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The Coronavirus Pandemic's Impact on the Environment Pollution of NCR Region

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ABSTRACT: The quality of ambient air directly affects the lives of humans and animals. Increasing particulate issues caused by the blend of agents, such as chemical, biological and radioactive matters to the air influence human and animal health. Air pollution causes a variety of diseases in humans. The present study aimed to analyze the variation in environmental factors during the two different months of same year. The effect of variation in these parameters is measured on Dwarka, Delhi's ambient air. The testing was performed with the help of ITL laboratory to collect the data. The data of different time zones are collected and compared to observe the impact of lockdown on the environmental air of Delhi. The improvement in the environment and most influential factors are highlighted. It is found that the harmful elements of environmental air are controlled during the national and local lockdown. The improvement in ecological factors emerged with significant improvement as PM10, PM2.5, CO, NO2, SO2, Ozone and NH3 is found with 54.73%, 58.33%, 82.70%, 56.52%, 139.29% and 45.45%, respectively. The comparative analysis of data for pre and post-lockdown has been performed, providing the significance of individual parameters. The impact of parameters on ambient air of Delhi is also compared with the standard data.

I. INTRODUCTION

The blend of agents, like chemical, carbon and other radioactive matters to the environment creates the air pollution. To retain the healthy human life it is necessary to maintain the air quality of a standard that avoids hazardous [1]. According to world health organization (WHO), anthropogenic contaminants makes unhealthy air in India every year. The Delhi and Kolkata are the two metro cities with poor air quality in India [2]. The environmental air is affected by increasing particulate issues, which further influence human and animal health. The blend of agents, like chemical, carbon and other radioactive matters to the environment creates the air pollution. To retain the healthy human life it is necessary to maintain the air quality of a standard that avoids hazardous [1]. According to world health organization (WHO), anthropogenic contaminants makes unhealthy air in India every year. The national capital region (NCR) of Delhi and Kolkata are the two metro cities with poor air quality in India [2]. The air quality is an issue not only for India but also for many countries [3]. The air pollution causes a variety of diseases in human. It is one of the major causes for human deaths worldwide.

The WHO acknowledged occurrence of the novel coronavirus COVID-19 in March 2020 and declared as global pandemic. At the same time, COVID19 infection is a big threat for human health worldwide. A confirmed cases on July 12, 2020 were over 12.80 million 12507849 over 570 thousands deaths worldwide [4]. The transmission of COVID19 virus through respiratory droplets to human was confirmed by WHO in January 2020. Many researchers and media reported that the air pollution decreased during national lockdown. In second most populated country i.e. India, the Janta Curfew was announced on March 22, 2020 and consequently, a national lockdown of three weeks was extended on March 24, 2020 [5]. The global spread of COVID-19 infection threatened the human life worldwide [6]. The reports of research studies, media and government organizations show that the lockdown due to COVID19 affected the human life but at same time it provided the positive effect to the environmental air across India [4, 5] [22]. The harmful factors of environmental air are controlled during the national and local lockdown. The parameters such as nitrogen dioxide (NO2), aerosols, atmosphere ozone, particulate matter (PM10, PM2.5), etc., are found to be in safe range due to the lockdown in India. Specially, the Delhi reason is always a focusing point for environmental issues. The report of Central Pollution Control Board of India, Delhi, Mumbai, Bengaluru, Chennai, Hyderabad and Lucknow are most polluted cities across the country. Many research studies are focused on investigating these cities' environmental impact [15][23].

