

Effect of Lockdown on Water Pollution of Musi River in Hyderabad, India, during COVID – 19 Pandemic

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Abstract

To control the new Coronavirus disease (COVID – 19) outbreak, a nationwide lockdown was imposed in India from 24th March to 17th May 2020 and it has enforced the human activities (industrial and commercial) to shut down forcibly within the cities. This pandemic situation affects all the aspects of life (both economic and social) in adverse manner, however, a significant improvement has been observed in the quality of the environment especially in urban areas. In this context we tried to assess the effect of COVID – 19 on the quality of Musi River water that flows through Hyderabad and Secunderabad, Telangana State, India. We acquired monthly online data of various parameters like Conductivity (EC), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH and Fecal Coliform of Musi River, from Telangana State Pollution Control Board portal from January to May 2020 to study the effect of lockdown. We chose four different locations namely BapughatSangham (BAP), Moosarambagh Bridge (MSB), Nagole (NAG) and Peerjadiguda (PRJ) which are major hotspots, responsible for the deterioration of the water quality of Musi River. Further, to understand the significant differences in parameters, we have assessed rate of change over a defined period of time. The results showed a very impressive recovery of the water quality during the lockdown phase as compared to the pre-lockdown status of water quality. This study helps to understand the reasons for the contamination of water quality in river due to human and industrial activities. This lockdown showed that the solution for natures' cleanliness lies in the hands of human beings that go through the path of preservation of natural resources and sustainable development. This short time frame study helps the policy makers to frame the policies and implement strict restrictions on human activities and release of industrial effluents into water bodies or rivers to improve the quality of water in future.

Keywords: -Water Pollution, COVID-19, BOD, COD, pH , Conductivity, Fecal coliform

INTRODUCTION

Hyderabad city is the capital of the Telangana, 29th state of India which is also known Pearl City and City of Lakes. In population it is the fourth largest city in India. The city has an estimated population of around 10 Million and it is known for its rich history, food and its multi-lingual culture, both geographically and culturally. Due to its geography a large number of various organizations / industries like Electronics Cooperation of India Ltd. (ECIL), Nuclear Fuel Complex (NFC), MIDHANI, Bharath Dynamics Ltd. Pharmaceutical industries and Bharath Heavy Electricals Ltd. (BHEL) are established. In addition to above a number of National and multinational IT industries, include Amazon, Google, Microsoft started their

campus in the city of Hyderabad. Due to this industrialization many people are migrated to Hyderabad from the entire country, this results the city faces problem of water pollution to the larger extent – both surface and ground water.

Musi River is the tributary of Krishna River in the Deccan Plateau flowing through Telangana state. This river divides the Pearl City into historic old city and the new city. Due to indiscriminate urbanization and lack of planning, the river has become a receptacle of untreated domestic and industrial waste dumping out of Hyderabad. It is estimated that nearly 350 MLD of polluted water and sewage originating from Hyderabad and Secunderabad flow into the river. In India the Novel COVID19 cases were reported in January 2020 and day by day increased gradually due to movement of people from one state to another state, one country to another country and different parts within the state. As a result, the COVID-19 has been declared as Pandemic. In this situation the Government of India announced the nationwide lockdown with effect from 24th March 2020 for 74 days till 17th May 2020 to break the chain of transmission and to minimize the spread of infection. Later government made some relaxation in a phased manner. For the first time in modern history all business activities including industrial and transport standstill except emergency services like hospitals, essential commodities etc., Around 210 countries with over 2 million people affected all over the world with Corona Virus by the mid of April 2020. Since the industries and people's activities standstill for a month or more in many parts of the world, it brings a notable behavioral change that gives an appearance that the entire globe is under lockdown for its repairing work. Number of scientists studied the effect of lockdown on quality of environment[1-3]. Reference [4] studied the effect of COVID -19 on quality of surface water and reported a declination of suspended particles. The Dissolved Oxygen (DO) and BOD have increased to around 8 ppm and decreased to 3 ppm respectively at Kanpur and Varanasi which ranged around 6.5 ppm and 4 ppm in 2019 respectively [5]. The CPCB data indicate the improvement in quality of Ganga water is suitable for propagation of wild life and fisheries[6]. Reference[2] studied on quality of water by measuring pH, EC, DO, BOD and COD of Yamuna river water and they found a reduction by 1-10%, 33-66%, 51%, 45-90% and 33-82% respectively during the lockdown phase in comparison to the pre-lockdown phase. The novel COVID -19 hits the world severely in the first quarter of 2020 in all aspects.

