Water Quality assessment of Ganga River and identification of bacterial population from several stations in the southern districts of West Bengal (Nadia, North & South 24 Parganas, Kolkata, Howrah, East Midnapore and Hooghly

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Abstract

River Ganga considered as the most sacred river by the population of India is currently under the threat of severe pollution due to large population explore, as well as massive industrialization and urbanization. Thus advancement of human civilization has raised serious question to the safe use of river water for drinking and other domestic purposes. the overall anthropogenic activity have generated important transformation in river aquatic environment during the last few decades. Earlier studies done by central pollution control board and other agencies showed that water quality of river Ganga in West Bengal is adversely affected by several point and non-point sources of pollution. Further, untreated surface waters are consumed for drinking and various household tasks making the public vulnerable to water-borne diseases and outbreaks.

We have measured and analyzed the physical and chemical properties of the water quality in terms of nine core parameters (Temperature, conductivity, pH, nitrate and nitrite level, DO, BOD,TC) . Heavy metal pollution load such as lead, nickel cadmium in some specific location was measured and compared the result with the rural and urban location. The comparison of all physical chemical and biological parameters were also prepared for different locations.

Keywords: water pollution, physical, chemical, heavy metals

INTRODUCTION

The river Ganga rising from the Himalayas and flowing into Bay of Bengal, traverses a course of more than 2500 Kms through the plains of Northern and Eastern part of India. The Ganga basin covers an area of 1,086,600 sq km extending over India, Nepal and Bangladesh.(1) The Ganga besin the largest basin in India– accounts for 26% of India's land mass, 30% of water recourses and 40% of its population. The basin covers eleven states viz Uttarakhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Hariyana, Himachal Pradesh, Chattishgarh, Jharkhand, Bihar, West Bengal and Delhi. Despite of tremendous importance of the river Ganga on social, economical and demographic growth of the country, extreme pollution pressure of the river due to rapid urbanization and industrialization pose a great threat to the bio diversity and environmental sustainability of the river, with the detrimental effect on the quality and the quantity of its water flow. The major sources of pollution of Ganga are due to the discharge of untreated and partially treated waste water from cities/towns and industries, mixing of surface runoff carrying pesticides, insecticides and agricultural wastes etc, discharge of cattle shed liquid waste, bathing of cattle in river and direct disposal of solid wastes in the river.

The principal sources of pollution of the Ganga River can be characterised as follows:

- Domestic and industrial wastes. It has been estimated that about
  - 1.4×10^6 m^3 of Domestic wastewater and,
  - 0.26×10^6 m^3 of industrial sewage are going into the river.
- Solid garbage thrown directly into the river.
- Non-point sources of pollution from agricultural run-off containing residues of harmful
- Pesticides and fertilisers.
- Animal carcasses and half-burned and unburned human corpses thrown into the river.
- Defecation on the banks by the low-income people.
- Mass bathing and ritualistic practices.

The ***Central Pollution Control Board*** (CPCB), which is India's national body for monitoring environmental pollution, undertook a comprehensive scientific survey in 1981-82 in order to classify river waters according to their designated best uses. This report was the first systematic document that formed the basis of the ***Ganga Action Plan (GAP)***. It detailed land-use patterns, domestic and industrial pollution loads, fertiliser and pesticide use, hydrological aspects and river classifications. This inventory of pollution was used by the Department of Environment in 1984 when formulating a policy document. Realising the need for urgent intervention the ***Central Ganga Authority*** (CGA) was set up in 1985 under the chairmanship of the Prime Minister.

It was realised that comprehensive co-ordinated research would have to be conducted on the following aspects of Ganga:

a) The sources and nature of the pollution.
b) A more rational plan for the use of the resources of the Ganga for agriculture, animal husbandry, fisheries, forests, etc.
c) The demographic, cultural and human settlements on the banks of the river.

The studies had revealed that:

a) 75 per cent of the pollution load was from untreated municipal sewage.
b) 88 per cent of the municipal sewage was from the 25 Class I towns on the main river.
c) Only a few of these cities had sewage treatment facilities (these were very inadequate and were often not functional).
d) All the industries accounted for only 25 per cent of the total pollution (in some areas, such as Calcutta and Kanpur, the industrial waste was very toxic and hard to treat).

In West Bengal the river traverses almost 520 km before confluences with the Bay of Bengal at Gangasagar. Nearly 373 towns/cities are located on the bank of the river with the estimated urban population of nine crore. Census studies in 2011 reveals that the population hike is almost 25% in last ten years on the river bank.

Due to massive population growth as well as urbanization and industrialization, the river water has been polluted at an alarming level. Fifty four drains were identified, out of which 34 drains are located on left bank and contribute 1179 MLD of wastewater to river Ganga and 20 drains are located on right bank of river and add 600 MLD of wastewater (CPCB report, 2013). Analysis of water quality data of 10 stations as studied by CPCB and SPCB showed that water of some stations like Howrah, Shibpur, Uluberia does not meet the criteria notified for bathing also. Fecal coliform level is also higher than many other stations studied and hence Ganga is polluted with respect to organic and microbial pollution at the stretch of West Bengal. A large volume of cultivated land is fed with river water and pesticides and insecticides are continuously drained in the river. Analysis of water quality is also very relevant in post cremation days as it is an age old practice in this state. Moreover the river water is

expected to be polluted at a significant level following the immersion of idols after festive season following the tradition of West Bengal.

