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SUSTAINABLE IMPROVEMENT OF AIR QUALITY DURING COVID-19 PHASE: A SPECIAL REFERENCE TO ASANSOL INDUSTRIAL TOWNSHIP, WEST BENGAL, INDIA

SAHA D[1], KESHRI JP[2] AND SAHA NC[3*]

1: Research Scholar, Department of Botany, The University of Burdwan, West Bengal, India, 713104

2: Professor, Department of Botany, The University of Burdwan, West Bengal, India, 713104

3: Vice Chancellor, The University of Burdwan, West Bengal, India, 713104

***Corresponding Author: Dr. Saha NC: E Mail: saha.buruniv@gmail.com;**

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ABSTRACT

Industry based township Asansol is always experiencing polluted environmental conditions in respect to the air quality. The present study is based on the measurement and analysis of air quality parameters to identify the intensity of pollution in this township. In this work, eight (08) stations of Asansol Township have been selected for measuring the air quality parameter through Temtop M2000C Air Quality Monitor. Data on PM2.5, PM10, Particles and $CO_2$of the study sites were taken into consideration for the analysis. Temporal variation of CO_2 was observed ($p < 0.01$) in a significant level but no statistically significant variation was noticed among these sites. ANOVA (Two ways) represents that the rate of CO_2 and particles decreased significantly during the month of May'20 because of adopting lockdown that restricted human mobility. Besides this, all types of social, economic, industrial and urban activities suddenly paused that are the main sources of CO_2 emission and its concentration in the atmosphere. Because of these, nature took adequate advantage and showed improvement in the ambient air quality during the outbreak of COVID-19. It has been observed that the vegetation cover in some areas of the township like Lahmeyer park, Nehru Park, Shatabdi Sishu, Udyan, Spandan Recreation Park, Gunjan Ecological Park, Vivekananda Park etc. did not allow the atmospheric CO_2 level to have a deep dip as the previous CO_2 level in these

sites were not very high due to carbon storage potential of the floral species present. The aim of the present work is to analyse the different air quality parameters during the period of COVID-19 lockdown in Asansol Industrial Township and to find out the degree of improvement in the air quality of this area.

KEYWORDS: ANOVA; Air quality; Carbon storage potential; COVID-19; Lockdown; Temporal Variation; Urbanization

INTRODUCTION

In the month of December 2019, a novel Corona Virus (COVID-19) was recognized in the city of Wuhan, China. This virus has a very fast infective property along with severe human respiratory travel, fever, pneumonia and other problems. The fatality rate of this disease is 2–3% **[1]**. Corona viruses are a group of viruses that are covered with an envelope of a positive sense. The genome of this rhinovirus consists of single-stranded and non-segmented ribonucleic acid **[2]**. The virus was initially transmitted from an animal like a pig or chicken etc. These animals are economically important reservoirs transmitted to humans possibly via a multiplying host. However human to human transmission has also been reported by the **[3, 4]**. In human beings, 6 types of corona viruses have been identified that cause respiratory diseases. Out of these Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) are the most out broken nationally and internationally **[5]**. The COVID-19 disease spread very fast transformed into a regional outbreak in China and very quickly converted into a global pandemic, resulting in more than 10 million worldwide affected during the first five months from 2019 to 2020. World Health Organization reported that the disease has spread rapidly globally, broke out in large-scale, in more than 225 countries, regions, and territories across the world, yielding more than 9,527,123 infected cases and 484,972 deaths till 25th June 2020 **[3]**. Community transmission has been reported in several countries like United States, France, Germany, Brazil, England, Japan, Spain, Singapore, South Korea, Italy, and Iran **[6]**. In Asian Continent India has maximum reported cases and deaths have been highest as on 15 September 2020 08.00 IST (GMT+5:30) active 990061, discharged 3859399 and deaths 80776 whereas in West Bengal discharged 86.6%, active 11.5% and death 1.9% **[7]**. The most common COVID-19 symptoms of this virus is the usual experience of mild to moderate respiratory illness. Mostly recovery occurs without any