The two most important aspects greatly showed positive effect due to COVID – 19 lockdown are air and water quality. Several researchers reported the effect of lockdown on air quality across the globe, but effect of lockdown on water pollution over Hyderabad is sparse which made us initiate to carry out this work [7-8].

I. METHODOLOGY

The Telangana State Control Board (TSPCB) is monitoring rivers and its tributaries, lakes, ground water, drains and cheruvus under National Water Quality Monitoring Programme (NWMP) sponsored by CPCB. Currently, under this programme there are 90 stations across the State and are being monitored regularly. Water samples are being analysed for 28 parameters which includes core and general parameters apart from other trace metals and pesticides. In

order to study the effect of lockdown on the quality of Musi River water at four main stations (BAP, MSB, NAL and PRG) we acquired monthly data (from January to April 2020) of five important parameters (Conductivity, BOD, COD, pH and Fecal coliform) from CPCB online portal [<https://tspcb.cgg.gov.in/Pages/Envdata.aspx>]. In the present studies we compared the data between average of January, February and March with the data of April as pre-lockdown and during lockdown respectively.

II. RESULTS AND DISCUSSIONS

Effect of lockdown on Musi River water quality

Due to Covid-19 pandemic the entire Nationwide Lockdown was imposed by Government of India since midnight of March 24th to break the chain of transmission. During the lock down period all the sectors includes industries, transportation, construction, academic institutes etc., are ceased. A large number of reports revealed that there is an improvement in water quality across the Globe during the lock down period. Musi River is the tributary of Krishna River which enters into Telangana from Ananthagiri hills, Ranga Reddy district. This city was attracted a large number of industries due to its geographical nature. In addition to the encroachment, pollution of river water by untreated domestic sewage and toxic industrial effluents has been increasing year by year. Due to urbanization and lack of planning, an approximately 350MLD of domestic and industrial waste flows into the river. During lockdown period a noticeable improvement was observed in the water quality of Musi River, which has been substantiated while analysing the data. A large number of industries are located in the catchment areas of Musi River like S. M. Plastic Industries, Dhumal Industries and Grown Sports Industries, GosalaDoop Sticks, S S industries etc., Along with these industries a large number of domestic colonies are come up along the river bank.

Conductivity level

The change in the conductivity during lockdown period was assessed in our study and the results are depicted in Figure 1a. The conductivity values fall within the range 1365 to 1690 mS/cm during pre-lockdown and 1289-1577 mS/cm during lockdown with maximum value at BAP and minimum at MSB. This shows a clear declination in conductivity which can be attributed to shutdown of human and industrial activities during lockdown. It is substantiated by decline in concentration of nitrate ions (~40%) during lockdown period. The reduction in conductivity was quantified by plotting the percentage change across different stations in Figure 1b. The maximum reduction (6.69%) of conductivity has been observed at the BAP followed by MSB (5.54%), PRG (4.97%), and NAG (2.42%) during the lockdown phase

Biological Oxygen Demand

Biological Oxygen Demand (BOD) is one of the important factors to decides the quality of water ie., it measures the amount of biodegradable pollutants. As BOD increases there is a rapidly depletes the oxygen in the water bodies making lesser availability of oxygen putting aquatic life under stress, suffocation and could be lethal [7]. The major sources of increase of BOD in the Musi river include dead plants and animals; animal manure; industrial/domestic effluents, wastewater treatment plants, faulty drainage system, failing septic systems; and urban storm water runoff.