Analysis of water quality from ten different stations in West Bengal reveals that DO varies from 4.3-13.4 mg/l and not meeting the water quality criteria notified for bathing at Tribeni, Howrah-Shivpur, Garden Reach and Uluberia. BOD ranges from 0.3-8.2 mg/l and not meeting the water quality criteria notified for bathing at most of the monitoring locations except Tribeni and Palta. Faecal coliform value ranges from 700-11,00,000 MPN/100ml. Faecal coliform is observed higher than the criteria at all monitoring locations. Total Coliform value ranges 900- 25, 00,000 not meeting the criteria for category 'C' at all monitored locations. (CPCB report , July 2013) Hence detail and continuous water quality assessment of river Ganga is very important for the sustenance of river ecosystem as well as to minimize the health risk of the population concerned (2)

Considering all the reports, it can be stated that the quality of the water of river Ganga a life-sustaining surface water resource for large population of West Bengal, is adversely affected by several point and non-point sources of pollution. Further, untreated surface waters are consumed for drinking and various household tasks in India making the public vulnerable to water-borne diseases and outbreaks. With an objective to be a part of clean Ganga mission, the water quality from different stations located in both rural and urban areas of the five to six districts of West Bengal was analysed following the guideline of National Water Quality Monitoring Programme (NWMP) in accordance to Water Quality Monitoring Protocol. (3)

- To measure and analyze water quality in terms of nine core parameters like PH, temperature, conductivity, DO (mg/ml), BOD (mg/ml), nitrate (ppm), nitrite (ppm), total count (cfu/ml), fecal count (MPN) in different seasons for consecutive three years. Beside these, depending upon the site of collection several other chemical and microbiological parameters will be studied.

METHODOLOGY

Sample collection

Collection stations:

Water samples of River Ganga had been collected from following locations consisting both rural and urban river bank areas of the seven different districts of West Bengal.

NADIA: Nabadwip (Burning ghat and Baral ghat) Mayapur (Shochi mayer ghat) ,Kalyani (Near Kathaltala)
NORTH 24 PARGANAS : Mongal pande ghat , Sodepur (Mahotsav Ghat), Kharda (Shyam Ghat)
HOOGHLY : Sreerampore (ferry ghat) ,Konnnagar batar ghat , Hooghly ghat , Chuchura ghat Rishra ghat , Tribeni ghat
HOWRAH : Belur Math ghat Baly ghat
SOUTH 24 PARGANAS : Budge budge ferry ghat , Raychwk snan ghat , Nainan ghat , Diamond harbour ghat


Farraka
Nabadwip
Kalna
Balagarh
Triveni
Hooghly Ghat
Nabwabganj
Baranagar
Godakhali
Raichawk
Diamond Harbour
Nischintapur
Harwoodpoint
Freserganj
Estuarine Mouth

MPN AND COLIFORM TEST :

The Most Probable Number of Coliforms(cfu/ml) :

To detect total coliforms count three successive tests namely presumptive test, confirmatory test and completed test will be performed. Presumptive test will be performed to determine the most probable number of coliforms through the fermentation of lactose production of gas. If after inoculation of water sample and incubation in lactose broth, gas is produced, it is presumed, that Coliforms are present in the sample. The MPN of Coliforms will be determined from MPN table (APHA, 1998).

A. ***PresumptiveColiforms Test*** –
   1. Single strength (1X)
   2. Double strength (2X) lactose broth.

B. ***Confirmed Coliforms Test*** –

1. **Lactose broth culture from positive presumptive test**.
2. **Eosine methylene blue (EMB) agar.**
   a) Peptic digest of animal tissue – 10 g
   b) Lactose – 10 g
   c) K_2HPO4 - 2 g
   d) Eosine "Y" - 0.4 g
   e) Methylene blue – 0.065 g
   f) Agar – 15 g
   g) Distilled water – 1 litre
3. **ENDO agar**
   a) Peptic digest of animal tissue – 10.0 g
   b) Lactose – 10.0 g
   c) Di potassium phosphate – 3.5 g
   d) Basic fuchsin – 0.5 g
   e) Agar – 15 g
   f) Distilled water – 1 litre

C. ***Completed Coliform Test:***
   1. EMB agar culture plates from positive confirmatory test.
   2. Lactose broth with Durhum tube.
   3. Nutrient agar slant.

Grams Staining:

1. Crystal violet (primary stain)
2. Gram's iodine
3. Alcohol
4. Safranine

Different core parameters as per the guideline of Water Quality Mission were measured accordingly to standard protocol.(3)

❖ **Physical parameters: (measured by using Sysronic Water Analyser) :**

Physical parameters like temperature, PH, conductivity and salinity was measured (4) .

Biochemical and Physical Parameters **:**

1. Water analyser for measuring physical parameters (pH, temperature, salinity, conductivity and TDS).
2. Himedia's rapid, accurate, and reliable Nitrate testing solution kits.
3. Himedia's rapid, accurate, and reliable Nitrite testing solution kits.
4. Himedia's rapid, accurate, and reliable Iron testing solution kits.
5. Himedia's rapid, accurate, stable and reliable chloride testing solution kits.
6. Himedia's rapid, accurate, and reliable Fluoride testing solution kits.
7. Himedia's rapid, accurate, and reliable Copper testing solution kits.
8. Himedia's rapid, accurate, and reliable Sulphide testing solution kits.
9. Himedia's rapid, accurate, and reliable Silica testing solution kits.

❖ **Dissolved Oxygen (DO):**

1. Water sample from different locations was collected in blue cap bottle (**250 ml**) and pH was adjusted to 7.0 if required
2. **2 ml of $MnSO_4$** was added and mixed by inverting the bottle. The tip of the pipette should be below the liquid level while adding these reagents. The bottle was capped immediately.
3. **2 ml of alkaline KI** was added and mixed by inverting the bottle upside down.
4. Brown precipitate appeared. The bottle was left undisturbed for **10-15 min** for the precipitate to settle down.

