

Prediction of Environmental System Model during Isolation period of Pandemic COVID-19: A Comparative Survey

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DOI: <https://doi.org/10.34256/irjmt2121>

Received: 23-02-2021, Revised: 26-02-2021, Accepted: 27-02-2021, Published: 27-02-2021

Abstract: This paper presents the environmental impacts on pandemic corona virus (COVID-19) during isolation period. Pollution and disease are correlated with each other. The world is busy combating with catastrophic disease which has become Pandemic worldwide within a short period. In a matter of months, the world has been transformed drastically. This Pandemic is getting more overwhelming day by day with extending social distancing across the world which eventually subsides the emissions of CO₂ and other potential hazards. Consequently, pollution and greenhouse gas emissions have fallen across the continents. As the COVID-19 affects the lungs, so air pollution could make the COVID-19 pandemic worse for some people. This paper highlights the pollutants effects on several periods and also mentioned the different health issues.

Keywords: COVID-19, Social Distancing, Potential Hazards, Environmental Effects, Clean environment.

1. Introduction

Thousands of people have already died, more than thousands have fallen ill from this deadly Corona virus which was previously unknown before appearing it in Wuhan (China) in December 2019 [1-3]. This Pandemic is claiming peoples' lives certainly within confined place during this crucial period. People living in the most polluted cities are more vulnerable to COVID-19 which made invisible visible and caused massive damage. Lung damage from polluted air may worsen infection but the isolation period resulted in the lowering of air pollution level which can prevent the vulnerability to COVID-19. Figure 1 depicts the present scenarios of the COVID-19 worldwide. Here the three main parameters (cases, deaths, and number of recovered patients) have been highlighted.

Water pollution, air pollution is considered to because of international public health problems resulted from lifestyle habits which will develop environmental systems to resist contamination [4,5]. There are various adverse health effects such as infant mortality, respiratory disorders, allergy, cardiovascular disorders and various other harmful effects [6,7]. The Novel Corona virus is changing remarkably in every fields of life with an outbreak. The COVID-19 Pandemic is a disaster which already hit some people harder than others. Since it's a lung disease, so the people line in

more polluted places are more vulnerable to this disease. Mainly there are two routes of transmission of the COVID-19 virus: respiratory and contact [8]. Any person is in direct contact with someone who has respiratory symptoms (sneezing, coughing) as respiratory droplets of coughing or sneezing are at risk of being exposed to potentially infective respiratory droplets.

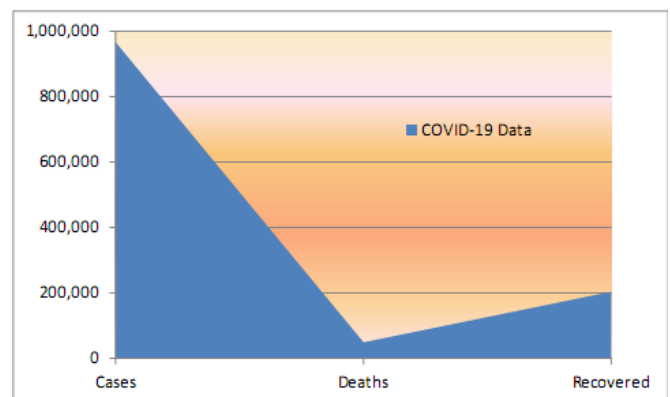


Figure 1 COVID-19 statistics worldwide (2nd April, 2020).

The crisis is not a simple public issue. It is directly to social equity and environmental justice. It is directly related to our fight for clean air, clean water, above all healthy environment. COVID-19 is affecting all of us, our way of life. Numerous studies have

