

STUDIES ON WATER PHYSIO-CHEMICAL PARAMETERS OF THE RIVER SAI IN UTTAR PRADESH

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Abstract— The present works have been taken to assess dynamics in physio-chemical parameter water following in river the Sai river, a holy river of the Uttar Pradesh. Sai river originates from a Pond in village Bijgwan near Phani in District Hardoi. It travels about 600 km from district Lucknow to and Unnao after Passing through Hardoi, Unnao, Raebarely, and Jaunpur district. It finally joins the Gomti river at Rajepur in Jaunpur District. The Sai river is worshipped as a holy river in U.P. Data collection for study of physicochemical parameter at a total of four water sample points for each district were collected. Due to recurring additions sewage agriculture fertilizer and domestic wastes, water for one year June 2018-19 including physio-chemical parameters like Temperature, pH, B.O.D., C.O.D. D.O. SO_4^{2-} , Cl^- , PO_4^{3-} , NO_3^- , Ca^{++} and Mg^{++} were periodically tested majority of value varies from permissible for the survival of Aquatic livestock and human beings.

Keywords—River Sai, Uttar Pradesh, Physio-Chemical Parameters, Dissolved Oxygen, Biological Oxygen Demand

1. INTRODUCTION

River Sai is a vital river of the Uttar Pradesh. It originates from a Pond in village Bijgwan near Pihani in district Hardoi. It travels about 600 km from district boundary between Lucknow and Unnao after passing through various district Hardoi, Raebarely, Jaunpur district, and finally, join the tributary of river Gomti at Rajanpur in Jaunpur. In local name, the stretch as "Jhabar" from the river called Bhainsta take shape. The river flow for around 10 km before getting it more popular name Sai.

The Sai river catchment is bounded in the north by Ghaghra catchment while Ganga's attachment is in the south. The river Sai travels in alluvial terrain and transport this sediment derived from Himalaya terrain in its long journey. The river receives water from other streams, namely Bhainsta, Loni, Sakarni, and Bakulahi rivers. Drinking water quality becomes a critical issue in the neighboring district of the U.P., primarily due to concern that freshwater will be as scarce.[1] Their uses include, among other things, domestic, agricultural, livestock, watering, industrial sports, and recreations. Apart from natural factors, the quality of water in an area may also be affected by the contribution from anthropogenic sources.

The release of waste gases and particulate matter into the atmosphere by various industries, the discharge of waste industrial effluents and sewage into watercourses and/ far on the land, etc., have added new dimensions to the water quality aspects.

The aquatic ecosystem comprises aquatic flora and fauna, including phytoplankton and algae. Algae are the leading primary producer in the marine ecosystem. Any type of anthropogenic disturbances and improper management of the river systems may affect the algal diversity and the quality of water for their uses for various purposes. The study of river ecology has gained immense importance in recent years because of the multiple applications of river water for human consumption in agriculture and industry.

Ecophysiological studies of the river and lakes help assess water quality since algae play an essential role as a pollution indicator of various types of water pollution. Therefore, the present investigation is intended to study the physio-chemical and biological properties of water to ascertain the quality of water and algal diversity

inhabiting therein as well as the biochemical properties of some common algae.

In India, several workers have contributed to this discipline. Still, most of them have restricted their study on the physio-chemical aspects. Only a few have made the physio-chemical analysis together with biological characteristics with particular reference to algae.[2-7] But there appears to be no available literature on such type of algal ecological studies on river Gomti flowing through Saidpur (Ghazipur). According to a WHO estimate [8], about 80% of water pollution in developing countries like India is caused by domestic waste. Most rivers are deteriorating gradually, and the maintenance of the quality of river waters will be several problems in the years to come. The water quality of river Sai and river Gomti has been extensively studied by various authors and was concluded to be significantly polluted[2][6] however, in [9] the water quality at upstream of Ghaat to be good for almost all beneficial uses.

2. EXPERIMENTAL WORK

Sai water samples of different grade to four selected sampling points viz., Bhatolaghat (S₁), Saidpur (S₂), Tarwania Ghat (S₃), and Shekhpur Ghat (S₄) were collected periodically in plastic stoppered bottles at monthly interval during course of the investigation (2018-2019). Selected sites continuously received daily the domestic, municipal, and industrial wastes from the Hardoi, Unnao, Lucknow (Bani), Raebareli, Pratapgarh, Jaunpur. Parameters such as-Temperature were measured by Celsius thermometer, pH by Systronic pH meter 335 digital type, total dissolved solids were determined by evaporating using Barium chloride solution in a trace amount of residue. Dissolved oxygen (D.O.) and Biological oxygen demand (B.O.D.) were measured by a modified Winkler method. Chemical oxygen demand (C.O.D.) was measured by the Dichromate Reflux method. Whereas, chloride by Mohr's method, Phosphate by colorimeter, Sodium by Flame photometric method, Calcium by EDTA titration, and Magnesium by calculations were studied. All parameters were analyzed by using the standard method of A.P.H.A. [10]

3. RESULT AND DISCUSSION

Results presented in Table 1 indicated that Physico-chemical quality of water deteriorated and

become harmful to man in his household needs and other aquatic life or balanced functioning of the marine ecosystem such as situation is referred to as marine pollution parameters affected by urban wastes as industrial effluent and heavy use in pesticide and artificial fertilizers through farmers.

3.1. TEMPERATURE

Results revealed that not much variation was found in the temperature of rivers water at different sampling sites. Maximum (24.8°C) temperature was recorded at site S₃ whereas, a minimum of 23.80°C at S₁. Temperature is one of the most important physical aspects of water pollution, which may be harmful as a primary pollutant and indirectly throughout the D.O., and causing the death of aquatic organisms.

