

# Study of Physicochemical Characteristics of the Ganga River

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**Abstract**—The study was carried out to find the physicochemical characteristics of River Ganga in district Haridwar, Uttarakhand. The surface water samples were collected from four different sites of Haridwar. The objective of the present study is to analyze the physicochemical characteristics of River Ganga in Haridwar at different sites and for the purpose of this study four sites were chosen from Haridwar namely Bhupatwala (Upstream), Harki pauri, Jwalapur and Bahadrabad (Downstream). From each site three samples were collected at an interval of 1 week between 10 -11 am. The study focuses on the comparative analysis of physicochemical parameter of river Ganga at four different sites. It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physico-chemical parameters. For the purpose of this study the following parameters were considered namely Temperature, pH, BOD, COD, TDS.

## 1. INTRODUCTION

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity, the ground water is highly polluted with different harmful contaminants. It is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know details about different physico-chemical parameters such as color, temperature, acidity, hardness, pH, sulphate, chloride, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), alkalinity used for testing of water quality. Heavy metals such as Lead (Pb), Chromium (Cr), Iron (Fe), Mercury (Hg) and etc. are of special concern because they contaminate water and chronic poisoning in aquatic animals. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Rivers are nothing more than surface water flowing down from a higher altitude to a lower altitude due to the pull of gravity. One river might have its source in a glacier, another in

a spring or a lake. Rivers carry dissolved minerals, organic compounds, small grains of sand, gravel, and other material as they flow downstream. Rivers begin as small streams, which grow wider as smaller streams and rivers join them along their course across the land. Eventually they flow into seas or oceans. There has been a steady deterioration in the quality of water of Indian rivers over several decades. India's fourteen major, 55 minor and several hundred small rivers receive millions of liters of sewage, industrial and agricultural wastes. Most of these rivers have been rendered to the level of sewage flowing drains. There are serious water quality problems in the cities, towns and villages using these waters. Water borne diseases are rampant, fisheries are on decline, and even cattle are not spared from the onslaught of pollution. In the Himalayan region the Bhagirathi is joined by the tributaries Alaknanda and Mandakini to form the Ganga. After entering the plains at Haridwar, it winds its way to the Bay of Bengal, covering 2,500 km through the provinces of Uttar Pradesh, Bihar and West Bengal.

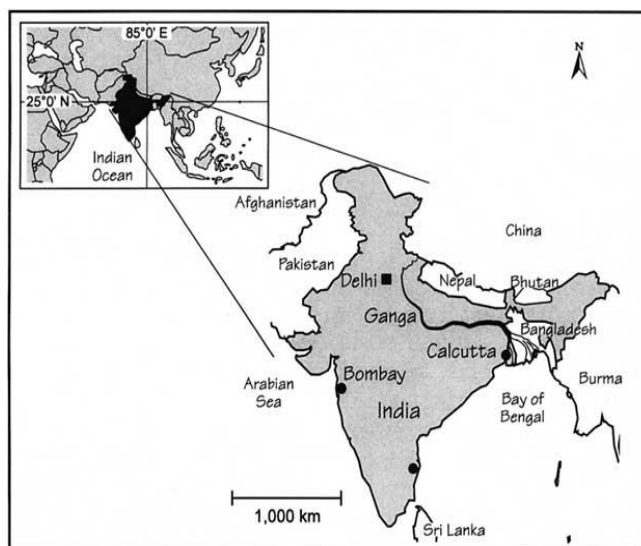


Fig. 1: Reproduced from Water Pollution Control - A Guide to the Use of Water Quality Management Principle Eds by Richard Helmer and Ivanildo Hespahol © 1997 WHO/UNEP ISBN 0 419 22910 8

The present study has been conducted to evaluate the physico-chemical characters of water of river Ganga at four different sites located in city Haridwar (Uttarakhand). These sites were Bhupatwala, Har ki pauri, Jwalapur, Bahadrabad . Haridwar is a city in Northern India on the bank of the Ganga River north east of Delhi. It is a Hindu pilgrimage centre. Haridwar lies along the Ganga River at the boundary between the Indo-gangetic plain (South) and the Himalayan foothills (North). The religious importance of Ganga may exceed than that of any other river in the world. From each site three samples were collected at an interval of 1 week between 10 - 11 am.

