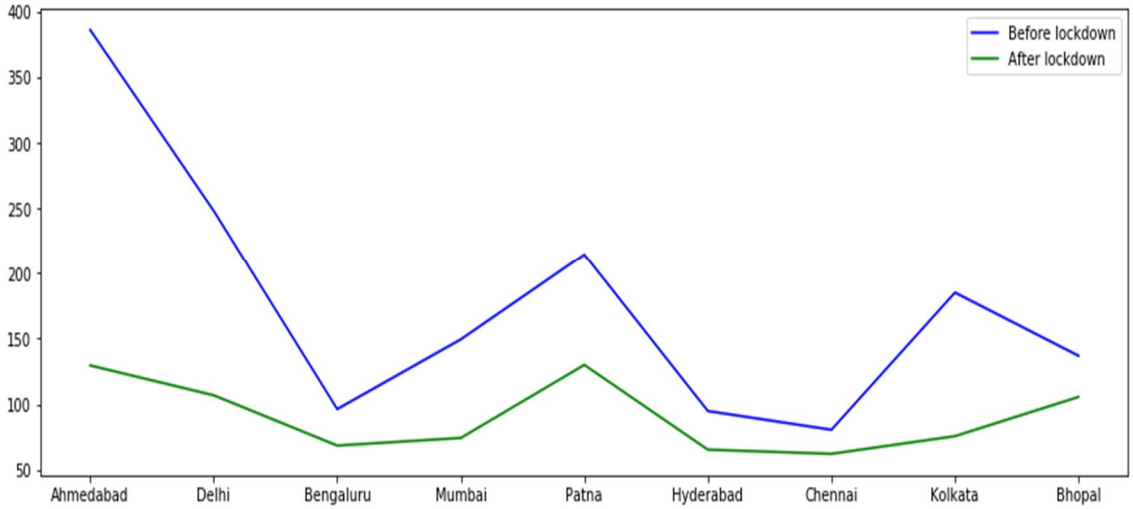
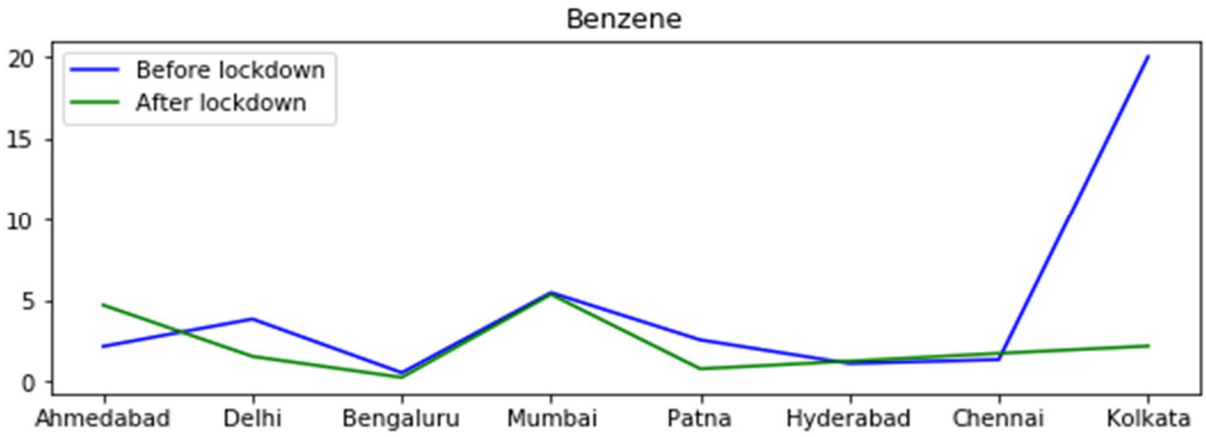
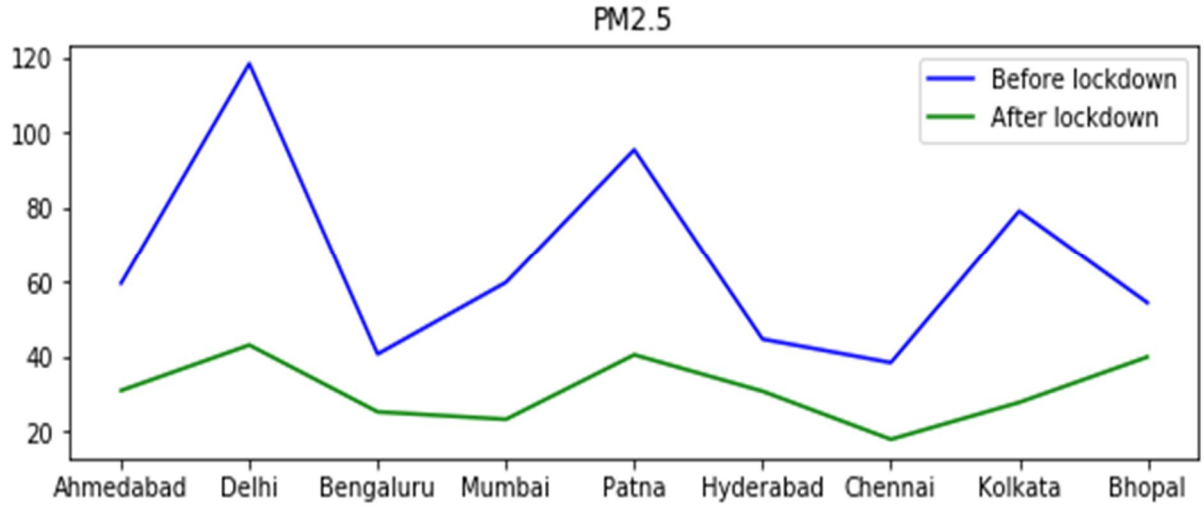


