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PRIMARY RESEARCH

The influence of environmental factors on COVID-19: Review

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Abstract

SARS-COV-2, a respiratory pathogen, causes Covid-19, a highly contagious respiratory infection. Many died and still die. The Covid-19 virus is most commonly spread by coughing or sneezing gout on infected areas. The Covid-19 is one of the highly critical global health catastrophes of this century and the biggest challenge for humanity; it has significant negative and positive effects on our health, economy, social life, and environment. This article will discuss atmospheric air conditions during confinement, the correlation between Covid-19 and weather parameters. Reviewing papers and journal articles discussed on Covid-19 have been used as a method to collect qualitative data. Temperature, wind speed, and humidity predict respiratory infectious diseases, virus viability, transmission, and expansion. There was a -28% to -31% decrease in PM10 and a 50% increase in Ozone (O_3). Because of the declining tourist population, rivers, beaches, and seas are more transparent and cleaner, improving ecosystem biodiversity. The volume of medical waste is increasing as several countries abandon waste treatment to avoid virus transmission and adverse environmental effects.

I. INTRODUCTION

In Wuhan City, Hubei Province of China, in December 2019, there were 27 cases of pneumonia of unknown etiology. COVID-19 is an exceptionally infectious respiratory disease caused by pathogen respiratory SARS-COV-2. As of 30 October 2020, more than 45 million COVID-19 confirmed WHO reported cases and over 1,185,000 worldwide deaths.

The majority of coronavirus deaths occur in older adults, most likely due to a weakened immune system. People with underlying non-communicable diseases are more likely to become infected with coronaviruses [1]. Evidence indicates that transmission from person to person is expected to spread Infection with COVID-19 [2], In addition to the contact by sneezing or coughing of contaminated surfaces by drops [3]. Coronavirus disease symptoms appear on average 5-6 days after someone has been infected with the virus, but symptoms may take up to 14 days [4]. Different countries took some precautions to prevent the spread of the virus, such as constantly wearing a masker, handwashing with a sanitizer, maintaining a social distance of 1m and, millions of people have been put under lockdown [5].

Besides, the governments imposed policy, requiring people to stay at home, students to study online, stopping all tourism-related activities, closing airports, canceling or postponing all activities, events, or meetings, and prohibiting the entire community from participating outside activities the home [6, 7]. Before the coronavirus epidemic, various regions worldwide faced complex difficulties due to various urban community activities that directly impacted the environment. Air pollution is one of the consequences of these actions. Motor vehicle exhaust gas contributes 60-70 percent of air pollution in Indonesia, the industry contributes 10-15 percent, and the rest comes from households, burning waste, forest fires, and other sources [8]. The contribution of ambient air pollution in the world comes from transportation activities, industry, settlements, waste, and burning forests. The lockdown also has an impact and influence on the environment [9]. Reduced activities out-

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side the home, such as reduced vehicles passing by, certainly affect air quality [10].

A report compiled by IQAir, a platform based on a line that contains updates and predictions of air quality conditions for all cities worldwide, presented a report presenting the findings of an investigation into the influence of coronavirus on air pollution levels in ten cities worldwide. Delhi, Milan, Los Angeles, Mumbai, London, New York, Rome, Sao Paulo, Seoul, and Wuhan are the ten world cities studied for the statistics. Overall, this analysis demonstrates that air pollution levels in ten major global cities have decreased by 9 to 60% in the last year due to the global Covid-19 pandemic [11].

A. *Objectives of the Study*

This study aims to examine the impact of the Covid-19 pandemic on the global environment and to give an overview of changes in air pollutant/aerosol concentrations, especially aerosol concentrations PM10, greenhouse gases (CO, SO_2, and NO_2), and Ozone (O_3) due to the presence of lockdown policy defined set since the Covid-19 pandemic in the world.

II. MATERIALS AND METHOD

We reviewed recent scientific articles, government regulations, books, and media information on covid-19 and air quality in various cities and countries for data collection. The study used scientific papers from recent publications, both international and national. Based on the review, we performed the analysis to evaluate the effects of environmental factors on covid-19 during the lockdown.

