



## SEASONAL VARIATION IN PHYSICO-CHEMICAL CHARACTERISTICS OF SHARDA RIVER WATER WITHIN TANAKPUR CITY, UTTARAKHAND

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**ABSTRACT:** Importance of rivers, bringing health and wealth to people, has long been understood from the existence of mankind, till today as most of the townships or major industrial complexes are established on the banks of rivers and aquatic resources. Rapid developmental activities and consequent hydropower projects have led to several problems of water quality management because of ecological imbalance. This study is emphasis on physico-chemical characteristics of Sharda river within Tanakpur City. Selected physico-chemical parameters viz. temperature, pH, velocity, transparency, total dissolved solids, dissolved oxygen and bio-chemical oxygen demand monitored monthly from July, 2013 to June, 2014 from Sharda River. It was found that all the physico-chemical parameters showed seasonal variation. Dissolved oxygen and temperature showed negative correlation, transparency and dissolved oxygen showed positive correlation and dissolved oxygen and bio-chemical oxygen demand showed negative correlation.

**Key words:** Water, River, Physico chemical characters

### INTRODUCTION

Water quality of receiving water bodies such as rivers and lakes is critically important because it is one of the most essential resources for human existence and settlement. However, rapid growth of population and increase of urban activities significantly influences the water quality of receiving water bodies. This is mainly due to the deterioration of water quality due to the higher pollutant loads resulting from various point and non-point sources of pollution. Due to the developmental activities in and around aquatic resources certainly degrading the water quality of various riverine ecosystem in India, which ultimately may lead to bad water quality, formation of algal bloom, slow running water and provide breeding place for the mosquitoes which affect the whole ecosystem and health of the people, respectively. Toxic waste materials if consumed by animals can be very dangerous to life and worse still, if these wastes are dumped in water bodies [2, 4]. Rivers are the most important natural resource but it is being polluted by indiscriminate disposal of sewage, industrial waste and plethora of human activities, which affects its water quality. Increasing problem of deterioration of river water quality, it is necessary to analyze water quality. Different rivers on India such as Ganga, Yamuna, Sahastradhara and others are being polluted due to such man made activities. The Sharda river originates from the greater Himalayas at Kalapani at an altitude of 3600m. Tanakpur City is just above hydropower projects on Sharda Reservoir at 29°3"N, 80°7"E where water is diverted into an irrigation canal. The river exits the last hills into the Terai plains, passing towns Banbasa and Mahendranagar. It was being experienced developmental activities and other human activities are increasing in and around these important Himalayan rivers which are socio-economically very important for the concern area. This study is mainly focused on water quality of Sharda River at Tanakpur City to find out the present status of the river.

## MATERIALS & METHODS

**Study Area:** Tanakpur hydroelectric project is a run of the river scheme on the Sharda River (Mahakali River in Nepal) located near the City of Tanakpur in the district of Champawat. It has a Barrage across the Sharda River for diverting river flows into a 6.2 km long power channel of 566 m<sup>3</sup>/s capacity for utilisation of 24 m head available between the Barrage at Tanakpur and the existing Sharda canal i.e. 0.6 km down stream of Banbassa Barrage. Tanakpur City was selected as sampling locations for the collection of water samples and analyzed physico-chemical characteristics of Sharda River water from July, 2013 to June, 2014. Following selected physico-chemical parameters were analyzed with the help of Standard analytical methods of APHA [1] and Trivedi & Goel [7].

### Selected Physico-Chemical Parameters:

1. Temperature

2. pH

3. Velocity

4. Transparency

6. TDS

7. Dissolved Oxygen (DO)

8. Bio-Chemical Oxygen Demand (BOD)

## RESULTS AND DISCUSSION

The comparative annual mean values and range values of physico-chemical parameters of Sharda River described below and also summarized in Table-1.

