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Impact of Lockdown during COVID-19 on water quality of River Ganga in Uttar Pradesh, India

Dr. Alka Misra[1], Dr. Akanksha Srivastava[2]
[1]Assistant Professor, Department of Zoology, DSN PG College, Unnao, Uttar Pradesh, India
[2]Assistant Professor, Department of Chemistry, DSN PG College, Unnao, Uttar Pradesh, India

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Abstract

The Corona virus (COVID-19) is a global pandemic caused by SARS-Cov-2, which has an enormous effect on human lives and the global environment. Due to outburst situation, India took the decision of sudden nationwide complete lockdown from March 24, 2020. Meanwhile, short period restrictions of industrial sectors and economic activities offered an opportunity to restore the river health itself from the usual exploitation by urban- industrial activities. During the pre lockdown phase, intensification of various human development projects has been generated huge pollution loads and these are dumped into nature. Almost zero industrial pollution due to complete lockdown increased the quality of water in the River Ganga. This impact has been recorded in terms of high DO and low BOD, COD, NO_3 and TC concentration. Observations suggests significant improved water quality at different stations monitored including major cities of Uttar Pradesh viz. Kanpur, Allahabad and Varanasi. Thus, it was concluded that the countrywide lockdown has brought noticeable change to the overall quality of river water, and it has turned to be positive condition for nature's restoration. In this review, the impact of lockdown during COVID-19 on water quality of River Ganga in Uttar Pradesh has been discussed.

Key Words- COVID-19, River Ganga, Lockdown, Physicochemical parameters

Introduction

Corona Virus Disease (COVID-19), due to the infection of highly contagious and fatal Corona Virus, massively and adversely affects human life worldwide. Corona Viruses, the large family of crown – like viruses, affect human beings through zoonotic transmission (Lokhandwala *et al.* 2020). COVID-19, a new disease due to infection of Corona Virus, particularly affects the respiratory system and is highly infectious, with a long incubation period. Its remarkable ability to spread and rapid expansion around the world has led the WHO to consider it a Pandemic (Rothan and Byrareddy 2020). COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization. Fever, dry cough, trouble in breathing, tiredness, loss of taste or smell, sore throat, diarrhoea, aches and pains, chills are the symptoms of early stage after infection. Serious symptoms are difficulty in breathing or shortness of breath, acute respiratory problem, kidney failure and cardiac injury appeared as the leading cause of mortality (Zhou *et al.* 2020). The main reported symptoms of the upper and lower respiratory tract are: dry cough, runny nose, sore throat and dyspnea, associated with headache and fever. Serious symptoms are difficulty in breathing or shortness of breath, acute respiratory problem, kidney failure and cardiac injury appeared as the leading cause of mortality (Zhou *et al.* 2020). Transmission of this disease occurs primarily between people through direct or close contact to infected person. The coughing sneezing, saliva and respiratory secretions from infected person are known to infect a healthy person (Wang *et al*. 2020).

Since no candidate vaccine is available till date, no specific treatment is known yet (Chakraborty and Maity 2020). Effective control and mitigation of this highly contagious virus spreading, people were advised to stay

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home isolated. By early 2020, a number of countries had begun to introduce nationwide lockdowns, including Italy, which was hard hit by the virus. Further, the most affected nations by the virus include the world's leading economies: The United States, United Kingdom, France and Germany as well as nations with huge human capital like India, despite their best efforts, found it difficult to control infection and combating the disease. To prevent the virus spreading in community, government of most of the affected countries imposed complete or partial lockdown, as it was one of the most meaningful strategy for curbing the spread of the virus. Western nations such as UK, and Canada as well as African nations such as Nigeria, Ghana, South Africa and Asian nations including China, Singapore and India have implemented complete national lockdowns (Ourworldindata.org,2021).

IMPACT OF LOCKDOWN ON ENVIRONMENT

The COVID-19 has posed enormous economic, social and environmental challenges to the entire human population. In India, lockdown completely altered the living standard of millions of people due to complete shutdown of transportation, industries, supermarkets work places, institutions and other gathering events (Soni P 2021). The economic progress of government and private sectors was very badly hampered due to countrywide full lockdown but the spread of infection among the people has been reduced. Many notable environmental changes were also seen during the crisis. Although enormous efforts are made from time to time to maintain the environmental standards, but during the pandemic phase, the corona virus lockdown had led to drop in pollution across the world including the second most populous country- India. The contingency measures have improved air and water quality as well as reduced environmental noise, released by vehicular honking. Aside from air pollution, industrial wastes also affect sources of water as well as land. This has also been reduced as a result of the pandemic. During the period, the water qualities of major rivers across India have also been reported to improve significantly (Singh 2020, Sharma B 2020, Khan *et al.* 2021, Chakraborty *et al.* 2021).