III. DISCUSSION

A. *Environmental Different Factors and the Covid-19*

1) Air quality: The COVID-19 outbreak is showing the way to bring about positive environmental change. During confinement, industrial activities and refineries also decline as a transportation system, and vehicle use has decreased significantly, thus resulting in lower greenhouse gas emissions [12, 13]. Many cities worldwide are reporting reduced levels of air pollution, especially SO_2, PM2.5, and black Carbon Concentrations (CN). There was a decrease in PM10 (-28 to -31.0%), and a 50% rise in O_3 (Ozone) concentration [14]. Satellites of NASA have shown that significant reductions in air pollution could have considerable health positive effects [15].

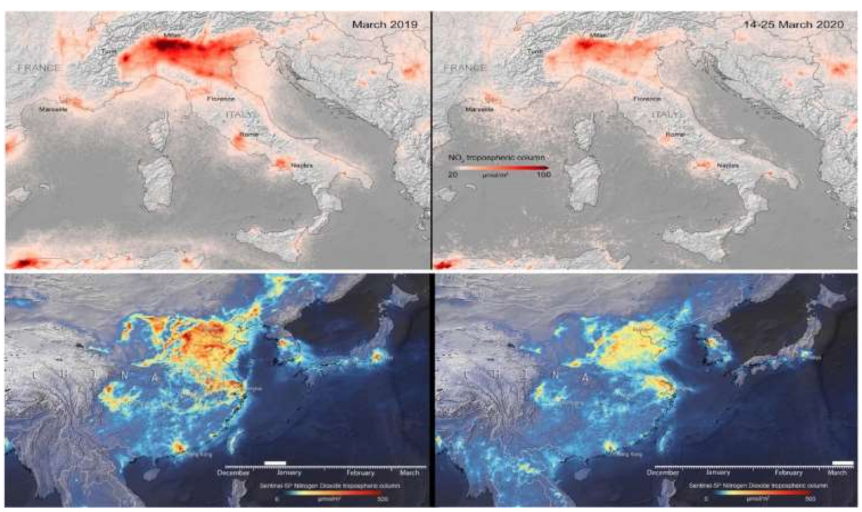

Fig. 1. Italy and China, nitrogen dioxide levels in the atmosphere before and during the pandemic (Source:https://bit.ly/3w1eioN)

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TABLE 1
THE DAILY AVERAGE CONCENTRATION OF AIR POLLUTANTS BEFORE AND AFTER LOCKDOWN AND ITS CHANGE IN PERCENTAGE OF 15 CITIES IN INDIA

City	$PM_{2.5}$			PM_{10}			SO_2		
	Before	After	Change in%	Before	After	Change in%	Before	After	Change in%
Ahmedabad	61.98	30.67	-50.51	134.69	80.93	-39.91	53.03	26.75	-49.55
Asansol	69.71	32.52	-53.35	137.84	76.7	-44.36	19.74	12.57	-36.34
Bengaluru	31.61	29.15	-7.8	none	none	none	5.77	6.72	16.59
Chennai	46.13	25.81	-44.06	none	none	none	24	3.08	-87.17
Delhi	100.83	81.31	-19.36	147.34	106.05	-28.02	17.78	13.32	-25.09
Ghaziabad	104.48	45.99	-55.98	199.61	105.58	-47.1	14.12	17.43	23.45
Hyderabad	47.54	33.37	-29.8	none	none	none	10.3	7.33	-28.87
Jaipur	35.38	22.08	-37.61	93.04	61.44	-33.96	13.06	11.07	-15.25
Kanpur	107.37	62.52	-41.77	none	none	none	4.86	4.39	-9.53
Kolkata	69.09	25.4	-63.24	140.23	45.99	-67.2	13.76	10.16	-26.18
Luckňo	107.37	62.52	-41.77	none	none	none	4.86	4.39	-9.53
Mumbai	36.62	24.35	-33.52	101.92	64.82	-36.41	13.87	33.47	141.38
Nagpur	34.8	23.33	-32.96	67.29	46.25	-31.27	11.57	1.77	-84.66
Patna	97.1	66.77	-31.24	none	none	none	11.54	15.99	38.53
Siliguri	90.07	46.32	-48.58	none	none	none	5.5	4.8	-12.64

Source: CAAQM and MAAQM, CPCB and SPCB, 2020

All transport modalities in the country were halted, and only critical commodities, blowers, police, and emergency services were allowed by the Indian government. Furthermore, educational institutions, industrial activities, construction projects, and hospitality services were all strictly prohibited. However, services such as banks/ATMs, gas pumps, medical shops, grocery stores, and other necessities were permitted during the lockdown. As a result, emissions of atmospheric pollutants have been reduced to a greater extent, improving overall air quality. [6] demonstrated that air pollution has been significantly reduced across the country's cities due to the lockdown (Fig. 2). It illustrates the overall pollution load of important pollutants like carbon monoxide (CO), Particulate matter PM2.5, PM10, nitrogen dioxide (NO_2), ozone (O_3), and sulfur dioxide (SO_2) before and after the lockdown in 15 major Indian cities.

