



## Studies in determination of some parameters of 'Ganga river' water, Kanwar Mela 2013, Haridwar

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**Abstract:** This paper deals with Physico-chemical parameters of River Ganga water in Haridwar during Kanwar Mela 2013. Different chemical parameters like temperature, pH, total solid, total dissolved solids, total suspended solid, hardness, DO, COD & chlorides in River Ganga water were analyzed. The physico-chemical parameters were found to be within the safe limits of drinking and domestic uses as World health organization WHO. This study indicates that there is a little increase in water pollution level in River Ganga during Kanwar Mela, Haridwar. The results clearly indicated that the mass bathing linked with ritual activities increased the values of different parameters of World Health Organization. The water was fit for drinking purposes on Holy days like Somvati Amavasya, Poonima.

**Keywords:** Physico-chemical parameters, COD, DO, Water pollution, Haridwar, WHO

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Water is the principal need of life on earth, and is an essential component for all forms of lives, from micro-organism to man (Praveen et al. 2012). Ganga plain is one of the most densely populated regions of the world, due to its availability of water, fertile soil and suitable landscapes Ganga is the sacred river of India which is originated from the Gangotri Glacier and empty in to the Bay of Bangal (Khare et al. 2010). In India, Ganga river water of Haridwar is life line of people. The holy water of Ganga is used for domestic and agricultural purposes (Trivedi et al. 2009). The increased anthropogenic activities (Praveen et al. 2012) and large scale deforestation and over grazing in the watershed areas of river basins leads to contamination of river and affecting the flora and fauna (Joshi et al. 2009). It is a fact that good water quality produces healthier humans than

one with poor water quality. Physico-chemical characteristics may describe the quality of water; therefore, an analysis on physico-chemical parameters of Ganga water was made by many workers (Sinha et al. 2000). The present research study is to provide information on the physiochemical characteristics of river Ganga. Physico-chemical parameters analyzed were: water temperature, pH value, turbidity, total hardness, chlorides, nitrates, phosphates (Atulegwu and Njoku, 2004).

### MATERIALS AND METHODS

#### Study area

The water sample were collected during kanwar mela from July 18 to August 7 2013 in triplicate form in a clean glass bottles from a depth of 1 foot below the surface of river. The bottles were rinsed before sampling and tightly sealed after collection. The temperature, colour and smell of water was observed before sealing. Water samples were stored in the ice box to retard the biochemical activities. Collection of samples took place between the hours of 10 am to 11.00 am.

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### Analysis of water sample

Analysis was carried out for various water quality parameters such as Temperature, pH, total dissolved Solids, total suspended solids, total hardness, carbon dioxide test, chloride test, and chemical oxygen demand (COD) and Biological Oxygen demand as per standard procedures (APHA, 2008).

### Determination of water quality parameters

The water quality parameters analyzed were; pH - measured using standard pH meter, total Dissolved solids (TDS) by standard methods, chloride content by silver nitrate method, total hardness (TH) by EDTA titrimetric method, BOD by dissolved oxygen loss method and chemical oxygen demand (COD) by potassium dichromate method (Vogel, 1978). The details of parameters are listed in Table 1. Water temperature was measured with the help of a mercury thermometer. Dissolved oxygen (DO) was determined by Winkler's titration. Total dissolved solid (TDS) was determined gravimetrically by evaporating a known volume of water to dryness in a pre-weighed crucible on a steam bath. Total hardness was determined by titrating with EDTA using Eriochrome black T as indicator and chloride by Mohr's argentometric method using Potassium chromate as indicator (APHA, 2005). Each sample was analyzed in duplicate.

### Temperature

Took a thermometer and put in to the water sample, note down the temperature.

### pH

pH was determined using standard pH meter. The electrode was dipped in the water and pH was recorded in triplicate reading.

### Dissolved Oxygen (DO)

The dissolved oxygen content of water sample was

measured by Winkler's method. 1 ml of Manganous sulphate and Pottasium Iodide was added to water sample. The precipitate formed which was dissolved by using sulphuric acid. The solution was titrated with sodium thiosulphate using starch as an indicator. The end point of titration was blue to straw pale colour (Ademoruti, 1996; Krishnamurthy, 1990).

