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Water quality and pollution status of Narmada River's Korni Tributary in Madhya Pradesh

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The physico-chemical characteristics of Korni river water in Pipariya Madhya Pradesh have been studied. The stretch of Korni river contained in the Hoshangabad district (located at 250 23'-260 52'N, 760 28'-790 15' E) is extended up to 65 km downstream from Satpura hills (Chhindwara) to the confluence of the Korni with Narmada river, Machha. Two sampling stations viz., Station-Nandwara and Khaparkheda, were established for the collection of water samples during June, 2010 to July, 2011. The water quality parameters, namely transparency , turbidity, electrical conductivity, total dissolved solids, pH, dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, chloride, nitrate, nitrite, sulphate, phosphate, silicate, biochemical oxygen demand, chemical oxygen demand, ammonia, sodium and potassium, reflects on the pristine nature of the river in Hoshangabad. On the basis of various parameters studied, the water quality analysis indicated that the river water in the Pipariya area is polluted and can serve as a bad habitat for many aquatic animals including endangered species with Narmada River.

Keyword: Korni River, Water quality, Pollution status, Pipariya area.

1. Introduction

The Satpura Range is a range of hills in central India. The range rises in eastern Gujrat state near the Arabian Sea coast, running east through Maharashtra and Madhya Pradesh to Chhattisgarh. The range parallels the Vindhya Range to the north, and these two east-west ranges divide the Indo-Gangetic plane of northern India and Pakistan from the Deccan Plateau to the south. The Narmada River runs in the depression between the Satpura and Vindhya ranges, and draining the northern slope of the Satpura range and running west towards the Arabian Sea. The Korni river is tributaries of Narmada river, it's run from Mahuljhir, Chhindwara to Machha Ghat of Narmada Hoshangabad. This river serves water about 4000 hec. in the crop land of Nayagaun, Dahalwara, Nandwara, Pali, Buchara, Budhani, Rampur, Ghurela, Vinaura, Jinoura, Khaparkheda, Kachhera, Jamara, Uatiya, Khapariya Tigara and Machha Villages. Pipariya is a city and a municipality in Hoshangabad district in the Indian state of Madhya Pradesh. It is famous as it is the railhead for the military station and tourist destination of Pachmarhi. Pipariya is on the Itarsi Jabalpur rail line. Its global location is 22°45' '2'' N 78°21' '29'' E.

River pollution in India has now reached to a point of crisis due to unplanned urbanization and rapid growth of industrialization. The entire array of life in water is affected due to pollution in water. The problem of water quality deterioration is mainly due to human activities such as disposal of dead bodies, discharge of industrial and sewage wastes and agricultural runoff, which are major cause of ecological damage and pose serious health hazards [1]. The degree of pollution is generally assessed by studying physical and chemical characteristics of the water bodies [2]. Studies related to water pollution of rivers like Godavari, Krishna and Tungbhdra [3], Cauvery [4], Jhelum [5], Kosi [6], Morar [7] (Kalpi), Alaknanda [8], Brahamani [9], Betwa [10], Ganga [11-14], Godavari [15, 16], Yamuna [17, 18], Pachin [19], Irai [20], Chambal river [21], Tansa [22] and Purna [1, 23] have received greater attention from time to time and during recent years. An attempt has, therefore, been made to study water pollution in river Korni in Pipariya area.

2. Material and Method

Two sampling stations were established almost equidistantly on the stretch of Korni River. Station Nandwara was established at Nandwara village and Station- Kharparkheda was established at Khaparkheda village. These villages were connected by a road so sampling easy for each month. The monthly samples of subsurface water were collected during the first week of each month in the early hours of the day i.e. between 7 am to 9 am Utmost care was taken to avoid spilling of water and air bubbling at the time of sample collection. Iodine treated polyethylene double Stoppard bottles were used for collection of sample. Some of the physico-chemical characteristics of water including water temperature, depth, color, transparency, flow rate, pH, dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, chloride, calcium and magnesium were determined at the sampling stations, while other parameters including turbidity, electrical conductivity, total dissolved solids, nitrate, nitrite, sulphate, phosphate, silicate, biochemical oxygen demand, chemical oxygen demand, ammonia, sulphide, sodium and potassium were analyzed in the laboratory within 4 to 6 hr of collection. The physico-chemical characteristics of water were analyzed according to the methods of APHA [24, 25].

3. Observation

Table-1

Parameter	Unit	Station Nandwara Range of variation	Mean Range of variation	Station Khaparkheda Range of variation	Mean Range of variation
Water temperature	°C	16.50-30.00	25.57	14.45-29.50	25.60
Transparency	cm	14.60-90.00	66.68	15.50-92.80	68.50
pH		7.8-8.7	7.56	7.5-8.7	7.56
Dissolved oxygen	Mgl^{-1}	5.45-10.33	7.45	4.60-10.30	6.70
Free carbon dioxide	Mgl^{-1}	0.00-3.40	1.65	0.00-3.20	1.40
Turbidity	NTU	1.80-76.44	22.60	2.20-70.50	23.40
Electrical conductivity	μScm^{-1}	150.60-380.00	285.40	156.20-375.40	256.40
Total dissolved solids	Mgl^{-1}	265.00-430.00	320.40	245.40-460.00	343.20
Total alkalinity	Mgl^{-1}	75.45-244.55	175.57	80.67-270.00	187.40
Total hardness	Mgl^{-1}	44.60-67.00	55.60	35.40-80.50	60.50
Chloride	Mgl^{-1}	14.34-34.45	26.44	15.68-36.70	28.50
Calcium	Mgl^{-1}	8.30-15.45	11.65	9.30-16.80	12.40