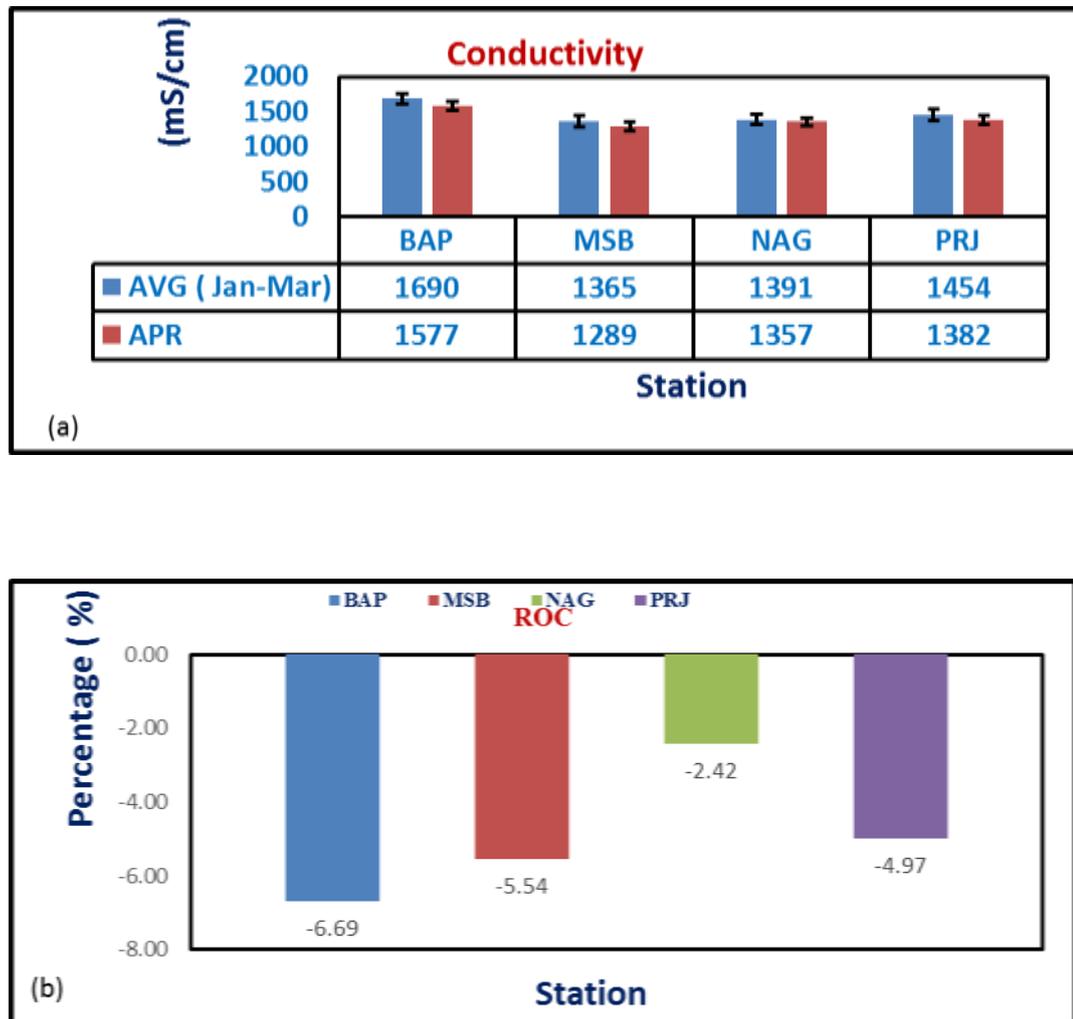


Figure 1 (a) Comparison of Conductivity between pre and during lockdown at different stations with standard errors (b) Corresponding Rate of Changes

Figure 2a shows the variations of BOD in Pre and during lockdown periods. A drastic reduction in BOD was found, at all four stations due to lockdown. It is around 35 mg/l at all stations during the pre-lockdown phase while it was observed between 16 - 32 mg/L during the lockdown phase. This declination during lock down period may be due to the reduction of industrial activities and weather conditions. The percentage change in BOD across the stations was shown in Figure 2b. The maximum reduction (52.48%) of the BOD level has been observed at the BAP during the lockdown phase followed by PRG (37.74%), NAG (32.08%) and MSB (7.69%). The results indicate that the levels of BOD are much higher than threshold limit (3mg/L) at all stations during study period (Pre and during lockdown). This may affect the aquatic life to the larger extent.