### Chemical Oxygen Demand (COD)

COD is the amount of oxygen consumed by oxidisable organic substance, here the chemical oxidant like dichromate is used to measure oxidisability of organic matter of sample where oxidants oxidize the constituents. Took 50 ml of sample in one flask and 50 ml of distilled water in other flask, 5 ml of  $K_2Cr_2O_7$  solution added in both flasks. Both bottles Incubated for 100 °C for 1 hours and then cool for 10 minutes. 2.5 ml of KI solution and 5 ml of  $H_2SO_4$  solution added in each flask. Titration is done against  $Na_2S_2O_3$  solution until yellow colour changes to blue (Vogel, 1978).

### Hardness

The total hardness of the water samples was determined by EDTA titration method where 50 ml of well mixed sample was mixed with 1-2 ml buffer of pH 10 and a pinch of Eriochrome black-T indicator. The contents were then titrated with 0.01 M EDTA till wine red solution changes to Blue (Basavaraja et al. 2011; Karanth 1987).

### Total Solids (TS)

A crucible was washed properly and kept in an oven for half an hour and then weighed. 10 ml of sample was taken in crucible and then again weighed it. Then it was kept in oven for 1 hour and weighed. Then again crucible was kept in oven for half an hour and weighed and calculate the total solid in the sample (Chan et al. 2008).

**Table 1.** Water quality parameters and analytical methods used in analysis of water samples

S. No.	Parameter	Materials Used
1	Temperature	Thermometer
2	pH	pH meter, Buffer
3	Total solid	Crucible, Hot air oven, Weighing Balance
4	Total dissolve solid	Crucible, Hot air oven, Weighing balance, Whatmann filter paper
5	Total suspended solid	-
6	Hardness	Buffer solution, EBT indicator, EDTA solution
7	Dissolved oxygen	Alkaline KI solution, $MnSO_4$ solution, $Na_2S_2O_3$ solution
8	COD	Potassium dichromate solution, $Na_2S_2O_3$ solution, Starch indicator
9	Chloride test	0.1N silver nitrate, 2% potassium chromate
10	Carbon dioxide test	N/44 NaOH, Phenolphthalein

**Total Dissolved Solid (TDS)**

A beaker was washed properly and kept in an oven for half an hour and then weighed. A known volume of sample was filtered with the help of Whatmann filter paper and was poured into crucible. Crucible was kept in oven for half an hour and weighed and calculate the total dissolved solid in the sample (Chan et al. 2008).

**Total Suspended Solids (TSS)**

The TSS was estimated by gravimetric method. The evaporating dish was dried at 100 °C for 1 h and cooled at room temperature to take the weight of the dish. 25 ml of the sample was taken for the analysis in a pre-dried dish and was evaporated to dryness in an oven at 100 °C. The dish was cooled and final weight was taken for the analysis of TS content (Chan et al. 2008).

**Biological Oxygen Demand (BOD)**

Equal volume of sample in one flask and equal volume Distilled Water in other flask, and add 5 ml of  $K_2Cr_2O_7$  solution in both flasks. Both bottles were incubated for 100°C for 1 hour and then cool for 10 minutes. 5 ml of KI solution and 10 ml of  $H_2SO_4$  solution added in each flask. Titration is done against  $Na_2S_2O_3$  solution until pale yellow colour changes to blue (Vogel, 1978).

**Chloride test**

The chloride present in water sample is titrated with silver nitrate solution. Potassium chromate is used as an indicator. At the end point, the concentration of solution reaches zero. The silver ion increases, due to which the solubility product of silver chromate exceeds. Then silver chromate is precipitated as a reddish brown product. The distilled water is measured in titration flask. Add few drops of potassium chromate that give lemon yellow colour. Titrate it with 0.1 N silver nitrate in burette till the colour changed to tinge of pink. Repeat the experiment (APHA, 2005).

**Carbon dioxide test**

Sample was taken in titration flask. Few drops of phenolphthalein indicator was added. Titrate it with N/44 NaOH till faint pink colour appears (APHA, 2005).