4. Result and Discussion

The physico-chemical characteristics provide a fair idea of the water quality in any water body. The result of the physic-chemical characteristics of Korani river water is summarized in Table-1. Temperature is basically important for its effects on certain chemical and biological reactions taking place in water and aquatic organisms [26]. It depends upon the season [27], time of sampling and also upon the temperature of effluents which is being added into the river. Korani River was given in Table-1. The lower water temperature was recorded in winter, while the highest was recorded in summer. Similar seasonal variation in water temperature was recorded [4] in river Ghaghara [28], in river Narmada [29], in river Tapti [26] and in river Purna [1].

Transparency or light penetration depends on the intensity of sunlight, suspended soil particles, turbid water received from the catchment area and density of plankton etc [7, 29, 30]. Transparency of river water is also affected due to total solids partly or fully decomposed organic matters, silts and turbulence caused by the currents, waves, human and cattle activities [28]. Seasonal impact was also seen on water transparency indicating higher values during winter and summer seasons, whereas lower values are evident in monsoon season. The transparency values were less in monsoon season due to high current which erodes the bank of the river and due to turbid flood water, suspended matter and dissolved particles. High value of transparency was recorded in late post monsoon and winter months as has also been observed [28, 29, 22]. The Flow rate of water bodies

generally depends upon the amount of water available and on its depth. Mean annual flow rate in Korani river was found to be minimum (14.60 cm sec-1) at Station Nandwara in the month of February and maximum (92.80 cm sec-1) at Station Khaperkheda in the month of September.

The pH range of 6.7 to 8.4 observed he is suitable for the growth of aquatic biota [31]. The water in Korni River was always alkaline throughout the period of study. Alkaline pH was also observed [22] in river Tansa during whole study period, while [32] have observed acidic nature of water of Subernarekha river due to discharge of copper industrial effluents in this river. The pH value (7.56) was recorded similar at Station Nandwara and Khaperkheda.

Dissolved oxygen is one of the important parameter in water quality assessment. Its presence is essential to maintain variety of forms of biological life in the water and the effect of waste discharge in a water body is largely determined by the oxygen balance of the system. Dissolved oxygen is regulator of metabolic activities of organisms and thus governs metabolism of the biological community as a whole and also acts as an indicator of trophic status of the water body [33]. Oxygen is generally reduced in the water due to respiration of biota, decomposition of organic matter, rise in temperature, oxygen demanding wastes and inorganic reductant such as hydrogen sulphide, ammonia, nitrites, ferrous iron, etc [13]. Inorganic reducing agents such as hydrogen sulphide, ammonia, nitrite, ferrous iron and certain oxidizable substances also tend to decrease dissolved oxygen in water [34] has suggested that a minimum of 3 mgl^{-1} dissolved oxygen is necessary for healthy fish and other aquatic life. In the present study, the value of dissolved oxygen was recorded as 7.45 mgl^{-1} at Station Nandwara and 6.70 mgl^{-1} at Station khaperheda. This level of oxygen in the river should be able to support good fauna and flora. Similar observation was recorded [12] in river Ganga, river Manjar [35], in river Godavari [16]. The pH, alkalinity and free carbon dioxide are interrelated in aquatic ecosystems. Most of the free carbon dioxide in water comes from the decomposition of organic matter and from respiration of organisms [29]. In polluted water, the free carbon dioxide is generally high. In Korani River, free carbon dioxide ranged from non traceable amount at stations to the value of 1.65 mgl^{-1} at Nandwara and 1.40 mgl^{-1} at Khaperheda. Good oxygen saturation and low free carbon dioxide indicate no pollution load in the river at both Stations.

Chloride concentration in water indicates the presence of organic waste in water, primarily of animal origin (Thresh *et al.*, 1949). It increases with ammonical nitrogen which also owes itself mostly to animal excreta. Chloride in Korani River varied from 26.44 mgl^{-1} at Station Nandwara and 28.50 mgl^{-1}at Station Khaperkheda. The chloride concentration was quite low in this river which reflects that there is very less amount of organic waste of animal origin and practically no discharge of municipal and industrial wastes. The calcium is one of the most abundant substances of natural water being present in high quantities in the rocks. The disposal of sewage and industrial wastes are also important sources of calcium. The calcium level in the river varied from 11.64 to 12.40 mgl^{-1}.

5. Conclusion

On the basis of various parameters studied, Narmada tributary Korani river in this stretch can be placed under oligosaprobic. When various parameters of our study are compared with that of Indian standards [36] for public use, fish culture and irrigation, it was revealed that all such parameters are well within the limits (Table-1). The water characteristics considered for the study indicate that the river water in the above area is pollution free and can serve as a good habitat for many aquatic organisms including endangered species.

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