3.2. pH

The pH of river water was observed in increasing order during the tenure of the work. Maximum 8.2 pH value was measured at S₄ and S₂ site. Whereas a minimum of 7.8 at S₁. The above description reveals that the pH of rivers water was usually on the alkaline side and lowers the acceptable limit of water quality standard (6.3-9.2) of India and therefore use of water for various purposes is not banned.

3.3. BIOLOGICAL OXYGEN DEMAND

It was evident from Table 1 that B.O.D. of Gomti river ranged from 6.06-1.00 ppm at different sites, which was higher than permissible limit (6.00 ppm), indicating more organic wastes and sewer water Reaching into the river through the drain. Maximum 10.00 ppm B.O.D. value was observed at S₄ and a minimum of 6.06 at S₁ sites. The above description was alarming that the water river required pre-treatment for use.

3.4. CHEMICAL OXYGEN DEMAND

The C.O.D. values of the river have been found a maximum of 120.82 ppm at S₁ and a minimum of 115.40 at S₂. All the costs were higher than the permissible limit of ten ppm, indicating pollution in the river water. Hence pre-treatment of water is essential for using multipurpose like drinking of livestock etc.

3.5. DISSOLVED OXYGEN

Dissolved oxygen is one of the essential physio-chemical parameters of water. Increase the value of D.O. exhibited biochemical changes due to an abundant population of flora and fauna. The D.O. value of river water ranged from 7.82-8.50 ppm at sampling sites. The maximum amount was observed at S₄, where minimum at S₁. D.O. level depends on the physical, chemical, and biological activities of water⁷. All the benefits are higher than the permissible limit (4.6 ppm) for natural water.

3.6. SULFHATE

The sulfhate ion is one of the measures anion occurring in natural water. The values of SO₄²⁻ content was varied, and it was found a maximum of 41.40 at S₄ and a minimum of 35.30 ppm at S₁ sites. SO₄²⁻ is an essential constituent of hard water in the form of Ca SO₄ and Mg SO₄, which reduces the water quality. Increase its concentration in river water due to industries, Agricultural and domestic wastes. Excess amount of sulfate in water has a cathartic effect on human health.

3.7. CHLORIDE

During the study, it was observed that chloride ion (Cl⁻) concentration was higher at all sampling sites. It was maximum (40.10 ppm) at S₁ whereas, a minimum (20.48 ppm) level was observed at S₃ sites. Increased percentage of chloride was probably due to the amount of sewage industrial influent and pesticide discharge in the river. A similar observation has been made in previous works.

3.8. PHOSPHATE

Phosphorus is considered the most critical single element for biological productivity [11], an essential component for all kinds of organisms being a constituent of nucleic acid, nucleoprotein, and ATP, which acts as a universal source of energy. By observing the values, Table 1 reveals

that concentration to phosphate ion in the river water was maximum (0.069 ppm) at S₁ sites and minimum (0.050 ppm) at S₃. The level of PO₄³⁻ at all sampling stations was slightly higher than the maximum allowed limit. Such higher concentration may be due to the continuous addition of detergents through sewage and industrial effluents, phosphatic fertilizer, and organic Phosphate. Which reaches to water bodies as surface runoff. The addition of these elements in the form of orthophosphate, Pyrophosphate, Metaphosphate, and dehydrogenate phosphate causes explosive growth of algae.

3.9. SODIUM

Sodium is the most critical mineral occurring naturally and essential element for the growth of animals but required in traces by the plants. A higher concentration of Sodium can be related to cardiovascular disease. In women's toxemia associate with pregnancy It was evident from Table – 1 that a maximum 3.50 concentration of Na⁺ was recorded at S₂ sites and minimum concentration of 3.10 at site S₄. These values are under the tolerance limit; therefore, water is used for various purposes.

3.10. CALCIUM

The presence of Ca⁺⁺ in water supplies results from over deposition of limestone, dolomite gypsum, and gypsiferous shalex. Minimum 12.40 ppm) concentration was observed at S₁, whereas. Maximums 16.42 ppm at S₄.

Table.1. The Physico-Chemical Character of The Sai River in Hardoi-Baholi, Unnao-Mohan, Lucknow-Bani Jaunpur-Jalalpur District Influent by Agricultural and Urban Wastes.

(2018-2019)					
S.No.	Parameters	S1 Harodi-Baghuli	S2 Unnao-Mohan	S3 Lucknow-Bani	S4 Jaunpur-Jalalpur
1.	Temperature (C)	23.8	24.4	24.8	24.6
2.	pH	7.8	8.26	8.32	8.50
3.	BOD(ppm)	6.06	6.50	6.80	10.00
4.	COD(ppm)	120.82	115.4	115.9	121.2
5.	DO(ppm)	7.82	8.08	8.12	8.50
6.	SO ₄ ²⁻ (ppm)	35.30	36.10	36.20	41.10
7.	Cl ⁻ (ppm)	33.81	21.76	20.48	40.20
8.	PO ₄ ³⁻ (ppm)	0.069	0.053	0.050	0.056
9.	Na ⁺ (ppm)	3.40	3.50	3.20	3.10
10.	Ca ⁺⁺ (ppm)	12.42	13.11	15.00	16.42
11.	Mg ⁺⁺ (ppm)	17.62	19.76	18.30	16.60

3.11. MAGNESIUM

The concentration of Mg⁺⁺ was found maximum (19.76 ppm) at S2 site and minimum (16.60 ppm) at S₄.

4. CONCLUSION

Based on the above findings, it may be concluded that the water of the Gomti river profoundly affected by urban and municipal wastes, which results in exceeding permissible limits. Calcium and Magnesium are responsible for the hardness of water, which is not suitable for drinking. Therefore, some precautions are essential for the survival of aquatic and human health.

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