**RESULTS**

The observed experimental ranges of different parameters of water testing are listed in Table 2. The observed pH value ranging from 6.6-7.0 showed that the present water samples are basic in nature. Besides these values are within limit prescribed by WHO ([www.lenntech.com/drinking-water-standards.htm](http://www.lenntech.com/drinking-water-standards.htm).) Other parameters like TH (16.2-41.3 mg/L), Chloride (18.5-20.85mg/L), TDS (256-500mg/L), DS (256-500mg/L), BOD (3.9-4.4mg/L), SS (100-190 mg/L) , COD (3.2-14.1) are found within the highest desirable or maximum permissible limit set by WHO (Trivedi et al. 2009; Trivedi and Goel, 1986) However Chloride content and Biological Oxygen demand is highly deviates as per WHO standard, respectively. ([www.lenntech.com/drinking-water-standards.htm](http://www.lenntech.com/drinking-water-standards.htm))

**DISCUSSIONS**

Our brief study indicates that temperature ranged from 35.2-36.1 which were in the relaxation zone of WHO. The pH of the water is very important for the chemical reactions such as solubility and metal toxicity. The pH value ranges from 6.6 to 7.0 which was found to be alkaline. The pH observed is within the WHO standards 6.5-8.5. Therefore, this water could be regarded as neutral and unpolluted (Fakayode, 2005). Various factors such as watershed, rainfall and amount of surface runoffs gives an indication of degree of dissolved solids.

The observed Total Dissolved Solid (TDS) value was 256-500mg/L and were comparable to WHO 500-2000. Result was supported and compared by the finding of Payne, 1986. Dissolved oxygen plays a vital role in supporting aquatic life and to evaluate the degree

**Table 2** Experimental values of water quality parameters

S. No	Parameters	Units	Experimental Values Range	WHO Standard
1	Colour	-	Colourless	No Relaxation
2	Smell	-	Odourless	No Relaxation
3	Temperature	°C	35.6	No Relaxation
4	pH value	-	7.2	6.5-8.5
5	Chlorides	mg/L	19.4	250-1000
6	Suspended solids	mg/L	120	20-150
7	Dissolved Solids	mg/L	500	500-2000
8	BOD	mg/L	4.4	2-6.5
9	COD	mg/L	14.1	200-1000
10	Total hardness	mg/L	41.3	20-70

of freshness of river. It also helps in determining the quality and organic pollution in the river (Wetzel and Likens, 2006). DO content varied from 3.9-4.4. It was found in the range of the WHO permissible limit which makes it suitable for drinking. The COD values were found to be 3.2-14.1 which was not found in the range of WHO permissible limit. The rise in temperature in the river water could be correlated with increase in carbon dioxide levels (Talling, 1957). Chloride is the one of indices of water pollution from sewage and drains. Chloride content of the rivers varied from 18.5-20.85 which was also not found in the range of WHO permissible limit and major cause of water pollution due to sewage contamination (Kleain, 1957). Total hardness is the parameter of water quality used to describe the effect of dissolved minerals mostly Ca and Mg and presence of bicarbonates, sulphates, chloride and nitrates of calcium and magnesium. It determines the solubility of water for domestic, industrial and drinking purposes. Its value in river water is 16.2-41.3, found to be in WHO limit.

The Physico-chemical characteristics of water quality analysed during the Kanwar mela 2013 revealed that due to activities like dumping and throwing of garbage's, municipal waste, washing clothes etc deteriorating the quality of water. Although the lowest amount of COD was below the permissible limit as indicated by WHO standard, it may be considered as temporary phase. The results indicated that most of the values studied were within the WHO limits for drinking water and, therefore, may be suitable for domestic purposes. Therefore there is a need to properly manage wastes in the city and control and monitor human activities.

### Conclusions

The water samples were collected in triplicate form from river Ganga, Haridwar during Kanwar mela 2013 and studied under various methods on number of parameters such as pH, Total Dissolved Solids (TDS), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Dissolved Oxygen (DO). The present investigations have led us to conclude that the quality of water samples subjected to study was acceptable from majority of physicochemical parameters. From the study it was clear that the water is suitable for drinking purpose with respect to the studied physico-chemical parameters

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