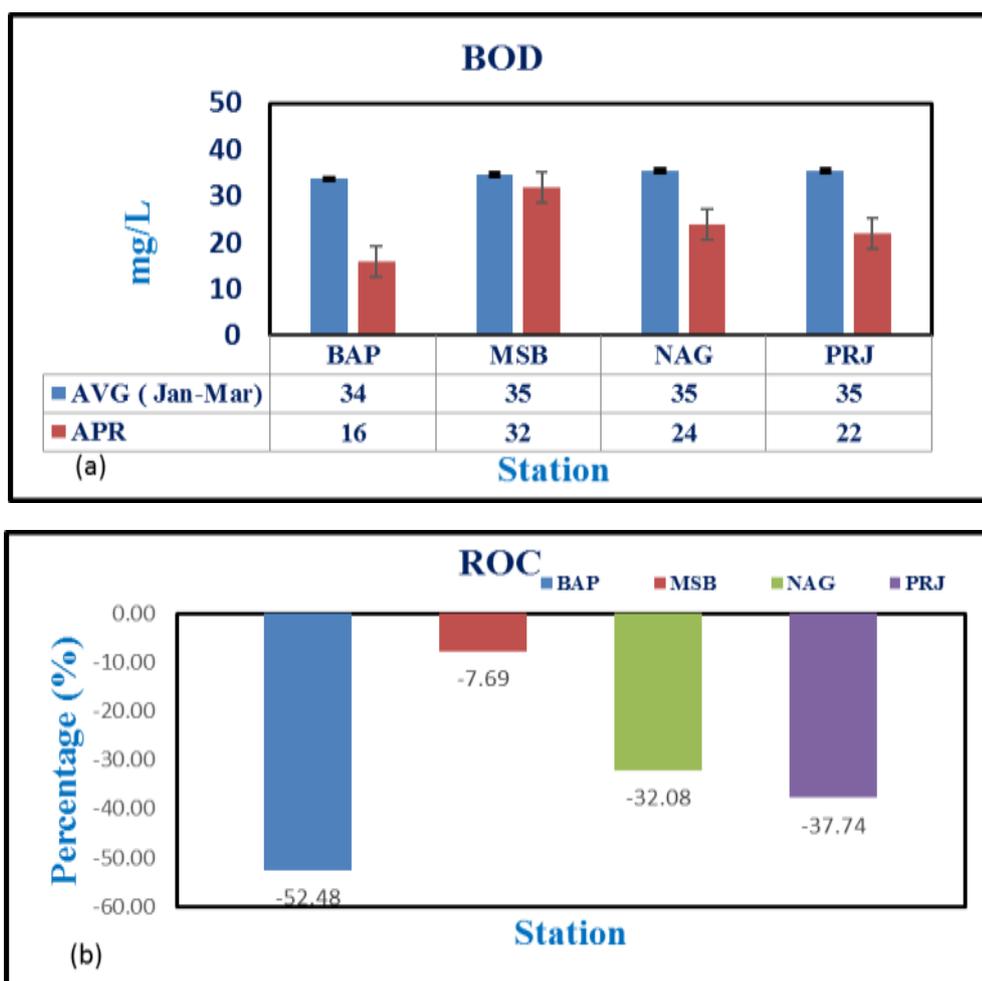


Figure 2 Comparison of BOD between pre and during lockdown at different stations with standard errors (b) Corresponding Rate of Changes.

Chemical Oxygen Demand

Chemical oxygen demand (COD) is an indicator of contamination that shows the amount of both biologically oxidizable and non-oxidizable pollutants present in water. Both BOD and COD are responsible for the reduction of dissolved oxygen (DO) in water bodies. Higher concentration of COD is responsible for quick deterioration of oxygen in water bodies and reduces oxygen availability for higher forms of aquatic life. The major sources that increase the COD in the Musi River are large and small scale industrial effluents and domestic effluents, wastewater treatment plants, failing septic systems; and urban storm water runoff.

The effect of lockdown on COD was shown in Figure 3a and corresponding percentage changes are shown in Figure 3b. COD varies from 197 to 262 mg/l during the pre-lockdown phase whereas it was found to vary between 159 to 182 mg/l during the lockdown phase. However, reduction in COD has been observed at all locations in the lockdown phase due to the halting of industrial activities like GosalaDooop Sticks and weather conditions. The maximum reduction

(30.45%) of the COD level has been observed at the MSB during the lockdown phase followed by NAG (27.16%), BAP (19.15%) and PRG (11.55%).

