International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 11, November-2016

Physico-Chemical Characteristics of River Water Due to Religious Festival

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***Abstract*-The River Godavari is a holy river known since ancient times. During Kumbh mela, people all across the country come to Nashik and take holy bath and perform various religious activities. This population is in lacs during Kumbh Mela. Keeping this in view, the physiochemical properties of the River Godavari at Ramkund, Dwarka Bridge, Triveni Sangam, Laxminarayan Bridge, Takali Bridge and Dashakpanch are studied. Water quality is assessed from 27th august to 10th October for a period of 45 days to know the impact of mass bathing and other ritual activities water bodies. For this we have selected the various parameters to be tested such as: Temperature, pH, EC, DO, BOD, COD, TH, Chlorides, TDS, TSS, and Turbidity. These Parameters were considered in the QUAL2k model for preparation of Graphs of various parameters affecting due to water quality. This study helps in determining the self-purification capacity of the Godavari River during the span of Kumbh Mela and other religious festivals. With this study, we came to the conclusion that the self-purification capacity of River water is decrease due to instantaneous load on flowing water. Keywords: River Godavari, Kumbh Mela, Pollution, Physiochemical study, QUAL2K.**

Keywords-Kumbh Mela, QUAL2K, Parameters.

1. INTRODUCTION

1.1Permeable:-

Godavari is the holy river and there are many religious festivals celebrated along the bank of river such as kartik poornima, adhik mass, Ganpati visarjan etc. in which thousands of people gather and take holy dip but there is one more festival which is widely celebrated along the bank of river i.e. kumbhamela in which Millions of people take bath in to the sacred river during this period. . Kumbhamela and ardh kumbhamela are the events in which many such millions of people take holy dips in river. Generally, it is restricted to limited stretches of river as they are considered to be more sacred such as ramkund and kushawart in nashik.

1.2 Problem Definition:-

The kumbhamela is not only the attraction point in India but also in other countries therefore MIT media lab located in Cambridge unites state see this event as a challenge. The event kumbhamela itself contains seven different types of management transportation management, water supply management, waste water management, sadhugram management, disaster management etc out of which my project focuses on how and why river water gets polluted and it decreases the self purification capacity of the river. The basic problems evolve during the religious festivals is

1) Sanitation load

2) Waste from rituals

1.3 Nasik Kumbh Mela Schedule of Events

14th July 2015 (Tuesday): Flag hoisting of the main ceremony at Ram Kunda

14th August 2015 (Friday): Flag hoisting of the Akhara at Sadhugram

26th August 2015 (Wednesday): Shravan Shudha- First Snan

29th August 2015 (Saturday): Shravan Purnima - First Shahi Snan at Ram Kunda

13th September 2015 (Sunday): Bhadrapad Amavasya - Second Shahi Snan/ Main bathing day

18th September 2015 (Friday): Bhadrapad Shukla Panchmi (Rushipanchami) -Third ShahiSnan

25th September 2015 (Friday): Bhadrapad Shukla Dwadashi - Vaman Dwadashi Snan

1.4 Objectives

1. To assess the changes in water quality between the pre and post bathing period as on the day of shahisnan (parvani) specially from 27th August to 10th October.2015

2. To evolve remedial measures to prevent environmental hazards due to mass bathing and alternatives for maintain bathing water quality of Godavari River.

3. To develop the model for predicting river water quality.

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ISSN: 2278-0181
Vol. 5 Issue 11, November-2016

2. METHODOLOGY

Table 2.1: Parameters to be tested and methods used

Parameters	Methods and equipments used
Temperature	Digital thermometer
pH	Digital pH meter
EC	Digital conductivity meter
DO,BOD,COD,TH,Chloride	Titrametry method
TDS	Filtration followed by weighing
TSS	By the use of imhoff cone
Turbidity	Digital nephalometer

2.1 Temperature-: Temperature is one of the important factors in an aquatic environment. During sample collection temperature varied from 21.2 degree to 28 degree the highest temperature values recorded in the month of September.

2.2 Turbidity-:in natural water it is caused by clay, silt, organic matter, plankton and other microscopic matter .turbidity in water restricts to the light of penetration required for the process of photosynthesis. Higher concentration of suspended partials observer in the period of anthropogenic activities like mass bathing, offering flowers, garlands etc.