Let's discuss the kind of pollutants that have been deteriorated in specific.





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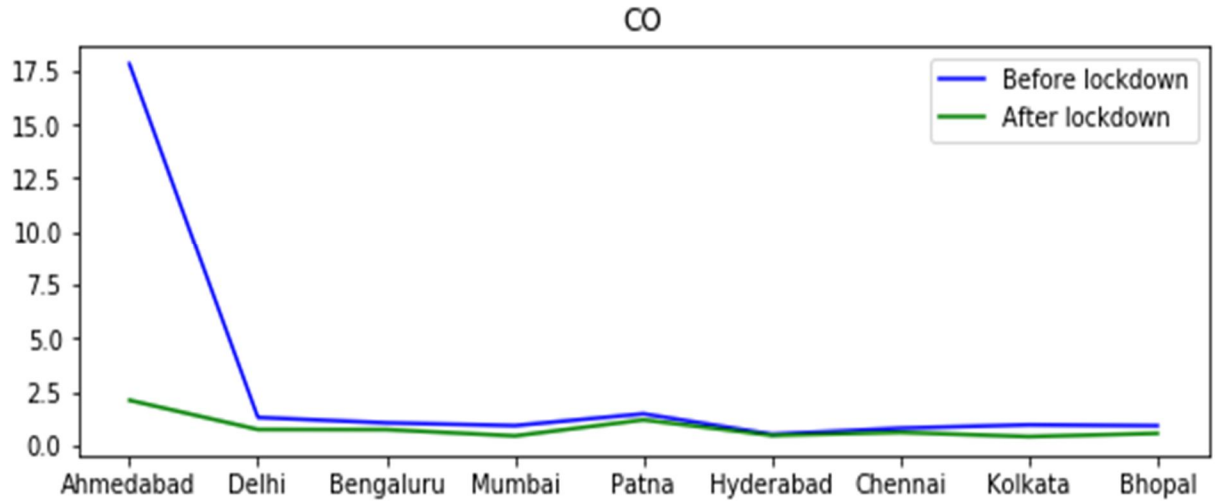