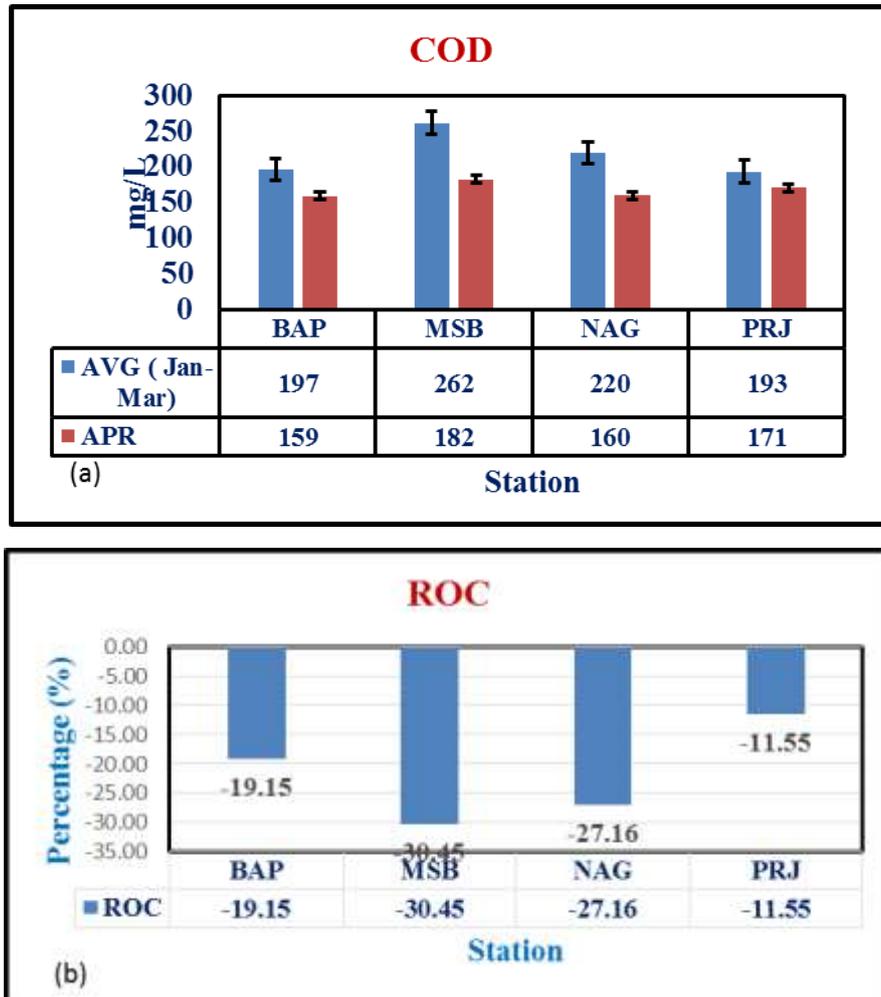


Figure 3 Comparison of COD between pre and during lockdown at different stations with standard errors (b)Corresponding Rate of Changes.

pH level

The variations in pH and corresponding percentage changes are shown in Figure 4a and 4b respectively. The pH of the Musi River observed alkaline in nature which varies from 7.58 to 8.0 during the pre-lockdown phase. However, pH varies from 7.29 to 7.67 in the Musi River during the lockdown phase. The highest pH (8.0) was recorded at BAP and lowest (7.58) at PRG during the pre-lockdown phase. During the lockdown phase, a marginally decreases in pH has been observed due to the reduction of industrial activities, the non-functioning of essential commercial units, and prevailing weather conditions. The maximum reduction (4.72%) of pH has been observed at NAG during the lockdown phase, whereas a slight enhancement was seen at MSB. The increase at MSB may be attributed to other local factors. So there is a scope to study further to understand the result obtained. The chemical and biological changes of water, decided by its pH controls the aquatic organisms. pH can also affect the solubility and toxicity of chemicals and heavy metals in the water. The majority of aquatic creatures prefer a pH range

of 6.5-9.0, though some can live in water with pH levels outside of this range. Hence beyond the optimum value of pH can adversely affect the biological diversity in water bodies including decreased reproduction and growth, attack of disease, or even death.