2.3 pH -: regulates most of the biological processes and biochemical reactions.scuthrope reported that the higher ph,free co2 and ammonia are critical factors in the survival of aquatic plants and fishes fluctuations in the ph values mostly due to ingredient input in the water bodies.

2.4 Dissolved oxygen-: in the water is of great importance to all aquatic organisms and is considered to be the factor which reflects physical and biological process taking place in a water body. Dissolved oxygen concentration should be more than 4 mg/lit for the survival of aquatic life

2.5 Biochemical Oxygen Demand-: determine the amount of oxygen require for biological oxidation of organic matter with the help of microbial activities. The valves differ due to loaded input of organic matter like offering flowers, garlands, mass bathing etc.

2.6 Chemical Oxygen Demand-: determine the amount of oxygen require for the chemical oxidation of most of the organic matter and oxidizable inorganic substances with the help of strong chemical oxidant.

2.7 Electrical Conductivity-: valves mainly depend on ionic concentration or dissolved inorganic substances. It denotes the salt concentration in water body.

2.8 Total Dissolved Solids-:are simply the sums of cations and anions concentration expressed in mg/lit. A high content of dissolved solids elevates the density of water, influence osmoregulation of fresh water organisms, and reduces the solubility of gases (like O2), reduces the utility of water for drinking purpose and results in to eutrofication of river.

2.9 Chloride-:is found widely distributed in nature in the form of salt of sodium, potassium and calcium. The chloride status in river is indicative of pollution especially of animal origin. Salinity of water found due to excess of salt present in water.

Since these parameters determines the quality of water and the load of pollutional agents which disturbs the river quality are studied and the improvement of river water is to be achieved.

3. RESULTS AND ANALYSIS

3.1 Permeable-:As stated earlier I have selected total six number of locations for the collection of samples and depending on the need and by the study of various paper s the parameters for knowing the quality of water before during and after religious festivals and its impact on human life. These sampling and testing carried out from 27th august to 10th of October. For the period of 45 days, to know the impact of mass bathing and other ritual activities on water body.

3.1 Water Quality Parameter of Sample and their results before one day of Parvani.

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAY AN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKP ANCH
1	Temperature	27.8ºc	27.9ºc	27.9ºc	28ºc	27.7ºc	28.1ºc
2	PH	8.06	7.76	7.83	7.94	7.83	7.69
3	DO (mg/lit)	7.7	7.5	7.1	7.4	7.1	7
4	Turbidity (NTU)	68.2	69.6	68.6	70.2	78.3	77.6
5	Electrical conductivity (µmohs/cm)	178	188	175	180	196	201
6	BOD (mg/lit)	5.5	5.6	5.8	6.0	6.3	6.5
7	COD (mg/lit)	20	19	18	21	23	22
8	Total hardness (mg/lit)	70	72	73	75	77	76
9	Chlorides(mg/lit)	31	32	32.2	34.2	33.1	32.5
10	TSS(mg/lit)	20	25	27	30	32	31
11	TDS(mg/lit)	70	75	79	83	88	86

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The pH value was observed in the range of 7.5-8.10. It regulates most of the biological processes and biochemical relationships. DO is much higher during this period as the water level is much higher because of kumbh parvani. The turbidity value varied from 67-80NTU it shows the content of clay, silt, organic matter etc. observed EC during this date is in between 170-205.it depends on ionic concentration or dissolved inorganic substances.BOD values are less because of higher level of dissolved oxygen.COD values moderate due to less oxidizable inorganic substances. There is a sudden lowering in the concentration of organic matter because the day before parvani water level is increased.