5. **2 ml of H_2SO_4** (con) was added.
6. The mixture was shaken to dissolve all the precipitate. A mustard yellow coloured solution was obtained.
7. The 10ml solution was titrated **using 0.025 (N) $Na_2S_2O_3$**.
8. Then **2 drops of starch indicator** was added to the sample and it turned deep blue.
9. **Titration was carried out again with 0.025 (N) $Na_2S_2O_3$**, and the volume used was noted as final volume.
10. The whole titration procedures was repeated thrice and mean volume was taken.

Calculation:-

DO is Calculated using the Formula,

$$DO = \left(\frac{8\times1000\times v\times0.025}{V}\right) \text{ mg/L.}$$

Where, v = Volume of $Na_2S_2O_3$

V = Volume of sample and strength of $Na_2S_2O_3$ = 0.025 N

❖ Biological Oxygen Demand (BOD):

1. Water sample from different locations was collected in blue cap bottle (**250 ml**).
2. If required the pH of the water samples were adjusted to 7.0.
3. **2 ml of $MnSO_4$** was added and mixed by inverting the bottle. The tip of the pipette should be below the liquid level while adding these reagents. The bottle was capped immediately.
4. **2 ml of alkaline KI** was added and mixed by inverting the bottle upside down.
5. Brown precipitate appeared. The bottle was left undisturbed for **10-15 min** for the precipitate to settle down.
6. **2 ml of H_2SO_4**(con.) was added.
7. The mixture was shaken to dissolve all the precipitate. A mustard yellow coloured solution was obtained.
8. The 10ml solution was titrated **using 0.025 (N) $Na_2S_2O_3$**.
9. Then **2 drops of starch indicator** was added to the sample and it turned deep blue.
10. **Titration was carried out again with 0.025 (N) $Na_2S_2O_3$**, and the volume used was noted as final volume.
11. The whole titration procedures was repeated thrice and mean volume was taken.
12. **Calculation:-**

For Day 1:

DO is Calculated using the **Formula,**

$$DO = \left(\frac{8\times1000\times v\times0.025}{V}\right) \text{ mg/L.}$$

Where, v = Volume of $Na_2S_2O_3$

V = Volume of sample

Strength of $Na_2S_2O_3$ = 0.025 N

For Day 3:

DO is Calculated using the **Formula,**

$$D.O = \left(\frac{8\times1000\times v\times0.025}{V}\right) \text{ mg/L.}$$

Where, v = Volume of $Na_2S_2O_3$

V = Volume of sample

Strength of $Na_2S_2O_3$ = 0.025 N

Therefore, **$BOD = (DO_{1st\ Day} - DO_{3rd\ Day})$ mg/L.**

RESULT

SURVEY

Before collection of waters, an initial survey was done for all stations and substations.

NORTH 24 PARGANAS:

1. In North 24 parganas, Dhobi Ghat , Mangal Pandey ghat and Gola ghat were seen very clean and healthy. No domestic use or any kind of wastages were found. Lakshmi Ghat in titagarh is located by the side of a local vegetable and fish market and many domestic wastes and market wastes are getting mixed with ganga river directly.
2. Sodepur Station Ghat, Kharda and Titagarh Ghat were also found to be almost clean. People use ganga water for domestic purpose, thus domestic and human wastes are getting mixed with the ganga water.

KOLKATA:

1. Nimtala Ghat is a burning ghat with electric chulli. All the wastes from chulli, Funeral wastes are getting mixed with the water.
2. Bag bazar ghat and Sova bazar ghats are mainly used as snan ghat for local people. Thus, all Human and domestic wastes along with the chemicals like oil, Shampoo, detergent are mixing with the water. Many temples were found nearby. These two ghats are numerously used for IMMERSION of idols during puja like Durga Puja, Kali Puja, Lakshmi Puja etc. The structures of idols were seen floating through water.
3. Satidaha Ghat has two different ghats for male and female bathing. Most of the local people use these ghats for thein daily domestic purposes as well as bathing. People from mixed community were found to use this water together.
4. Alambazar Ghat is located by the side of a local fish, vegetable, fruit and meat market. A Jute Mill was also found just by the side of the Ghat. People use this Ghat for all kind of domestic use, Bathing, CATTLE BATHING**.** Immersion is also done here. All kind of domestic wastes, chemicals present in oil, shampoo, detergent are also getting mixed here. Sometime dead animals can be seen floating nearby.
5. Dakshineswer Ghat is located by the side of Dakshineswer Kali temple. This ghat is hugely used as snan ghat for people coming to the temple.

HOOGLY:

1. Chunchura and Hoogly Ghat, Konnagar Ghat were found to be apparently clean. Only these ghats are used as snan ghats.
2. Rishra Ghat was found very dirty. People use ganga water for bathing and other kinds of domestic uses. Domestic and Human wastes are getting mixed with the river water hugely.
3. Tribeni ghat water of this ghat is used for bathing and domestic purpose. Many chemicals due to bathing and cleaning of clothes and utensils are getting mixed. This water was found very dirty.

4. Two ghats were surveyed in Srirampur. The Roy Ghat was found to be used for bathing and some domestic activity purpose. Floating Flowers and leaves were found as there was a temple just by the side of the river ghat. This ghat is located beside the Srirampur ferry ghat.

Silbari Ghat water was found extremely dirty and the colour of the water was black. A lair of oil and chemicals were found over the water surface. The main drainage of the city is getting exposed with ganga through this ghat which causes **a** foul smell also.

