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Short communication

Physico-Chemical Characteristics of Water in River Gaula

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ABSTRACT
Present study was conducted with the qualitative estimation on seasonal fluctuation in physico-chemical parameters on Gaula River at Haldwani, Nainital, Uttarakhand, India. Various physico-chemical parameters such as temperature, transparency, conductivity, TDS, pH, total alkalinity, chloride, free CO_2 and DO were analyzed for various seasonal changes from the period of January 2019 to December 2019. Some parameters were tested on the spot whereas some parameters were tested in the laboratory according to standard method. The present study indicates that assessments of physico-chemical parameters of river are necessary for its various beneficial purposes.

Key words: Gaula River, Physico-chemical parameter, assessment, seasonal change, Pollution

INTRODUCTION

The Gaula River is a Himalayan river which flows in India. It originates from southern slopes of Gajar range near Motia pather (Mohan 2004). The source of this river is Pharpani and the end point is Kichha. The length of this river is about 103 km. It flows through Kathgodam, Haldwani and shahi. Then it merges with Ramganga river, a tributary of Ganga, which is about 15 km northwest of Bareilly in Uttar Pradesh.

Water is essential to all forms of life. It is indispensable for agriculture, manufacturing, transportation and many other human activities. Despite its importance water is the most poorly managed resource in the world (Fakayode 2005), and contaminated by several sources due to various anthropogenic activities and some natural processes. The quality of water is decreasing continuously and is posing a great threat to all forms of life including humans (Khan et al. 2012).

Pollution of a river first affects its chemical quality and then systematically destroyed the community disrupting the delicate food web. The discharge urban, industrial and agriculture waste has added the quantum of various harmful chemicals to the water body considerably altering their inherent physico-chemical characteristics (Kim et al. 2001). River pollution has several dimensions and effective monitoring and control of river pollution requires the expertise from various disciplines (Trivedy 1990, Singh and Gupta 2004).

Pollution of river is a global problem. The availability of good water quality is an indispensable feature for preventing disease and improving the quality of life (Mezgebe 2015). The physicochemical properties will also help in the identification of sources of pollution for initiating necessary steps for remedial action. In case of polluted water bodies therefore the nature of any aquatic community are an expansion of quality of water (Ekwenye and Oji 2008, Singh and Singh 2008).

Due to use of contaminated water, human population suffers from water borne diseases. It is therefore to check the water quality at regular interval of time (Zindal 2005), the present study is an attempt to make an assessment of the change in the water quality of water of river Gaula.

MATERIAL AND METHODS

Sampling of water was done at monthly interval in the fore noon between 11:00 a.m. to 2:00 p.m. throughout the study period. For physico-chemical analysis of water the water samples from the surface (15cm deep) of the water bodies were collected in

the plastics bottles the bottle were closed immediately under the water to avoid exchange of gases between water sample and atmosphere. Two replicate samples were analyzed from each station. The samples of DO were processed immediately after collection and CO_2 were analyzed at the site. Temperature were analyzed by thermometer, for other analysis water sample brought to the laboratory under dark cover and analyzed with shortest time, Welch (1948) and APHA (2005).

RESULTS AND DISCUSSION

Variations in some physical and chemical parameters of Gaula River were recorded and are summarized in Tables 1 and 2.

In the present study the fluctuation in water temperature ranged between maximum 26.1°C in the month of June and minimum 13.4°C in the month of December. The annual pattern of the heat distribution in any water body depends upon the seasonal variation in air temperature. The low air temperature during winters results into considerable heat loss from the surface layer of the water bodies which was evidenced by lower temperature in the surface water, with increases in solar radiation from spring onwards there is a considerable heat accumulation in water this accumulation of heat results in higher water temperature during summers. The amount of total dissolved solids increases in monsoon from 71.66 mg/l to 77.33 mg/l in the month of July and August respectively due to more run off, soil erosion etc. The highest value of TDS 77.33 mg/l was recorded in the month of August and the lowest value 48mg/l was recorded in the month of December. Reverse phenomena of TDS happened in the case of water transparency, i.e. water transparency was maximum 319 cm in the month of February and minimum 25 cm in the month of August.

The pH value was recorded maximum 8.6 in the month of January and minimum 7.5 in the month of August. Main sources of oxygen in water bodies are: i) Atmospheric diffusion, and ii) Photosynthetic activities of autotrophs.

The utilization of oxygen includes respiratory activity of organisms and decomposition process. These factors greatly influence the availability of oxygen in water bodies. In present study, the maximum value of DO 10.5 mg/l was recorded in the month of January and minimum 8 mg/l in the month of July.

The main source of carbon dioxide in any water bodies includes atmospheric distribution, respiratory activity of organisms and production of it from the decomposing material it varies rapidly in all water bodies. In this study the maximum value of CO_2 4.6 mg/l was recorded in the month of September and minimum 2.4 mg/l was recorded in the month of January.

The alkalinity of water is its capacity to neutralize acids. In this study the highest concentration of alkalinity 73 mg/l was recorded in the month of December and lowest concentration 56.33mg/l was recorded in the month of August.

In this study the highest level of conductivity 166.1 s/cm, was recorded in the month of August and the lowest value 100 s/cm was recorded in the month of December.

The permissible limit of USPHS for phosphate is 100µg/l. All the collected samples have Phosphate concentration ranging from 0 to 80.8µg/l which is under the limit of USPHS as 100µg/l. The importance of phosphorous in the productivity of aquatic ecosystem is well known. High amount of this chemical in the water body increases the phytoplankton productivity while its deficiency limits the productivity of the system (Welch 1948). The value of Phosphate-Phosphorus was recorded maximum during 80.8 µg/l in the month of January and minimum 20.4 µg/l in the month of April.