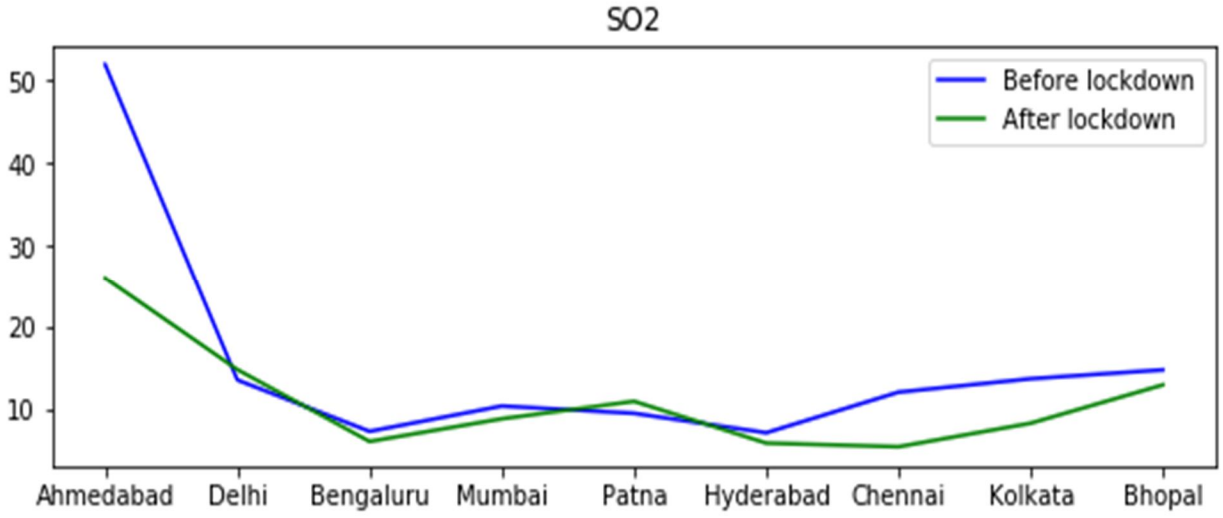

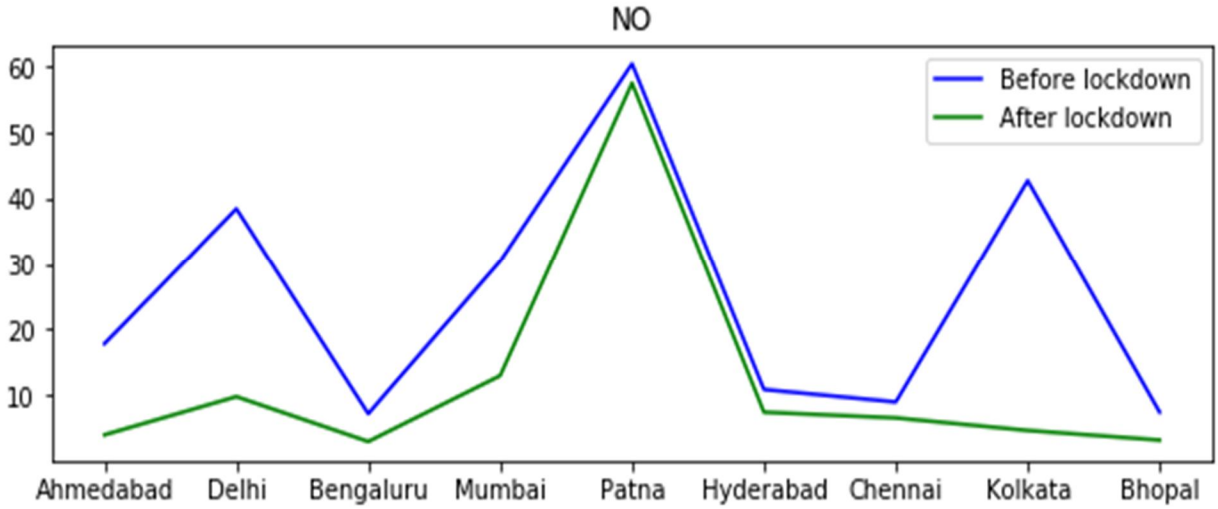

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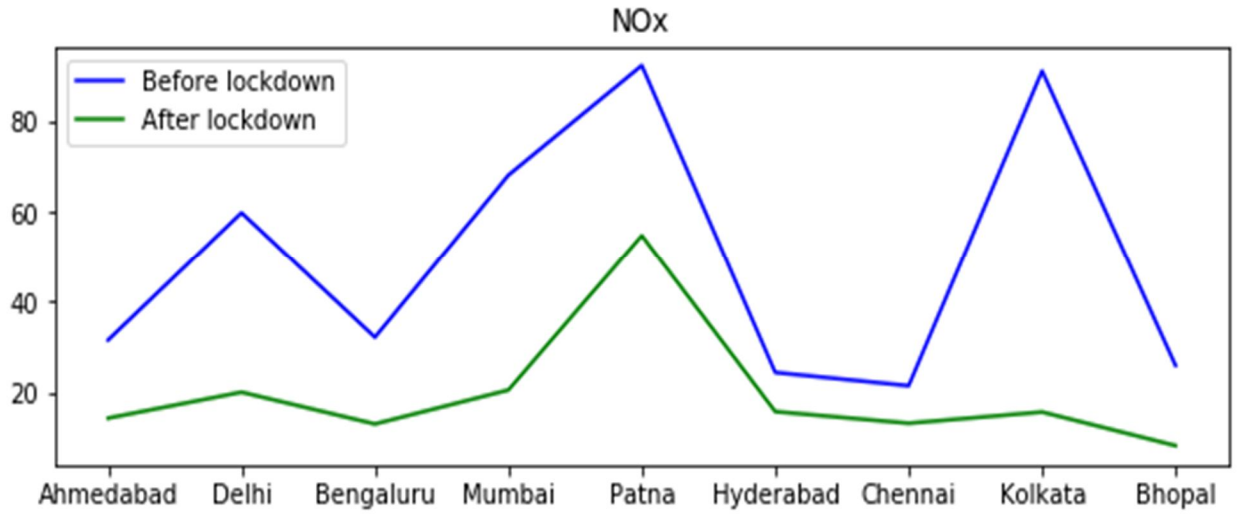

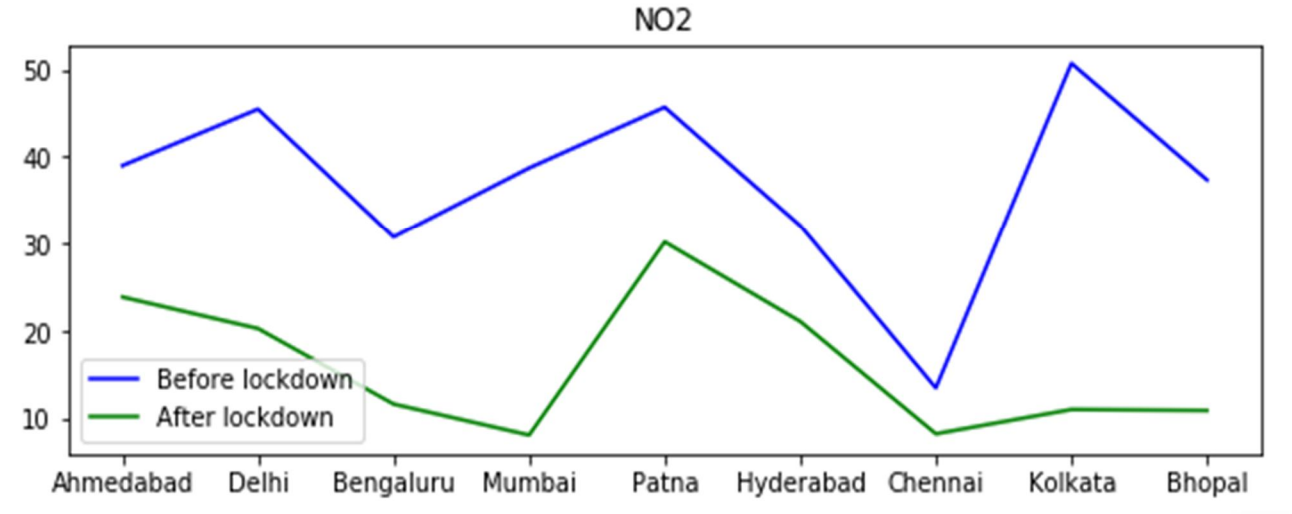

By the above line graphs depict the values after lockdown except for benzene all other hazardous gaseous have taken the edge off. But, in a few cities, the benzene release has been increased after shutdown like Ahmedabad, Banglore, and Mumbai.