NADIA:

1. Two ghats were surveyed in Mayapur. One was Mayapur ferry Ghat which seemed to be clean comparatively. People generally use this ghat for bathing purpose only. Mayapur Burning Ghat was found very dirty. All kinds of Funeral wastes along with wastes caused by funeral rituals are getting mixed with the water.
2. Kalyani Ghat was found very significant as the river is just beside the Agricultural field. The for need for agriculture purpose are supplied directly from the river ganga along with the agricultural wastes are also getting mixed with the river water directly. The water seemed very clean and clear visually.
3. Nabadwip Ghat is a Ferry ghat. People were also seen using river water for all kinds of domestic activities along with bathing. So, the chemicals used by the people, human and domestic wastes are mixing with the water directly. **Dead Cattles** were also found floating through the water.

SOUTH 24 PARGANAS:

1. Noorpur Ramnagar Ghat: These ghat is located in complete rural area. These are many kinds of small Industries like Cotton, Plastic and Jute Industry. Solar power cells were also found there.
2. Raychwk snan Ghat was found to be purely as snan ghat. Some kind of domestic activities are done here.
3. Diamond Harbour Ghat water was found to be dirty. Many kind of Domestic wastes, Human wastes are getting mixed with the river water.
4. Budge budge Ghat is located in Pujali. There is a tourist spot just by the side of this ghat. There was found a growing Composting Unit from the domestic wastes just by the side of the river. White sand was found which seemed to be white ash.

MIDNAPORE:

Kunkrahati ghat is a burning ghat located beside the ferry ghat. Here wooden chulli is used. As a result, the ashes are getting mixed directly with the river water. The funeral wastes are also mixed through this ghat. Any kind of domestic use was not found here.

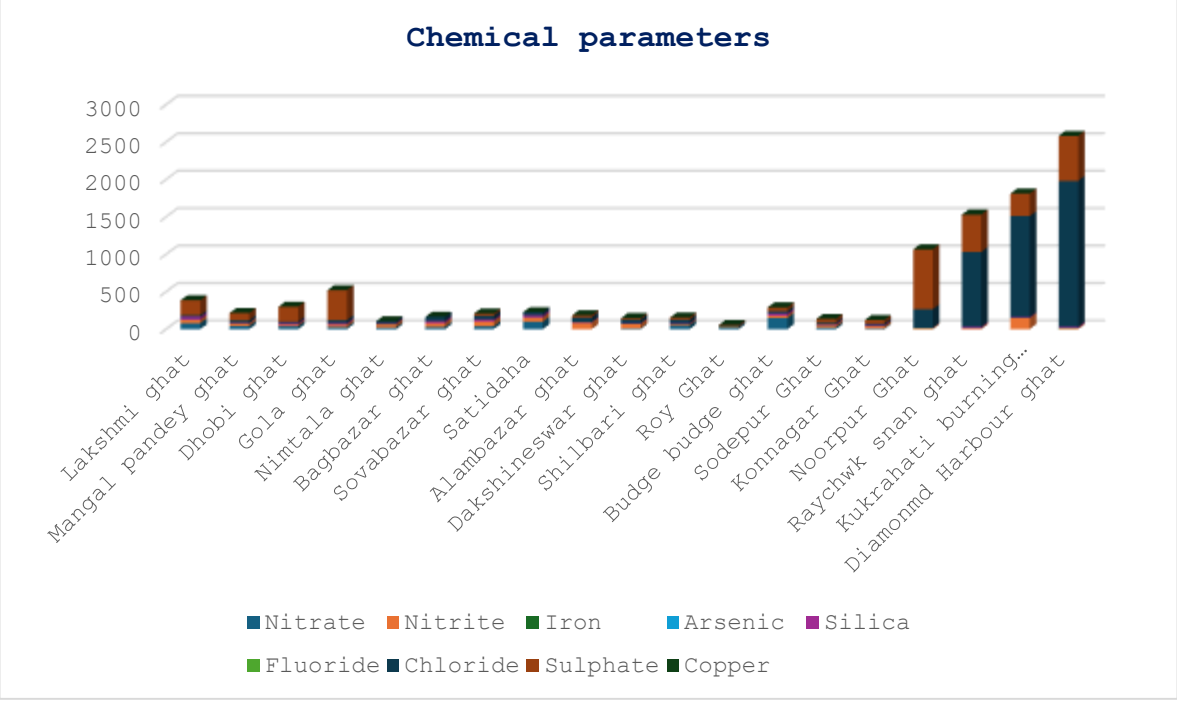
The following physicochemical properties were examined for all the selected locations

CHEMICAL TEST PARAMETERS FOR FOLLOWING GHATS OF GANGA RIVER

Ghats	Nitrate Test (mg/L)	Nitrite Test (mg/L)	Iron Test (mg/L)	Arsenic Test (mg/L)	Silica Test (mg/L)	Fluoride Test (mg/L)	Chloride test (mg/L)	Sulphate test (mg/L)	Copper Test (mg/L)
Lakshmi Ghat	80	45	0.5	0.0	40	0.5	20	200	0
Mangal Pandey ghat	45	30	1.0	0.0	10	0.0	30	100	0
Dhobi ghat	40	20	0.3	0.0	20	0.5	20	200	0
Gola ghat	30	30	0.5	0.0	20	0.5	40	400	0
Nimtala ghat	25	40	1.0	0	10	0.5	30	O	0.25
Bagbazar ghat	30	50	0.5	0	25	0.0	60	0	0.0
Sovabazar ghat	40	65	0.3	0	25	0.0	50	30	0.0