GEOGRAPHICAL COURSE OF RIVER GANGA

The River Ganga originates from Gangotri glacier at Gaumukh in Uttarkashi district of Uttarakhand as Bhagirathi. At Devprayag River Bhagirathi is joined by River Alaknanda form Ganga – "The Holi River". It drains into the Bay of Bengal after running approximate 2525 km. through the plains of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. Ganga appears in plains for the first time at Haridwar and enters in Uttar Pradesh through Bijnor. It flows approximate 1140 km. length through 28 districts of Uttar Pradesh and then enters Bihar through Ballia. It is the longest river of India as well as of Uttar Pradesh (Dwivedi *et al.* 2018).

Ganga covers more than 861, 404 km^2 basin area, 26.2% of geographical area of the country (Rahaman 2009). Nearly 80% of the total Ganga River basin is in India, the rest is in Nepal, China and Bangladesh (Gopal B 2000).The Indo-Gangetic basin covers 29 cities, 97 towns and thousands of villages (Dutta *et al.* 2020). Along with hundreds of millions of peoples, the Ganga basin also nurtures a diverse assembly of aquatic including rare and threatened species. These include the Gangetic Dolphins, Otters, endangered species of ghariyals and crocodiles, fresh water turtles and approximately 140 species of fresh water fishes. In Uttar Pradesh, the Ganga basin is the largest drainage region, covering about two-third of the state's area. It comprises the Ganga and its major tributaries like Yamuna, Ghaghara and Gomati. This region is known for its fertile alluvial plains and is home to some of the most populous cities in the state including Varanasi, Allahabad and Kanpur (Rahaman 2009).

SOURCE OF POLLUTION IN RIVER GANGA AT UTTAR PRADESH

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The Ganga is also a source of water for irrigation, hydroelectric power and industries. However, pollution becomes a major issue in the river and a matter of great concern. Anthropogenic activities have generated huge transformations in the river ecosystem during the past few decades. In 2007, the Ganga was ranked among five most polluted rivers in the world (Jhariya and Tiwari 2020). Rapid development of agricultural and industries in Indian Sub-continent have, however put severe strain on the river and, to an extent; have resulted in degradation of its water quality. Excessive discharge of industrial waste, untreated sewage, agricultural runoff, residues of burning dead bodies and dumping of human and animal bodies into the river has raised serious concern about the safe use of river water for drinking and other purposes (Roy and Shamim 2020).

The most important industrial pollution sources is from Uttar Pradesh due to the major industries located along the river are tanneries (Kanpur), carpets and locomotives (Varanasi) and engineering (Allahabad) (Dwivedi *et al.* 2018). The main constituent of sewage water is organic matter, nutrients (viz N, P & K), inorganic matter (dissolved minerals) and toxic chemicals (heavy metals & pesticides) (Roy and Shamim 2020).

Another significant source of pollution is open defecation, responsible for worrying disease causing microorganisms that dwells in River Ganga. In the river beyond Kanpur, fecal coliform have crossed the acceptable bathing standard (Srinivas *et al.* 2020). Accumulation of high pollution level increases the chances of obstruction in running water, ultimately leads to stagnant condition which breeds fatal diseases such as Dengue, Malaria and Chikunguniya. These deadly diseases are responsible for loss of millions of lives every year. In 1986, the Government of India initiated the Ganga Action Plan (GAP) with a specific objective of controlling point-sourced industrial pollution, non-point-sourced pollution from agricultural run-off, cattle and human defecation, and disposable of carcasses and other organic wastes, etc. (Mukherjee 2018). Subsequently, in 2014, an advanced version of GAP was launched as Namami Gange Mission (NGM) with an aim of integrated river conservation (Mukherjee 2018). Despite all these Government plans to clean Ganga, the amount of untreated waste water discharge into Ganga has increased by many folds in past few decades resulting disturbed physicochemical parameters. The Ganga River has shown a sign of rejuvenation and a significant improvement in these parameters; following the eight week nationwide lock down due to COVID 19 pandemic. In this review, the observation made by many environment researchers on the comparative assessment of pollution levels during pre lockdown and lockdown periods in River Ganga at major cities of Uttar Pradesh has been compiled.

