

ANALYSIS OF WATER QUALITY OF RIVER GODAVARI DURING KUMBHMELA 2015

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Abstract— Water is the most vital thing in this world, without which we can't live. Indian civilization mostly started at the banks of rivers; therefore rivers are considered to be sacred. There are various reasons to water pollution as industries, urbanization, improper agricultural practices, water withdrawal, religious and social activities.

Kumbhmela is one of the most religious events regarding ritualistic activity. It is one of the biggest Hindu festivals which occur on rivers at four different places. Nasik is the place where Kumbhmela occurs in every twelve years on Godavari River. The present study is carried out to assess the impact of mass bathing on water quality of river Godavari River during Kumbhmela 2015 at Nasik. The Godavari river water samples collected from three different selected sites at different times of the day. The physico-chemical and biological parameters were analyzed such as Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), pH, Chlorides, Conductivity, Turbidity, Hardness and Most Probable Number (MPN). Few parameters were within the permissible limit but it is also observed that water is not fit for drinking purpose. The parameters were compared with BIS standards (2012). The turbidity and MPN was also observed more than permissible limit.

Index terms- Mass bathing, Water Quality, Physico-chemical Parameters, Biological Parameters.

I. INTRODUCTION

Water is the most treasurable entity in this world, which we can't live without. Water being an important part of environment occurs in solid, liquid and gaseous forms on earth. Water is also used by people for different aspects. A public event is an event addressed to a large number of public. Mass gathering is through an assemblage of more than 1000 person at a particular place for a certain period. It is a planned event held for a definite period of time at particular location.

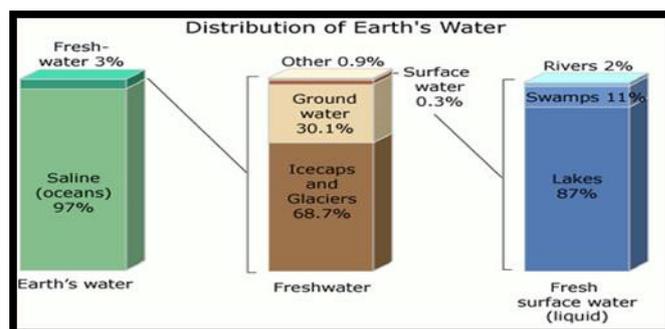


Fig.1 Distribution of water on earth's surface.

Above figure explains the distribution of water on earth surface. The only available of fresh water is three percent of all water. The rivers contain two percent of fresh surface water, so it is important to achieve finest usage of water.

Pollution is the introduction of contaminants into the natural environment that cause adverse change. Water pollution is a terrible problem, powerful enough to lead the world on a path of destruction. 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. Water pollution is the contamination of [water](#) bodies. There are various reasons to water pollution as industries, urbanization, improper agricultural practices, water withdrawal, religious and social activities.

Amongst all these paper focuses study is related to Ritualistic activities. A ritual is a sequence of activities involving gestures, words, and objects, performed in a sequestered place, and performed according to set sequence. Mass bathing is one of these ritualistic events in which people gather together to take holy deep in sacred rivers. This gathering of people and mass bathing is known as Kumbhmela. At Nasik – Trimabkeshwar it is held at the banks of river Godavari. At Prayag it is held at Sangam, the confluence of the rivers Ganga-Yamuna and the invisible Saraswati, at the banks of Ganga at Haridawar and at the banks of Kshipra at Ujjain. It is marked by the fact that millions of people participate in this great fair without any summons, call, notice or invitation.

Nasik is believed to be the part of Dandakaranya, where Lord Rama lived during his exile. Trimbakeshwar is one of the twelve Jyotirlingas. The sacred river Godavari originates here on Bramhagiri hills. The last Sinhastha Kumbhamela was held at Nasik and Trimbakeshwar in the year 2003-04. The Kumbh Festival, a human worshipers of spirituality is held at Nasik-Trimbakeshwar, Prayag (Allahabad), Haridwar and Ujjain. Ardh Kumbh is held at Prayag and Haridwar after every six years. The Kumbh Fair is held at the banks of sacred rivers every 12 years. These kumbh times are the periods where huge congregations of people of all ages and both sexes have a holy dip in the river Godavari. The main bathing day is decided by the Hindu priests based on the Zodiacal planetary position. Kumbhmela in Nasik was held from 14th July to 25th September 2015. The Shahi Snan dates was 29th Aug., 13th Sept. and 18th Sept.