revealed that environmental particulate exposure has been linked to increased risk of morbidity and mortality cancers, and other chronic diseases [9, 10]. Prevention of infection and control of pandemic prone can help to resist transmission of disease. We should follow the publications of the World Health Organization (WHO) which are available on the WHO website. World Health where recommendations and best practice are provided for acute respiratory infections in health care [11]. But low-income communities may face added risk. The disease is deadliest for aged people and those with pre-existing health conditions is very harder to fight against it. From the Large-scale experiment, it is proved that there is marked fall in global nitrogen dioxide levels. The present scenario of shutting down industrial activity leading to huge drop in air pollution. From the satellite imagery shown by European Space Agency the level of NO₂ over cities and industrial clusters in Asia and Europe were remarkably lower than in the same than in same period last year. Nitrogen Dioxide which is produced from car engines, power plants can worsen the respiratory illnesses [9] such as COPD (Chronic Obstructive Respiratory Disease), Asthma. The main source of world's carbon emission which can drive global heating, is not only greenhouse gas, other industrial pollutants. According to WHO, NO₂ is a toxic gas which causes significant inflammation of airways above 200 µg/cc. These particles are vector for pathogens which exacerbated health related problem. After lockdown NO₂ levels have been 10-30 % lower than normal. In this investigation it is revealed that the comparative study of AQI (Air Quality Index) contributed by different air pollutants (Data collected from Central pollution Control Board, Delhi) and mathematical prediction model for our future environmental effects.

2. Literature Survey

According to the renowned scientist at SAFAR, Gufran Beig, the level of pollution in March remarked as moderate category (Air Quality Index). According to Jyoti Pande Lavakare (Co-founder of Care for Air NGO), the low AQI indicated that a lot of the polluted air was "anthromorphic, means artificial". Lavakare focused on the importance of air pollution which weakens the respiratory system. Recently environmentalists sell masks and purifiers to combat pollution so that we people go back to the normal and find a more sustainable life. Mainly as a result of reduction in traffic the levels of particulate matter and NO₂ has reduced considerably. According to Fei Liu, first time there is drastic change in NO₂ over several countries during the economic recession [12] that began in 2008, but the decrease was gradual. There was a remarkable reduction of level of pollution around

Beijing during 2008 Olympics, but the effect was mostly localized around that city, and pollution levels increased after the completion of Olympic. According to Barry Lefer, an air quality scientist at NASA, there was abnormal data in OMI. Because it has collected data on NO₂ and various air pollutants for long time.

3. Data acquisition

According to Air Quality Index, the value between 0 to 50 means it has less impact on health, 51 to 100 means satisfactory with minor breathing discomfort to sensitive people, 101 to 200 means moderate, and the possible health impact likely to cause breathing discomfort to people with health disease. 201-300 means poor which may cause breathing discomfort to people on prolonged exposure, 301-400 very poor may cause respiratory illness to people on prolonged exposure and more than 401 is categorized as severe which may cause respiratory effects even to healthy people. Considering the results of Air Quality and Weather Forecasting and Research, the consequences of coronavirus outbreak has resulted in drop in PM (particulate matter) 2.5 by 30% in Delhi and 15% in Ahmedabad and Pune. In Pune, the level of NO_x pollution has reduced by 43%, in Mumbai by 38% and in Ahmedabad by 50%.

4. Comparative Analysis

According to the CPCB Air Quality Index (AQI) Data, the air quality in Delhi is presently satisfactory. In northern region which is usually highly polluted, now it is in satisfactory category. From **Figure2** it is depicted the categorical data with rectangular bars with heights or lengths (bar chart) proportional to the values of PM 2.5, PM 10 and NO₂ from March.2019 to March 2020.

From **Figure3** it is represented the variation of the average concentration of major air pollutants in Delhi throughout March 2020. So, from comparative analysis it can be concluded that during lockdown period in India, AQI (Delhi) was under 100. Except this period throughout the year, AQI(Delhi) is above 150, which reflects lockdown impact. So, the different factors like closing of industrial activities, construction and traffic have contributed in improving the air quality. Now the air is believed to be healthiest to breathe.

5. Environmental impact assessments

It has been reported that during pandemic drastic change in air pollution levels around the world as a result of reduction in activities for COVID 19. As a consequence of reduction in traffic and industrial activity caused by COVID-19 led to remarkable reduction in NO₂ across India.