3.2 Water Quality Parameter of Sample and their results on the day of Parvani.

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAYAN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKPANCH
1	Temperature	27.8ºc	27.9ºc	27.9ºc	28ºc	27.7ºc	28.1ºc
2	PH	8.56	8.66	8.03	7.15	7.64	7.60
3	DO (mg/lit)	7.9	7.6	7.8	7.2	6.7	6.9
s4	Turbidity (NTU)	65.3	69.3	70.8	72.5	79.5	77.8
5	Electrical conductivity (µmohs/cm)	169	189	204	215	225	221
6	BOD (mg/lit)	5.8	5.9	6.1	6.2	6.25	6.19
7	COD (mg/lit)	20	18	21	18	23	19
8	Total hardness (mg/lit)	68	69	70	72	74	73
9	Chlorides(mg/lit)	31.3	33.2	32.6	34.2	33.7	32.6
10	TSS(mg/lit)	25	27	32	40	42	41
11	TDS(mg/lit)	65	66	68	70	72	71

The pH values were observed in the range of 7-8.6. It regulates most of the biological processes and biochemical relationships. DO is much higher during this period as the water level is much higher because of kumbh parvani. the turbidity value varied from 64-80NTU it shows the content of clay, silt, organic matter etc.observed EC during this date is in between 170-225.it depends on ionic concentration or dissolved inorganic substances.BOD values are less because of higher level of dissolved oxygen.COD values moderate due to less oxidizable inorganic substances. There is a sudden lowering in the concentration of organic matter because the day before parvani water level is increased.

3.3 Water Quality Parameter of Sample and their results after the one day of Parvani

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAYAN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKPANCH
1	Temperature	23ºc	23.2ºc	23.5ºc	23ºc	23.8ºc	24ºc
2	PH	6.8	6.5	5.9	5.6	5..0	5.1
3	DO (mg/lit)	6.5	6.6	6.7	5.4	5.0	5.3
4	Turbidity (NTU)	64	65.1	67.5	70.1	78.8	78.2
5	Electrical conductivity (µmohs/cm)	193	199	215	222	245	239
6	BOD (mg/lit)	6.2	6.5	6.9	6.6	7.1	6.9
7	COD (mg/lit)	24	21	25	22	23	21
8	Total hardness (mg/lit)	75	77	75	76	79	76
9	Chlorides(mg/lit)	34.8	35.1	33.8	35.9	32.8	33.1
10	TSS(mg/lit)	73	75	80	85	89	87
11	TDS (mg/lit)	78	75	80	85	92	90

The pH value was observed in the range of 5-8. It regulates most of the biological processes and biochemical relationships. DO level is depleting as due to parvani the content of organic matter increased due to visarjan of nirmalya, waste from rituals and mass bathing and at the same time other characteristics which depends on DO varies. The turbidity value varied from 64-80NTU it shows the content of clay, silt, organic matter etc. observed EC during this date is in between 182-245.it depends on ionic concentration or dissolved inorganic substances COD values moderate due to less oxidizable inorganic substances .There is a sudden lowering in the concentration of organic matter because the day before parvani water level is increased.

3.4 Water Quality Parameter of Sample and their results before one day of 2nd Parvani

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAYAN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKPANCH
1	Temperature	27.5ºc	27.7ºc	27ºc	27.2ºc	27.5ºc	27.4ºc
2	PH	8.0	6.89	7.4	7.07	7.2	8.5
3	DO (mg/lit)	7.8	7.5	6.8	6.9	6.2	6.5
4	Turbidity (NTU)	68.1	69.4	68.1	70	78.1	77.5
5	Electrical conductivity (µmohs/cm)	177	187	174	181	194	198
6	BOD (mg/lit)	5.7	5.8	5.9	6.1	6.6	6.5
7	COD (mg/lit)	17	16	18	15	21	18
8	Total hardness (mg/lit)	71	73	74	77	78	77
9	Chlorides(mg/lit)	72	81	83	85	90	89
10	TSS(mg/lit)	22	26	28	31	33	34
11	TDS (mg/lit)	71	74	78	84	87	85

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3.5 Water Quality Parameter of Sample and their results on the day of 2nd Parvani

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAY AN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKP ANCH
1	Temperature	28°c	28.2°c	27.7°c	27.8°c	28.2°c	28.0°c
2	PH	7.87	8.32	7.6	8.80	7.1	8.2
3	DO (mg/lit)	7.7	7.4	6.7	6.9	6.1	6.3
4	Turbidity (NTU)	50.26	51.44	52	53.8	55.4	54.1
5	Electrical conductivity (µmohs/cm)	155	166	167	169	171	165
6	BOD (mg/lit)	5	5.1	5.3	5.3	5.5	5.4
7	COD (mg/lit)	14	15	17	16	19	17
8	Total hardness (mg/lit)	72	74	75	78	79	77
9	Chlorides(mg/lit)	31	32	32.2	34.2	33.1	32.5
10	TSS(mg/lit)	27	30	32	35	39	38
11	TDS (mg/lit)	75	78	82	88	90	89

