Assessment of Mass Bathing on River Ganga Water Quality During kumbh Mela 2019 in Prayagraj, Uttar Pradesh, India

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Abstract - *The primary aim of the study was to assess few impacts on River water quality of Mass gathering and taking a holy dip during Kumbh mela from 14 January 2019 to 5 March 2019 in Prayagraj and to make a comparison of few parameters to standard Stipulated by Central Pollution control Board (CPCB), New Delhi during the Mela Days. River water samples were collected from three sites Phaphamau ghat, Daraganj ghat, and Sangam were analysis for a few physico-chemicall Parameters like Biochemical Oxygen Demand (BOD), pH, Dissolve Oxygen (DO) and Temperature .According to result obtained by analyzing various physic-chemical parameters of Ganga river in Prayagraj city, maximum BOD and minimum DO were recorded at Phaphamau ghat and These were noted to Phaphamau ghat in Prayagraj during kumbh at these sites parameter are observed to be more polluted in comparison to other two sites Daraganj ghat and Sangam. The water quality was reported to be of very bad status. As per Central pollution control board (CPCB) norms water was found to be of D class and was not fit for drinking, bathing. Several cases of water borne diseases like typhoid, skin, eye, ear, and urinary tract infections were reported from local and nearby city hospitals immediately after mass bath especially in summer.*

Keywords **- Mass bathing, Water Quality, physico-chemical parameters, Ganga River**

I. INTRODUCTION

Water is the most precise thing in the world, which we cannot live without. Water is super abundant on the planet as a whole, but fresh potable water is not always available at the right time or the right place for Human or ecosystem use. The water being an important part of environment occurs as solid, liquid and gas forms on the earth. As a liquid, it forms hydrosphere, which covers approximately three-fourth of the earth's surface. About 97% of the total available water on earth is saline, and hardly 3% is fresh. A small portion of the fresh water fulfills the fresh water requirements of Human beings. River plays a significant role in fulfilling the fresh water requirements in the world. The most basic effect of water pollution is directly suffered by the organisms and vegetation that survive in water, including Amphibians. On a human level, several people die each day due to consumption of polluted and infected water.

India is a secular country so there many festivals celebrated like Deepawali, Dussahra, Eid etc except this festival some other festival which is celebrated enthusiastically; KUMBH MAHOTSAV is one of them. It is mass gathering of Hindus along the banks of Holy River in India. It is held by turn in four different cities of India i.e. Haridwar, Nasik, Prayagraj and Ujjain. The Venue depends on the position of the stars and planets. It is held every third year at the one of four venues by rotation. It is believed that, a holy bath in sacred river during Kumbh mela has purifying effects. For this reason, Hindu religion follower believes that Kmbh mela is the most auspicious place in the universe to take a holy bath. Armed with this faith pilgrims attend the kumbh mela and bath in the Ganga in a mood of solemn reverence. Around 150 million pilgrims were collected in Prayagraj for dip in Gnaga River during Kumbh.

II. LITERATURE REVIEW

A. Nayak et. Al., (2014), studied physico-chemical parameter and biological parameter were collecting samples and after analysis of this samples they have compared with pre sagarmela (non-bathing time). The physico-chemical parameter of water like dissolved oxygen (D0), Bio-chemical Oxygen Demand (BOD), pH. In comparison to pre sagarmela, higher bacterial load was recorded during sagarmela.

B. Bhutiani and Tyagi (2012) studied water quality of Ganga River during Maha Kumbh-2010. Water samples were collected from five different sites and analyzed various physico-chemical and microbiological parameters. It has been seen that all Parameter tested were within the permissible limit according to WHO (2009) and i.e Har-ki-pauri and Mayapurghat at haridwar.

C. Sharma et. Al.,(2012) carried out study to evaluate the mass bathing on water quality of Ganga River during Maha Kumbh-2010. The water samples were collected from three different bathing ghats of river Ganga and they analyzed for different physic-chemical parameters. It was observed that all parameters were slightly affected at the ghat of saptrishi ashram, which was least used for bathing purpose and so it remains least disturbed zone among all three, whereas almost all parameters were highly affected at Har-Ki-pauri, the site used most by the pilgrims for ritualistic bathing purpose.