People collected data from different sources and compared with either previous data or the different locations of country. Even many studies analyzed the environmental conditions of different countries during the worldwide

lockdown. In general, the studies summarized the macroscopic effect of some environmental factors on ambient air. The studies compared the effect on air pollution with different locations rather than the specific place at different time zones. The data collected for analysis is satellite based for most of the studies rather than actual measurement. Therefore, the study on the important factors related to air pollution is necessary for the future. The present study aimed to analyze the variation in PM10, PM2.5, CO, NO2, SO2, Ozone, NH3 during the period of March 2020 to May 2020. The effect of variation in these parameters is measured on Dwarka, Delhi's ambient air. The testing was performed with the help of ITL Delhi laboratory to collect the data. The data of different time zones are collected and compared to observe the impact of lockdown on environmental air of Delhi. The improvement in environment and most influential factors are highlighted.

II. METHODOLOGY

To prepare a valid and conceptual theme for analysis the literature has been explored and then matches with the observed data. A sequential theme of overall work methodology is summarized in Figure 1.
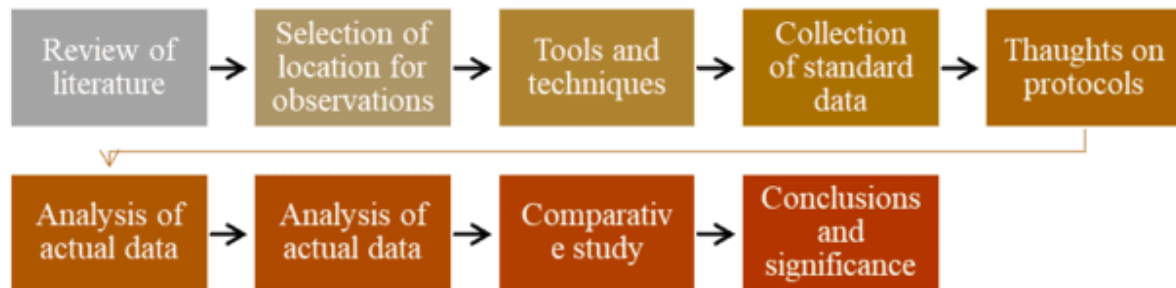

Figure 1 Steps of overall methodology

Major factors of ambient air

Sulfur dioxide (SO$_2$): The SO$_2$ is a colorless gas with a sharp, irritating odor. The burning of fossil fuels. The erupting volcanoes can also a substantial natural source of sulfur dioxide releases. It combines with water and air and forms the sulfuric acid that further causes the acid rain. It also affects the respiratory system including lung function which causes the diseases such as asthma and chronic bronchitis. During lockdown the concentration of SO2 varied that influenced the environment.

Nitrogen Dioxide (NO$_2$): The NO$_2$ is a group of highly reactive gases (oxides of nitrogen (NOx)). The burning of fuels through cars, trucks and buses, power plants, and other processes produces nitrogen dioxide. When its concentration increases over the standard value, it polluted air, affecting the respiratory system and causes many diseases. The concentration of NO2 affected greatly during the lockdown due to COVID19 pandemic [24].

Particulate Matter (PM$_{10}$): India's air quality, especially in the north Indian region, is very poor, which is creating the health emergency. It creating respiratory diesis due to increased particulate matter which increasing number of death of people suffering from the COVID-19 infection. Therefore, it is necessary to maintain the concentration of particulate matter (PM$_{10}$) in desired range [4].

Particulate Matter (PM$_{2.5}$): Different chemical compositions form the PM2.5. Basically PM$_{2.5}$ derived from various emission sources. The burning of oil, fuels, gas and wood produce the PM$_{2.5}$ which causes the air pollution. The increase in concentration of PM$_{2.5}$ reduces the visibility and makes the air hazy. Many studies concluded that the concentration of PM2.5 controlled during the national lockdown duet to COVID19 pandemic [25].

Ozone (O3): The sensitive vegetation and ecosystems influence by the Ozone (O3). During the growing season the vegetation affected by ozone and it is very sensitive to the environment. Several researchers investigated the impact of lockdown on ozone level. The ozone levels increases in period of COVID19 pandemic. It is because all industrial and transportation activities minimized during this period [26].