The pH value was observed in the range of 5-8. It regulates most of the biological processes and biochemical relationships. DO level is depleting as due to parvani the content of organic matter increased due to visarjan of nirmalya, waste from rituals and mass bathing and at the same time other characteristics which depends on DO varies the turbidity value varied from 64-80NTU it shows the content of clay, silt, organic matter etc.observed EC during this date is in between 182-245.it depends on ionic concentration or dissolved inorganic substances..COD values moderate due to less oxidizable inorganic substances. There is a sudden lowering in the concentration of organic matter because the day before parvani water level is increased.

3.6 Water Quality Parameter of Sample and their results after one day of 2nd Parvani

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAY AN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKPA NCH
1	Temperature	27.5°c	27.7°c	27°c	27.2°c	27.5°c	27.4°c
2	PH	8.7	8.12	7.26	8.75	7.9	8.3
3	DO (mg/lit)	7.5	7.3	6.6	6.8	6.0	6.1
4	Turbidity (NTU)	65.3	69.3	70.8	72.5	79.5	77.8
5	Electrical conductivity (µmohs/cm)	169	189	204	215	225	221
6	BOD (mg/lit)	5.2	5.3	5.4	5.5	5.2	5.3
7	COD (mg/lit)	20	16	21	18	23	19
8	Total hardness (mg/lit)	77	79	85	86	89	88
9	Chlorides(mg/lit)	31.2	32.4	32.5	34.5	33.3	32.6
10	TSS(mg/lit)	30	33	36	39	41	40
11	TDS (mg/lit)	76	79	83	89	92	91

The pH value was observed in the range of 5-8. It regulates most of the biological processes and biochemical relationships. DO level is depleting as due to parvani the content of organic matter increased due to visarjan of nirmalya, waste from rituals and mass bathing and at the same time other characteristics which depends on DO varies the turbidity value varied from 64-80NTU it shows the content of clay, silt, organic matter etc.observed EC during this date is in between 182-245.it depends on ionic concentration or dissolved inorganic substances..COD values moderate due to less oxidizable inorganic substances. There is a sudden lowering in the concentration of organic matter because the day before parvani water level is increased.

3.7 Water Quality Parameter of Sample and their results before one day of 3rd Parvani

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAY AN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKPA NCH
1	Temperature	27.2°c	27.4°c	27.5°c	27.7°c	27.9°c	27.8°c
2	PH	7.68	8.29	7.59	7.3	8.6	7.4
3	DO (mg/lit)	7.3	7.5	7.4	7.5	7.2	7.1
4	Turbidity (NTU)	68.3	69.4	68.1	70	78.1	77.5
5	Electrical conductivity (µmohs/cm)	177	187	174	181	194	198
6	BOD (mg/lit)	3.4	3.5	3.7	4.5	5.4	5.1
7	COD (mg/lit)	17	16	18	15	21	18
8	Total hardness (mg/lit)	72	73	74	77	78	77
9	Chlorides(mg/lit)	50	53	54	55	65	61
10	TSS(mg/lit)	22	26	29	31	33	34
11	TDS (mg/lit)	75	75	78	84	87	85

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3.8 Water Quality Parameter of Sample and their results on the day of 3rd Parvani

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAYAN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKPANCH
1	Temperature	27°c	27.1°c	27.2°c	27°c	27.2°c	27.3°c
2	PH	7.5	8.35	7.2	7.14	8.32	8.6
3	DO (mg/lit)	6.9	6.8	6.1	6.2	5.6	5.7
4	Turbidity (NTU)	50.28	51.48	52.3	53.9	55.4	54.2
5	Electrical conductivity (µmohs/cm)	156	168	169	170	172	169
6	BOD (mg/lit)	3.6	3.7	3.8	4.7	5.6	5.2
7	COD (mg/lit)	15	16	18	19	20	19
8	Total hardness (mg/lit)	72	74	75	78	79	77
9	Chlorides(mg/lit)	53	54	55	57	67	63
10	TSS(mg/lit)	28	31	33	36	40	39
11	TDS (mg/lit)	77	79	83	89	91	92

The pH value was observed in the range of 5-8. It regulates most of the biological processes and biochemical relationships. DO level is depleting as due to parvani the content of organic matter increased due to visarjan of nirmalya, waste from rituals and mass bathing and at the same time other characteristics which depends on DO varies. The turbidity value varied from 64-80NTU it shows the content of clay, silt, organic matter etc.observed EC during this date is in between 182-245.it depends on ionic concentration or dissolved inorganic substances.COD values moderate due to less oxidizable inorganic substances. There is a sudden lowering in the concentration of organic matter because the day before parvani water level is increased.