III. Material & Method

Method and material used in the present study were further divided into following parts.

1) Site Description

Prayagraj is located in the southern part of the Uttar Pradesh, at latitude and longitude coordinate are 25°28′N, 81°52′E, it is an ancient and unique city in India where two big river of the country namely ganga an Yamuna meet at this place colled triveni sangam.kumbh mela celebrate on the bank of ganga.the ganga is note just a river, the mythological importance associated with the river is deep-rooted in the Indian culture consider as 'holly river'.

In the present paper an attempt has been made to analyze the change on main bathing days before and after main bathing days from 14 January 2019 to 5 march 2019, on the physiochemical properties of water of river ganga at three selected sampling sites viz: Phaphamau ghat, Daraganj ghat and Sangam. The water of river Ganga at aforesaid sites was analyzed for Biological Oxygen Demand, pH, Dissolved Oxygen and Temperature. Distance of these following Ghats from Railway station Prayagraj are Phaphamau ghat (10 km), Daraganj ghat(6.1 km) km,Sangam (7.5 km).

- S1- phaphamau ghat
- S2- Daraganj ghat
- S3- sangam

Fig 1: Map of U.P showing Prayagraj city and an enlarged view of Prayagraj city showing study sites

2) Sampling Procedure

For collection of water sterilized bottles was used. Bottles were washed thoroughly and rinsed with distilled water, for microbial analysis each dry bottle was rinsed with 0.5ml sodium Thiosulphate (10% solution). Water samples were collected from a depth of 30-40 cm by lowering pre-cleaned plastic bottles into the river. Water collected in the air tight bottles was takes to the laboratory for further analysis.

The parameters analyzed during study including physico-chemical characteristics are BOD, pH, DO and Temperature.

1) Biochemical Oxygen Demand – BOD is a measure of the amount of oxygen used by biological and chemical processes in a stream of water over a 5-day. BOD is calculated by measuring the oxygen level of the water on collection and then 5 days after storage in the dark at a constant temperature of 20ºC. The difference between DO and BOD is the demand or consumption of oxygen by chemical and biological process. The BOD is measured in milligram per liter of water. Unpolluted and natural water should have a 3 mg/l or less.

2) pH - Assessment of this parameter was made using electronic pH meter.

3) Dissolved Oxygen: DO was determined by Winkler's Method.

4) Temperature: For the measurement of Temperature glass thermometer was used. At the site thermometer was dipped into the water at various points (5-7) and reading was noted.

IV. RESULT

The comparison of individual parameter for all the ghats have been done during the Kumbh Mahotshov 2019 in Prayagraj .Main bathing day, before main bathing day and after main bathing day during kumbh mela in graph 2 to 13 to show the variation BOD, pH ,DO and Temperature respectively and fig. 14 & 15 shown comparison of BOD and DO respectively.

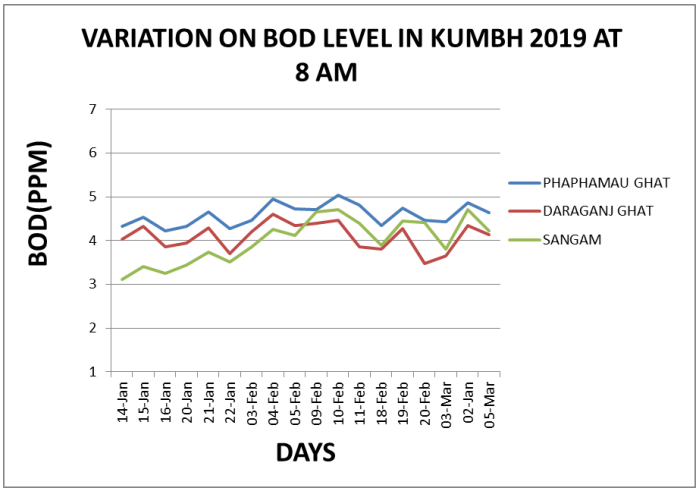

Fig. 2: BOD variations (14 January to 5 march)