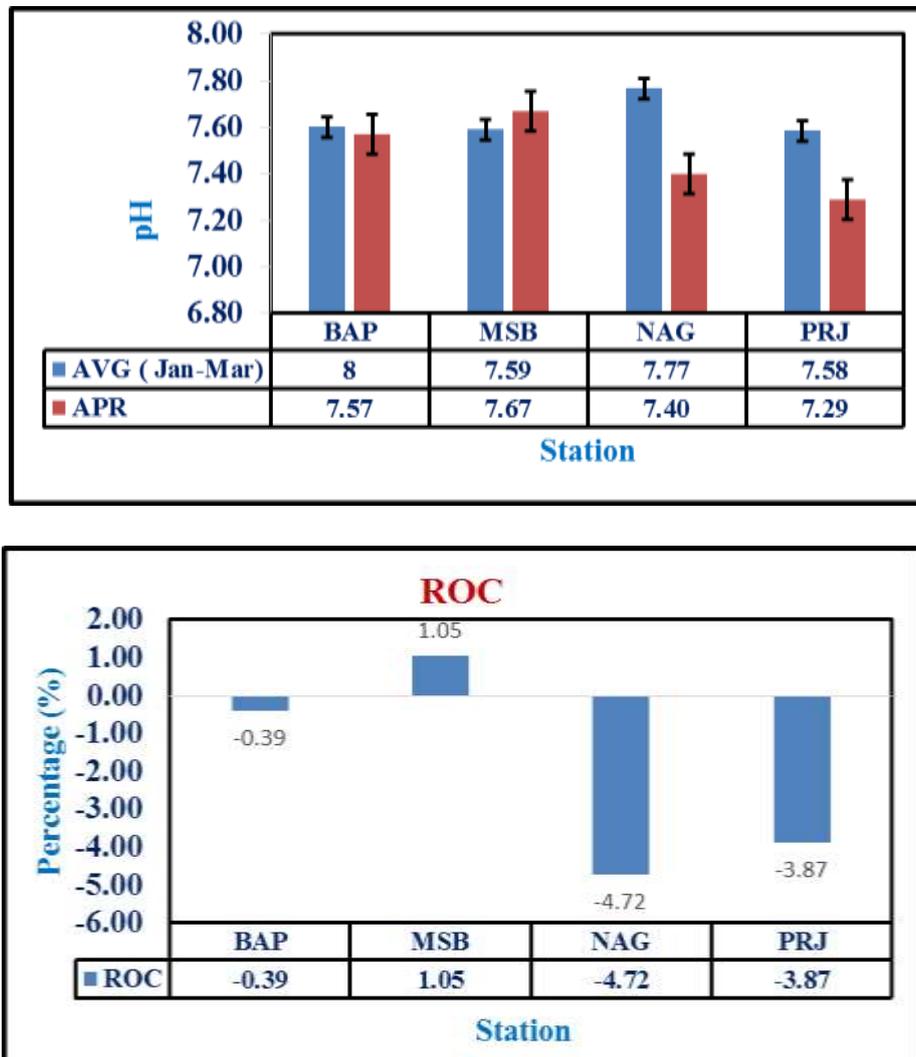


Figure 4 Comparison of pH between pre and during lockdown at different stations with standard errors (b) Corresponding Rate of

Dissolved Oxygen level

Dissolved oxygen (DO) is one of the most important indicators of water quality on which the survival of aquatic life depends. Aquatic organisms cannot survive when the value of DO is very low. In present study at all four stations DO is found to be very low (less than 0.1mg/L) at all stations, when compared to required value (6.5 - 8mg/L) for survival of aquatic organisms. DO affects most biological processes in water and responsible for lower biological diversity in water bodies.

Fecal Coliform.

One of the factors that decides the quality of water is presence of micro-organisms which includes total coliform, Fecal coliform, and *E. coli* etc., The Fecal coliforms is a type of total coliform that mostly exist in feces and industrial wastes mainly composed of NO₃ ions. Untreated feces material which contain Fecal coliform, add excess organic material to the water. The decay of this organic material decreases the dissolved oxygen in water. This lowered

oxygen may kill fish and other aquatic life. Presence of these micro-organisms in potable water is also harmful to the human beings which may cause typhoid fever, hepatitis, gastroenteritis, dysentery and ear infections. Monitoring of Fecal Coliform in water bodies is very important and appropriate action should be taken as and when this exceeds standard values.