3.9 Water Quality Parameter of Sample and their results after one day of 3rd Parvani

SR NO	PARAMETERS	RAMKUND	DWARKA BRIDGE	LAXMINARAYAN BRIDGE	TRIVENI SANGAM	TAKALI BRIDGE	DASHAKPANCH
1	Temperature	27°c	27.1°c	27.2°c	27°c	27.2°c	27.3°c
2	PH	8.9	8.74	8.6	8.66	8.55	8.3
3	DO (mg/lit)	5.5	5.7	4.8	4.1	3.4	3.5
4	Turbidity (NTU)	65.4	69.4	70.9	72.2	79.6	77.9
5	Electrical conductivity (µmohs/cm)	170	190	205	216	227	222
6	BOD (mg/lit)	5.6	6.7	6.8	7.1	8.2	7.5
7	COD (mg/lit)	20	16	21	18	23	19
8	Total hardness (mg/lit)	77	79	85	86	89	88
9	Chlorides(mg/lit)	65	67	71	74	79	75
10	TSS(mg/lit)	30	33	36	39	41	40
11	TDS (mg/lit)	76	79	83	89	92	91

The pH value was observed in the range of 5-8. It regulates most of the biological processes and biochemical relationships. DO level is depleting as due to parvani the content of organic matter increased due to visarjan of nirmalya, waste from rituals and mass bathing and at the same time other characteristics which depends on DO varies. The turbidity value varied from 64-80NTU it shows the content of clay, silt, organic matter etc.observed EC during this date is in between 182-245.it depends on ionic concentration or dissolved inorganic substances.COD values moderate due to less oxidizable inorganic substances. There is a sudden lowering in the concentration of organic matter because the day before parvani water level is increased.