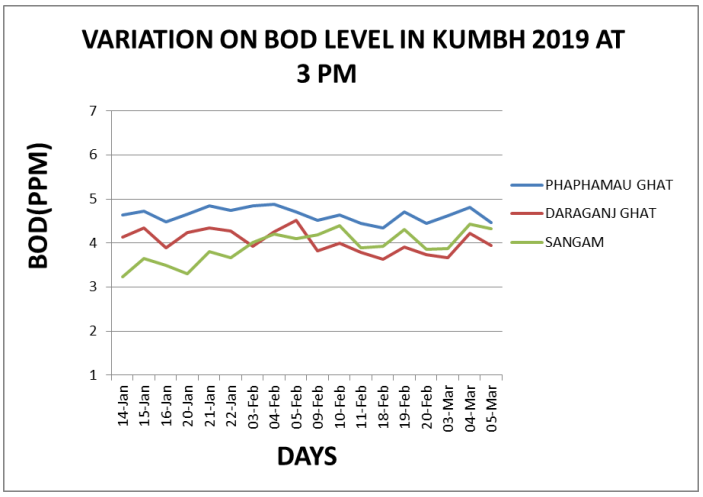

Fig. 3: BOD variations (14 January to 5 march)

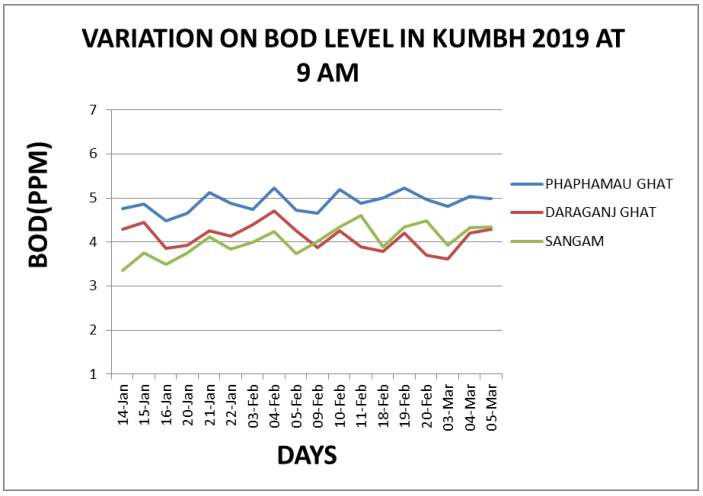

Fig. 4: BOD variations (14 January to 5 march)

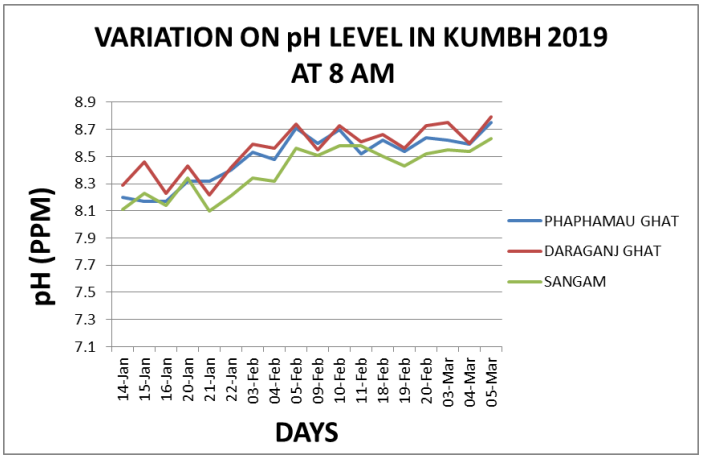

Fig. 5: pH variations (14 January to 5 march)

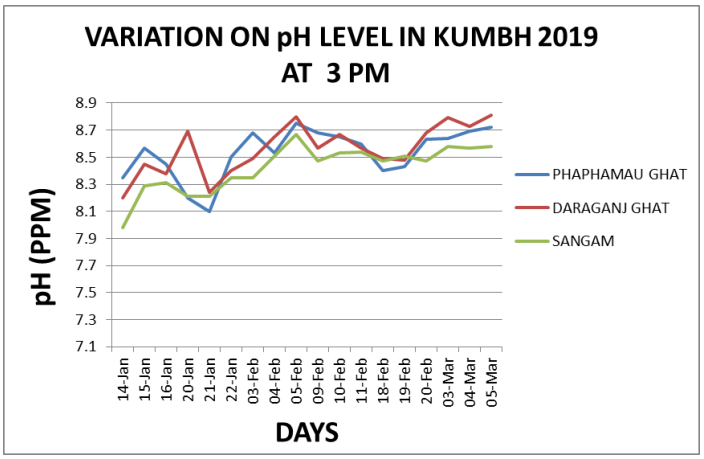

Fig. 6: pH variations (14 January to 5 march)