II. LITERATURE REVIEW:

Kumawat D.M. and Manish Sharma (2015) studied on Quality status of river Kshipra situated in Ujjain; the study was carried to assess the quality status of Kshipra before its proper linkage with river Narmada. Water quality was assessed in terms of physical, chemical and biological parameters. Four sampling sites were selected covering almost whole city along the river traverse. Physical parameters included pH, temperature, conductivity and opacity, while chemical parameters assessed were TDS, TSS and hardness. Total Coliform (TC), Fecal coliforms(FC), TVC were taken as microbial parameters. After studying all these parameters it was found that all the parameters were above the permissible limits laid by WHO/CPCB.

Nayak et. al., (2014), studied physico-chemical parameters and biological parameters 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 (DO), Bio-chemical Oxygen Demand (BOD), pH. In comparison to pre Sagarmela, higher bacterial load was recorded during Sagarmela.

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 parameters tested were within the permissible limit according to WHO (2009) and BIS (2004). But it was seen that MPN was positive for all this samples. It was seen that two sites were more affected than remaining three i.e. Har-ki-pauri and Mayapurgat at Haridwar.

Sharma et. al., (2012) carried out study to evaluate the impact of 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 Physico-Chemical parameters. It was observed that all parameters were slightly affected at the Ghat of Sapt Rishi 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.

Bhatnagar and Sangwan, (2008), Studied impact of mass bathing on water quality on new moon day i.e. amavashya in terms of physico-chemical and biological characteristics. The result revealed by increase in organic pollution. They have to develop base line data on physical and biological aspects of this sacred ecological unit that may need attention for its upkeep in near future and provided some health remedial measures.

H.kulshetra and Sharma (2004), Researchers studied about the mass bathing during Ardhakumbha. They found that due to mass bathing water quality of river was changed drastically and it was not fit for any usage like drinking or bathing. It was celebrated in Haridwar, from 26th January to 15th May 2004. Researcher's study showed that presence of Faecal Coliforms (FC) which states that there was presence of pathogenic micro-organisms. And might cause water borne diseases. But still the water was safe with respect to DO content, the values of BOD and COD values exceeded the maximum permissible limits.

Sinhaet. al., (1990), analysed impact of mass bathing on the water quality of the Ganga River at haudeshwarnath (Pratapgarh). They have analysed the water quality or the impact observed on river on Maha-Shivaratri festival. Water samples were collected from three different ghats on the bank of Pratapgarh and studied different physico-chemical and biological parameters. From results they have concluded that the mass bathing causes a major change in water quality of the river which may cause different health issue on the river water users.

III. MATERIALS AND METHODOLOGY:

In the present study, a study on water quality of river Godavari at Nasik impairment is made during Kumbhmela 2015 to assess the impact due to mass bathing on the river Godavari water with special reference to Shahi Snan days. Sampling sites were selected after detailed site visit which included inspection of river from origin to place where actual bathing was going to take place. The selected sites were 'Bapu Pull (Upstream)', 'Ramkund (Midstream)', and 'Amardham (Downstream)'. Ramkund site has the maximum anthropogenic activities happened during Kumbhmela. All these sites have been located in Nasik region. After the start of Kumbhmela i.e. the duration of near about three months, on normal days once in a week on a selected day, samples were collected on three different timings at three selected sites. The samples were collected in 1L clean and sterilized plastic containers for physico-chemical parameters and 300 ml disinfected glass bottles for microbiological parameters during Kumbhmela. The samples were analyzed for physico-chemical parameters are pH, hardness, turbidity, chlorides and conductivity, while for biological parameters are DO, BOD and MPN as per the standard methods at the environment lab in college.

While during Shahi Snan the frequency of collection of samples is increased to five times which is to be collected from same three sites. To know hourly variation the was frequency is increased by reducing the time duration, so as to collect more number of samples and to specify the condition or change in the water quality during Shahi Snan more accurately. The samples were collected before a day of Shahi Snan, on the day

of Shahi Snan and after a day of Shahi Snan. The samples were collected for in all 17 days including normal and Shahi Snan days.

The pH is determined by pH meter (ELICO LI120) and litmus paper, chloride content was found out by using Mohr's Method, Hardness by EDTA titrimetric method, Turbidity by using Nephelometer (ELICO CL 52D), Conductivity by conductivity meter (ELICO CM 180), DO by Winkler's method with azide modification, MPN by multiple test tube fermentation method. After analysis, test results were compared with standards for drinking and bathing purpose and graphs were plotted for variation in parameters against date with respect to all three sites.