special or very advanced treatment. But the aged people and the persons having suffering from cardiovascular symptoms, nephrological disorders, diabetes, chronic respiratory problems, cancer etc. are more likely to get the disease **[8, 9]**. The best way to prevent the aggression of the transmission is to have proper knowledge about the mode of transmission symptoms etc. and to take proper precaution. One of the best practices to stay safe from infection is washing hands or using an alcohol-based rub (sanitizer) frequently without touching the face by avoiding crowded places and, maintain physical distances **[10-12]**. As there is no vaccineor appropriate medicine officially available till date, the Government agencies and local authorities have imposed lockdowns to restrict the movement of people and to maintain physical distancing. This was found the only way to prevent the spread of the pandemic. On 22-March-2020 (07:00 AM-09:00 PM IST) the Government of India has initiated a 14-hour citizen-led voluntary social distancing campaign (called as Janata Curfew) that excluded essential services, such as medical services, police forces as a pre-empties, preparedness and prophylactic measure for the disease. Further Indian government announced a mandatory lockdown restricting all movement international as well as inter and intrastate to restrict social isolation measures. The entire 1.35 billion population of the country came into mandate of lockdown with effect from 25 March 2020. Different phases of lockdown have imposed in different forms or levels of restrictions in different locations or areas.

The main objectives of this study are to investigate and examine the effects of lockdown on the atmosphere or environment i.e., how much the air quality is sustainably improved in Asansol Industrial Township, West Bengal context.

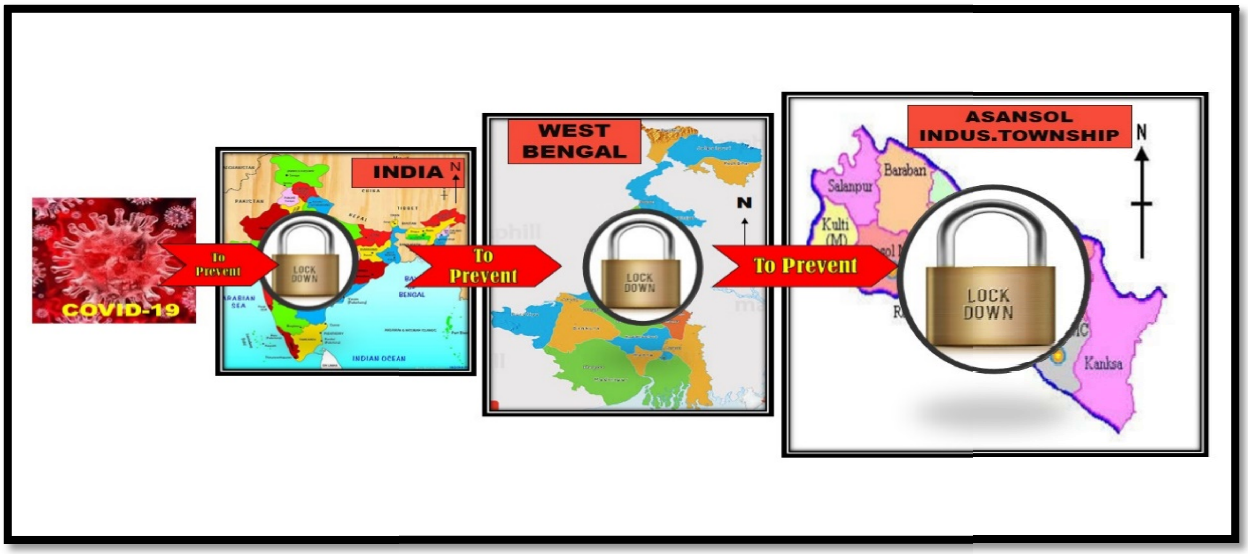

Figure 1: Government agencies to prevent the spreading of COVID-19 lockdown has been undertaken

STUDY AREA

Asansol Industrial Township is one of the most important cities of West Bengal lying in Paschim Bardhaman district. It is popularly known as "The City of Brotherhood". It is the most populated and second-largest city of West Bengal and the 39th largest urban agglomeration in our country. Geographically it is located at latitude $23^0$673944 N, and the longitude is $86^0$952393 E, bounded by the west by Dhanbad district of Jharkhand, east by Durgapur subdivision, south across the Damodar river are the Purulia and Bankura districts and in north are Dumka and Birbhum districts. It lies in the Damodar valley. Its expanding nature of this township has been noticed in east and west. The total population of this township is 1,243,414 out of which 646,052 are males and 597,362 are females, as per the census report, 2011.