Ammonia (NH₃): Naturally, the ammonia comes in environment by decomposition of organic waste, forest fires, nitrogen fixation and gas exchange with the atmosphere. It also reaches to environment from the utilization of agricultural fertilizers. A significant variation in ambient quality found during global pandemic [27].

Benzo (a) Pyrene (BaP), Lead, Nickel & Arsenic: The Benzo (a) Pyrene is a significant factor of PACK which is cancer-causing chemical. The standard range of these factors affected during the lockdown due to global pandemic i.e. COVID19. The heavy metals such as lead (Pb), nickel (Ni) & arsenic (As) are natural elements with high atomic weight. Their over concentration directly affects the human health and environment. Their high degree of toxicity damages the organs of human [28][29]. The steps of sample processing and Rotary Evaporator for Sample Concentration are provided in Figures 2 and 3 respectively.
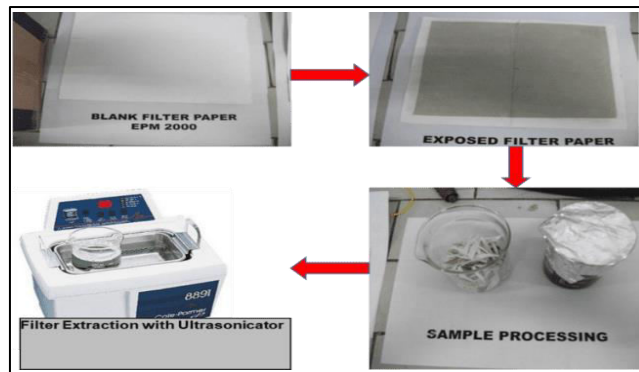

Figure 2 Main steps of sample processing

Figure 3 Rotary Evaporator for Sample Concentration

The extracted sample must be Cover/Cap. The marking should be done for necessary identification. Prior to the analysis the sample keeps in the place of 4°C temperature. The samples ready to Inject are shown in Figure 4.

Figure 4 The samples ready to Inject

III. RESULTS

The impact of lockdown on ambient air quality of Delhi has analyzed and defined clearly. The reason of air pollution explained based on differentiation of measured data. The observed data during 1st March to 16th March is shown in Table 1.

Table 1 Observations made in March 2020

Parameters	SO2 (µg/m^3)	NO2 (µg/m^3)	PM10 (µg/m^3)	PM2.5 (µg/m^3)	O3 (µg/m^3)	NH3 (µg/m^3)
Req. value	20	30	142	67	180	100
1 Mar	23	74	271	148	28	44
2 Mar	18	42	138	165	50	40
3 Mar	21	39	169	166	43	35
4 Mar	14	49	157	157	23	32
5 Mar	16	62	220	139	22	33
6 Mar	13	45	253	196	32	36
7 Mar	23	43	272	182	38	28
8 Mar	22	49	173	153	51	26
9 Mar	24	32	171	179	51	33
10 Mar	22	56	249	155	28	31
11 Mar	24	45	196	148	32	30
12 Mar	20	50	178	141	27	35
13 Mar	25	60	160	134	67	49
14 Mar	24	70	142	127	77	63
15 Mar	22	80	124	120	94.5	77
16 Mar	23	43	272	182	38	29

The observations for the similar factors is made during 15th May 2020 to 30th May 2020. The observed data is shown in Table 2. The results are varied in every duration of observation. It is because the temperature difference and lockdown duration.