**Temperature:** The value for individual observations for temperature of Sharda river ranged between 14.80-24.9<sup>o</sup>C for selected site in the month of January and month of June, respectively, the lowest and highest value recorded. The maximum mean value of temperature (24.70<sup>o</sup>C) was at selected site in the month of June and minimum mean value of temperature (15.00) was at selected site in the month of January.

**pH:** The value for individual observations for pH of Sharda river ranged between 6.8-8.4 for selected site in the month of January and month of July, respectively, the lowest and highest value recorded. The maximum mean value of pH (8.2) was at selected site in the month of January and minimum mean value of pH (7.0) was at selected site in the month of July.

**Velocity:** The value for individual observations for velocity of Sharda river ranged between 0.19-0.60 for selected site in the month of January and month of August, respectively, the lowest and highest value recorded. The maximum mean value of velocity (0.52m/s) was at selected site in the month of September and minimum mean value of velocity (0.20 m/s) was at selected site in the month of January.

**TDS:** The value for individual observations for total dissolved solids of Sharda river ranged between 100-280mg/l for selected site in the month of January and month of July, respectively, the lowest and highest value recorded. The maximum mean value of total dissolved solids (255mg/l) was at selected site in the month of July and minimum mean value of total dissolved solids (120mg/l) was at selected site in the month of January.

**DO:** The value for individual observations for dissolved oxygen of Sharda river ranged between 8.30-10.8mg/l for selected site in the month of June and month of January, respectively, the lowest and highest value recorded. The maximum mean value of dissolved oxygen (10.6mg/l) was at selected site in the month of January and minimum mean value of dissolved oxygen (8.50mg/l) was at selected site in the month of June.

**BOD:** The value for individual observations for bio-chemical oxygen demand of Sharda river ranged between 1.40-3.10mg/l for selected site in the month of January and month of June, respectively, the lowest and highest value recorded. The maximum mean value of bio-chemical oxygen demand (2.90mg/l) was at selected site in the month of June and minimum mean value of bio-chemical oxygen demand (1.50) was at selected site in the month of January.

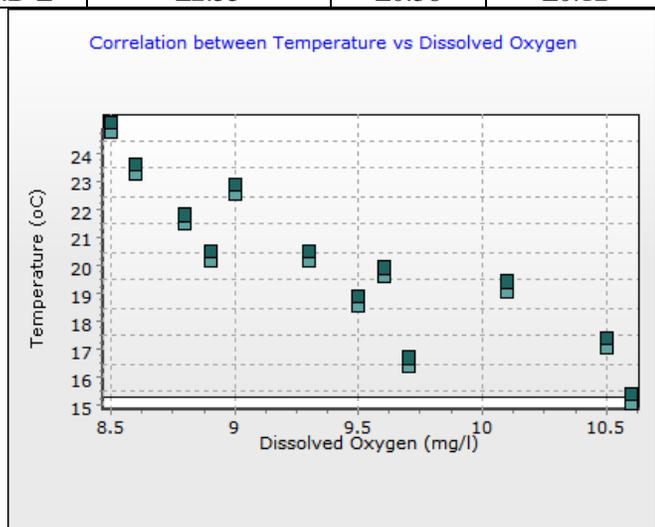
## DISCUSSION

The standard deviation of physico-chemical parameters like Temperature, pH, transparency, velocity, TDS, DO and BOD of Sharda River are presented in Table-1. The maximum mean value of water temperature was recorded as 27.70<sup>o</sup>C at study site during summer season in the month of June and minimum was recorded at study site during the month of January. Temperature showed negative correlation with the dissolved oxygen. Similarly, [3], who studied on physico-chemical characteristics of Sahasradhara Stream and find out that water temperature showed negative correlation with dissolved oxygen. Temperature (in general) must be viewed as the main factor affecting almost all physico-chemical equilibria and biological reactions. It is well known that all physico-chemical "constants" vary with temperature, and frequently increasing endothermic reactions [5].