Figure 2: GIS map of Asansol Industrial Township

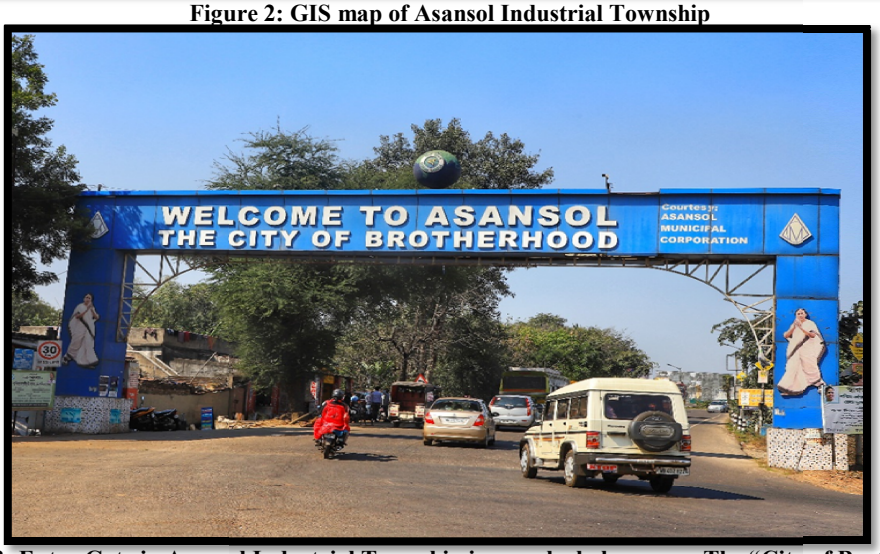

Figure 3: Entry Gate in Asansol Industrial Township in popularly known as The "City of Brotherhood"

MATERIAL AND METHODS

The air quality of Asansol Industrial Township was measured in 8 different points through Temtop M2000C Air Quality Monitor. Data on PM2.5, PM10, Particles, and CO_2 of these sites were taken into consideration for the analysis during April 2019 and May 2020 in afternoon hours. 10 readings were taken from each site at a distance of 10 meters apart and the mean values were considered for statistical analysis. The two periods are significantly different in terms of anthropogenic disturbances as April 2019 was the period of the normal situation and May 2020 is the month under the lockdown phase. The studied points were 1) Airport, 2) SAIL-ISP Burnpur gate, 3) Burnpur bus stand, 4) Asansol court 5) Asansol District Hospital, 6) BNR more 7) Asansol railway station & 8) Asansol bus stand.

Figure 4: Observation points in Asansol Industrial Township

RESULTS AND ANALYSIS

Lockdown is a procedure to control the spread of COVID-19, and reduce the spreading rate but this process also led to some unexpected consequences in the environment. As industries, transport networks, recreational units, educational institutions, shopping malls, markets, offices, businesses etc. have been imposed completely closed. It has brought a sudden drop in carbon dioxide emission, suspended particles etc. that affected the pollution profile. A similar picture was observed in New York. Compared with the last year

(i.e., 2019), levels of pollution in New York and other urban areas in the world have reduced by nearly 50% or more because of measures to restrict the spread of the virus.

Table 1 shows the compression of PM 2.5, PM 10, Particles and CO_2 in atmosphere prior lockdown and at the time of lockdown due to prevention of aggression during COVID-19 pandemic.

In the present study, decrease in % was noticed in PM 2.5, PM 10, particles and CO_2 in during 2019 &2020 range from 0.048 to 0.091(ug/m3), from 0.068 to 0.149(ug/m3), from 2.2 to 2.68 (per/L) &from1.47 to1.88 (ppm) respectively **(Figure 5)**. The highest % rate of decrease of atmospheric $CO_2$was recorded at Asansol Railway Station **(Figure 6)**. The variation in CO_2 level between years can be substantiated by the COVID-19 pandemic, but the apparent variation between sites is attributed to existing vegetation in the site along with manmade activities of various scenarios.