Table 2 Observations made in May 2020

Parameters	SO2 (µg/m^3)	NO2 (µg/m^3)	PM10 (µg/m^3)	PM2.5 (µg/m^3)	O3 (µg/m^3)	NH3 (µg/m^3)
Req. value	20	30	142	67	180	100
15 May	14	4.3	122	69	38	22
16 May	10	4.4	138	41	56	18
17 May	12	6.7	125	25	59	23
18 May	9	4.2	143	23	48	18
19 May	6	7.3	118	52	52	16
20 May	9	5.9	129	56	44	19
21 May	12	5.6	126	63	50	12

22 May	13	5.5	133	60	59	17
23 May	18	6.9	124	52	58	25
24 May	10	12.8	142	67	67	24
25 May	12	5.5	129	63	76	17
26 May	13	6.9	126	60	85	25
27 May	14	8.3	141	61	94	33
28 May	15	9.7	144	63	103	41
29 May	16	11.1	150	65	112	49
30 May	18	6.9	124	52	58	21

Comparative analysis of parameters in March and May months

The variation in environmental factors has been recorded and on starting of observation in both months is compared with the results of Central Pollution Control Board. The improvement is observed in all selected factors from starting of lockdown to the two months later. Though, the standard values have not attained during this period. The comparison graph Figure 5 shows the variation in parameters in starting of observation in March and May.
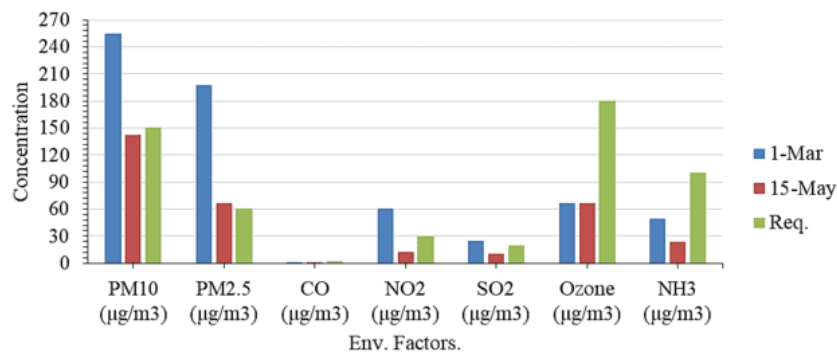

Figure 5 Comparison on starting of observations

Similar to the starting of observation, at the end of observations data has been compared. The variation in environmental factors has been recorded for all selected parameters i.e. PM10, PM2.5, CO, NO2, O3 and NH3 at the end of observations of both months. A quit comparable results are found with the improvement in air quality. The improvement in air quality of selected location was recorded in lockdown due to COVID19 pandemic. The SO2 and NO2 are found to be changed maximum which are the very dangerous blends of ambient air. Figure 6 shows the data at the ends of observations of March and May 2020 along with required range of factors for safe air.
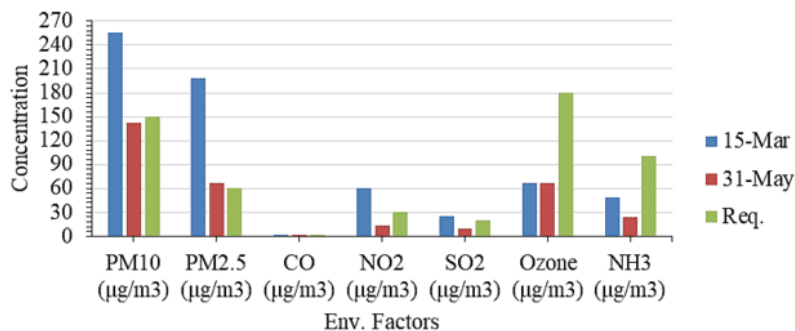

Figure 6 Comparison at the ends of observations

For the more insight on environmental factors, the data of the same months in previous year is also analyzed. The data at different observatory dates has been collected from Central Pollution Control Board. The air quality data of February months of 2019 and 2020 is compared as shown in Figure 7. Because both time zones are of before lockdown, therefore the quality of air is almost same for February of both years. The quality of air is also far better in April 2020 than April 2019. The AQI index in April 2019 was 199 whereas in April 2020 is 75 which is better for the environment and human being.