Satidaha ghat	100	55	2.0	0	30	0.0	40	0	0.75
Alambazar ghat	0	85	0.5	0	10	0.5	60	30	0.0
Dakshineshwar ghat	10	60	0.3	0	7.5	0.5	50	20	0.0
Shilbari ghat	50	15	0.5	0	10	0.5	50	30	0.0
Roy ghat	25	10	0.5	0	0.0	0.0	10	10	0.0
Budge Budge ghat	150	30	1.0	0.0	30	0.5	30	50	0.5
Sodepur station ghat	25	30	0.3	0	12.5	0.0	20	50	0.0
Konnagar Ghat	10	30	0.3	0	12.5	0.0	20	50	0.0
Noorpur ghat	0.0	15	0.3	0	1.5	0.25	250	800	0.0
Raychwk snan ghat	0.0	15	0.1	0	15	0.5	1000	500	0.0
Kukrahati burning ghat	0.0	150	1.0	0	10	1.0	1350	300	0.5
Diamond harbour ghat	0.0	15	0.3	0	15	0.75	1950	600	0.0

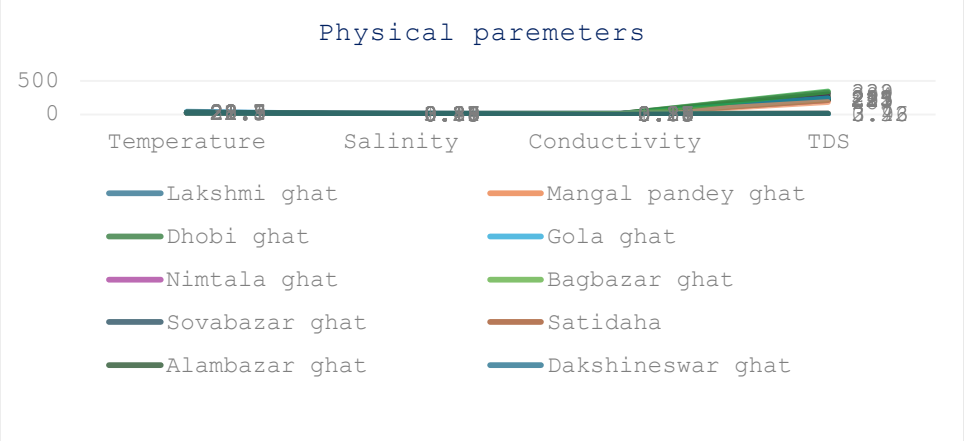
Table 1 showing the physical parameters of different locations



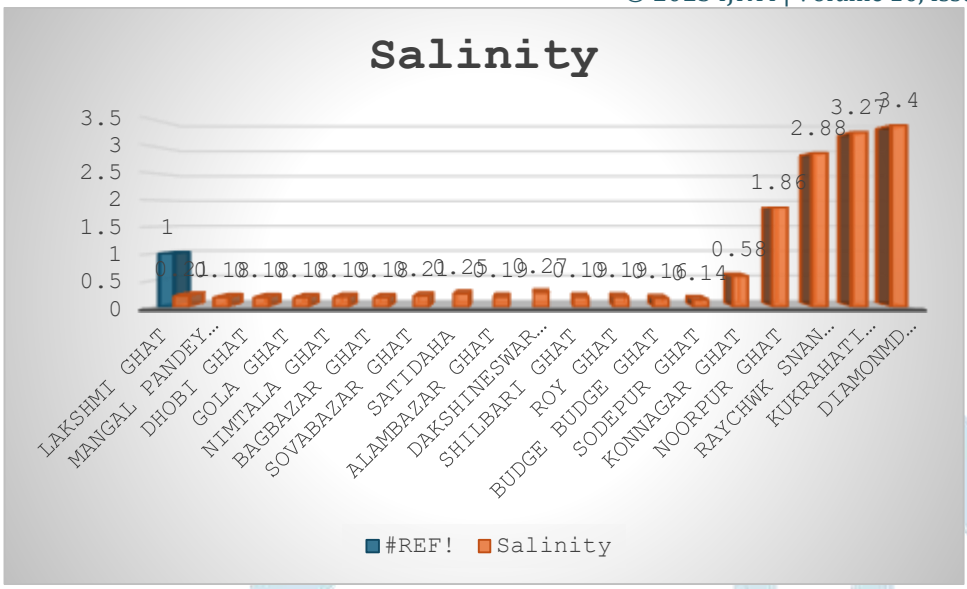
Graph 1 showing comparative results of chemical parameters