From the ANOVA: Two-Factor without replication **(Table 2)** it was noticed that the% of decrease in atmospheric PM 2.5, PM 10, particles and CO_2at each point. The rows indicate significant statistical difference (F>Fcrit) between the mean of each point's test scores. Whereas in columns F statistical difference has been noticed is much greater than the value for F crit the null hypothesis is rejected. There is a significant statistical difference in the calculated means of the 4 categories.

Figure 5: Air quality of Asansol Industrial Township was measured at different sites through Temtop M2000C Air Quality Monitor

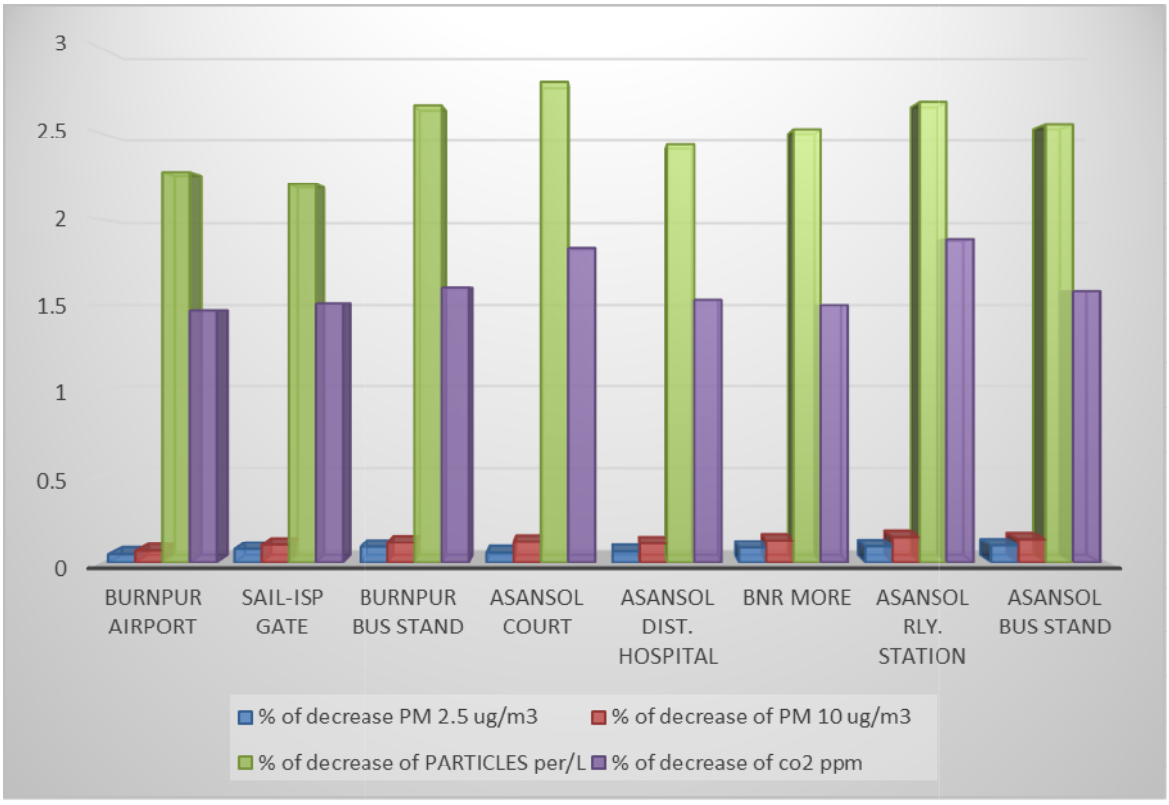

Figure 6: Variation of atmospheric PM 2.5, PM 10, Particles and CO2 at 8 points in Asansol Industrial Township during 2019 & 2020

Table 1: Level of atmospheric PM 2.5, PM 10, Particles and CO_2 and percentage of decrease of CO_2 at 8 sites in Asansol Industrial Township during 2019 and 2020