IV. RESULTS AND DISCUSSIONS:

Fig.1.a (1st Shahi Snan 29th aug.)

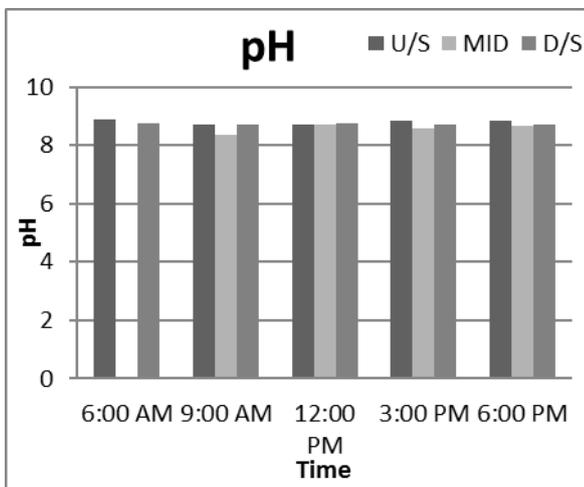


Fig.1.b (2nd Shahi Snan 13th sept.)

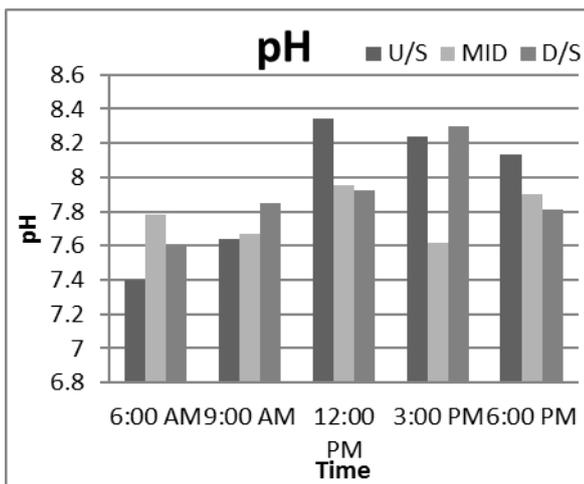


Fig. 2.a Chloride (1st Shahi Snan 29th aug.)

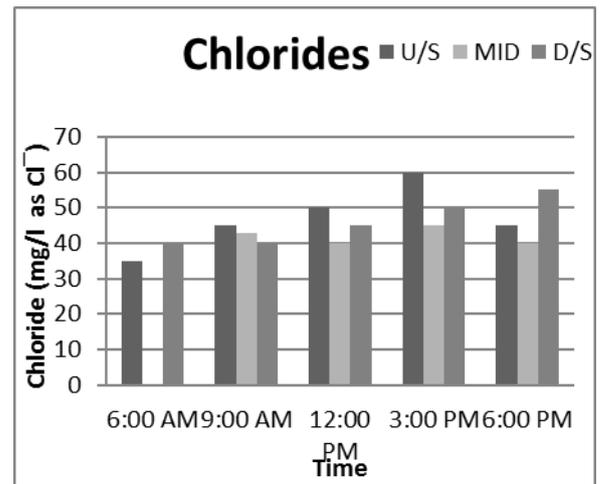


Fig.2.b Chloride (2nd Shahi Snan 13th sept.)

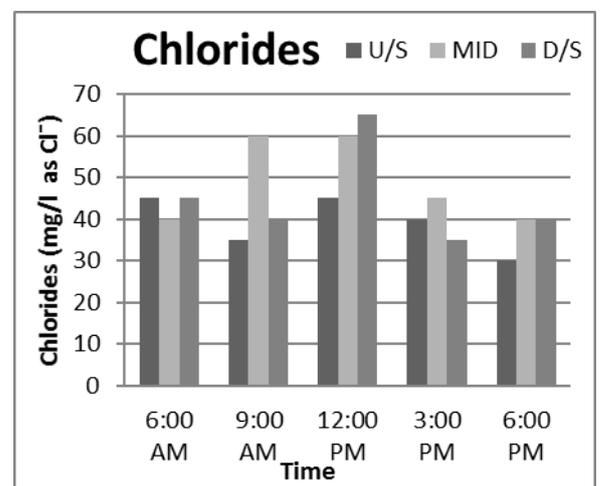


Fig.3.a (1st Shahi Snan 29th aug.)

