Studies on assessment of water quality of Punpun River at Nabinagar, Aurangabad District, Bihar, India

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Abstract:

The present research paper work focuses on the variations in different Punpun river water quality parameters of the selected locations at Nabinagar, Aurangabad. The water samples collected from the selected sites were analyzed at specific time intervals. The parameters studied were namely Temperature, pH, Dissolved Oxygen (DO), Total Suspended Solids (TSS), Total dissolved Solids (TDS), Alkalinity, Hardness and Chloride. This study also helps us to understand the changes in water quality due to anthropogenic influence. However, no attempt has been made to analyze the water quality of these areas.

Key Words: Punpun, Water quality, pH, Hardness, Chloride

Introduction: It is well known fact that clean water is absolutely essential for healthy living. Adequate supply of fresh and clean drinking water is a basic need for all human beings on the earth, yet it has been observed that millions of people worldwide are deprived of this. Freshwater resources all over the world are threatened not only by over exploitation and poor management but also by ecological degradation. The main source of freshwater pollution can be attributed to discharge of untreated waste, dumping of industrial effluent, and run-off from agricultural fields. Industrial growth, urbanization and the increasing use of synthetic organic substances have serious and adverse impacts on freshwater bodies. Freshwater resources are under severe and increasing environmental stress. At a global level, two thirds of the withdrawals are used for agriculture and one fourth for industry.

The problem of fresh water pollution in India came to the forefront towards the beginning of 1960 with the domestic waste water, sewage, effluent and industrial waste water discharges being the most critical sources of pollution in various towns and cities. In recent years, because of continuous growth in population, rapid industrialization and various technologies involving waste disposal (Jain, P, 2009). Human factor is the main cause of river pollution. Besides human factors, natural factors such as low rainfall, water consumption for agricultural and industrial purposes, development of agricultural lands at the expense of natural lands wastefulness and finally, all increased the physical and chemical pollution of the river and leads to natural disruption of its biological and bioavailability capacity.

In Nabinagar, Punpun is the primary source of drinking water. In the last few decades, there has been a serious concern over the deterioration in its water quality. The river has been receiving large amounts of be indiscriminate disposal of domestic effluents, immersion of idols, dumping of plastics into drain, bathing of cattle and agricultural runoff, partially treated and untreated wastewater during its course, especially between Tandwa to Nabinagar areas. Pollutants flowing into the river are contributed from the waste of the villages situated along its bank. Table No 1 gives the drinking water quality standards as per IS: 10500-1991.

Table No 1. Drinking Water Quality Standards (IS: 10500-1991)

S. No	Parameters	Range	Effects
Physical			
1	Turbidity, Units on J.T.U scale	2.5	Undesirable effects on human beings
2	Color	5.0	Undesirable effects on human beings
3	Taste and Odor, Units on Platinum cobalt scale	Unobjectionable	Undesirable effects on human beings
Chemical			
4	pH	6.5-8.5	Beyond this range the water will affect water supply system and mucous membrane
5	Total hardness	300	Adverse effect on domestic use
6	Iron	0.3	Adverse effect on human health
7	Chloride	250	Cause Taste, corrosion and palatability are affected
8	Residual free chlorine	0.2	--
9	Dissolved solids	500	Cause gastrointestinal irritation
10	Nitrates	45	Beyond this Blue Baby Syndrome may be caused in infants.
11	Fluoride	1.0	Cause fluorosis
12	Alkalinity	200	Beyond this water becomes unpleasant
13	PAH, Hexavalent chromium	0.01	May be carcinogenic
14	Pesticides	Absent	Very toxic
15	Heavy metals	0.001	Becomes more toxic

2.0 Materials and Methods:

2.1 Study area: Nabinagar is located at 24.62°N 84.12°E in Aurangabad District. It has an average elevation of 138 metres (452 feet) and 35 km from Aurangabad. Nabinagar is a power hub since Bihar Govt and NTPC are setting thermal power plants there based on coal. Figure No

1 gives the map of study area and bank of river. The three sampling stations (S1, S2, and S3). were marked out for the collection of water samples.