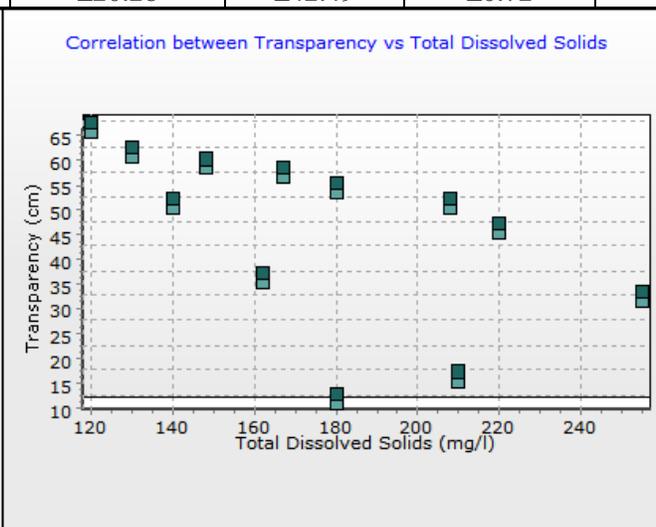
pH is measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. In the present study the maximum value of pH of Sharda River water were increased during the winter months and decreased during the summer season. In natural water, pH also changes due to variation in photosynthetic activities which increases the pH due to consumption of CO<sub>2</sub> in the process.

**Table-1: Showing Physico-chemical parameters in Sharda River at Tanakpur during July 2013 to June 2014**

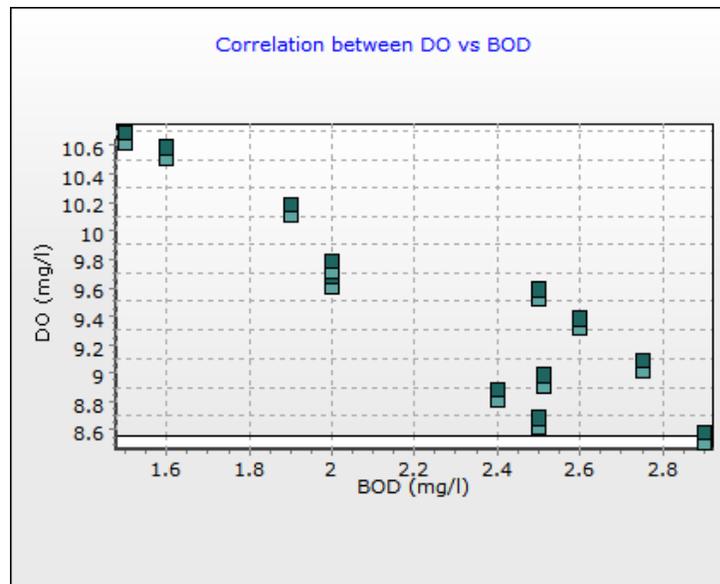
Months	Temp. (°C)	pH	Vel. (m/sec)	Trans. (cm)	TDS (mg/l)	DO (mg/l)	BOD (mg/l)
April	20.10 (19.50-20.90)	7.7 (7.5-7.9)	0.24 (0.22-0.27)	53.10 (50.0-55.90)	180 (170-188)	9.30 (9.10-9.50)	2.60 (2.40-2.80)
May	22.50 (22.00-23.00)	7.5 (7.3-7.6)	0.25 (0.20-0.29)	50.00 (48.0-52.00)	208 (190-220)	9.00 (8.80-9.20)	2.75 (2.45-2.90)
June	24.70 (24.50-24.90)	7.3 (7.1-7.6)	0.26 (0.25-0.27)	45.00 (42.0-48.20)	220 (210-235)	8.50 (8.30-8.70)	2.90 (2.70-3.10)
July	23.20 (22.80-23.50)	7.0 (6.8-7.3)	0.50 (0.45-0.57)	31.10 (28.0-34.60)	255 (240-280)	8.60 (8.40-8.80)	2.50 (2.40-2.70)
Aug	21.40 (20.50-21.90)	7.4 (7.2-7.6)	0.51 (0.42-0.60)	15.00 (13.0-16.90)	210 (200-225)	8.80 (8.60-9.00)	2.40 (2.30-2.60)
Sept	20.10 (19.70-20.50)	7.3 (7.2-7.7)	0.52 (0.40-0.58)	10.60 (10.0-10.90)	180 (175-195)	8.90 (8.80-9.20)	2.51 (2.45-2.70)
Oct	19.50 (19.30-20.00)	7.5 (7.3-7.7)	0.40 (0.38-0.53)	34.90 (32.0-36.10)	162 (150-180)	9.60 (9.40-9.80)	2.00 (1.90-2.20)
Nov	19.00 (18.70-19.60)	7.9 (7.7-8.2)	0.25 (0.22-0.28)	50.00 (47.5-54.20)	140 (130-158)	10.10 (9.90-10.20)	1.90 (1.80-2.00)
Dec	17.00 (16.70-17.20)	8.0 (7.8-8.2)	0.34 (0.30-0.37)	60.40 (58.0-62.50)	130 (120-140)	10.50 (10.30-10.7)	1.60 (1.40-1.70)
Jan	15.00 (14.80-15.40)	8.2 (8.0-8.4)	0.20 (0.19-0.25)	65.30 (62.9-67.10)	120 (100-135)	10.60 (10.4-10.80)	1.50 (1.40-1.70)
Feb	16.30 (16.00-16.50)	7.9 (7.7-8.1)	0.27 (0.25-0.30)	58.10 (56.6-60.00)	148 (130-160)	9.70 (9.50-9.90)	2.00 (1.80-2.20)
March	18.50 (18.20-18.70)	7.7 (7.4-7.8)	0.25 (0.20-0.28)	56.32 (54.0-57.10)	167 (155-180)	9.50 (9.30-9.80)	2.50 (2.40-2.60)
Average	18.88	7.65	0.36	42.41	168	9.58	2.10
S.D ±	±2.55	±0.38	±0.12	±20.28	±42.49	±0.72	±0.39