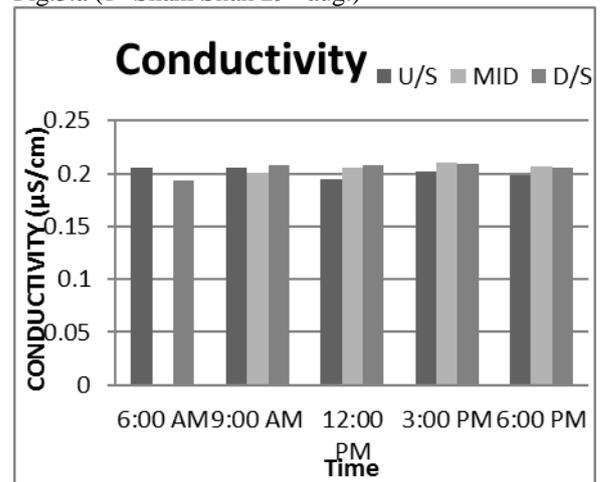


Fig.3.b (2nd Shahi Snan 13th sept.)

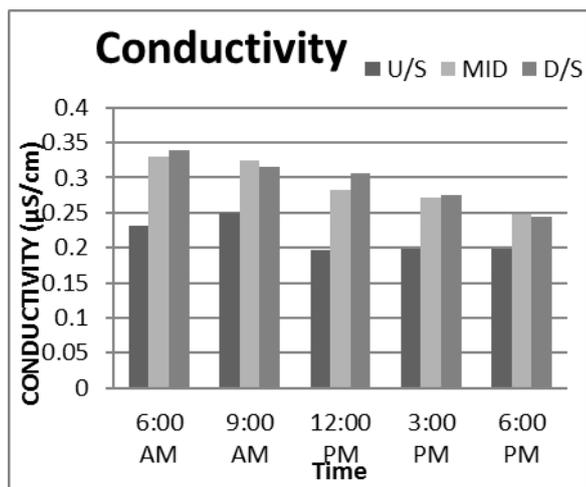


Fig.5.a (1st Shahi Snan 29th aug.)

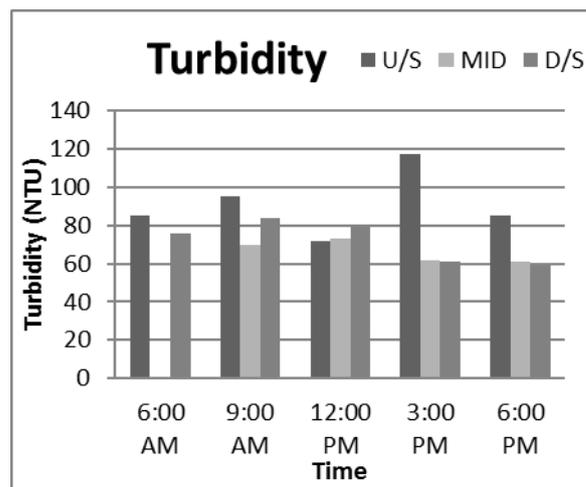


Fig.4.a (1st Shahi Snan 29th aug.)

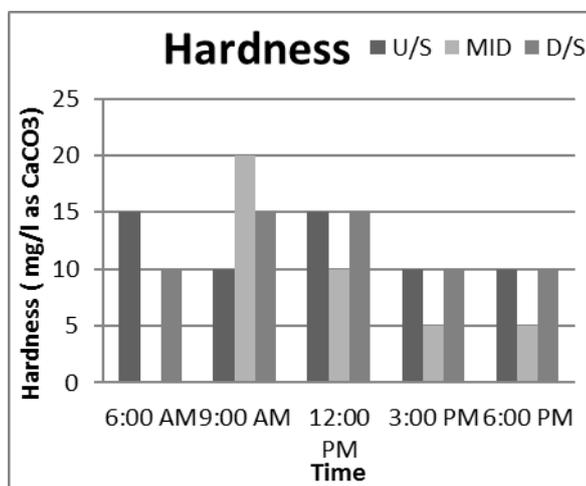


Fig.5.b(2nd Shahi Snan 13th sept.)