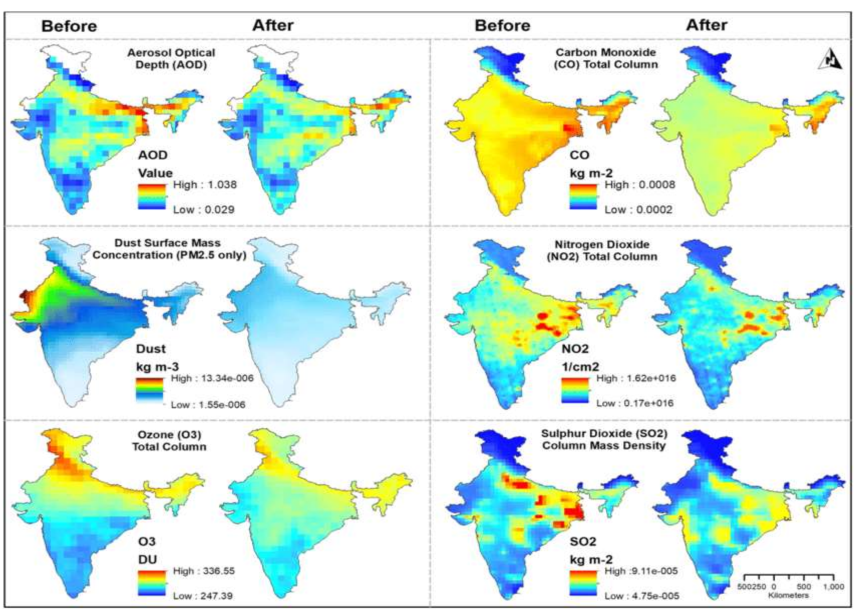

Fig. 2. India has a spatial distribution of AOD, CO, Dust (PM2.5 only), NO2, O3, and SO2. Average daily and time concentration before and after the lockdown (9 February 2020, to 23 March 2020)

2) Covid-19 and particles in the atmosphere: In the atmosphere, there is ozone (O_3), Particulate Matter PM2.5 and PM10, nitrogen dioxide (NO_2), and sulfur dioxide (SO_2), which are minute particles in the air that are highly hazardous to somebody's health if inhaled. When the concentration of these particles rises and penetrates deeply

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into the lungs, you can experience some health impacts like breathing problems, burning or sensation in the eyes, etc. [16]. NO_2 is commonly used to indicate air pollution and industrialization, correlated with sickness and death [12]. Everyone, including healthy people, is susceptible to both chronic and contagious respiratory illnesses if they live in heavily polluted areas for a long time [17].

Fine particles with a 2.5 mm (PM2.5) diameter suspended in the air are most likely to enter the low respiratory tract, which gives the lower respiratory tract a more significant opportunity to enter and resulting in an increased probability of joining the respiratory system and induce continuous changes in the immune system, thereby increasing the likelihood of severe breathing diseases and viral infections [18].

SARS-COV-2 viruses have proven to adhere to particles and continue to spread through the atmosphere, thus promoting their diffusion in the atmosphere [19]. Chronic air pollution exposure indicates the significance of the symptoms of Covid-19 and the greater rate of death outcomes [15]. The chronic nature of exposure to nitrogen dioxide (NO_2), Ozone (O_3), particulate matter PM 2.5, and PM10 pollutants has been identified to correlate with the spread of Covid19 virus cases in Italy, with mortality rates ranging from 18% to 100% [20, 21].

3) Weather parameters and COVID-19 infection: Humidity, temperature, and wind speed are the main predictors of infectious respiratory diseases based on the virus's viability, transmission, and range of spread [22]. The spread of COVID-19 has been estimated to be correlated with ambient temperature and air quality. The average temperature is associated with an increased chance of virus transmission (the threshold is three degrees Celsius when the temperature is lower than three degrees Celsius)[23, 24].