Being the raw material of protein nitrogen is important for the organism of any ecosystem. It is supposed to be one of the important limiting factors for the growth of organism. In this study the highest concentration of Nitrate 0.95 mg/l, was recorded in the month of January and the lowest value 0.12 mg/l was recorded in the month of May.

The maximum value 37.2 mg/l of Calcium was recorded in the month of September and minimum 24.3 was recorded in the month of July. Like Calcium Potassium also varied from month to month in the river however no seasonal pattern was noticed. The concentration of Potassium was recorded maximum 16.5 mg/l in the month of May and December and minimum 11.0 mg/l was recorded in the month of January.

Table 1. Physico-chemical parameters in Gaula River during January to December 2019. T = Temperature; CON = Conductivity; TDS = Total dissolved salts; ALK = Alkalinity and TRN = Transparency

Months	T °C	pH	CON	CO_2 mg/l	DO mg/l	No_3-N mg/l	Po_4-P µg/l	K mg/l	Ca mg/l	TDS	ALK	TRN
January	14.0	8.6	113.91	2.4	10.5	0.95	80.8	11.0	29.0	54.33	71.66	242.33
February	15.4	8.3	118.50	2.7	10.1	0.45	40.0	12.5	27.5	56.00	71.00	319.66
March	17.2	8.1	122.90	2.9	9.9	0.29	25.0	13.0	28.4	58.33	67-66	202.66
April	20.4	8.0	126.10	3.5	8.5	0.15	20.4	13.5	30.3	58.33	64.66	181.33
May	24.8	7.8	127.30	3.9	8.1	0.12	25.4	15.2	30.8	62.33	63.33	175.00
June	26.1	7.7	134.70	4.0	8.3	0.25	55.0	16.5	30.0	64.33	60.66	161.00
July	22.5	7.6	154.10	4.3	8.0	0.28	59.4	14.5	24.3	71.66	57.66	30.66
August	22.0	7.5	166.10	4.5	8.4	0.25	40.0	14.5	32.4	77.33	56.33	25.00
September	19.0	7.9	135.90	4.6	8.5	0.29	49.0	14.9	37.2	66.00	61.33	51.66
October	16.2	8.1	124.30	4.3	9.2	0.27	55.5	14.8	32.4	60.00	63.00	85.00
November	14.1	8.3	105.20	3.9	10.0	0.35	65.0	12.5	33.0	50.00	68.66	111.33
December	13.4	8.5	100.00	3.4	10.1	0.46	72.0	16.5	35.0	48.00	73.00	141.66

Table 2. Correlation between different physico-chemical parameters in Gaula River. T = Temperature; CON = Conductivity; TDS = Total dissolved salts; ALK = Alkalinity and TRN = Transparency

Months	T °C	pH	CON	CO_2 mg/l	DO mg/l	No_3-N mg/l	Po_4-P µg/l	K mg/l	Ca mg/l	TDS	ALK	TRN
pH	**-0.8842**	**1**										
CON	**0.7053**	**-0.899**	**1**									
CO_2 (mg/l)	0.5166	**-0.734**	**0.594**	**1**								
DO (mg/l)	**-0.9063**	**0.918**	**-0.760**	**-0.756**	**1**							
NO_3-N	**-0.6283**	**0.715**	-0.408	**-0.652**	**0.731**	**1**						
PO_4-P (µg/l)	-0.4667	0.461	-0.310	-0.072	0.433	**0.706**	**1**					
K (mg/l)	0.5102	-0.476	0.232	**0.619**	**-0.569**	**-0.565**	-0.049	**1**				
Ca (mg/l)	-0.2265	0.149	-0.234	0.387	0.048	-0.102	0.136	0.359	**1**			
TDS	**0.7304**	**-0.910**	**0.993**	**0.630**	**-0.784**	-0.423	-0.309	0.279	-0.179	**1**		
ALK	**-0.7914**	**0.957**	**-0.919**	**-0.816**	**0.895**	**0.609**	0.298	-0.423	0.068	**-0.932**	**1**	
TRN	-0.3022	**0.596**	**-0.574**	**-0.894**	**0.573**	0.411	-0.139	-0.467	-0.341	**-0.587**	**0.727**	**1**

Ø **Figures in bold are significant correlations between parameters.**

Ø Degree of freedom =N-1, i.e. 12-1=11

Ø Critical Value (Pearson values) for Significant correlation at 0.1=0.476 (90% Confidence level)
at 0.05=0.553 (95% Confidence Level)
at 0.01=0.684 (99 % Confidence level)

The statistical correlations between different hydrological Parameters are shown in table 2. Temperature is positively correlated with TDS (r=0.7304) and Conductivity (r=0.7053). Temperature is negatively correlated with DO (r=-0.9063), pH (r=-0.8842) and Alkalinity (r=-0.7914). pH is negatively correlated with TDS (r=-0.910) and positively correlated with DO (r=0.918) and Alkalinity (r=0.957). Conductivity and TDS (r=0.993) shows positive correlation whereas conductivity shows negative correlation with Alkalinity (r=-0.919). Alkalinity is positively correlated with transparency (r=0.727) and DO is also positively correlated with Alkalinity (r=0.895).

CONCLUSION

The present study concluded that the most of the physicochemical parameters of river Gaula is within permissible limits WHO (2011) for domestic

purpose, drinking and aquatic life. Most of the parameters show significant positive correlation with values p>0.01.

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