S. No.	Sites	Coordinates	PM2.5 ug/m3			PM10 ug/m3			PARTICLES per/L			Atmos. CO_2 ppm		
			21st April 2019	21 st May 2020	Decrease of PM2.5%	21st April 2019	21 st May 2020	Decrease of PM2.5%	21st April 2019	21 st May 2020	Decrease of Particles%	21st April 2019	21 st May 2020	Decrease of CO_2%
1	Burnpur Airport	23.630294 86.970441	15.3	10.5	0.048	21.3	14.5	0.068	652	425	2.27	545	398	1.47
2	SAIL-ISP Gate	23.665304 86.916347	17.5	9.7	0.078	22.8	12.5	0.103	630	410	2.2	552	401	1.51
3	Burnpur Bus stand	23.674713 86.946727	18.2	9.1	0.091	23.1	11.5	0.116	668	402	2.66	555	395	1.6
4	Asansol Court	23.630294 86.970441	15.4	9.8	0.056	24.1	12.1	0.12	678	398	2.8	585	402	1.83
5	Asansol Dist. Hospital	23.677573 86.974690	17.1	10.8	0.063	23.5	12.4	0.111	648	405	2.43	558	405	1.53
6	BNR More	23.693327 86.953311	18.5	9.9	0.086	24.1	11.3	0.128	654	402	2.52	559	409	1.5
7	Asansol Rly. Station	23.690936 86.975831	19.1	9.8	0.093	25.1	10.2	0.149	669	401	2.68	589	401	1.88
8	Asansol Bus stand	23.688022 86.969849	19.9	10.1	0.098	24.8	11.2	0.136	678	423	2.55	578	420	1.58

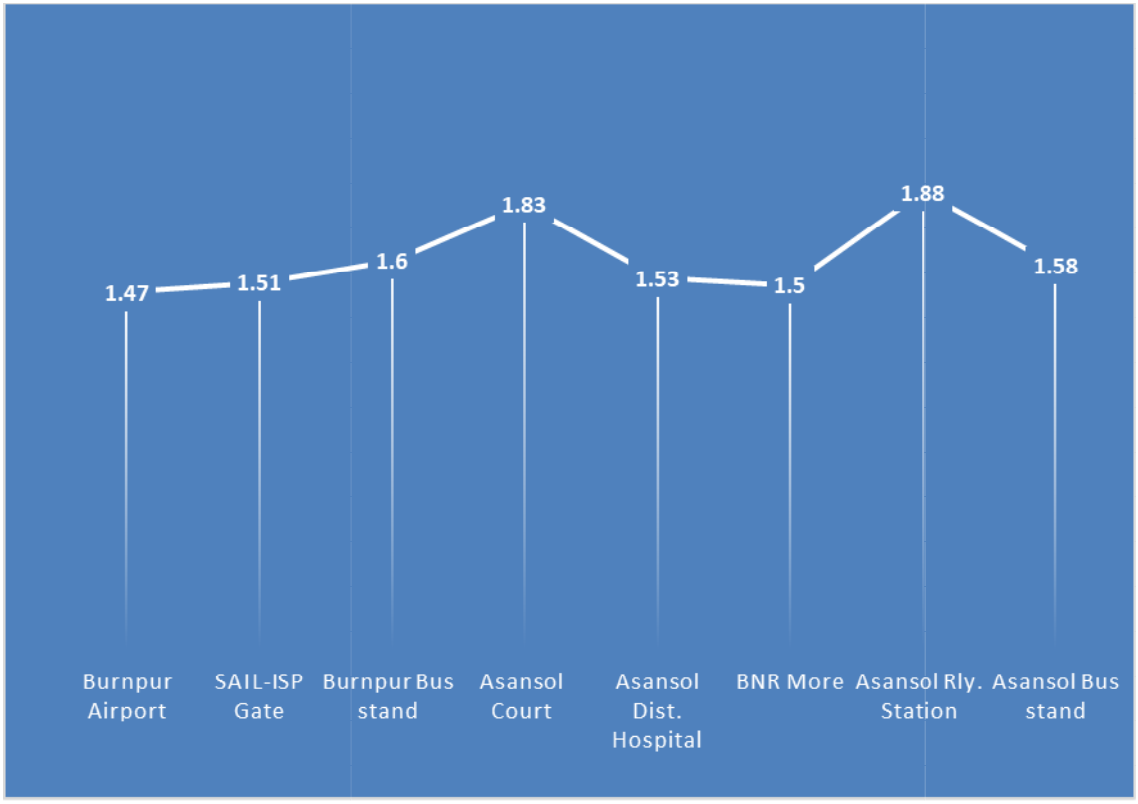

Figure 7: Percentage (%) rates of decrease atmospheric CO2 level in the study areas