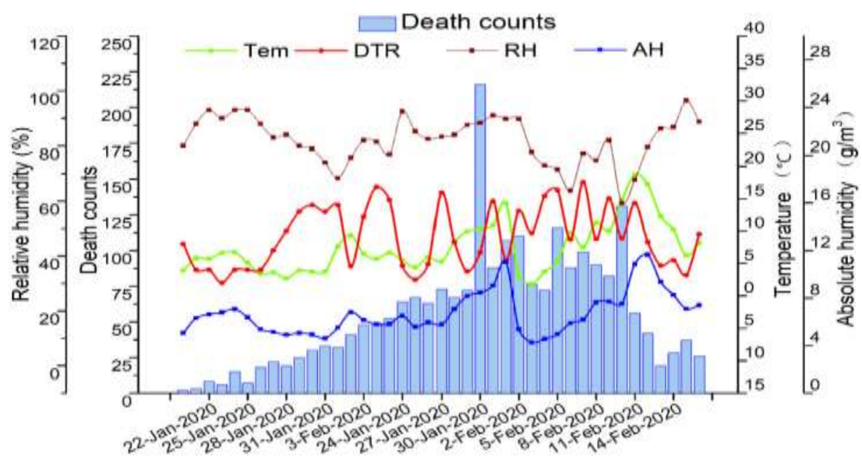

Fig. 3. The daily Covid-19 mortality and meteorological factors in Wuhan, China. From 20 January to 29 February 2020 [25]

Weather conditions can also contribute to COVID19 mortality rates. In Wuhan, China, they were reported to have influenced the death rate and several Covid-19 cases [26]. Lower humidity may also contribute to increased Covid-19 mortality.

B. Effect of Covid-19 on Waste and Water

During the existence of the SARS-CoV-2 virus globally, the water of rivers, seas, and coasts is more transparent due to the reduction of touristic movement, the use of motorboats, and decreased sediment agitation, water pollutants have also been reduced accordingly. Social containment strategies worldwide to mitigate COVID-19, clean recreational areas (beaches, parks, gardens, etc.)

At the beginning of the pandemic, China has reported a decrease in solid waste production of up to 30%, while in Hubei province, medical waste increased considerably (þ370.00%) [27]. During the COVID-19 emergency, safe waste management was critical. Many countries have abandoned waste management and recycling programs to reduce the risk of the virus spreading, which can negatively impact the environment and health [28]. The delay in municipal waste recycling and the rise in medical waste volumes can adversely affect the environment.

The increase in plastic waste volumes in products used for personal safety purposes, including face masks made of long-lasting materials, empty hand-sanitizing bottles, solid wastes, paper, and cartons, due to increasing concerns about natural pollution, is becoming a major environmental problem.

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During the covid-19 pandemic, some countries proposed measures of municipal waste management, such as segregation, storage, appropriate transport, disposal, and treatment at hospitals and homes, including waste collection trained teams following safety rules and procedures. The elimination of residual germs for safe waste disposal is currently a high priority [27].

IV. CONCLUSION

Air quality has a temporary positive effect on health by reducing viral pathogen spread and infection based on seasonality. The covid-19 pandemic has various impacts on the global environment. The positive effects include reducing greenhouse gas emissions, improving urban water and air quality, and increasing biodiversity. But on the other hand, the negative impact is felt, especially in the waste. The amount of medical waste produced has increased, several countries have abandoned waste management treatment and recycling, which is the secondary negative healthy and environmental effect. Reduction of emission during the Covid-19 pandemic is only a temporary and unplanned effect, which does not necessarily mean long-term changes in the quality of the global environment. Therefore, each country should continue to monitor so that the government implements various policies and strategies to mitigate, adapt, and reduce climate change and ensure that the SDGs are running according to the expected targets. A topical solution to prevent the spread of COVID-19 is to vaccinate the entire population. Study implication, limitation, and future research directions The results of this study reinforce previous findings that indicated a close relationship between air pollution and the incidence of COVID-19. However, this result is necessary further investigated to get the whole picture. Further research can include other factors such as socio-ecological and economic parameters, health preconditions, and population mobility as a control variable.

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