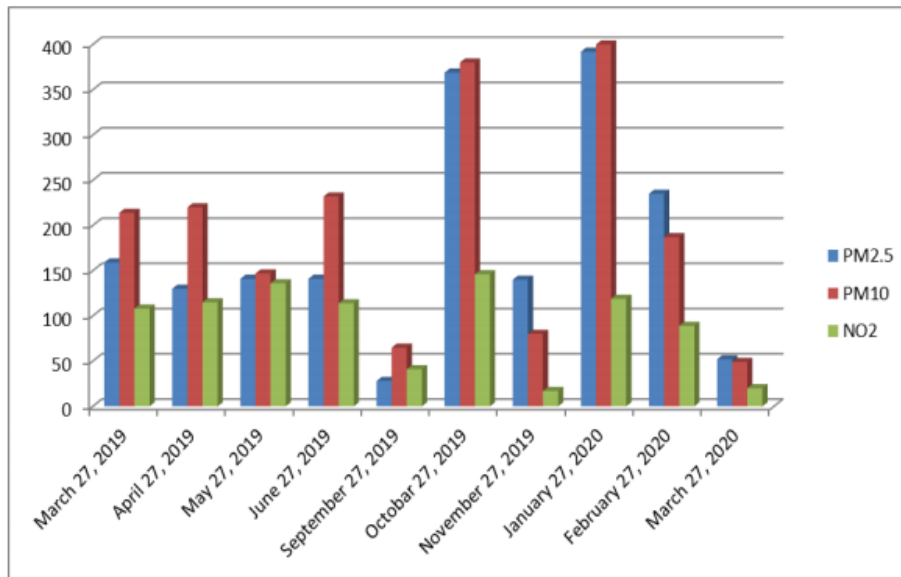


Figure 2 Major Air pollutants (Avg.) in Delhi measured in $\mu\text{g m}^{-3}$

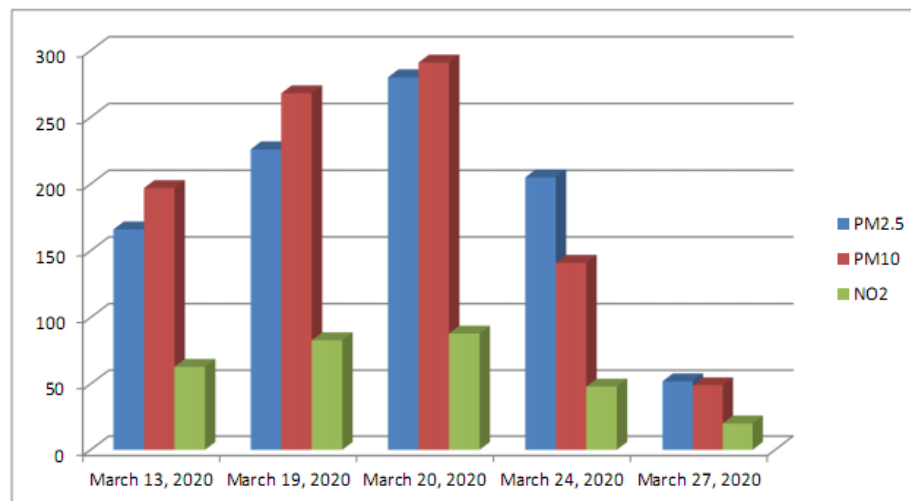


Figure 3 Major Air pollutants (Avg.) in Delhi in March – 2020 measured in $\mu\text{g m}^{-3}$

As a result of social distancing more people stay at home, which resulted in some domestic emissions may rise to some residential areas such as particulate emission from woodstoves as long as outside temperatures remain cool. The same results are observed in UK, USA due to substantial contribution to particulate matter pollution in spring agriculture. By the end of January, 2020 Chinese authorities had shut down transportation going into and out of Wuhan [13-14], to reduce the spread of the disease. It was the first of several quarantines set up in the country and around the world.

As COVID 19 was first appeared in China, so there was remarkable reduction in NO_2 pollution, dominated near Wuhan.

5.1. System Model and Prediction

IoT platform can be monitoring the person's health status [15,16] on both the cases like (a) with social distancing, and (b) without social distancing. Some viral diseases are spreading from one-to-many persons or nation-to-global. This platform used to monitor the air quality, and CO_2 levels for preventing the infectious diseases. IoT can cover-up the infected person's information and location information also. Social distancing can be reducing the mortality rate and also avoid the infectious diseases. The major pollutants ($\text{PM } 2.5$, $\text{PM } 10$, NO_2) becomes stronger when there are no social distancing.