Table 2: Physical parameters for all samples taken from selected locations

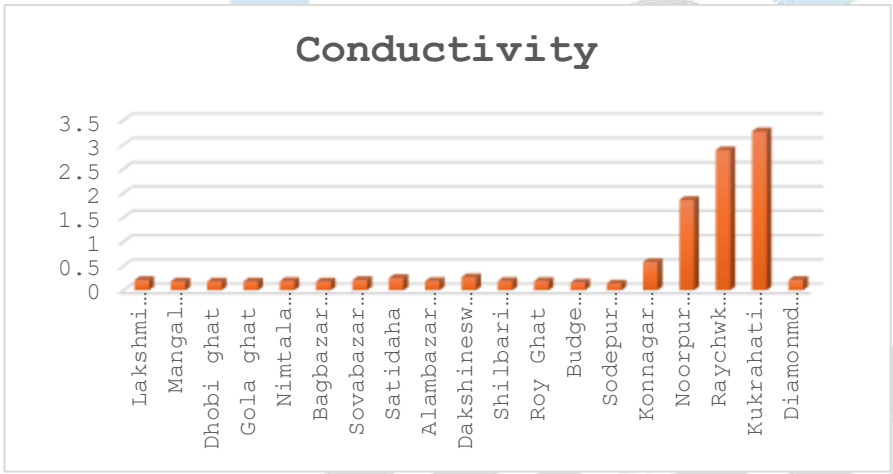
	Temperature	Salinity	Conductivity (uS)	TDS (ppm) (1ppm=mg/L)	P^H
Lakshmi ghat	22.3	0.21	0.21	251	7.07
Mangal pandey ghat	22.0	0.18	0.18	217	6.87
Dhobi ghat	22.0	0.18	0.18	227	7.55
Gola ghat	21.	0.18	0.18	223	7.12
Nimtala ghat	21.8	0.19	0.19	215	7.27
Bagbazar ghat	21.7	0.18	0.18	231	7.18
Sovabazar ghat	22.0	0.21	0.21	217	7.34
Satidaha	21.9	0.25	0.25	252	7.13
Alambazar ghat	21.9	0.19	0.19	294	7.13
Dakshineswar ghat	21.7	0.27	0.27	225	7.02
Shilbari ghat	21.9	0.19	0.19	332	7.23
Roy Ghat	21.1	0.19	0.19	225	6.88
Budge budge ghat	21.0	0.16	0.16	243	7.21
Sodepur Ghat	32.1	0.14	0.14	187	7.04
Konnagar Ghat	30	0.58	0.58	339	7.03
Noorpur Ghat	29.8	1.86	1.86	0.70	6.95
Raychwk snan ghat	29.4	2.88	2.88	2.22	6.73
Kukrahati burning ghat	29.9	3.27	3.27	3.46	6.69
Diamonmd Harbour ghat	29		0.21	3.93	6.66



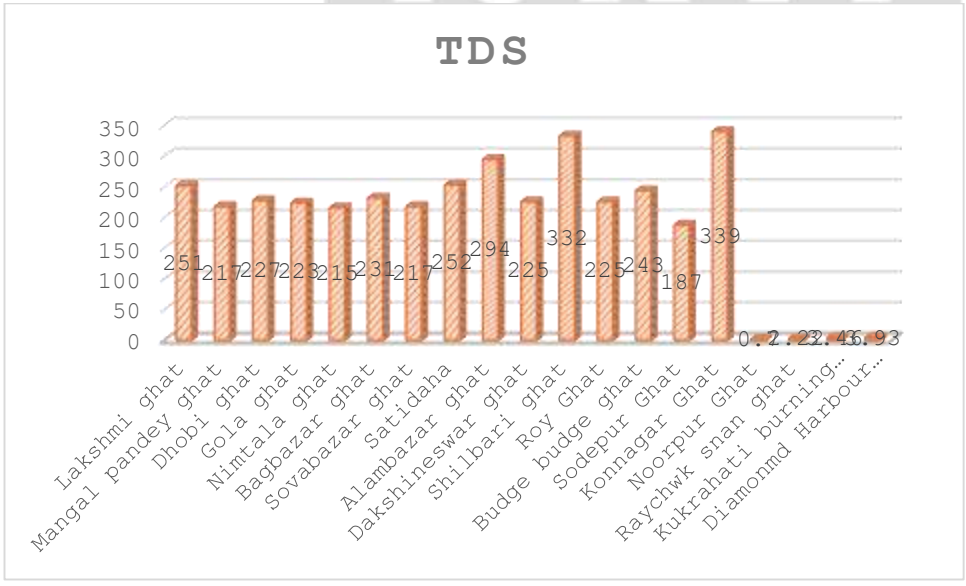
Graph 3 showing comparative results of physical parameters



Graph 4 salinity of all individual location



Graph 5 showing conductivity of all individual location



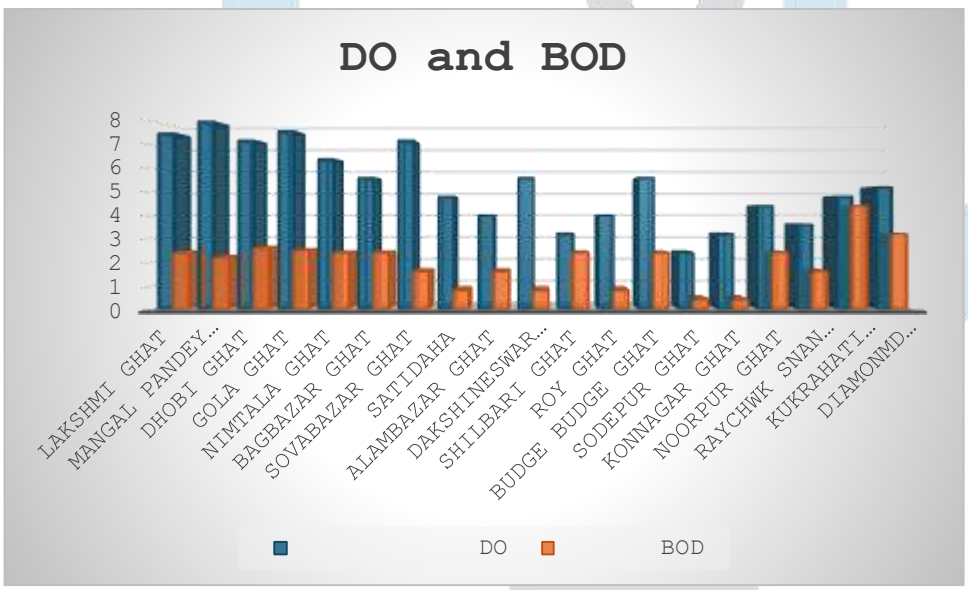
Graph 6 showing Total dissolved Solid of all individual location

