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## Physico-chemical characteristics of different locations of river Ganga and river Sone

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### Abstract

During the present study, the physico-chemical characteristics of the water of the Ganga and river Sone, Koshi and Ganga (Near Buxar, Patna, Mokama and Barh) were analysed. The physico-chemical parameter as Temperature, pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total alkalinity (TA), Total Hardness (TH), Total Dissolve Solids (T.D.S), Turbidity & Chloride were used to analyse from these sites. It was reported that Inorganic constituents (*viz.*  $K^+$ ,  $Na^+$ ,  $Ca^{++}$ ,  $Cl^-$ ,  $SO_4^{--}$  and  $PO_4^{--}$ ) of the water sample from different sites did not show any significant variations. However the values of DO of the water samples collected from different sites show variations. It was observed that dissolved oxygen level were highest in the water samples collected from river Ganga near Barh (12.0 mg/lt) and river Koshi near Saharsa.

**Keywords:** Physico-chemical, temperature, pH and Dissolved Oxygen

### Introduction

Water is among the most important requirements for sustaining life on earth that nature has created. There won't be life without water. Growth in the population, rapid growth and indiscriminate and unsustainable use of water have resulted in significant water supply depletion and degradation. Water resources are contaminated by disposal of the catchment area's waste, industrial effluent and run-off water. Therefore, it is a straightforward call to take the requisite measures to protect and restore the dignity of water bodies [1, 2]. The highest silt load of any river in the world is borne by the River Ganga and the deposition of this material in the delta zone affects 400 km from north to south and 320 km from east to west in the world's largest river delta [3]. The physico-chemical characteristics of the water of the Ganga and river Sone, Koshi and Ganga (Near Buxar, Patna, Mokama and Barh) are evaluated in this report. There is a distinct link between both the excellently-balanced physico-chemical and biological structure of rivers. Due to inputs from cities, factories, agricultural land and all other kinds of human activities, this equilibrium is greatly disturbed. The physico-chemical characteristics of river water, which largely decide the pattern of aquatic biota and biological productivity, are therefore important to be studied. In addition, chemical variables are very relevant in the assessment and regulation of water contamination, either individually or in conjunction with each other. The parameters affect each other, so it has become mandatory to evaluate significant water parameters from time to time that can indicate the beneficial or negative changes that occur in the environment. This study was carried out in river Sone, Koshi and Ganga (Near Buxar, Patna, Mokama and Barh) to determine the physico chemical parameters of water.

### Materials and Methods

The present study was carried out on teleost fishes mainly because of economic importance and suitability with respect to maintenance under laboratory conditions. Fishes were collected from different experimental sites i.e. River Sone, Koshi and Ganga (Near Buxar, Patna, Mokama and Barh). The collected fishes were stocked in earthen containers (Capacity 20 lt.) in the water of the sites from where it was collected. Fishes were acclimatized to laboratory conditions under natural photoperiod and temperature for three days. They were fed *ad libitum*. The Non Air breathing Fishes are; *Cirrhinus mrigala* (Hamilton), *Catla catla* (Hamilton), *Labeo rohita* (Hamilton) and *Mystus vittatus* (Bloch).

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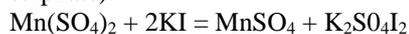
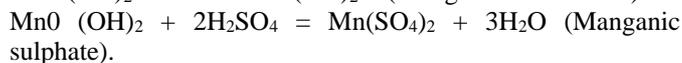
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The selected fishes are found in freshwater and estuaries of India, Ceylon, Burma, Malaya, Pakistan etc. Various Physico-chemical analysis of river water were done by standard methods as described by American public health Association (APHA), American water works Association and water pollution control federation (1985). The following reagents and chemicals were used in the experiment were i.e. NADH, N B T, P.M S, Glacial Acetic Acid, Acids and Salts of Analytical grade and deionized water was used for the preparation of reagent in the study.