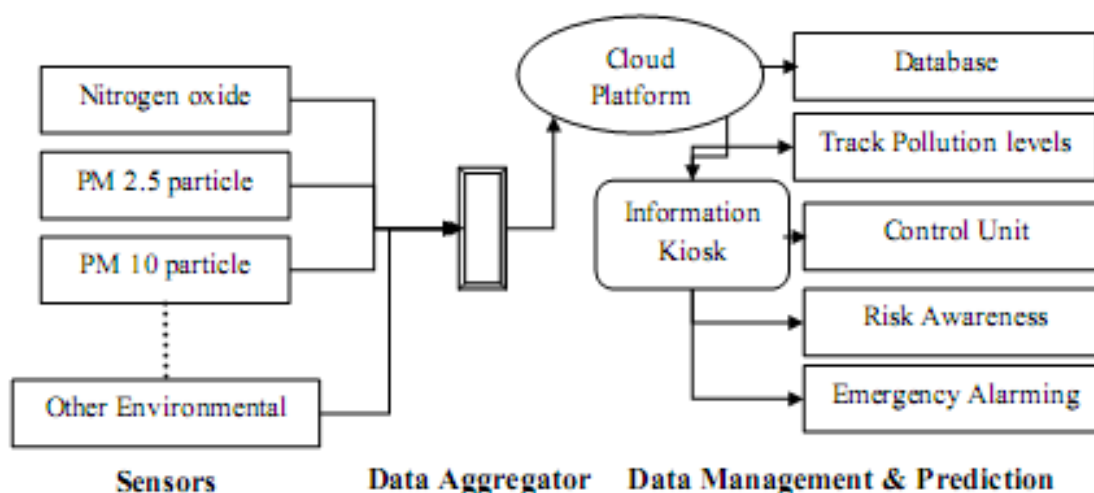


Figure 4 IoT based environmental system model

Therefore, IoT can predict and control the environmental effects. IoT helps to monitor the air quality of the hospitals or indoor environments effectively. The several numbers of patients are stayed in multiple rooms in a hospital, so proper ventilation is required. These ventilators related information can be processed to the IoT platform for better management. Also, toilet hygiene monitoring can be possible through IoT. The environment monitoring using IoT use cases are as follows: (a) Air monitoring (indoor ozone levels, smog-like gasses, CO₂, etc.), (b) Water monitoring (chemical leakage, thermal contaminants, pollutants, etc.), (c) Soil monitoring, (d) Forests monitoring, (e) Disaster monitoring, (f) Fisheries monitoring, (g) Snowfall level monitoring, and (h) Data centers monitoring (humidity and temperature) [17].

The proposed system model for environment pollution control is shown in Figure 4. This model consists of three major sections like sensors, data aggregator, and data management and prediction. The nitrogen oxide sensor, PM 2.5 particle sensor and PM 10 sensor and other environmental sensors are acquiring the information and process to data aggregator. The cloud platform receives all environmental information from aggregator for storage and management. The information kiosk is mainly used to provide the following information: track pollution levels, risk awareness, emergency alerting, control unit, etc. A high-temperature device like Nitrogen oxide is used to sense nitrogen oxides in combustion environments (smokestack and automobile).

PM_{2.5} and PM₁₀ particle sensors are used to sense the scattered light on the suspended particles [18].

5.2. Awareness

In future if the step is taken by Government as 10 days lockdown in a year, then it can be a better remediation to have clean environment without potential hazards to some extent for our nation. So, the reduced pollution levels in this pandemic is the alarming call for all common people. So, reducing pollution seems to reduce the rate of infection and we should follow WHO and CDCP (Centers for Disease Control and Prevention) guidelines [19, 20] for getting green and clean environment without potential hazards.

6. Conclusion

For the first time it is believed that at present generation will discover the critical importance, significance of public health and the quality of air for breathing. Generally, people are problem creators. As a human being, we should solve our problems means reduce pollution at personal levels by understanding our behavior and consequences on our environment. It is obvious that the ideal way to reduce air pollution is not the slowing down the economy. So, it can be concluded that the people can bring down air pollution by using environment-friendly technology and low-emission alternatives.

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Funding

No funding was received for conducting this study.

Conflict of interest

The authors have no conflicts of interest to declare that they are relevant to the content of this article.

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Cite this Article

Swapnila Roy, Chinmoy Chakraborty, Prediction of Environmental System Model during Isolation period of Pandemic COVID-19: A Comparative Survey, International Research Journal of Multidisciplinary Technovation, Vol 3, Iss 2 (2021) 1-6.

DOI: <https://doi.org/10.34256/irjmt2121>