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RESEARCH ARTICLE

ASSESSMENT OF PHYSICO-CHEMICAL PARAMETER OF SOLANI RIVER AT ROORKEE, UTTARAKHAND, INDIA

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ABSTRACT

The current experimental study was carried out to determine the physico-chemical parameters of Solani River at Roorkee district Haridwar, Uttarakhand. For this purpose three sampling sites were selected to analyze various parameters like temperature, pH, total solids, total dissolved solids, total suspended solids, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, total hardness, free carbon dioxide and chloride. Among these parameters TDS and BOD was observed beyond the desirable limits of BIS at all the sampling sites. Maximum value of TDS (847.23 mg/l) was found during March month at the sampling site SS1 and maximum value of BOD 4.7 mg/l was found during April month at the sampling site SS1. The present study concluded that the TDS and BOD in water sample were above the desirable limit and rest all other parameters were within the desirable limits.

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INTRODUCTION

Water is an essential and important component for our life-support system. Surface water may be defined as the water found on the surface of the earth. Lakes, rivers, streams and wetlands are all examples of surface water. Protecting the quality and quantity of our surface water now and for the future use is a goal of drinking water source protection. The quality and quantity of our drinking water affects us all; our health and our way of living all rely on having clean water resources. By protecting our drinking water at its source, we can help to preserve a healthy water supply for our present and future use for drinking as well as for irrigation uses.

Pollution is caused due to solids liquids or gases which are non- permissible, undesirable or objectionable. According to Bhargava, (1978) pollution is the entry of foreign matter to make it unfit for a specific use Water is said to be polluted when it changes its quality or composition directly or indirectly as a result of waste disposal and other human activities so that it becomes less suitable or harmful for drinking, domestic, agriculture recreational, fisheries or other purposes.

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Rivers are part of the hydrological cycle and water generally collects in a river from precipitation through a drainage basin from surface runoff and other sources such as groundwater recharge, springs, and the release of stored water in natural ice and snow packs. Roorkee is a small town located in the foothills of Himalayas in the beautiful state of Uttarakhand in north India. In the present study attempt have been made to analyze physico-chemical parameters of urban waste with special reference to Solani River at Roorkee.

MATERIALS AND METHODS

Study area

The present study was conducted in Solani River at Roorkee, Uttarakhand, India. It is a part of the district Haridwar which is merely 30 km away, located between the rivers Ganga and Yamuna on the banks of the upper Ganga canal the experimental site is located at latitude 29°52′N 77°53′E / 29.87°N longitude 77.88°E and at the altitude of 268 metres (879 feet). The mean annual temperature in summer ranges from 26°C to 35◦C and in winter it varies from 10◦C to 20◦C. It also experiences heavy rains primarily during the periods of monsoon with an average rainfall of 1,200 to 2600 mm Rainfall begins earlier in the month of June and continues up to the end of September.

Fig. 1. Study area and sampling sites at Solani River at Roorkee, Uttarakhand, India

Table 1. Global Positioning System (GPS) coordinate of each sampling site

Sampling site	Location	Latitude	Longitude	Elevation
SS 1	Saliar village Roorkee	29°55′35.36”N	77°51’45”E	856 ft
SS 2	Mahigran Roorkee	29°53′08.57”N	77°53’24.83”E	843 ft
SS 3	Solani puram, Adarsh nagar	29°52′35.98”N	77°54’14.93”E	834 ft

Collection of samples and there analysis

Total 09 Water samples were collected from three sampling sites i.e. SS1, SS2, SS3 (Table 1) in plastic containers brought to laboratory and analyzed for various physico-chemical parameters viz. temperature, pH, total solids, total dissolved solids, total suspended solids, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, total hardness, free carbon dioxide and chloride following standard method of APHA (1995).

RESULTS AND DISCUSSION

The average value of various parameters studied is shown in table-2. The temperature is one of the most important parameter in aquatic environment. The maximum temperature recorded during the study period is 22.65 at site ss2 and the minimum temperature recorded is 18.55 at site ss. Similar values have been observed by (Garg, 2006). Similar trend has been observed in the river by Chaturvedi *et al.* (2003). The pH is a measure of hydrogen ion activity, and the measure of intensity of acidity or alkalinity of the sample. The pH of different sampling sites was found in range of 7.8 to 8.8 which were slightly beyond the desirable limit of BIS i.e. 6.5. Highest value of pH 8.8 was found of sampling site SS2, while the minimum pH value 7.8 was found at sampling site SS1. Similar values have been observed by (Fakayode 2005 and Tare 1997). Total solids were residues, that left after evaporation and drying of the unfiltered sample. The Total solids of different sampling sites were in range of 834.24 to 987.45 mg/l. highest value (987.45mg/l) of total solids was found of sampling site SS1, while the minimum total solids value (834.24 mg/l) was noted at sampling site SS2. Sayed and Gupta (2010) reported that the total solids were found maximum in summer. Total dissolve solids (TDS) refers to substance suspended or dissolved in water or waste water TDS with high content is inferior and may be polluted the water content (Choudhary 2014). In the present study it was found that the (TDS) of Solani River at Roorkee is in high range. Maximum value of TDS (847.23 mg/l) was found at the sampling site SS1 and minimum value of TDS (612.76 mg/l) was found at the sampling site SS2. TDS were observed beyond the desirable limits of BIS at all the sampling sites. Similarly value have been recorded in different watershed area by Kamboj *et al.* (2013) and Jain (2002). The maximum total suspended solids in site SS2 were recorded (261.92mg/l) and he minimum total suspended solids in site SS1 were recorded (98.12 mg/l Similar values have been observed by (Kumar *et al*., 2010).