Table 2 ANOVA: Two- Factor without Replication shows the percentage of decrease of atmospheric PM 2.5, PM 10, Particles and CO2 at 8 sites in Asansol Industrial Township during 2019 and 2020

ANOVA: Two-Factor Without Replication						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.22976	6	0.03829	3.10183	0.04504	2.99612
Columns	20.9985	2	10.4992	850.469	1.2E-13	3.88529
Error	0.14814	12	0.01235			
Total	21.3764	20				

Notes: SS = Sum of Squares, df = Degree of Freedom, MS = Mean Sum of Squares, Fobs = statistical F, P- value = Probability, Fcrit = Critical F

DISCUSSION

Day by day the air quality is deteriorating throughout the world. In the last few decades, the lifespan of human beings has reduced and the annual death toll has been found increased across the globe. In the countries of Africa, a partial portion of Europe and Asia near about 8% of human demise had been caused due to the deterioration of air quality **[3]**. As per World Health Organization, 2020, air pollution is responsible for human deaths that is directly connected with stroke and heart disorder (17-19%), respiratory disorder (24-26%), chronic obstructive pulmonary disorder (25-27%). 1.1 billion people of world population are compelled to inhale polluted-poisonous air **[13]**. From the different corners of the globe, it is reported that the proportion of respiratory

and allergic illnesses are directly corrected to the rapid deterioration of air quality **[14]**. In India, movement of vehicles, the gaseous emissions from the chimneys of factories, power plants etc., burning of coal, biomass, solid waste and dust particles from mines, constructional activities are the main sources of air pollution including CO_2, CO, NO_2, SO_2, PM 10, PM 2.5 (suspended particulate matters). Due to the fast urbanization, increasing trend in morbidity as well as mortality due to asthma, bronchitis, chronic obstructive pulmonary disorders, cardiovascular disorders, infections, carcinogenic diseases have been observed. These diseases are regarded as the fatal consequences in decline of air quality in municipality and corporation areas of our country.

Figure 8: Shows the extent of pollution in Asansol Industrial Township

The present study is based on the sustainable improvement of air quality sustainable improvement during the lockdown period in the COVID-19 pandemic at Asansol Industrial Township. It's the second-largest city in West Bengal and ranked 42nd in the world and 11th among Indian cities in its list of 100 fastest-growing cities **[15]**. The emission of various gases from vehicles and different industries chiefly based on iron, fly ash particles, smoke, dust and toxic materials from the coal mines has been found to cause the deterioration in air quality. It is found that road dust, gaseous emission of vehicles, industrial chimneys, and combustion of coal and burning of municipal wastes are the predominant source of PM10 and PM2.5, particles, CO_2. Recently, this industrial township has

passed through the lockdown. The industrial and transport activity were utterly paused. Railways, roadways, mines activity have also stopped during this lockdown period that reduced the percentage of suspended particles and CO_2 levels. In the present study, the sustainable improvement of air quality was measured through Temtop M2000C Monitor at 8 different points in the township. Among these sites in PM10, PM2.5, particles, CO_2 percentage were found massively reduced in Asansol Court, Burnpur Bus stand, Asansol Railway Station, Asansol Bus Stand from 21 May 2019 to 21 May 2020. These are the busiest places in the township. It is highly significant that the lockdown process affects the socio-cultural rhythm, academic affairs, economic affairs etc., mental and physical health of the human beings. But it is remarkably noticed that the atmosphere becomes able to restore its balance through homeostatic mechanism due to the temporary pause of industrial, transportation and commercial activities.

