International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; SP6: 487-490

Nikita Kumari
Research Scholar, Forest Plantation Research and Evaluation Department Ranchi, Jharkhand, India

Rashmi Khushboo Minz
Research Scholar, Forest Plantation Research and Evaluation Department Ranchi, Jharkhand, India

Rachna Sunanda Kachhap
Research Scholar, Forest Plantation Research and Evaluation Department Ranchi, Jharkhand, India

Zeba Perween
Research Scholar, Forest Plantation Research and Evaluation Department Ranchi, Jharkhand, India

Pradeep Kumar Thakur
Research Scholar, Forest Plantation Research and Evaluation Department Ranchi, Jharkhand, India

Kamlesh Pandey
Conservator of Forest Plantation, Research and Evaluation Department, Ranchi, Jharkhand, India

Corresponding Author:
Nikita Kumari
Research Scholar, Forest Plantation Research and Evaluation Department Ranchi, Jharkhand, India

(Special Issue -6)
3rd National Conference
On
PROMOTING & REINVIGORATING AGRI-HORTI, TECHNOLOGICAL INNOVATIONS [PRAGATI-2019]
(14-15 December, 2019)

Assessment of water quality of doomar river in dry peninsular sal forest of barkagaon, Hazaribagh

Nikita Kumari, Rashmi Khushboo Minz, Rachna Sunanda Kachhap, Zeba Perween, Pradeep Kumar Thakur and Kamlesh Pandey

Abstract
The present paper was intended to assess the water quality of river Doomar in Barkagaon range of Dry Peninsular Sal Forest, Hazaribagh. In order to determine the quality of its water for public use, drinking and other purposes, fourteen parameters like temperature, pH, total dissolved solids, dissolved oxygen, biological oxygen demand, total alkalinity, total hardness, calcium, magnesium, chloride, nitrate, sulphate and iron were determined. Watershed of the river was studied in depth to understand the drainage pattern and flow accumulation of the area. Water samples were collected from eight different sampling stations of the river Doomar near its origin to the point of confluence of the river Sakri near Kandtari village. Hydrochemistry of the water samples in the study area has indicated that the current status of local stream is satisfactory for drinking purposes with a few incidences of high Iron, mostly due to the rock composition and geothermal activity of the area.

Keywords: Watershed, Water Quality, Hydrochemistry, Geothermal activity, Drainage

Introduction
A large part of the world's drinking water comes from forested areas, and millions of people depend on high-quality freshwater flowing from forests. Water is one of the most essential elements for all existing organism on this planet earth. The quantity and quality of water both surface or ground water have been deteriorated as a result of some significant points such as growing population, industrialization and social process (Imneisi and Aydin 2016) [3]. Forest ecosystem forms are a prime natural resource and valuable national resource and water. Forests help maintain high water quality, influence the volume of available water, and regulate surface and groundwater flows. Forests also help reduce water-related risks such as landslides, floods and droughts and prevent desertification and salinization.
Chotanagpur like any other terrain has been an area of special interest for the forestry and water conservation (Sharma *et al.,* 2019) [6]. Since the state receives 1100 mm to 1442 mm of rainfall out of which 23800 MCM comes as surface water and 500 MCM as ground water but due to geographical set up about 80 % surface water and 74% ground water goes outside state which is responsible for 38% drought of Jharkhand (Water Resource Department, Jharkhand). Most of the rivers originate in forest or follow their course through forest. As a result of which it is expected that the forest have a large impact on the quality of water. Recognizing the degrading water quality, a detailed study on water quality in different forest types of Jharkhand is being carried out by Forest Department.