According to Trivedi R (2010), the amount of industrial waste water by volume is about 20% of the total volume of waste water generated in the Ganga basin, out of which nearly 55% comes from Uttar Pradesh (approx. 350 km long worst affected stretch between Kannauj and Allahabad). For instance, in Kanpur alone, approximate 400 tanning units contribute 500 MLD (millions liters per day) of hazardous waste and 140 MLD of domestic waste (Haider Naqvi 2020).

IMPACT OF LOCKDOWN ON WATER QUALITY OF RIVER GANGA

Amid of Lockdown, as per published reports, based on comparative assessment of water quality of river Ganga at different stations of Anoopshaher, Farrukhabad, Kannauj, Kanpur, Fatehpur, Allahabad and Varanasi in Uttar Pradesh (Dutta V 2020 and CPCB 2020), noticeable changes has been recorded in all the physicochemical parameters. The Dissolved Oxygen (DO) level was observed to be significant high up to 14 mg/l during lockdown than pre lockdown period. On an average, DO concentrations remained above the bathing criteria norms (5mg/ml) at all stations.

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No steep reduction in Biological Oxygen Demand (BOD) has seen at most of the monitoring stations till first three weeks of lockdown, though lower BOD values were observed during fourth week. BOD level in Farrukhabad station has continuous remained low and no effect of lockdown is discernible. While at Deorhi Ghat station, Kanpur, the BOD has shown an increasing trend (with an exception of 15.29 mg/ml) during lockdown period. At Fatehpur station, higher BOD during lockdown period may be attributed to the discharge of polluted waste water through Pandu River. In the remaining stretch of river within UP, the BOD has remained unchanged (range recorded 1.13 mg/ml to 5.56mg/ml during lockdown period as compared to 1.37mg/ml to 5.58 mg/ml during pre lockdown period). At stations of Farrukhabad, Kannauj and Assi Ghat, Varanasi, BOD recorded exactly as 3mg/ml. There is a positive impact, though not substantial, of lockdown on BOD level (CPCB 2020). In an another study, Singh (2020) has made a remarkable observation that the level of DO increase from 25-30% at ghats monitored in Varanasi, while the level of BOD decrease up to 35% in all the ghats.

Comparative high values in Chemical Oxygen Demand (COD) level were recorded at few stations such as Kannauj, Bithoor, Kanpur and Fatehpur. This variation can be attributed to continued sewage water discharge into river stream. However, marginal reduction in level has been reported from other stations too. The range of COD was 6.14 mg/l to 17.7 mg/ml during pre lockdown and 6.0mg/ml to 33.2 mg/ml during lockdown period (CPCB 2020).

A declining trend in nitrate (NO_3) concentration was observed due to limited industrial and agricultural activities with an average varied from 0.5- 2mg/ml. Most stations recorded a decrease (varying from 2% - 66%) except in Allahabad, where it increases up to 21% (CPCB 2020).

There was also an improvement in the bacteriological quality of the Ganga River was seen during the lockdown period. Most of the stations recorded large decline in the Total coliform (TC) count except in Anoopshaher (no detectable change is observed) and Bithoor, Kanpur (increase in level was seen) though it was in the range delineated by CPCB, India.

CONCLUSION

Extreme industrial units and anthropogenic activities associated with the bank of Ganga River leads to high BOD, COD, TC count, fecal coliform (FC) and NO_3 concentration and low DO in polluted water. Since industrial units and commercial establishments were closed during lockdown, water was not lifted by them with a negligible discharge of industrial waste water. Water quality of River Ganga has observed to improve significantly for bathing purposes in most of the surveillance centers including major cities (Kanpur, Allahabad and Varanasi) of Uttar Pradesh. The impact could be seen in terms of increased DO and reduced BOD, COD, TC and NO_3 concentration. This may be attributed to the combined effect of reduced discharges/ dumping of industrial or agricultural wastes in the river stream. Thus, it seems that COVID-19 pandemic has provided an opportunity to environment for effective rejuvenation and also served as an environmental vaccine to improve the strength of environment.

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