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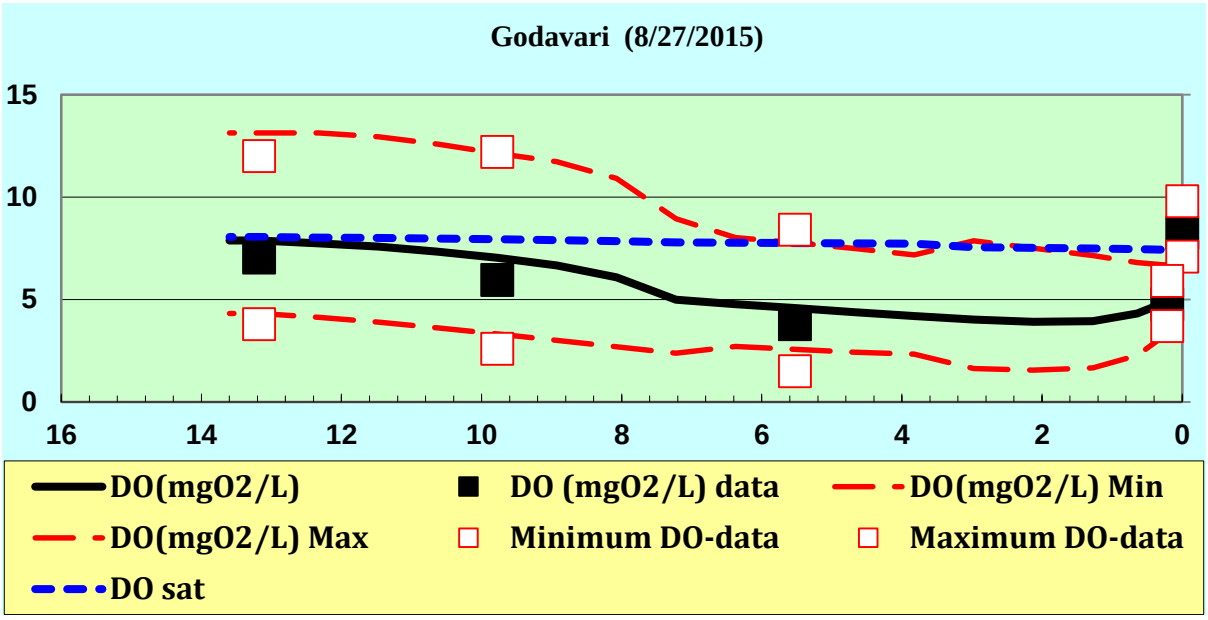
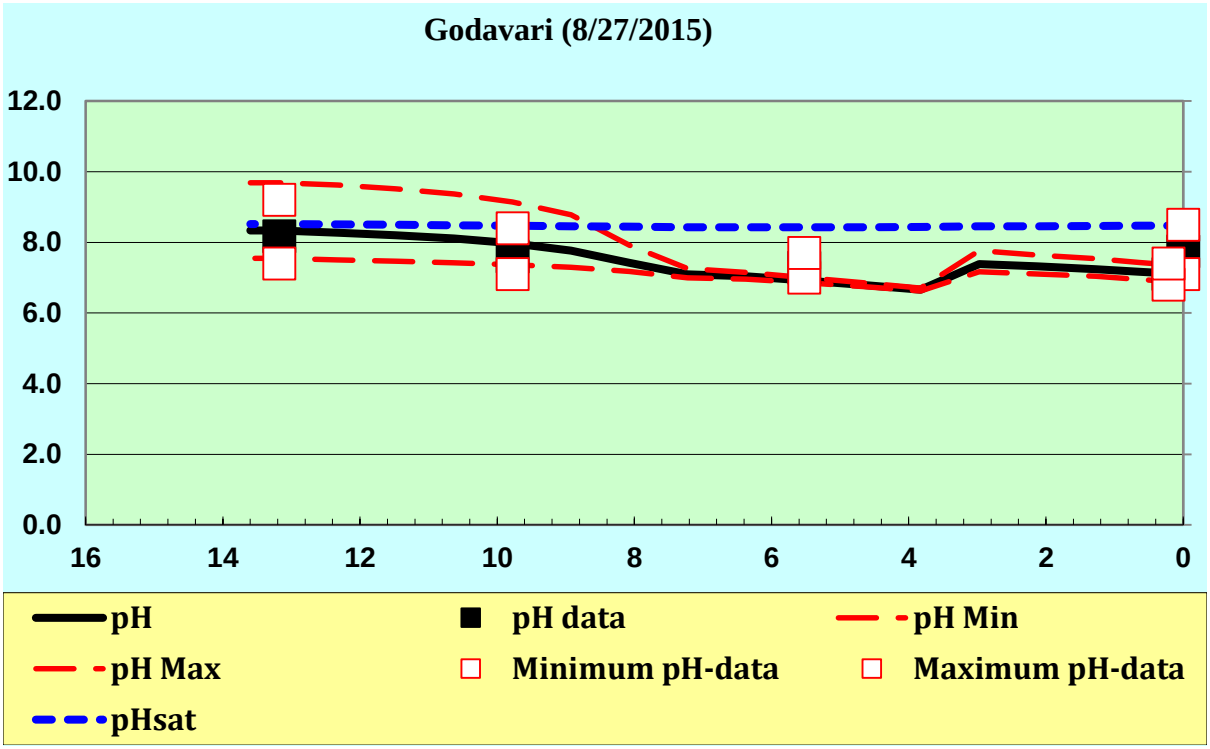
BEFORE PARVANI



: Variation in the Dissolved oxygen values on different sampling stations before first parvani