The present study was carried out in Dry Peninsular Sal forest extensively found over Hazaribagh plateau, lower Palamau and the Pat lands. Sal is found mixed with Bamboos and Catechu especially in the north-western part. The Doomar river is a small river stream originating from Mahadeo hills in Kaarntari village of Barkagaon range. Barkagaon is located at 23°51′19″N 85°12′54″E. It has an average elevation of 508 m in Hazaribagh West Division. The geology of the area lying in the division consists of two systems Archeans and Gondwana. The general formation is archean but in the valleys of the Damodar and its tributaries extensive areas of Gondwana formation which is one of the oldest of the sedimentary rocks are found (Working Plan, Forest Department Jharkhand, 2000) [5]. The archeans consists of the metamorphic and igneous rocks like gneiss, schist and granites. These rocks are intersected by acid pegmatite veins. (DIEAA, 2016) [2]. The inter-bedding of coal seams with the stone or shale is a common feature. The area contains Loamy sand soil, having general water capacity of 1.10-1.20 inches/foot of depth (Jeff Ball, 2001) [4]. Thus, water conservation and management becomes a necessity in such areas.

The study aimed at a comparative assessment of the water quality and suitability of River Doomar for domestic water supply in rural communities in Barkagaon, Hazaribagh. The specific objectives are to assess the portability of water and to ascertain whether the quality of water from the river is suitable for domestic water supply in the area.

Materials and Methods

The study is an empirical research that adopted both experimental design and expost-facto design. The experimental design involves field survey, collection of water samples of the river and laboratory analysis of the water samples collected. While the expost-facto design draws a relationship between the physico-chemical parameters of the water and their effects on domestic purposes in the area.

Study of Watershed: Watershed of the river was studied in depth to understand the drainage pattern and flow accumulation of the area. The elevation and flow pattern was derived using toposheet map and DEM data in ARC GIS 10.1. It was found out in field survey that the river was diverted and channelized from the actual flow direction which is shown by blue line in the map. The river was diverted to provide water to water deficit area. The watershed of the river covers 1234.59 hectare area.