## 2. MATERIALS AND METHODS

### 2.1 Analytical methods and equipment used in the study

S. no	Parameter	Method	Instrnt/equipment
1	pH	Electrometric	pH Meter
2	TDS	Electrometric	Conductivity/TDS Meter
3	BOD	5 days incubation at 20°C followed by titration	BOD incubator
4	COD	Digestion followed by titration	COD digester

A Total of three surface water samples were taken from each site at an interval of 1 week between 10 am-11am and slightly different results were obtained and an average value of all the parameter is taken. The results obtained from the entire Site are given below in the tabular form.

SITE	TEMPERATURE	pH	BOD (mg/l)	COD (mg/l)	TDS (mg/l)
SITE-I	16.8	7.71	0.1	05	88
SITE-II	17.1	7.70	0.6	08	100
SITE-III	17.2	7.60	0.2	05	50
SITE-IV	17.4	7.60	0.3	07	70

**Fig. 2: Average value of physicochemical parameter at all the sites**

The average values of the parameters obtained from different sites are given above. At site-I the average value of temperature is 16.8, pH is 7.7, BOD(mg/l) is 0.1, COD(mg/l) is 05, TDS(mg/l) is 88. At site-II the average value of temperature is 17.1, pH is 7.70, BOD(mg/l) is 0.6, COD(mg/l) is 08, TDS(mg/l) is 100. At site -III the average value of temperature is 17.2, pH is 7.60, BOD (mg/l) is 0.2, COD (mg/l) is 05, and TDS (mg/l) is 50. At site-IV the average value of temperature is 17.4, pH is 7.60, BOD (mg/l) is 0.3, COD (mg/l) is 07, and TDS (mg/l) is 70.

**According to the standards given by BIS(Bureau of Indian standards)** for drinking water the value of the pH lies between 6.5-8.5. The value of permissible limit of BOD lies

up to 5mg/l. The value of COD is up to 10mg/l. The value of the permissible limit for TDS lies between 200-500. There is not as such limit prescribed for Temperature but according to BIS temperature of river water up to 40°C is suitable for drinking.

### 3. PERMISSIBLE LIMITS OF THE PHYSICO-CHEMICAL PARAMETERS BY BIS

S. NO	Parameter	Permissible limit for drinking water
1	pH	6.5-8.5
2	BOD	5
3	COD	10
4	TDS	200-500
5	Temperature	<40°C

### 4. RESULT & DISCUSSION

The results obtained from analysis of water samples of river Ganga are shown in above tables.

The reported values refer to the mean value of water samples collected from different sites along the stretch of Ganga River. The results indicate that the quality of water varies inconsiderably from location to location. A summary of the findings is given below:

In the present study the water temperature range of River Ganga in Haridwar was recorded between 16.8-17.4. WHO (1993) did not recommend any definite temperature value for drinking water. A temperature of about 40°C is permissible limit for drinking water (BIS 1991). Temperature below 14°C and above 39.5°C is harmful for fish (Hossain *et al.*, 2008) [10]. Hence it can be concluded that the water temperature of River Ganga in Haridwar is suitable for both drinking purpose and fish production.

In the current study the pH was found ranging between 7.1 - 7.6. pH as such has no adverse effect on health, however a lower value below 4 will produce sour taste and a higher value above 8.5 an alkaline taste. pH range from 6.5 to 7.5 is most favorable for production in a water body. The WHO and BIS recommendation of pH is 6.5- 8.5. In the current study the pH range is a safe for aquatic life and drinking water.

In the present study BOD varies from 0.1-0.6 mg/l .The BIS (1991) has set desirable limit of BOD value to be 05 mg/l. In the present Study BOD values were found well within the standard permissible limit which accounts for its suitability for use.

In the present study COD varies from 05-08 mg/l .The BIS (1991) has set desirable limit of BOD value to be 10mg/l. In the present Study BOD values were found well within the standard permissible limit which accounts for its suitability for use.

In the present study TDS varied from 50 mg/l - 100 mg/l. The BIS (1991) has set desirable limit of TDS value to be 500 mg/l

in potable water. However the permissible limit is 2000 mg/l in the absence of any alternative source in water. According to WHO (1993), the standard permissible limit for TDS is 1000 mg/l. Water at a TDS level of above 500 mg/l is unsuitable for flora and tastes unpleasant to drink. In the present study TDS values were found well within the standard permissible limit which accounts for its palatability

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