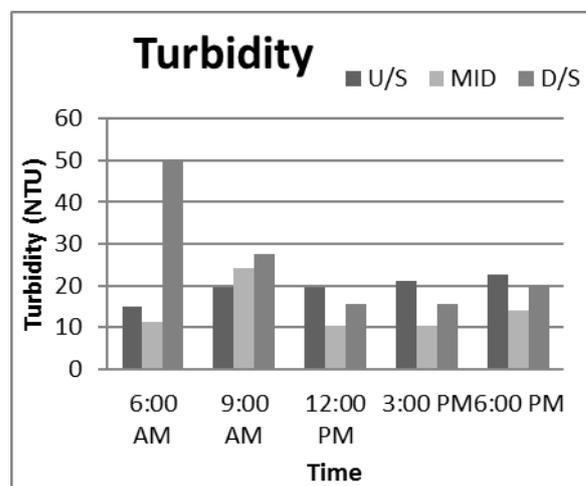


Fig.4.b (2nd Shahi Snan 13th sept.)

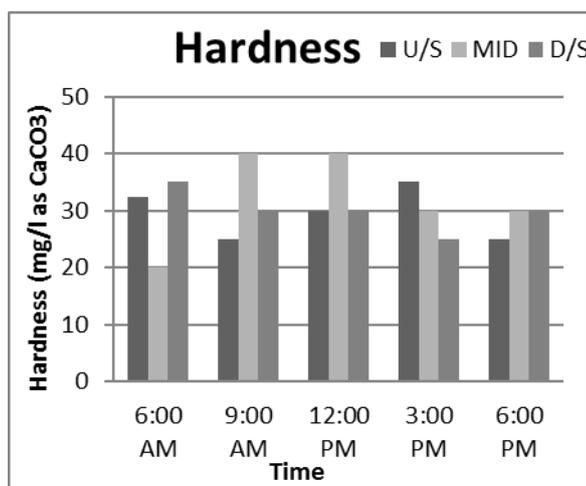


Fig.6 (29th aug and 13th sept.)

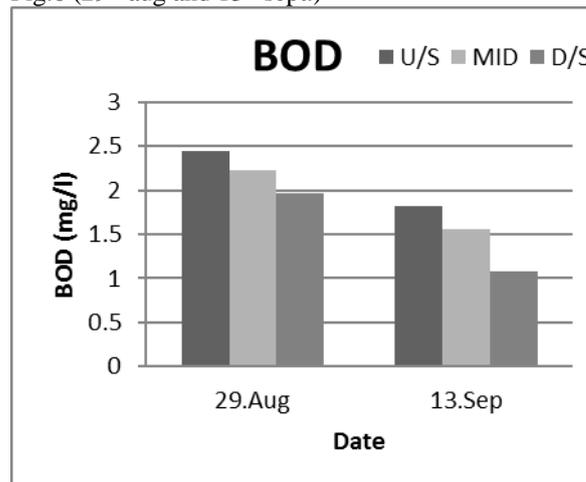


Fig.7 (29th aug and 13th sept.)

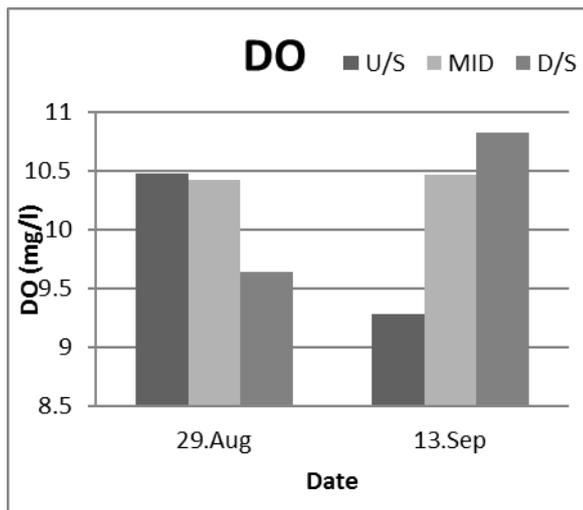
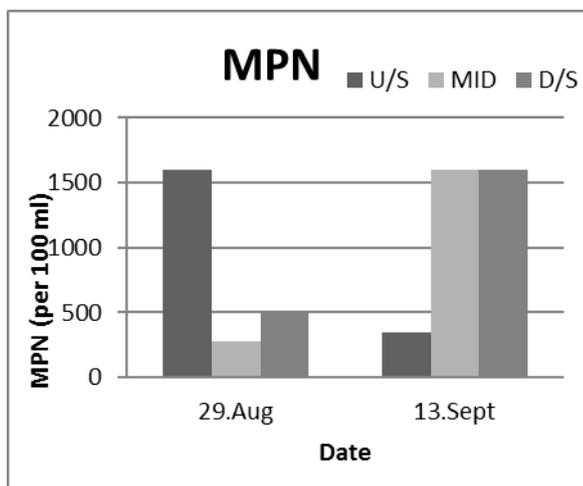


Fig.8 (29th aug and 13th sept.)