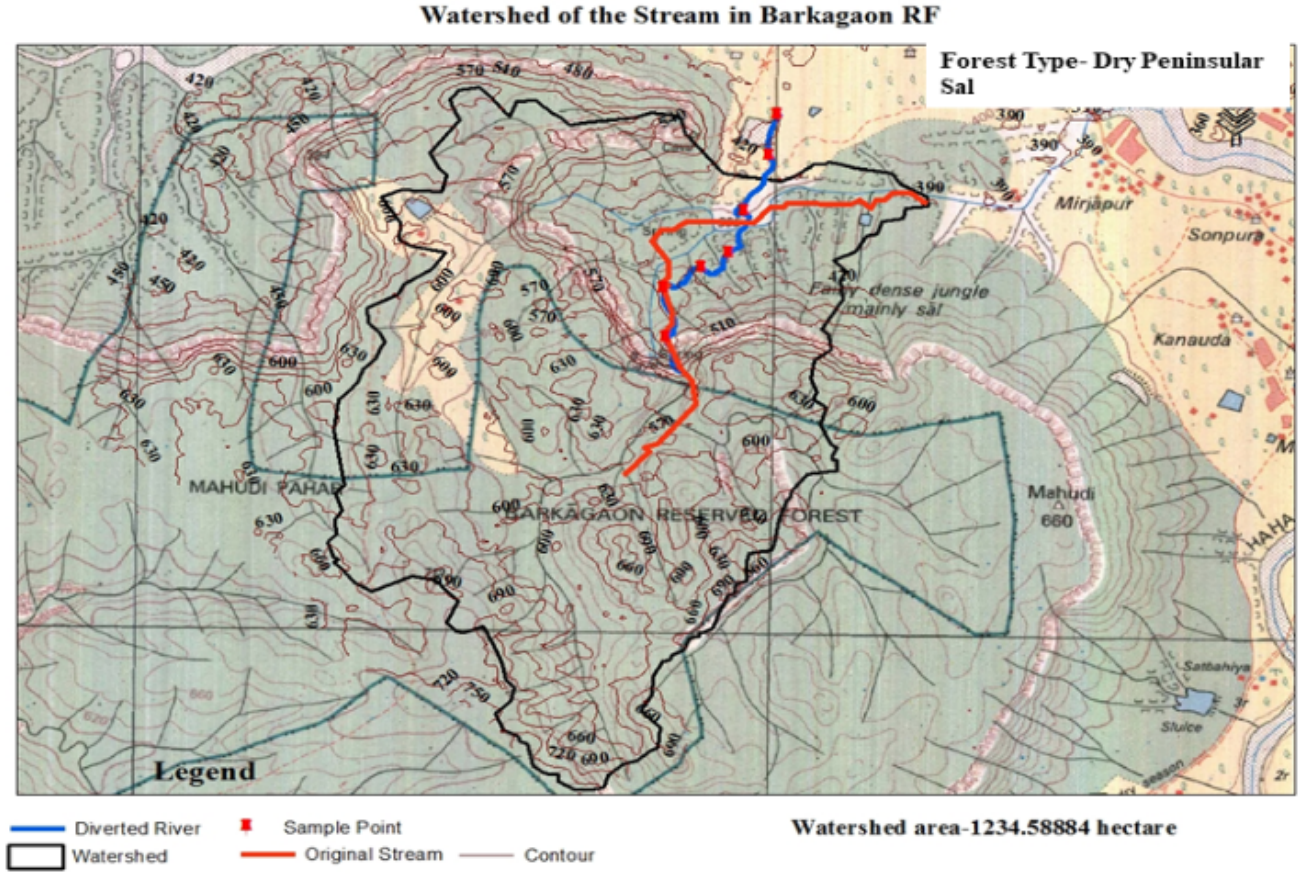

Fig 1: Map Type-Drainage Pattern

Collection of Sample- The systematic and simple random sampling techniques were adopted for the study. Water samples were collected from eight different sampling stations of the river Doomar near its origin to the point of confluence of the river Sakri near Kandtari PF and were sent for laboratory testing in IEM, Pundaag. The sample collection was done during Pre-Monsoon season of the year.

Results and Discussion

The results of the physico-chemical analysis of the water samples collected and analyzed for Doomar river, Barkagaon are shown in Table 1. The mean temperature of the samples collected was observed to be 27.1˚C. The highest standard deviation was found to be 54.74 for TDS and lowest 0.49 for pH. The TDS of the river is very less which might be due to

minimum leachate from soil. The iron content in the river is above acceptable limit of 0.3mg/L, out of eight samples only one sample had high iron content which is beyond the permissible limit. No fluoride content was found in any of the collected samples. Furthermore, all other parameters examined in the area are within the BIS 10500 approved standard for drinking water quality.

Table 1: Physico- chemical parameters of the collected samples

Parameters	Mean	Median	S.D.	SE	BIS	CPCB -A	CPCB -D
Temp(˚C)	27.10	-	-	-	-		
pH	8.14	8.30	0.49	0.17	8.50	6.50 - 8.50	6.50-8.50
TDS(NTU)	70.00	54.00	54.74	19.35	500-2000	500	-
DO(mg/L)	6.76	6.50	1.34	0.47	6.00	-	4.00
BOD(mg/L)	1.75	1.40	26.60	9.40	2.00	2.00	-
EC(µS/cm)	118.50	92.00	99.41	24.85	-		1000
Total Hardness (mg/L)	22.30	15.80	28.12	9.94	200-600	300	
Total Alkalinity (mg/L)	25.50	12.00	7.37	2.60	200-600		
Calcium	5.98	4.80	1.99	0.70	75	200	
Magnesium (mg/L)	1.75	0.93	1.76	0.62	30	100	
Nitrate (mg(/L)	1.94	1.10	16.80	5.94	45	20	50
Sulphates(mg/L)	16.30	8.30	11.78	4.17	200	400	
Chlorides(mg/L)	14.30	10.00	0.58	0.20	250-1000	250	
Iron(mg/L)	0.55	0.41	99.41	35.14	0.30	0.30	0.50
Fluoride	0	0	0	0	1.00-1.50	1.50	1.50

*S-Sample, *STDEV-Standard Deviation,*SE-Standard Error, BIS-Bureau of Indian Standards

Correlation Analysis

Correlation coefficient is used to indicate the sufficiency of one variable to predict the other (Davis, 1986) [1]. This coefficient is used to determine the correlation between the variables when the dependent (x) is only influenced by the independent (y) and vice versa (Voudouris *et al*., 2000) [7]. In this study, the correlation matrix of 13 variables for the pre-monsoon season was computed and is presented in Table 2. The table shows the degree of a linear association between any two of the parameters, as measured by the simple correlation coefficient (r).