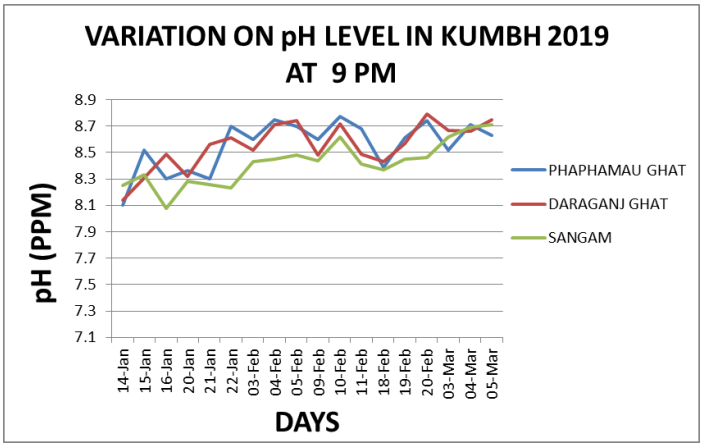

Fig. 7: pH variations (14 January to 5 march)

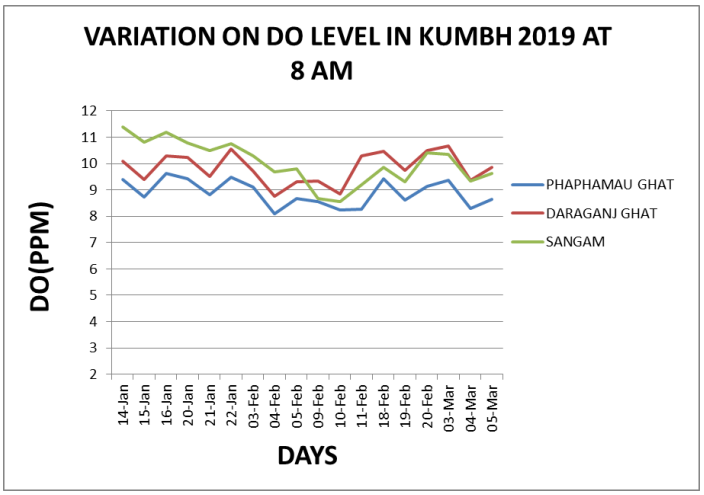

Fig. 8: DO variations (14 January to 5 march)

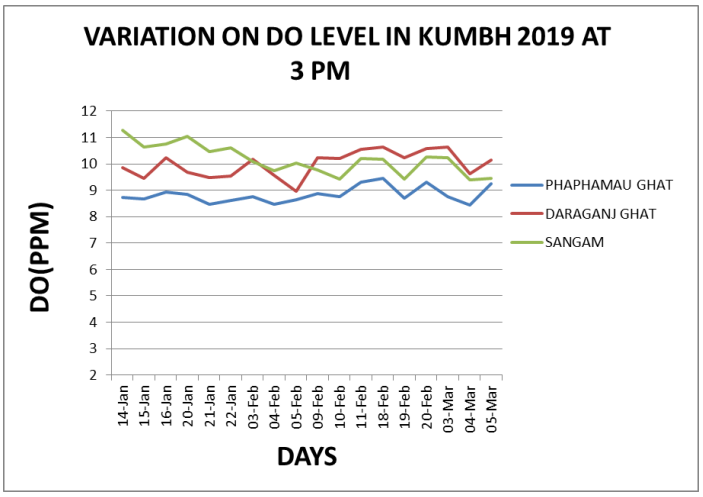

Fig. 9: DO variations (14 January to 5 march)