#### Physico-Chemical Parameters

- 1. Temperature:** The temperature of river water was recorded with the help of Celsius thermometer at the time of sampling on the sites and expressed in degree centigrade ( $^{\circ}\text{C}$ ).
- 2. pH:** pH was measured in the laboratory with the help of systronic pH meter with combination electrode having a precision of 0.05. pH meter was standardized with stock buffers before each reading.
- 3. Alkalinity:** Titration method was used for the determination of alkalinity of water.
- 4. Dissolved Oxygen (DO):** Winkler's modified azide methods was used for the estimation of dissolved oxygen in water. DO of water sample is measured by precipitating as manganic basic oxide which is dissolved by concentrated sulphuric acid forming manganic sulphate. It immediately reacts with potassium iodide, already present liberating iodine which is determined by titration with sodium thiosulphate (0.025 N).

The chemical reactions involved are:



The quantity of iodine liberated during these reactions is equivalent to the quantity of oxygen present in the sample. The DO value was calculated with the help of following

formula:

$$\text{Dissolved oxygen} = \frac{V \times N \times 8 \times 1000}{\text{ml sample}}$$

Where,

V and N are volume and normality of the titrant respectively.

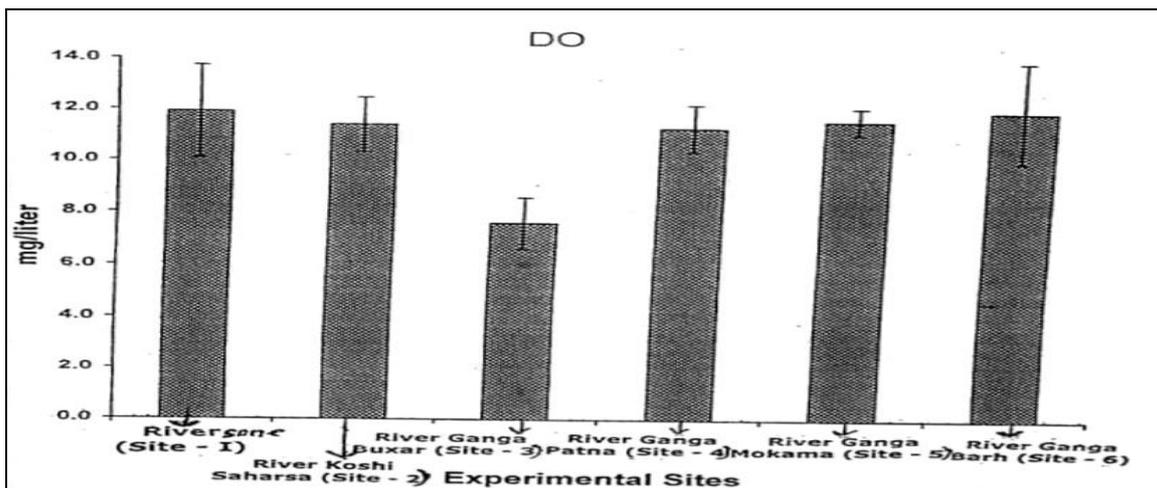
- 5. Sodium ( $\text{Na}^+$ ) and Potassium ( $\text{K}^+$ ):** Sodium and potassium were estimated using Systronics Type 121 Flame Photometer with specific filters.
- 6. Chloride ( $\text{Cl}^-$ ):** Mohr's argentometric method was used for the determination of chloride in sample water.
- 7. Calcium ( $\text{Ca}^{++}$ ):** EDTA titrimatic method was used for the analysis of calcium in water sample.
- 8. Sulphate ( $\text{SO}_4^{--}$ ):** Sulphate was measured by colorimetric method in which barium sulphate was precipitated by addition of barium chloride.
- 9. Phosphate ( $\text{PO}_4^{-}$ ):** Stannous chloride method was used for the determination of phosphate concentration in water sample.