VII. CONCLUSION

Ahmedabad notices a level of increase in benzene during lockdown than before lockdown. Except that, all other hazardous gases levels have dwindled thereby the level of impurities has been decreased in the atmosphere. It is remarkable to see the reduction in the concentration of many harmful gaseous in most of the major cities in India. This is mostly because of the unusual situations that have been arrived in different factories and minimal pollution of vehicles. Due to this, not only the air but also the rives have become clean from different wastes and pollution. As the levels of pollution decrease, the health effect of pollution has also been decreased.

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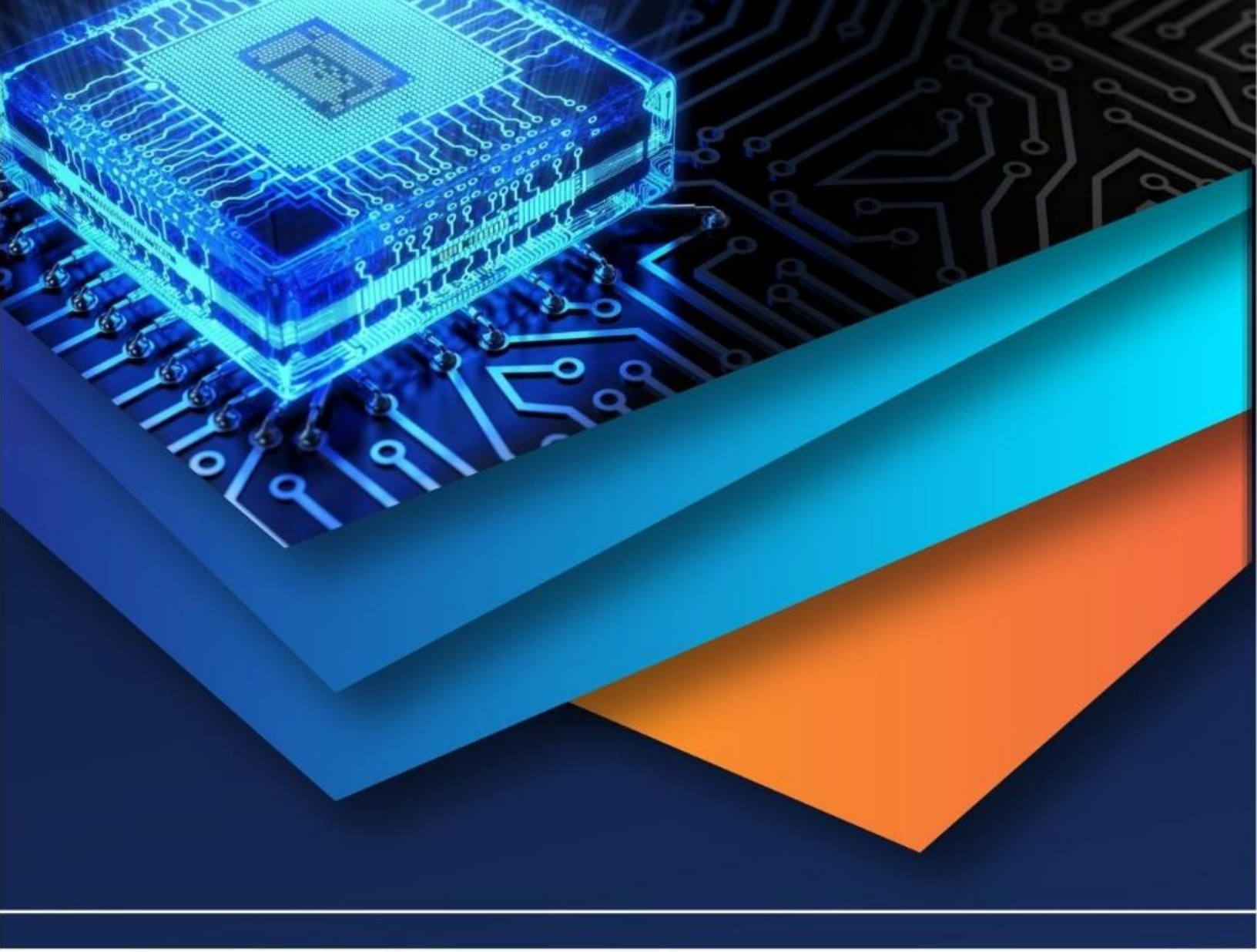

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