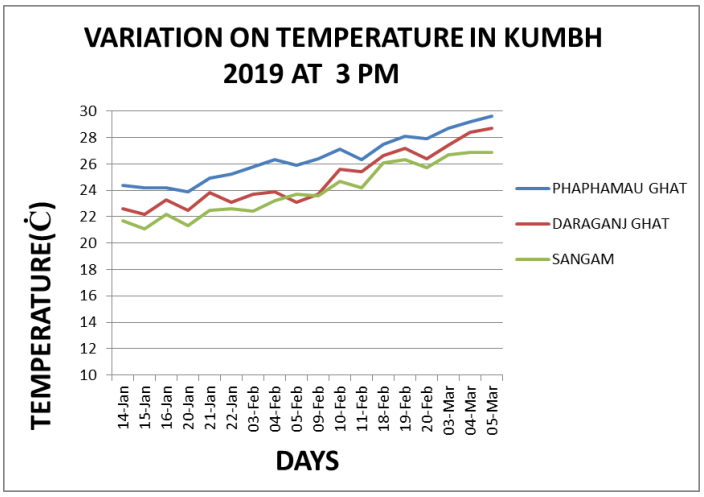

Fig. 12: Temperature variations (14 January to 5 march)

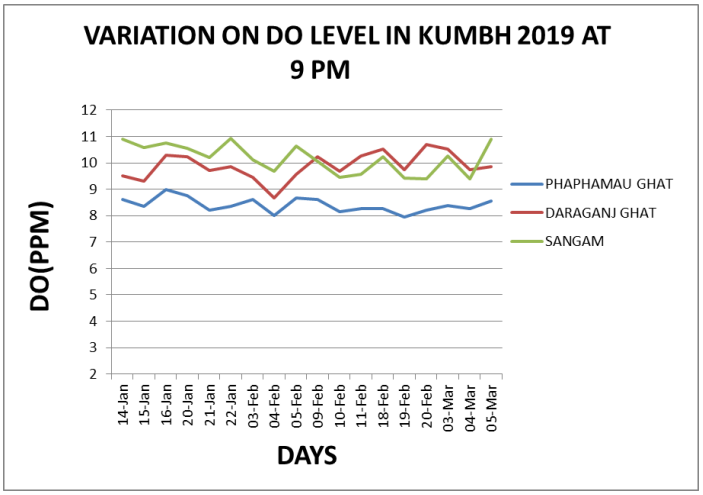

Fig. 10: DO variations (14 January to 5 march)

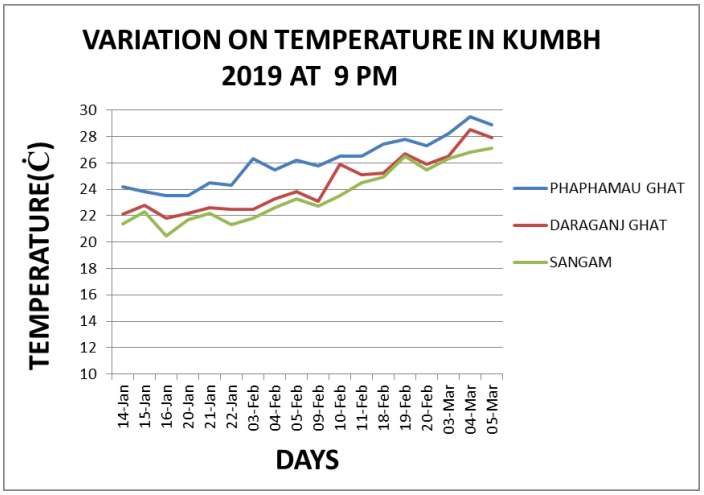

Fig. 13: Temperature variations (14 January to 5 march)

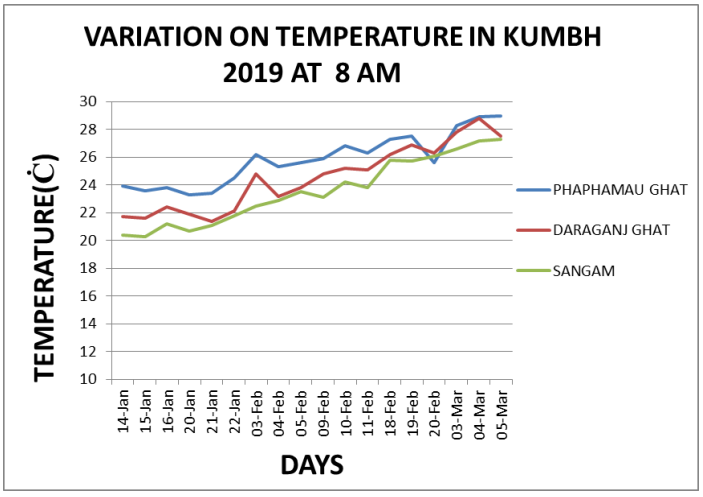

Fig. 11: Temperature variations (14 January to 5 march)