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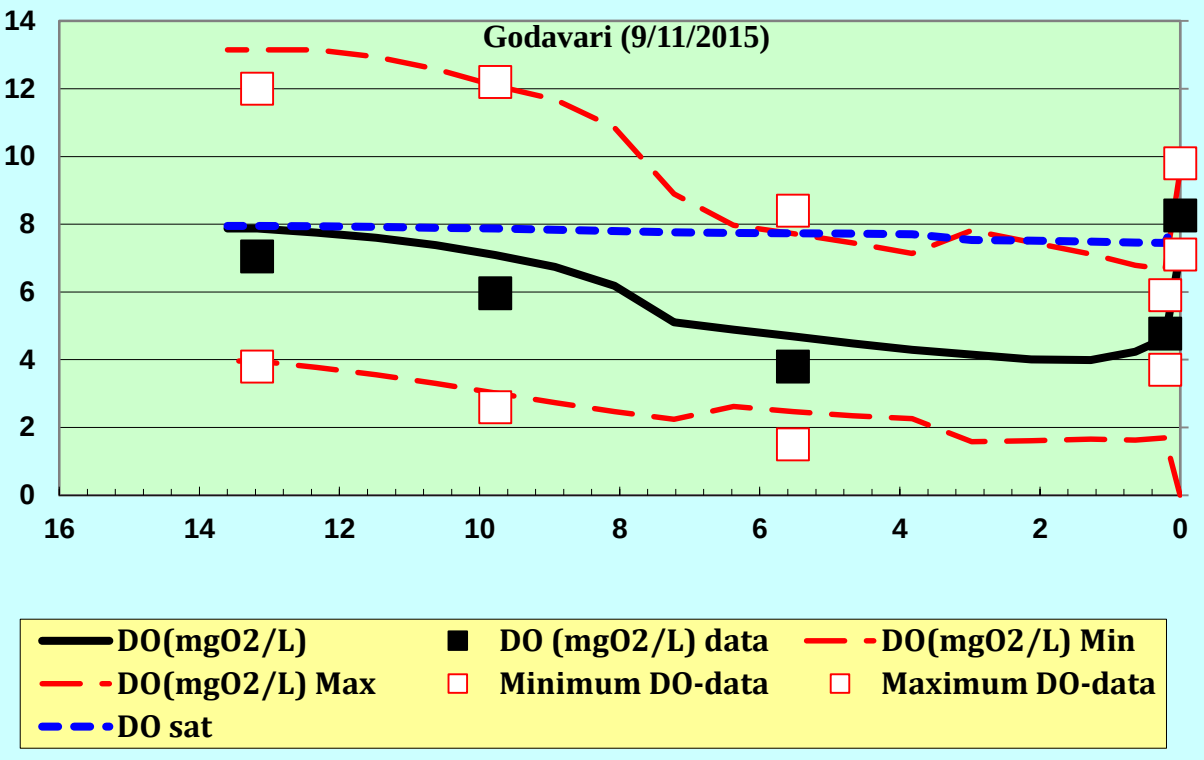
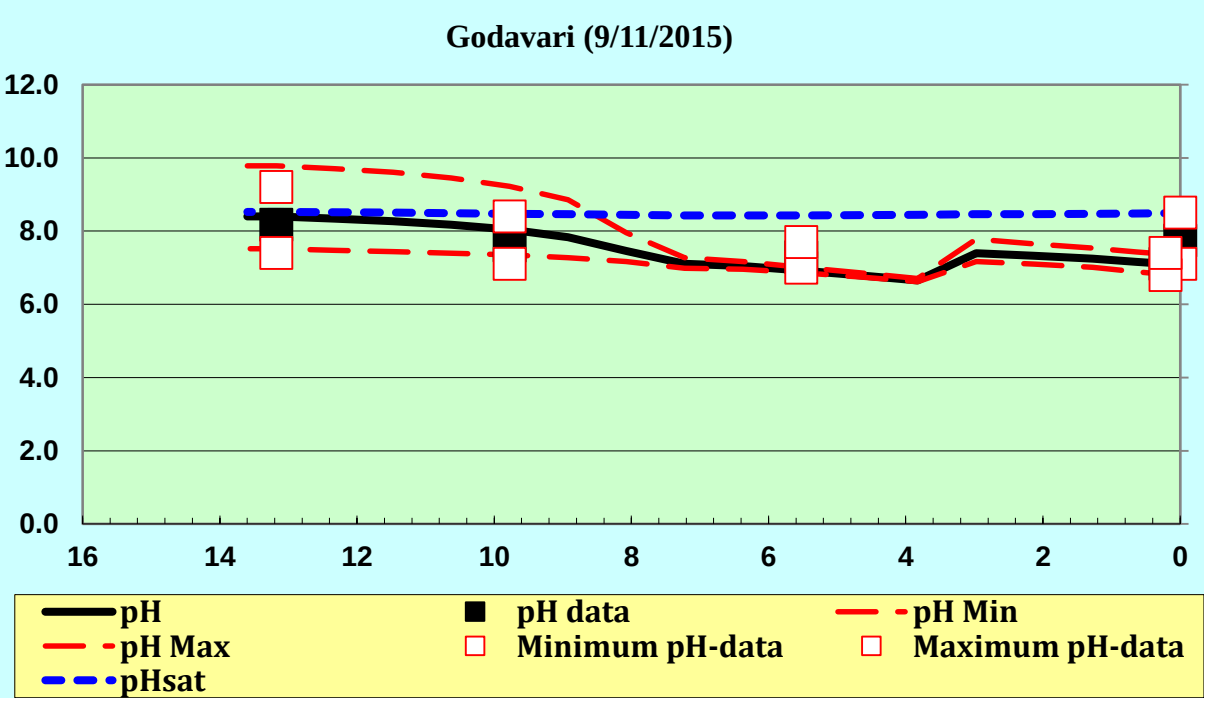
AFTER PARVANI