The similar comparison of AQI for May 2019 and May 2020 is compared through the Figure 8. It can be observed that the average values of almost all environment parameters improved after lockdown. For example the PM2.5 in May 2019 was 172, which is reached to 35 in May 2020. In similar manner other environmental parameters such as PM10, NO2, NH3, SO2, CO and Ozone are 329, 61, 6, 38, 39 and 115 in May 2019 whereas these parameters are 65, 19, 12, 24, 27 and 75 respectively in May 2020. The values of environmental factors in graphs are indicating the effect of lockdown due to COVID19 Pandemic on ambient air of Delhi.
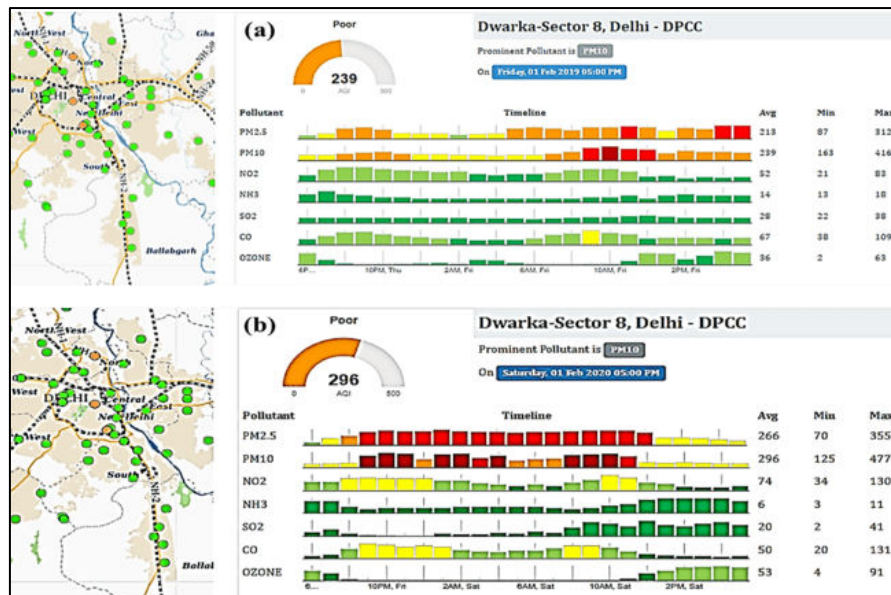

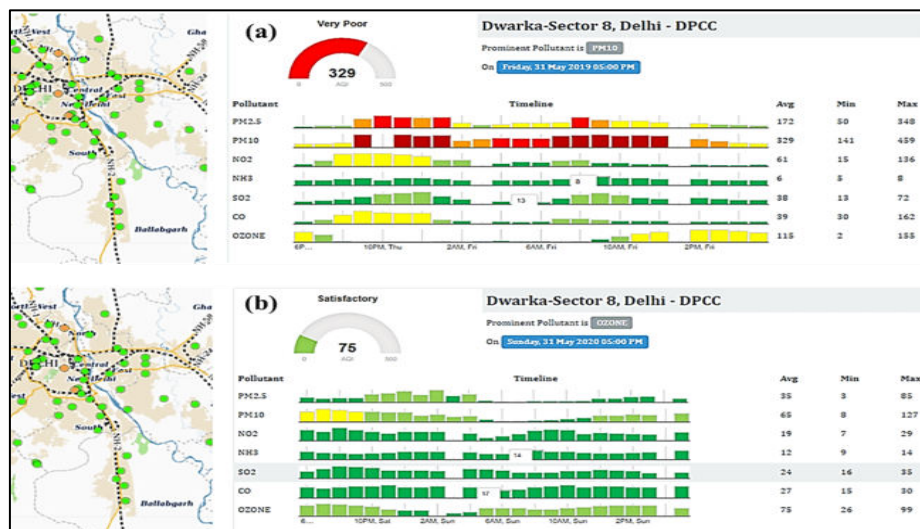**Figure 7** Air quality data in Feb. 2019 and 2020