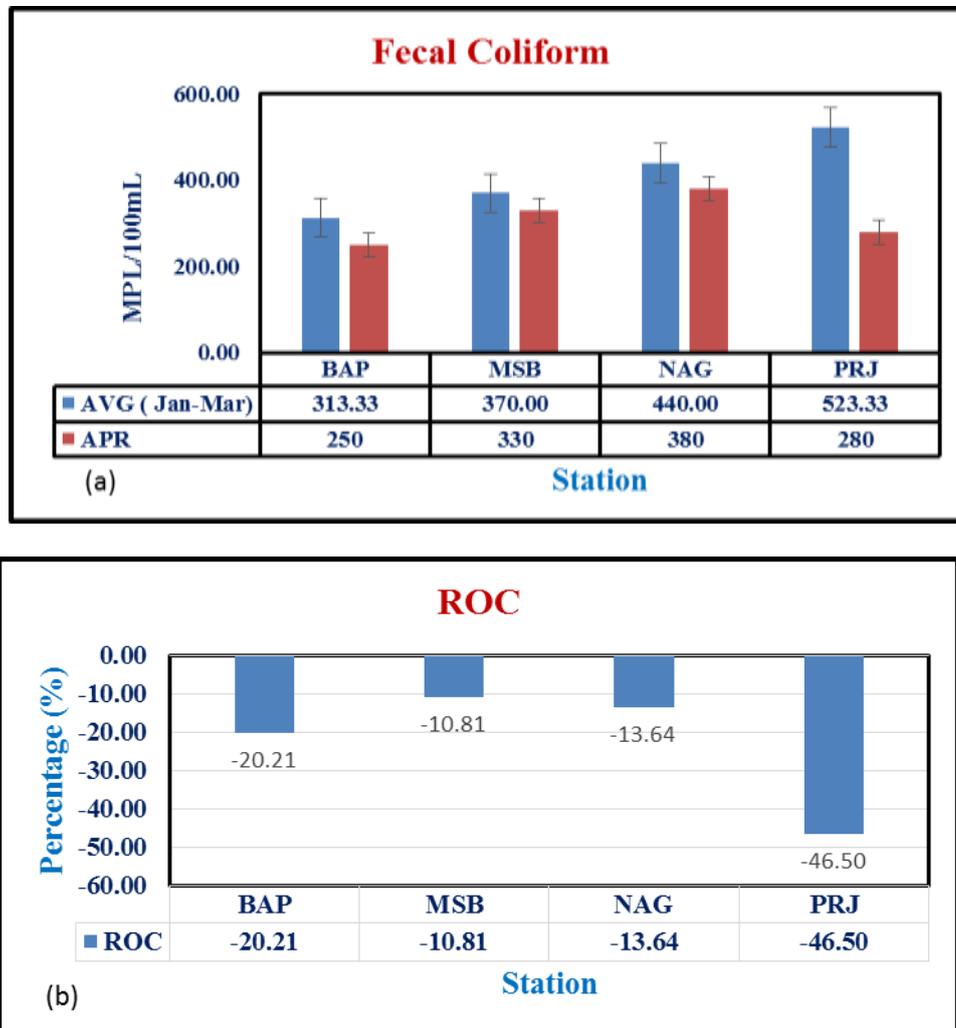


Figure 5 Comparison of Fecal Coliform between pre and during lockdown at different stations with standard errors (b) Corresponding Rate of Changes

Figure 5a shows a clear reduction in Fecal coliform during the lockdown period. The maximum Fecal concentration was observed at PRG (523.33MPL/100mL) in pre-lockdown period when compared to all other stations. However, during lockdown the value (280 MPL/100mL) of this concentration is found to be less. This indicates that a large declination (46.5%) of Fecal Coliform concentration was seen at this station. At other stations also a reasonable declination was observed. This is mostly due to shut down of industries causing decrease in industrial effluents which includes concentration of NO₃⁻ [8]. In our study we found that the nitrate value is almost same at four locations during pre-lockdown. But during lockdown the values are reduced at all locations. On an average a sharp decline in nitrate during lockdown (7mg/L) when compared to pre-lockdown (13mg/L) was observed.

Conclusion

During the lockdown period, a notable improvement in water quality of Musi River was noticed as a result of the restrictions imposed during the lockdown and due to less contribution of effluent from all the sources. The concentrations of EC, BOD, COD, pH, and Fecal Coliform showed 2.47 - 6.9%, 7.69 - 52.48%, 11.55-30.45%, 0.39 - 4.7%, and 10 – 46.5 % of reduction in EC, BOD, COD, pH, and Fecal Coliform concentrations, respectively during the lockdown phase, as compared to the pre-lockdown phase in Musi River. A significant positive correlation between BOD and COD was observed at all locations except at MSB. The Covid-19 lockdown has shown the importance of nature in our day to day life and gave a true picture of the overexploitation of the natural resources and proved that we are responsible for the degradation of nature and putting risk to our wellbeing as well. This lockdown showed that the solution for nature's cleanliness lies in our hands goes through the path of preservation of natural resources and sustainable development. The cleanliness observed to some extent in the Musi River during the lockdown period.

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