CONCLUSION

The lockdown planning from the Government agencies and local bodies due to the COVID-19 pandemic disaster renders a positive message to all the countries throughout the world for purification of the environmental quality as well as natural ecosystem viz., it appears to show pronounced improvement in air quality in the most populated urban areas. The purification of the atmosphere along with air quality modification has become certainly the most valuable gifts of a temporary lockdown system during the pandemic. In Asansol Industrial Township, the upgrading of air quality standard in respect of suspended particles and CO_2 in the atmosphere definitely brought a fresh environment during the lockdown period. The results show a pronounced decline in air pollutants during lockdown especially in Asansol Court, Asansol Railway Station, Burnpur Bus stand, Asansol Bus standarea etc. These 4 sites are known as highly polluted areas of this industrial township. The results will attract the attention of the Local authorities as well as the Government agencies to consider how to strictly minimize the industrial urban pollution to refine air quality that may help to sustain public health in an Industrial township like Asansol. In conclusion, the temporary lockdown policy may be considered blessings for the urban- industrial environment in place of the ruthless curse.

REFERENCES

[1] Li Q., Guan X., Wu P., Wang X., Zhou L., Tong Y., Ren R., Leung K.S.M., Lan E.H.Y., Wong J.Y., Xing X., Xiang N., Wu Y., Li C., Chen Q., Li D., liu T., Zhao J., Liu M., Tu W., Chen C., Jin L., Yang R., Wang Q., Zhou S., Wang R.,

Liu H., Luo Y., Liu Y., Shao G., Li H. Tao Z., Yang Y., Deng Z., Liu B., Ma Z., Zhang Y., Shi G., Lam T.T.Y., Wu J.T., Gao G.F., Cowling B.J., Yang B., Leung G.M., Feng Z., (2020), Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia, National Library of Medicine, 26;382(13):1199-1207, 10.1056/NEJMoa2001316.

[2] Wertheim J. O., Smith M. D., Smith D. M., Scheffler K. and Kosakovsky P. S. L., (2014), Evolutionary origins of human herpes simplex viruses 1 and 2, Molecular Biology and evolution, 31(9), 2356-2364.

[3] Whorl Health Organization, https://www.who.int

[4] Zhao S., Lin Q., Ran J., Musa S.S., Yang G., Wang W., Lou Y., Gao D., Yang L., He D. and Wang M. H., (2020), Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak, International journal of infectious diseases, 92, 214-217.

[5] Steele T., Singer R.D. and Bjørnson S., (2020), Effects of food availability on microsporidiosis and alkaloid production in the two-spotted lady beetle, *Adalia bipunctata* L. Journal of Invertebrate Pathology, 175 (107443), https://doi.org/10.1016/j.jip.2020.107443

[6] Amanat F. and Krammer F. (2020). SARS-CoV-2 vaccines: status report, Immunity, 52(4), 583-589.

[7] Ministry of Health and Family Welfare, Govt. of India,https://www.mohfw.gov.in

[8] Tian H., Liu Y., Li Y., Wu C.H., Chen B., Kraemer M.U., Li B., Cai J., Xu B., Yang Q. and Wang B., (2020), An investigation of transmission control measures during the first 50 days of the COVID-19 epidemic in China. Science, 368(6491), 638-642.

[9] Wang P., Chen K., Zhu, S., Wang P. and Zhang H., (2020), Severe air pollution events not avoided by reduced anthropogenic activities during COVID-19 outbreak. Resources, Conservation and Recycling, 158 (104814), https://doi.org/10.1016/j.resconrec.2020.104814

[10] Huang C., Wang Y., Li X., Ren L., Zhao J., Hu Y.(2020), Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China, The Lancet, 395(10223), 497-506,

https://doi.org/10.1016/S0140-6736(20)30183

[11] Zhou F., Yu T., Du R., Fan G., Liu Y., Liu Z., Xiang J., Wang Y., Song B., Gu X. and Guan L., (2020), Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. The lancet, 395(10229), 1054-1062.

[12] Zhu N., Zhang D., Wang W., Li X., Yang B., Song J., Zhao X., Huang B., Shi W., Lu R. and Niu P., (2020), A novel coronavirus from patients with pneumonia in China, 2019. New England Journal of Medicine, 382,727-733, 10.1056/NEJMoa2001017.

[13] UNICEF, United Nations Children's Fund and World Health Organization, (2002), Children in the New Millennium: Environmental Impact on Health, UNEP/Earthprint, ISBN: 92-807-2065-1, www.unep.org

[14] Haque M. and Singh R.B., (2017), Air pollution and human health in Kolkata, India: A case study. Climate, 5(4), 77, https://doi.org/10.3390/cli5040077

[15] Asansol – Wikipedia, wikipedia.org