Figure 8 Air quality data in May 2019 and 2020

From the air quality data plots, a significant enhancement in ambient air was found by the lockdown. Figure 9 represent the overall improvement in factors of ambient air for pre and post lockdown.
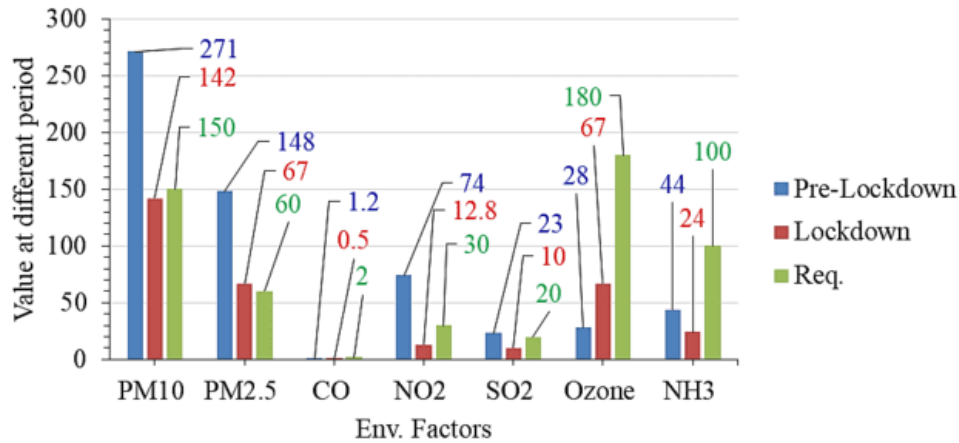

Figure 9 Overall improvement in factors of ambient air

The analysis of data collected with respected different time zones for various environmental factors shows many conclusions. The required value of factors in ambient increase or decrease depending upon the human activities. The results predict the major contribution of environmental parameters for healthy ambient in Delhi. The major advantages of such studies is to select the most influencing factors in ambient air of a particular place. When we want to develop a new system to control the safe air quality, then the suggestions of such study provides the significant information to considerable parameters for system. The design of any system without pre-requisition analysis and affecting factors may not provide satisfactory output. The conflicting nature of environmental factors also makes the system design complex. Some factors are required to be increase and other to be decreases such as SO2, NO2 etc. The Ozone and Ammonia should not to be decrease below desired values. On the other hand more the reduction in SO2 and NO2 is preferable for good quality of ambient air. The above graphical analysis shows a significant improvement in environmental factors. The improvement in environmental factors including PM10, PM2.5, CO, NO2, SO2, Ozone and NH3 is found with 47.60%, 54.73%, 58.33%, 82.70%, 56.52%, 139.29 and 45.45 respectively.

IV. CONCLUSIONS

The main aim of the present study is to investigate the impact of environmental factors such as PM10, PM2.5, CO, NO2, SO2, O3 and NH3, etc., on the quality of the ambient air of Delhi. The testing was performed with the help of the ITL Delhi laboratory to collect the data. The data of different time zones are collected and compared to observe the impact of lockdown on the environmental air of Delhi. The systematic insight on environmental factors for the safest ambient air of Delhi has been studied through the actual measurement. The reason for air pollution is explained based on the differentiation of data. It is found that the harmful factors of environmental air are controlled during the national and local lockdown. The improvement in environmental factors emerged with significant improvement as PM10, PM2.5, CO, NO2, SO2, Ozone and NH3 is found with 54.73%, 58.33%, 82.70%, 56.52%, 139.29% and 45.45%, respectively. The comparative analysis of data pre and post-lockdown has been performed, providing the significance of individual parameters. The impact of parameters on ambient air of Delhi is also compared with the data published by Central Pollution Control Board Gov. of India which confirms the accuracy and validation of observations.

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