#### Results

The Physico-chemical parameters of the water samples collected from different experimental sites as detailed elsewhere in the text have revealed that temperature of all the sites were almost same. There were nominal fluctuations in the pH of the water samples collected from different sites. Alkalinity of the water samples was also found to be almost same at different sites. Inorganic constituents (viz.  $\text{K}^+$ ,  $\text{Na}^+$ ,  $\text{Ca}^{++}$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{--}$  and  $\text{PO}_4^{-}$ ) of the water sample from different sites did not show any significant variations. However the values of DO of the water samples collected from different sites show variations. It was observed that dissolved oxygen level were highest in the water samples collected from river Ganga near Barh (12.0 mg/lt) and river Koshi near Saharsa, while it was lowest in the river Ganga near Buxar (7.5 mg/lt), while at other sites the dissolved oxygen values differs in the order as: Experimental site 6 < expt. site 1 < expt. site 5 < expt. Site2 < expt. site 4 < expt. site.3. (Table: 1 and Figure:1).

**Table 1:** Physico-chemical parameters of water samples collected from different experimental sites

Month : March											
Parameters	Temp.	pH	Alkalinity	DO	Free	K <sup>+</sup>	Na <sup>+</sup>	Ca <sup>+</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>-</sup>	PO <sub>4</sub> <sup>-</sup>
Expt. Sites	(°C)		(mg/lit)	(mg/lit)	CO <sub>2</sub>	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
1. River Sone	24.0±	7.3±	194±	11.9±	Not	0.010±	0.016±	0.018±	1.58±	0.023±	0.4±
	1.35	0.63	16.3	1.83	checked	0.008	0.006	0.005	0.09	0.007	0.04
2. River Koshi (Saharsa)	24.0±	7.4±	190±	11.4±	Not	0.012±	0.018±	0.020±	1.93±	0.32±	0.3±
	1.89	0.71	17.8	1.08	checked	0.009	0.007	0.004	0.01	0.005	0.07
3. River Ganga (Buxar)	24.2±	7.5±	199±	7.6±	Not	0.013±	0.018±	0.13±	1.0±	0.020±	0.08±
	1.18	0.61	13.8	0.98	checked	0.005	0.006	0.7	0.009	0.007	0.009
4. River Ganga Patna	23.8±	7.1±	1708±	11.6±	Not	0.011±	0.017±	0.012±	1.60±	0.019±	0.07±
	1.45	0.68	16.8	0.93	checked	0.005	0.007	0.06	0.08	0.005	0.06
5. River Ganga Mokama	23.8±	7.0±	168±	11.6±	Not	0.014±	0.017±	0.019±	1.50±	0.022±	0.20±
	0.215	0.60	13.8	0.53	checked	0.006	0.005	0.004	0.10	0.008	0.05
6. River Ganga (Barh)	24.1±	7.2±	172±	12.0±	Not	0.013±	0.014±	0.19±	0.70±	0.018±	0.11±
	1.20	0.67	14.1	1.97	checked	0.004	0.003	0.06	0.04	0.005	0.07



**Fig 1:** Concentration of dissolved oxygen (mg/liter) in the water sample collected from different experimental sites.

**Discussion**

Water sample of experimental sites from where fish for the study were collected were analysed and observed that most of the inorganic constituents of these samples were mostly identical. Dissolved oxygen content and pH of these samples varied significant. This suggests that availability of dissolved oxygen were non-identical at different experimental sites. It was also observed that dissolved oxygen content was minimum in the water samples of site 3 i.e. water sample of River Ganga (at Buxar) this may be due to organic pollutants of factory effluents drained into this river (Near Varanasi). It is known that temperature is inversely proportional to dissolved oxygen content. Therefore, during most of the time level of DO is poor in river Ganga (Buxar). Highest level of DO content was observed in Ganga river (near Barh). This may be due to high level of aquatic flora. This place is also used as inland fish culture centre by the state fisheries department. Water samples from other experimental sites

have more are less identical DO level. Slight variations in temperature, pH and other parameters may be due to local pollution activities of the cities situated near by the experimental sites. During the winter season, higher DO levels were reported primarily due to low turbidity and increased photosynthetic activity of green algae found on submerged stones and pebbles [6]. Similar results of DO were reported by Khatoun *et al.* (2013) [7] from different sites of Ganga.

**Conclusion**

From the present study it is concluded that there is a fluctuation of different physico chemical parameters from different sites of river Sone, Koshi and Ganga (Near Buxar, Patna, Mokama and Barh). If immediate firm environmental monitoring is applied to verify their consistency, the water quality of the Ganga river can be improved to a certain extent.

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