DISSOLVED OXYGEN (DO)

	DO	BOD
Lakshmi ghat	**7.5**	**2.4**
Mangal pandey ghat	**8.0**	**2.2**
Dhobi ghat	**7.2**	**2.6**
Gola ghat	**7.6**	**2.5**

Nimtala ghat	**6.4**	**2.4**
Bagbazar ghat	**5.6**	**2.4**
Sovabazar ghat	**7.2**	**1.6**
Satidaha ghat	**4.8**	**0.8**
Alambazar ghat	**4.0**	**1.6**
Dakshineswar ghat	**5.6**	**0.8**
Silbari Ghat	**3.2**	**2.4**
Roy ghat	**4.0**	**0.8**
Budge Budge Ghat	**5.6**	**2.4**
Sodepur Ghat	**2.4**	**0.4**
Konnagar Ghat	**3.2**	**0.4**
Noorpur Ghat	**4.4**	**2.4**
Raychwk snan ghat	**3.6**	**1.6**
Kukrahati burning ghat	**4.8**	**4.4**
Diamond Harbour ghat	**5.2**	**3.2**

Table 3: data for Dissolved oxygen and Biological oxygen demand



Graph 7 showing cpmparative result of dissolved oxygen and biological oxygen demand of all individual location

DETECTION OF HEAVY METALS:

Name of the ghats	**Mercury (mg/l)**	**Cadmium (mg/l)**	**Lead (mg/l)**	**Chromium (mg/l)**	**Nickel (mg/l)**
Bagbazar Ghat (Before immersion)	<0.001	<0.001	<0.001	<0.001	<0.001
Bagbazar Ghat (After immersion)	<0.001	<0.001	<0.001	**0.001**	<0.001

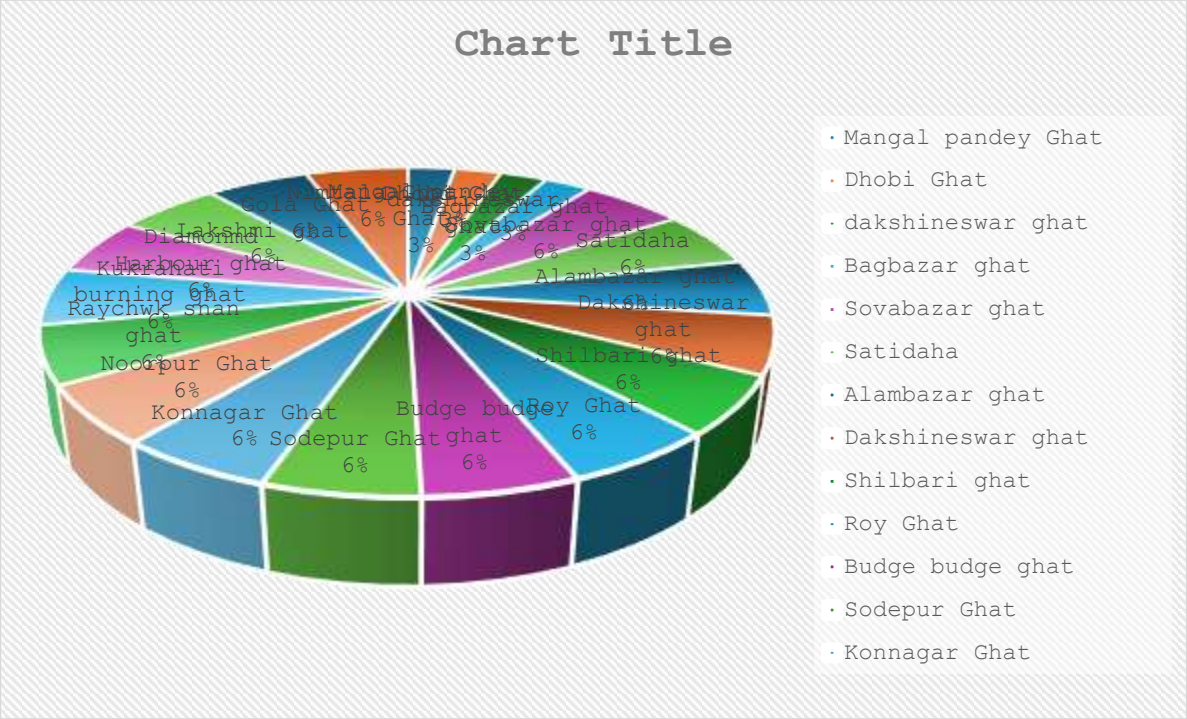
Golabari Ghat (Howrah)	<0.001	<0.001	<0.001	<0.001	<0.001
Lakshmi Ghat (Titagarh)	<0.001	<0.001	<0.001	<0.001	**0.001**
Kalyani Ghat	<0.001	<0.001	<0.001	<0.001	<0.001
Nainan Ghat	<0.001	<0.001	<0.001	<0.001	**0.001**
Kukrahati burning ghat	<0.001	<0.001	<0.001	<0.001	**0.002**

Table3: Shows the amount of heavy metal present in water sample collected from different locations and analysed by ICP-MS (Limit of quantitation equivalent to 0.001).