Variation in the Dissolved oxygen values on different sampling stations after first parvani



Variation in the pH values on different sampling stations after first parvani

Such graphs were prepared by QUAL2K software for DO, BOD, Temperature, COD, pH and various other parameters before and after parvani to determine the changes occurred.

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4. SUMMARY AFTER KUMBHAMELA

Electrical conductivity-:
Ionic concentration and dissolved Inorganic substance theses are two factors are affects the electrical conductivity. The conductivity value was observed in the range 269 to 349 (µmohs/cm).

PH-:
The ph regulate most of the biological processes and biochemical relationship. Ammonia is very important factor and which play critical role in survival of aquatic plants and fishes. The PH value was observed in the range of 6.35-7.29. This shows the alkaline nature of the water.

BOD-:
BOD values were observed to be elevated due to mass bathing during parvani. BOD was found in the range of 4 to 8 that is the maximum not acceptable level as per ISI BIS and WHO values. Temperature increase also shows increase in BOD concentration that is temperature and BOD are directly proportional to each other. The highest value recorded at the day of parvani. It may happen due to over load of input organic matter.

Temperature-:
The physico-chemical analysis of the Godavari river water indicates that water temperature varied from 28 to 28.3. Temperature is the one of the most important factor in an aquatic environment. Temperature shows an inverse relationship with DO. That is with increase in temperature, DO decreases and with decrease in temperature, DO concentration increases. The factors like water temperature leads to change in oxygen exchange rate, amount of precipitation, pH, rain etc.

DO-:
Dissolved oxygen is reflects physical and biological process while taking in the water body. It is very important factor in production and support of life. DO level was observed range 00 to 4.7 mg/l that is depleting due to increase in organic content. If DO concentration drops below a certain level, fish mortality rates will rise. Thus reduction in DO concentration bears effect on fish life.

CHAPTER 5 -: CONCLUSION

The study of Godavari river water particularly at six different locations provided for shahi-snaan exhibits low DO, high BOD,COD,turbidity,hardness,chlorides etc.above the permissible limits which makes water undesirable for drinking as well as domestic use. The high values of BOD are due to ritual activities like mass bathing, nirmalya visarjan, puja archna etc.

During the period of kumbhamela such infected water caused many water borne diseases like cholera, typhoid etc.

Since it becomes necessary to give the water some sort of prior treatment, because of the reason during kumbhamela the pollution load is significantly high especially on the day of parvani. Higher pH values indicate slightly alkaline nature of water.

QUAL2K is a one dimensional stream water quality model. . The objective of this study is to determination the overall quality of water and its suitability for different purposes like domestic and safe for aquatic life.

The main advantage of QUAL2K is the capability of simulation of algae, an extensive documentation of its code and theoretical background.

It require small amount of data to represent the sediments and only partial hydraulic terms.

The water quality scenario of the Godavari River was modeled with QUAL2K to measure the potential impact of improvements in the water quality management actions on the total daily maximum load during kumbhamela.

CHAPTER 6 -: REFERENCES

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