The Punpun River is a sacred river for Hindus. The 210 km long river is mostly rainfed and carries little water in the dry season. The Punpun River is a tributary of the Ganges. It originates in Gajandham, Palamu District of Jharkahand. It flows through Chatra, Aurangabad, Gaya and Patna Districts of Jharkhand and Bihar. The river mostly flows in a north east direction and the join the Ganges at Fatuha, Bakhtiyarpur, Patna. The main tributaries of the Punpun are the Adari, Batane, Batre, Madar and Morhar. The catchment area of the Punpun is 8,530 square kilometers. Basic information of Aurangabad District and study area is shown in Table No 2.
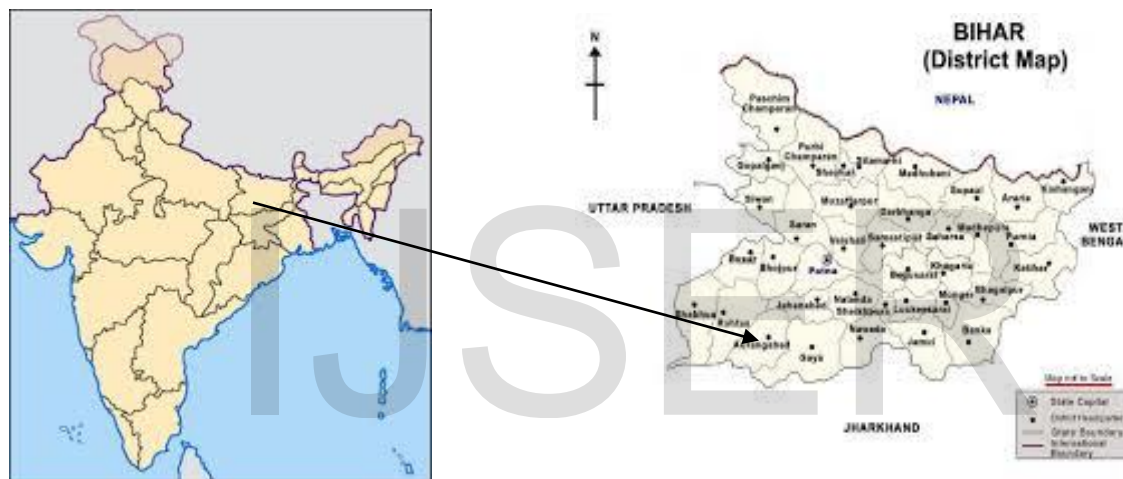

Figure No 1

Table 2. Basic information of Aurangabad District, Bihar

1	Latitude	86^021'E to 86^042'E
2	Longitude	24^0 57'N to 25^0 29'N
3	Height from sea level	30 to 60 meters
4	Geographical area	1419.7 Sq. km
5	Rainfall	1231 mm
6	Sex Ratio	840 Female/ 1000 Male
7	Forest	2375 Ha
8	Cultivable areas	8600 Ha
9	Net Irrigated areas	2514.5 Ha

2.2 Collection of samples

Water samples were collected from the locations along the route of the Punpun River from different locations at Nabinagar areas. The water samples were collected in the cleaned, air tight water glass bottle and taken to the laboratory for analysis as per guidelines of APHA, 1995. The water samples were transported under ice cooled conditions with appropriates sealing.

3.0 **Results and Discussion:** Analysis of the selected parameters of the Punpun River is shown in Table No 3.

Table 3. Physico Chemical Water Quality Parameters of Punpun

S. No	Parameters /units	Methods	S1	S2	S3
			Average	Average	Average
1	Temperature,0^C		27.54	28.44	23.21
2	pH	Potentiometer	7.3	7.5	7.1
3	DO, mg/l	Winkler's method	5.23	6.0	5.28
4	TSS, mg/l	Gravimetric method	119.44	128.73	126.26
5	TDS, mg/l	Gravimetric method	238.23	241.54	228.14
6	Alkalinity, mg/l	Titration	40.12	29.43	33.56
7	Hardness, mg/l	EDTA method	112.27	68.27	83.31
8	Chloride, mg/l	Titration	31.22	34.56	33.61