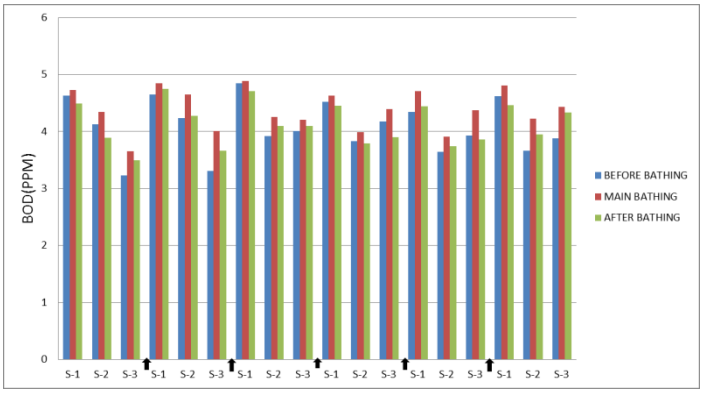

Fig. 14: comparison graph of BOD level during main bathing days, before main bathing days and after main Bathing days (14 January to 5 march)

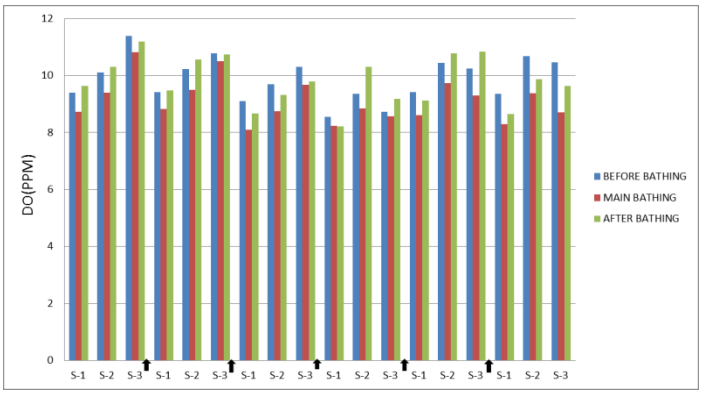

Fig. 15: comparison graph of DO level during main bathing days, before main bathing days and after main Bathing days (14 January to 5 march)

V. RESULT & DISCUSSION

A. BOD

During mela period value for BOD ranges 3.12 to 5.23 PPM and according to Central pollution control board (CPCB) the permissible limit of BOD is < 3 PPM. It is clear from the graph shown in fig. 2 to 4 as expected the date on which maximum value of BOD was recorded as 5.23 ppm on 4th February (2nd Shahi snaan) at Phaphamau ghat at 9 PM and the minimum value of BOD as 3.12 ppm was recorded at Sangam 14th January at 8 AM. It is clear from the graph shown in fig 2 to 4 in BOD that the least polluted site was Sangam in starting of Kumbh mahotsav then it increases with time and after 2nd shahi snaan BOD level at Sangam more than the Daraganj ghat due to increasing pilgrims during the mela or in the Kumbh duration for holy dip. Also the most polluted site was Phaphamau ghat during the mela dates. This was because of the fact that the industrial effluent as well as domestic sewage was disposed in these rivers either with partial or no pre-treatment.

Graph 14 shown comparisons of BOD during main bathing days, before main bathing days and after main bathing days, we observed that at the time of main bathing days BOD level was maximum in comparison of pre bathing and after main bathing days. Reason behind the maximum pilgrims took dip in the holy river Ganga on the day of main bathing. The high organic matter and pollution load of pilgrims on the river such as bathing, adding ash, flour and floral etc.it increases BOD of river water. On other side we observed that BOD before main bathing was comparatively less than BOD level after main bathing days at maximum day.