(A)



(B)



(C)

**Graphs A to C showing correlation between different parameters.**

The water transparency was recorded by Secchi disc and it was higher during winter months and decrease during the monsoon period and it may be due to high rain fall during this period and high amount of debris in the water. Transparency showed negative correlation with the total dissolved solids. Similarly, other researchers find out that transparency was higher during winter months and negatively correlated with total dissolved solids and total solids. Total dissolved solids in water comprise organic salts and small amount of organic matter, In the present study, the maximum value of Total dissolved solids was recorded during the month of September and minimum value was in the month of January and it may be due to high amount of debris in water during the monsoon season. The high amount of total dissolved solids adversely affect the quality of water and unsuitable for any purpose including irrigation. Dissolved solid substances also influence the taste, hardness and corrosive property of water. Dissolved Oxygen is one of the most important parameters in water quality assessment and reflects the physical and biological processes prevailing in the water. In the present study the maximum value of dissolved oxygen in the Sharda river water was recorded month of January and the minimum value was recorded month of June. High DO content is an indication of a healthy system. Dissolved oxygen showed negative correlation with the temperature. Temperature is fundamental to the health of water system as it affects the solubility of DO and in-stream biochemical processes. Warm water, often originating from urban areas, holds less DO than colder water and increases the rate of chemical reactions, which then dissolves more substances [6]. BOD is the oxidizable organic matter present in the solution and the BOD value can be used as a measure of waste strength. The BOD test is useful in evaluating the self-purification capacities of streams which serves as a measure to assess the quality of wastes which can be safely assimilated by the stream. During this study it was found that all the physico-chemical parameters influence with the seasonal variation and the water of Sharda river is not acceptable for drinking water during the months of monsoon.

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