Temperature: The temperature of water has very important ecological effects. Arise in temperature of the water leads to the speeding up of the chemical reactions in water, reduces the

solubility of gases and amplifies the tastes and odours. Water in the temperature range of 7^0C to 11^0C has a pleasant taste and is refreshing. At higher temperature with less dissolved gases the water becomes tasteless and even does not quench the thirst. In present study, the values of temperature were ranged between 23.21^0C to 28.44^0C.

pH: pH is the one of the most important single factor which influences aquatic production. pH has no direct adverse effects on health, however a lower value below 4.5 will produce odd taste; and higher value above 7.5, an alkaline taste. Most rivers have a neutral pH of 6.5-8.5. Low pH levels (below optimal) can result in fish kills by stressing their systems causing physical damage, which in turn can make them more vulnerable to disease, similarly high pH particularly in combination with high water temperature, can increase the amount of unionized ammonia which is highly toxic to fish (Kumar et al.,2010). In present study, the values of pH were ranged from 7.1 to 7.5. All the pH values represent alkaline nature of river water samples were within the permissible limit as per IS: 10500.

DO: Oxygen saturation in the environment refers to the amount of oxygen dissolved in the water bodies. Water bodies have different types of micro-organisms such as virus, bacteria, and fungi. When too much biodegradable matter end up in water bodies, it encourages more microorganism growth, and they use up more oxygen in the water. If oxygen is depleted, aerobic organisms die, and anaerobic organism grow more to produce harmful toxins such as ammonia and sulfides (Mishra et al., 2009). In the present study, the values of DO were ranged from 5.23 mg/l to 6.0 mg/l.

Total Suspended Solids (TSS): Total suspended solids are particles that are larger than 2 microns found in the water column. Anything smaller than 2 microns is considered a dissolved solid. Most suspended solids are made up of inorganic materials, though bacteria and algae can also contribute to the total solids concentration. In present investigation, TSS was ranged from 126.26 mg/l to 128.73 mg/l.

Total Dissolved Solids (TDS): In natural waters dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, sulphates, phosphates, and nitrates of calcium, magnesium, sodium, potassium, iron and manganese etc. In present investigation, TDS was ranged from 228.14 to 241.54 mg/l. All the TDS values of river water samples were within the permissible limit as per IS: 10500.

Alkalinity: Alkalinity is also important to aquatic organisms because it protects them against rapid changes in pH. During the study period, Alkalinity values ranged between 29.43 mg/l to 40.12 mg/l. Alkalinity itself is not harmful to human beings but desirable limit of 100 mg/lit is always required for domestic supply of water.

Hardness: The total hardness of water is defined as the sum of calcium and magnesium concentrations, both expressed as calcium carbonate, in mg/L. Based on present investigation, hardness varied from 68.27 mg/l to 112.27 mg/l. The permissible limit of Hardness for drinking

water is 300 mg/l (IS 10500). Hence, all the hardness values of river water samples in study area were within the permissible limit.

Chloride: Chloride may get into surface water from several sources such as industries, municipalities, agricultural runoff and other sources. During the study period, Chloride varied from 31.22 to 34.56 mg/l. Hence, all the Chloride values of Punpun river water samples were within the permissible limit. The EPA Secondary Drinking Water Regulations recommend a maximum concentration of 250 mg/1itre for chloride ions.

Conclusions:

The above mentioned results show severe deterioration of water quality of the Punpun River at Nabinagar areas of Aurangabad. Domestic waste water, agricultural run-off, urban effluents, fertilizer run-off contain phosphorus and nitrogen, manure from livestock operations, which increase the level of nutrients in water bodies and can cause deterioration of water quality in the rivers. The nitrates come mainly from the fertilizer that is added to the fields. Excessive use of fertilizers cause nitrate contamination of groundwater, with the result that nitrate levels in drinking water is far above the safety levels recommended. Organic matter and nutrients causes an increase in aerobic algae and depletes oxygen from the water column. This causes the suffocation of fish and other aquatic organisms in and around Nabinagar district.

Acknowledgement:

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