The results of all physico-chemical and biological parameters are described below and also summarized in following respected figures.

pH ranges between 7.4 pH to 8.88 pH. From fig.1.a it was maximum at upstream site and minimum at middle stream site. While from fig.1.b it was ranges in between 7.4 to 8.34 pH. The permissible limit of pH is 6.5-8.5 pH. The above sample is not permissible for drinking purpose. It was above the limit due to industrial waste flow, sewage flow. Chlorides of river Godavari River during Shahi Snan ranges between 64.974-29.988 mg/l as Cl⁻. During 1st Shahi Snan from fig.2.a the highest value was 59.976 mg/l as Cl⁻ at upstream site while minimum is 34.986mg/l as Cl⁻ upstream site only. On 2nd Shahi Snan from fig.2.b it was maximum 64.974mg/l at downstream and minimum 29.988 mg/l as Cl⁻ at upstream site. The required limit is 250mg/l as Cl⁻ and its permissible limit is 1000 mg/l as Cl⁻. It is less than its permissible limit. Pilgrims use to urinate in river, the sweat of body are the main reason for decrease in chloride. Conductivity ranges between 0.34 µS/cm to 0.193 µS/cm. From fig.3.a it was maximum at

downstream and minimum at downstream but at different timings. While from fig.3.b it is maximum at downstream and minimum at upstream. The permissible limit is 5 µS/cm to 50 µS/cm. It was less because of offering of ashes, urinate, sweat of body, irons content.

From fig.4.a and fig.4.b the range was observed to be in 5mg/l as CaCO₃ to 32.5mg/l as CaCO₃. The desirable range of hardness is in between 200 mg/l at CaCO₃ to 600 mg/l as CaCO₃. The hardness value is less than its permissible limit due to use of soap, detergent, ashes by pilgrims. Turbidity was ranges between 117 NTU to 10.2 NTU. During 1st Shahi Snan from fig.5.a the maximum turbidity was 117 NTU while minimum is 59 NTU. While 2nd on Shahi Snan from fig.5.b the range was in between 27.4 NTU to 10.2 NTU. It was above permissible limit according to BIS (2012) which is greater than 5 NTU. The turbidity was more than that of permissible limit due to mass bathing, turbulence and the sadhu's applies ashes on their bodies to protect from winter, they directly take dip in river without taking any precautions.

Bio-Chemical Oxygen Demand was in range of 1.08 mg/l to 2.45 mg/l. From fig.6 it can be seen that it was maximum on 1st Shahi Snan day at upstream site and minimum was on 2nd Shahi Snan day at downstream site. It is should be less than 3 mg/l according to BIS(2012). Dissolved Oxygen ranges between 9.68 mg/l to 10.82 mg/l. From fig.7 it is seen that it was maximum at downstream site and minimum was at upstream site on 2nd Shahi Snan day. Its permissible limit is 5 mg/l. Not desirable for existent and growth of fish and such aquatic life. It is not suitable for bathing purpose as it exceed 6-8 mg/l. From fig.8 Most Probable Number was in the range of 280 to 1600 per 100ml. Its permissible limit is 50 per 100ml. The samples were above permissible limit due to dirt, flowerings, bacteria's, contamination, sweat from bodies, urinate and due to breath.

V. CONCLUSION

The present study is directed to evaluate the water quality during Kumbhmela 2015 at Nasik at three different locations. It may be resolved from the present study that mass bathing causes a computable change in the water quality. The physico-chemical, microbiological characteristics were analyzed. It is observed that the all biological parameters exerts spoiling effects on water and physico-chemical parameters like pH, Chlorides, Conductivity, Hardness and Turbidity also altered. These above parameters were found to be increased during bathing days. There is drastic change in Turbidity and MPN. So it can be concluded that mass bathing has disturbing effect on Godavari River. Appropriate mitigation measures and good sanitation must be implemented.

VI. ACKNOWLEDGMENT

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