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Research Article

PHYSICO-CHEMICAL ANALYSIS OF RIVER TAWI, RAJOURI (SUKHTAO), A RIVER OF NORTH WESTERN HIMALAYAN REGION (J&K)

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ABSTRACT

The present study was conducted for the summer season (May – June 2010) with an aim to find out the physico –chemical nature of water at different sites of River Tawi (Sukhtao) in order to access the physical nature and chemical properties of its water and the impact of sites on their concentration. Seven sites were selected for the study purpose and the samples were collected on monthly bases. The samples thus collected were processed for the detection of chemicals with their relative concentrations following the standard methods. It was observed that their concentration was varying with respect to the collection sites, so was the case with respect to its physical nature. Also it was observed that there was a difference in their concentration at different sites when compared among themselves. The data of physico- chemical nature of water of river Tawi obtained during study have been mentioned in Table 1 and it was observed that concentration of the chemicals was within the permissible limits except a few as recommended by WHO and if it exceeds the limit, which would have a definite impact on life. Keeping the same in view, the present study was taken into consideration in which an attempt was made to access the water quality of river Tawi and it is believed that this study would be helpful in formulating control strategy in near future.

Keywords: Physico-chemical, Concentration, River Tawi (Sukhtao), Rajouri.

INTRODUCTION

Water is one of the most important components of life and life without it is impossible. However due to increasing anti-environmental human activities and some natural processes the quality of water is decreasing continuously and is posing a great threat to all forms of life including humans¹. Polluted water is the major cause for spread of many epidemics and some serious diseases like cholera, tuberculosis, typhoid, diarrhea etc. Although several attempts have been made by a number of researchers²⁻⁴ to study various aspects of water quality and the factors responsible for its degradation in order to formulate a significant control strategy all over the globe yet the problem is on rise. The need of the hour is to make immediate steps to treat the water and minimize its negative steps⁵. River Tawi (Sukhtao) originates from Pir Panjal range in district Rajouri from Darhal and Thanna belts and combine at Bela. The increasing rate of construction, development of small scale industrial units, increasing rate of transportation, human population, immense use of fertilizers and pesticides and use of some other harmful substances have bring a drastic change in the quality of river water which pose a threat to life.

Adjoining areas of river has rice fields. People use different types of pesticides for controlling the pests. When there is a heavy rain, these pesticides like DDT, BHC etc. flow through rain water and pollute the river water. The effect of DDT is more on aquatic life particularly on fishes.

The biotic structure and water quality of the river reflect an integration of the physical, chemical and anthropogenic processes occurring in the catchment area, leading to the concept of ecological integrity. Human induced hydrological changes, physical disturbances⁶ (habitat alteration, urban land use) and point and non-point sources of pollution⁷⁻⁸ (chemical contamination, surface runoff, intensive agriculture) are examples of processes responsible for a broad-scale deterioration of lotic ecosystems^{9,10}. Keeping the same in view the present study was taken to aware people that how they are contaminating the source of life and possible use of chemicals and other substances in day to day life.

MATERIALS AND METHODS

Study area: This study was carried out in summer season in the month of May to June 2010 to cover the riverine system of River Tawi, in the Rajouri district; J and K. River Tawi drains

through the vicinity of Rajouri city that lies between latitude 32°58' and 33°35' N and 70°00' and 74°40' E longitude. This river is also very liable to floods which occur at the time of periodical rains of summer and in the season of more irregular winter rains. This river water is used for domestic, irrigation, recreation, sewage disposal, fishing etc.

Physico-chemical determinations:

The variations of the physico-chemical factors of water were studied from May to June 2010 in summer season by collecting samples from various places. Utmost care was taken to avoid spilling of water and bubbling of air during sampling in iodine treated polyethylene bottles. Some of the characteristics were determined/studied at the sampling sites, while others were analysed in the laboratory within 4 to 8 h. The water temperature was recorded by a mercury bulb thermometer, transparency by sacchi disc, dissolved oxygen, free CO₂, pH, carbonates, bicarbonates, calcium, magnesium etc. were analysed according to (APHA 1985; Golterman and Clyno, 1969).^{11,12}

1. **pH:** pH was determined by using a portable pH meter. (Hanna, model HI 98130).
2. **Electrical conductivity:** EC was measured by direct reading of conductivity meter at room temperature.
3. **Temperature:** Temperature was recorded by a mercury bulb thermometer in degree Celsius. (°C).
4. **Calcium and Magnesium (Hardness):** The estimation of Ca⁺⁺ and Mg⁺⁺ was done using phenolphthalein indicator.
5. **Bicarbonates:** Bicarbonates was estimated as per Indian Standard Method (1973) and A.P.H.A (1985).
6. **Chloride:** Chloride was estimated by Argentometric titration in the form of AgCl.
7. **Nitrate:** Inorganic form of nitrogen found mainly as nitrate was estimated by titrimetric method recommended by A.P.H.A. (1985).
8. **Fluoride and Iron:** Fluoride and Iron were estimated according to A.P.H.A. (1985).
9. **Sodium and Potassium :** The estimation of Na⁺ and K⁺ was done by the method suggested by I.S.I (1973) and A.P.H.A. (1985).
10. **Dissolved Oxygen (DO):** Dissolved Oxygen of the water was determined by Iodometric azide modification.
11. **BOD:** Biological Oxygen demand of the water was determined by using DO test kit (A.P.H.A., 1985).
12. **COD:** Chemical Oxygen Demand of the water sample was determined through oxidation of material in presence of chromate followed by titrimetric method with standard Mohr^{'S} salt solution using Ferrion indicator.