Table 2. Value of different physico-chemical parameters of water samples collected from Solani River at Roorkee, Uttarakhand

S.No.	Parameters	February 2015			March 2015			April 2015		
		SS1	SS2	SS3	SS1	SS2	SS3	SS1	SS2	SS3
1.	Temperature (°C)	18.55	22.65	20.45	19.30	21.25	22.20	19.64	21.45	22.15
2.	pH	7.9	8.2	8.6	8.2	8.8	8.4	7.8	8.2	8.0
3.	TS (mg/L)	967.00	834.24	889.65	987.45	984.24	976.65	887.55	954.76	932.44
4.	TDS (mg/L)	775.54	612.76	687.46	847.23	722.32	789.54	789.43	765.34	789.67
5.	TSS (mg/L)	191.46	221.48	202.19	140.22	261.92	187.11	98.12	189.42	142.77
6.	DO(mg/L)	7.9	4.7	6.5	8.5	4.9	7.4	7.3	4.1	6.9
7.	BOD (mg/L)	3.4	2.9	4.1	3.9	2.2	4.2	4.7	2.4	3.9
8.	COD (mg/L)	734.76	987.54	879.76	698.45	932.32	889.65	765.86	876.87	923.75
9.	Chloride (mg/L)	56.34	78.52	69.44	49.95	66.45	71.33	55.74	74.52	69.69
10.	Free CO_2 (mg/L)	35.54	46.64	53.43	41.23	51.33	59.55	39.43	46.81	52.32

Table 3. Mean and standard deviation of Physico-chemical parameters of water samples collected from Solani River at Roorkee, Uttarakhand

S.No.	Parameters	February	March	April	BIS Standard	
					Desirable limit	Permissible limit
1.	Temperature(°C)	20.55±2.05	20.92±1.48	21.08±1.30		
2.	pH	8.23±0.35	8.47±0.31	8±0.2	6.5 to 8.5	No relaxation
3.	TS(mg/L)	896.96±66.69	982.78±5.55	924.92±34.23	-	-
4.	TDS(mg/L)	691.92±81.48	786.36±62.52	781.48±13.98	500	2000
5.	TSS(mg/L)	205.04±15.21	196.42±61.38	143.44±45.65	-	-
6.	DO(mg/L)	6.37±1.60	6.93±1.08	6.1±1.74	5.0	More
7.	BOD(mg/L)	3.47±0060	3.43±1.08	3.67±1.17	3.0	-
8.	COD(mg/L)	867.35±126.85	840.14±124.55	855.49±81.09	-	-
9.	Chloride (mg/L)	68.1±11.15	62.58±11.20	66.65±9.75	250	1000
10.	Free CO_2(mg/L)	45.20±9.03	50.70±9.18	46.19±6.47	-	-

During the study period the dissolved oxygen was recorded maximum during March 8.5mg/l and minimum 4.1 mg/l at sampling site ss2. Similar values were also reported by Panday *et al*. (2003). Maximum biochemical oxygen demand was recorded during April 4.7 mg/l at site ss1 and the minimum Biochemical Oxygen Demand 2.2 mg/l in site SS2 was during March (4.2mg/l). Abida and Harikrishana (2008) recorded similar values of Biochemical Oxygen Demand. COD is widely used to characterize the organic strength of waste waters and pollution of natural waters. Maximum Chemical Oxygen Demand was recorded during April 987.54 mg/l and the minimum chemical oxygen demand was recorded 698.45 mg/l at site ss1 during march month. Similar observations of COD have been shown by Kamboj (2012), Semwal and Akolkar (2006) in Uttarakhand rivers.

High concentration of Chloride ions results in objectionable taste in water as per study it was found that the Chloride level in water samples were in range between 49.95 to 78.52 mg/l minimum and maximum respectively as permissible limit is 250 mg/l all the samples were within permissible limit. Highest value (78.52 mg/l) of Chloride was found at the SS2 during februry month while the minimum value (49.95mg/l) was found at the SS1 in the March month . Rajkumar *et al.,* (2010) studied and find the similr chloride concentrations. Carbon dioxide is a normal component of all natural water. Free CO_2 can be determined by titrating the sample using a strong alkali (such as carbonate free NaOH). Maximum Free CO_2 was recorded during March 59.55 mg/l at the sampling site ss3 while the minimum Free CO_2 was recorded 35.54 mg/l at sampling site ss1 during February similar observation was also revealed by Bhatnagar and Sangwan (2009).

Conclusion

It was concluded that the Solani River at Roorkee was found prone to river water contamination through urban wastes discharged. The concentration of various physico-chemical parameters viz. temperature, pH, total solids, total dissolved solids, total suspended solids, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, total hardness, chloride and free carbon dioxide were recorded and among these parameters TDS and BOD were recorded in higher concentration. Though the concentration of several other parameters in river water are within the permissible limits. Yet it is significant and is through provoking as river water should have been free from any kind of contamination thus there is a need of scientific management of the urban effluent and wastes discharge in Solani River at Roorkee. To prevent river water contamination and the regular monitoring of the river water in and adjoining area of urban waste discharge effluent treatment plant is also required .

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