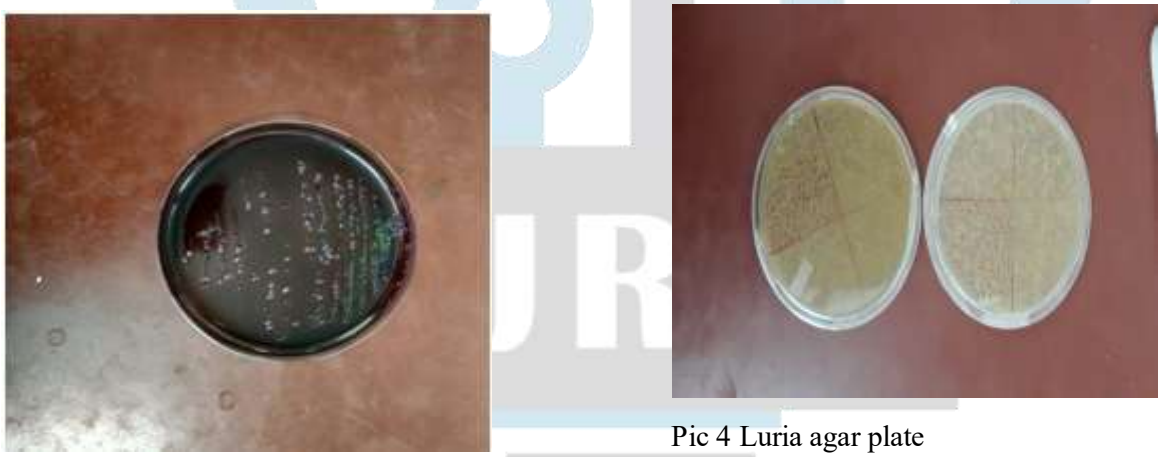
We have estimated the heavy metals like mercury, lead, cadmium, chromium and nickel in the river water collected from Bagbazar ghat before and after the immersion of Durga idol with a perception that heavy metal from the paint used in idol may contaminate the water after immersion. We have estimated the above metal level seven days post immersion at Bagbazar ghat but all the metals except chromium were found bellow the quantitation level. The chromium level found equal to the quantitation level (0.001). Moreover we have also estimated the metal level in the water sample from Golabari ghat of Howrah district, Lakshmi ghat of North 24 parganas, Kalyani ghat of Nadia, Nainan ghat of south 24 parganas and Kukrahati of East Midnapore. In Lakshmi ghat and Nainan ghat nickel was found at the concentration of 0.001mg/l, and in Kukrahati burning ghat Nickel level was 0.002mg/l

DETECTION OF COLIFORMS

Location	MPN INDEX
Mongal Pande Ghat	**1100**
Dhobi Ghat	**1100**
Dakshineshwar Ghat	**1100**
Bagbazar Ghat	**1100**
Rest 27 ghats	**≥2400**



Graph 7 showing cpmparative result of coliforms present in all individual location



Pic 4 Luria agar plate

Pic EMB agar plate

CONCLUSION AND DISCUSSION

Our studies for the measurement of physical parameters of the water samples from the selected ghat of different districts for the survey period of 2018-19 revealed the following:

Temperature and pH of all water samples are within normal range

Conductivity ranges between 230 to 7150 µs

Water samples from Hooghly ghat shows the lowest conductivity (230µs)

Water samples from Diamond Harbour shows the highest conductivity (7150 µs)

Water samples from Nabadwip Baral ghat, Lakshmi ghat of Titagarh, Silbari ghat of Serampore, Alambazar ghat of Kolkata, Diamond Harbour, Raichawk, Nainan and Kukarahati burning ghat show conductivity ≥400µs.Conductivity of water samples from the selected ghats of south 24 Pargana district ranges between 399 (Budge budge Pujali ghat) to7150 (diamond Harbour) µs . TDS of the water samples ranges between 124 to 3930 ppm. Highest TDS was found in water sample from Diamond Harbour ghat (3930 ppm) and lowest was in Hooghly ghat's water sample (124 ppm)

Water samples from Mongal Pande ghat, Dhobi ghat, Lakshmi ghat, Sodpur Mohotshav ghat, of 24 Pgs (N), Silbarighat, Roy ghat, Konnagarh ghat of Hooghly, all selected ghats of Kolkata, Golabari ghat of Howrah, all selected ghats of 24 Pgs (S) and Kukrahati burning ghat of Midnapore (East) shows TDS ≥200 ppm. TDS of Water samples from all selected ghats of south 24 Pargana district ranges between 243 to 3930 ppm

Salinity of water samples selected from different ghats ranges from 0.11 to 3.27 ppm with highest from Diamond Harbour (3.3 ppm) and lowest from Nabadwip burning and boral ghat, Belur Math ghat, Chuchra, and Rishra ghat.

River water in all locations of southern districts are highly polluted by anthropogenic activity.

Dissolve oxygen level was recorded below 5.0 in the water samples collected from 14 different locations. DO above 7.0 was noticed in water samples from Mangal Pande Ghat, Dhobi Ghat of Barrackpore region, Hooghly Ghat and Sova bazar ghat only.

In the southern districts of West Bengal River water is polluted alarmingly with the coliforms. High MPN index is found ≥ 2400

River water does not contain any heavy metal like mercury, copper, lead, cadmium, chromium and nickel beyond permissible limit

nitrate and nitrite level vary significantly from location wise that may depend on local anthropogenic activity or mixing of industrial wastes.

High sulphate is found in Dhobi ghat (200ppm), Gola ghat (400 ppm), Lakshmi ghat (200 ppm) of Barrackpore region and Nainan, Diamond harbour and Raychawk

Copper and Fluoride at the level of 0.5 to 0.75 ppm are found in some location. No arsenic is detected in Ganga river water from our selected locations.

As the river is highly polluted with bacteria, we are aimed to characterize the bacterial population location wise in future.

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