RESULTS

The results obtained during the present study shows that the physico-chemical nature of water of river Tawi was good to some extent and the concentration of some of the constituents was within permissible limits except a few as recommended by WHO. At all the study sites the temperature varies within a range of 20-32.4 °C with minimum recorded at site S-1 and maximum at site S-7. There was a moderate increase in temperature while moving downstream of the river. The pH was found within the range of 7.2-7.8 with the lowest recorded

at site S-1 followed by S-2, S-3, S-4, S-5, S-6 and then S-7 respectively, the pH was increasing while moving downstream from site S-1 to site S-7. Likewise the concentration of dissolved oxygen show a decrease from site S-1 to S-3 and then again increases to some extent upto site S-6 and then show a decrease in concentration at site S-7, the dissolved oxygen concentration was in between 13.1-6.71mg/l with maximum value at site S-1 and minimum at site S-7. However the situation was reverse in case of free carbon dioxide, the concentration was observed in between 21-28 mg/l and was highest at site S-3 and lowest at site S-1. There was a positive correlation in between pH and dissolved oxygen while a negative correlation between pH and dissolved oxygen with free carbon dioxide. Likewise the conductivity was found within the range of 299-455. The conductivity was found less than the permissible limits. Chloride in water is generally due to the salts of sodium, potassium and calcium. In the present study the chloride content was in the range group of 11.00-13.00 mg/l. The comparison of chloride content of present values with that of WHO reveals that it is much lower than the permissible limits. The concentration of other constituents with a range like nitrites (0.92-1.44 mg/l), bicarbonates (42.00-86.75 mg/l), calcium (0.12-0.29 mg/l), magnesium (9.70-43.00 mg/l), BOD (0.42-2.16 mg/l) and COD (4.12-19.30 mg/l) were within the permissible limits whereas the concentration of nitrates (0.5-45.70mg/l), fluoride (0.11-2.05mg/l) and iron (0.16-0.42mg/l) were more than the permissible limits as revealed by WHO.

DISCUSSION

The results obtained during the study show that the geographical location and season have a direct impact on the various physico-chemical properties of river Tawi. Air temperature at different sites followed the general climatic regime of the area with minimum at site S-1 followed by S-2 to S-6 and maximum at site S-7. The reason for comparatively low temperature at site S-1 could be due to the presence of more plants at this site which shades the site at their and makes it less visible to direct sunlight. The alkaline nature of water could be attributed to the buffering properties of some inorganic substances.¹³ The increase conductivity towards downstream could be due to the increased urban and agricultural land use drainage into the river¹⁴. The various ions added to the water regulate the conductivity of the water¹⁵. The higher concentration of DO at site S-1 could be due to the fact that cold water contains more oxygen as compared to warm water as the DO is inversely proportional to water temperature¹⁶. The gradual increase in chloride content down the river could be due to the increase in urban land use and due to the addition of some industrial/factory discharge¹⁷⁻¹⁹. The reason for higher concentration of nitrates than the permissible limits could be due to the excessive use of fertilizers, pesticides and addition of human excretory products. The reason for increasing trend of calcium down the river could be increased concentration of waste material especially the calcium rich substances like bones and milk products of slaughtered and killed animals^{20,21}.

Table 1: Physico-chemical properties of River Tawi (Sukhtao):

Sl.No.	Parameter	Unit	Sampling sites						
			S-1	S-2	S-3	S-4	S-5	S-6	S-7
PHYSICAL:									
1.	Electrical Conductivity	$\mu\text{S/cm}$	299	310	450	435	390	420	455
2.	Temperature	$^{\circ}\text{C}$	20.00	22.50	24.6	26.4	28.2	30.6	32.4
3.	pH		7.2	7.3	7.6	7.4	7.5	7.5	7.8
CHEMICAL:									
1.	Calcium	mg/l.	0.12	0.13	0.32	0.34	0.28	0.25	0.29
2.	Magnesium	mg/l.	9.70	10.11	23.6	24.2	31.4	36.8	43.0
3.	Bicarbonate	mg/l.	42.00	46.5	54.2	56.0	66.7	75.2	86.75
4.	Chloride	mg/l.	11.00	12.10	13.9	14.2	13.7	12.6	13.0
5.	Nitrates	mg/l.	0.5	10.12	18.9	21.7	23.4	36.4	45.70
6.	Fluoride	mg/l.	0.11	0.72	0.94	0.92	1.20	1.87	2.05
7.	Iron	mg/l.	0.16	0.21	0.24	0.25	0.31	0.39	0.42
8.	Sodium	mg/l.	0.90	10.20	35.6	36.0	48.9	72.6	88.47
9.	Nitrites	mg/l.	0.92	1.02	1.35	1.37	1.41	1.44	1.44
10.	Free CO ₂	mg/l.	21	23	24.5	25.9.5	26.7	27.2	28
11.	DO	mg/l.	6.71	7.21	9.28	1.6	11.6	12.9	13.1
12.	BOD	mg/l.	0.42	0.99	1.58	11.50	1.90	2.11	2.16
13.	COD	mg/l.	4.12	7.15	10.90		14.50	17.6	19.30

S-1 = Darhal, S-2 = Ujhan, S-3 = Rajouri city, S-4 = Muradpur, S-5 = Chingus, S-6 = Narian and S-7=Nowshera bridge

CONCLUSION

The present study concludes that water quality of river Tawi was in general good both for irrigation and domestic purpose. From the sample collected, the EC is generally below 1000 $\mu\text{S/cm}$ at 25 $^{\circ}\text{C}$. Other chemical parameters were also within the permissible limits except Iron, Fluoride and at one place Nitrate.

From this, it is clear that water quality of River Tawi is good to some extent qualitatively due to the permissible limits except few parameters and this could pose a threat to all kinds of life directly or indirectly. Therefore steps must be taken to protect this divine gift of nature and the present study is a step towards the same.

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