The correlation between the various physicochemical parameters have been observed: (1) electrical conductivity with pH, TDS, total hardness, total alkalinity, calcium, magnesium, chloride, sulphates, nitrates, iron, DO and BOD; (2) TDS with total hardness, total alkalinity, calcium, Magnesium, chloride, sulphates, nitrates, iron, DO and BOD ; (3) total hardness with total alkalinity, calcium, magnesium, chloride, sulphates, nitrates, iron, DO and BOD. This correlation indicates that all of them have originated from the same source. Electrical conductivity and TDS are strongly correlated, consistent with the fact that conductivity increases as the concentration of all dissolved constituents/ions increases.

Conclusion

The spatial pattern of the water quality of the sampled settlements showed that the quality of water is higher at the upstream than at the downstream. The major objective of this paper is to evaluate the quality of water in Dry Peninsular Sal forest of Hazaribagh district. As the region usually faces water crisis mainly in summers thus availability as well as quality of water is equally important. Hydrochemistry of the water samples in the study area has indicated that the current status of local stream is satisfactory for drinking purposes with a few incidences of high Iron, mostly due to the rock composition and to the geothermal activity of the area. However, the water from the river should be purified through the addition of alkaline materials to reduce the high concentration of pH and other trace elements found in it in order to upgrade its quality for domestic consumption.

Table 2: Correlation coefficient matrix of physicochemical parameters of pre-monsoon water samples

	EC	pH	TDS	TH	Ca	Mg	TA	Cl	Sulphates	N	Fe	DO	BOD
EC	1.00												
pH	-0.00	1.00											
TDS	1.00	-0.30	1.00										
TH	0.90	-0.00	0.90	1.00									
Ca	0.90	-0.00	0.90	1.00	1.00								
Mg	0.90	-0.00	0.90	1.00	0.97	1.00							
TA	1.00	-0.20	1.00	1.00	0.96	1.00	1.00						
Cl	0.90	-0.00	0.90	1.00	0.96	0.90	0.92	1.00					
Sulphates	0.60	-0.8	0.60	0.30	0.32	0.30	0.38	0.28	1.00				
N	0.60	-0.80	0.70	0.40	0.36	0.40	0.43	0.35	0.99	1.00			
Fe	0.80	-0.20	0.80	0.80	0.78	0.80	0.80	0.89	0.33	0.41	1.00		
DO	-0.00	0.60	-0.30	-0.00	-0.10	-0.00	-0.21	-0.24	-0.48	-0.53	-0.42	1.00	
BOD	0.70	-0.70	0.70	0.50	0.51	0.40	0.57	0.49	0.60	0.61	0.55	-0.51	1.00

References

1. Davis JC. Statistics and Data Analysis in Geology, 2nd ed. John Wiley & Sons: New York, 1986.
2. DIEAA, District Survey Report of Minor Minerals, Hazaribagh, Govt of Jharkhand, 2016.
3. Imneisi IB, Aydin M. Water Quality Index (WQI) for Main Source of Drinking Water (Karaçomak Dam) in Kastamonu City, Turkey. J Environ Anal Toxicol, 2016; 6:407
4. Jeff Ball, Noble research Institute, Soil and water relationship, 2001.
5. Working Plan, Forest Department Jharkhand, 2000.
6. Sharma *et al*., Forest cover change over Chotanagpur- An empirical approach on periodic sequence. Indian Forester. 2019; 6:145
7. Voudouris K, Panagopoulos A, Koumantakis J. Multivariate Statistical Analysis in the Assessment of Hydrochemistry of the Northern Korinthia Prefecture Alluvial Aquifer System (Peloponnese, Greece). Natural Resources Res., 2000; 9(2):135-146.
8. WRD Jharkhand; http://wrdjharkhand.nic.in/