B. pH

pH is an important parameter which is important to evaluating the acid base balance of water. The Central pollution control board (CPCB) limit of pH drinking water is 6.5 to 8.5 PPM. During the mela period values of pH varied between 7.98 to 8.79as shown in graph 5 to 7.The present investigation observed the highest values of pH found at Daraganj ghat within taking time period, whereas Sangam have minimum pH values in comparison to other two sites and it increases with time during kumbh mela days. The values of pH increases from January to March may be due to increased photosynthesis of algal blooms resulting into the precipitation of carbonates of calcium and magnesium from bicarbonates.

C. DO

Dissolved oxygen in natural and waste water depend on the physico-chemical in the water body .The CPCB (central pollution control board) suggested that the standard parameter for DO is > 5.0 mg/l. The concentration of DO in three ghats water samples in during mela days was found to be in the range of 8 to 11.26 mg/l as shown in graph 8 to 10. During the mela days the DO was recorded minimum value of 8 mg/l observed on 4th February (2nd shahi snaan) at 9 pm and maximum value 11.26mg/l of DO was recorded on 14th January at 8 am. we observed that in the starting of kumbh mela maximum DO level at sangam, approximately after 2nd shahi snaan DO at sangam would be reduced as compare to other two ghats, and it vary between daragnaj ghat and Phaphamau ghat. This is because that after 2nd shahi snaan (4 february 2019) huge number of pilgrims dip in holy river ganga at sangam. Also we observed that at Phaphamau ghat had always minimum amount of DO. Graph 15 shows comparisons of DO during main bathing days, before main bathing days and after main bathing days.In main bathing days there was less DO because of huge number of pilgrims comes and took the holy dip and spread flour, flowers and other worship organic materials in the river ganga than others bathing days.

D. Temperature

Temperature measurement are sometimes important to identify such as saturation values of solid and gases dissolve and BOD value are dependent on temperature of water. The CPCB (central pollution control board) suggested the permissible limit of temperature is 25-27ºC. Temperature higher than 27ºC is considered objectionable. The temperature in three ghats water sample in during main bathing days, before main bathing days and after main bathing days was found to be in the range of 20.4°C to 29.6ºC as shown in graph 10 to 13. During the mela again the temperature was observed of minimum value 20.4ºC at Sangam (14th January) at 8 am and maximum value observed 29.6ºC temperature was recorded at Phaphamau ghat (5th march) at 3 pm. In the present investigation observed that the temperature increases within given main bathing day interval at phaphamau due to major disposal of untreated sewage, industrial effluent.

VI. CONCLUSION

The present study is directed to evaluate the water quality during kumbh mela 2019 in Prayagraj at different locations. It may be resolved from the present study that mass bathing causes a computable change in the water quality. The physico-chemical parameters were analyzed BOD, pH, DO and Temperature respectively. Biochemical Oxygen Demand(BOD) were found to be maximum during the main bathing days as compare to pre and post bathing days that is why there is drastic change in water quality. During the kumbh mela we observed that maximum BOD found 5.23 PPM at 4 February 2019(2nd shahi snaan) at Phaphamau ghat and minimum value of BOD found at 3.12PPM at Sangam at 14 January 2019. pH and temperature were increases from starting to end of kumbh mela due to anthropogenic activity or it may be due to increases photosynthesis in water and seasonal effect in water(range of 20.4°C to 29.6ºC from January to march) respectively. While maximum ph value observed 8.79 PPM at Phaphamau ghat and minimum pH value 7.98 at Sangam. Dissolved oxygen were found to be minimum during main bathing days and at phaphamau ghat(ranges 8 to 9.46 PPM) whereas we found that maximum DO at Sangam(ranges 8.57 to 11.26 PPM) in maximum days. After It can be said that the water quality from among three ghats Phaphamau ghat was most polluted ghats and Sangam was least polluted ghat. It was observed that in the beginning of kumbh mela water quality was comparatively better than last bathing of Kumbh mela. The main reason behind this is huge influx of all the sorts of waste and organic matter during the holy occasion at their various ghats as these are the ghats where mainly bathing and other customs were performed. Regular monitoring at times should be performed and appropriate mitigation measures and better management of resources and provision of basic facilities although, could be minimize the elevated levels of water pollution.

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