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Water potability assessment of Boranakanive Reservoir in Chikkanayakanahalli Taluk of Tumkur District, Karnataka, India

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ABSTRACT

Owing to the severe scarcity of the freshwater resources, proper assessment of water quality of the available freshwater resources is very essential, mainly in the rural parts of India. The present study aims to adjudge the water potability of Boranakanive reservoir in Chikkanayakanahalli Taluk of Tumkur district, Karnataka. Surface water from three different stations of the reservoir were collected on monthly basis for a span of one year (JULY 2018- JUNE 2019) and subjected to analysis of various parameters such as pH, Turbidity, Electrical Conductivity (EC), Total Alkalinity, Total Hardness, Total Dissolved Solids (TDS), Calcium, Chloride, Fluoride, Nitrate and Sulphate. The results brought to limelight, the discernible elevation in pH, turbidity and EC above the permissible limits, making the water unsuitable for drinking purpose.

Key words : *Boranakanive reservoir, Freshwater resource, Water quality, Potability, Parameters.*

Introduction

Our Earth currently faces a dearth of freshwater resources unfortunately due to lack of timely rains, over exploitation, diminishing resources or by environmental degradation through various anthropological means (La Rivere, 1989; Schindler and Bayley, 1990). Such being the situation, proper assessment of the water quality of available freshwater resources becomes crucial. One such lentic freshwater ecosystems in India is the Borankanive reservoir. It was constructed as early as 1892, during the British rule under the administration of the Mysore Maharaja Sri Chamarajendra Wadiyar X GCSI. The Borankanive reservoir is located at 6 km east of Huliyar Hobli, Chikkanayakanahalli Taluk of Tumkur District, Karnataka, which falls 76° 37′59. 60" N longitude and 13° 35′54.55" E latitude. It stands approximately 80ft above the ground level, having a catchment area of 359.5 Square miles. Today the reservoir plays a vital role as a major water resource to the Huliyar town and its adjacent villages like Ballakatte, Kenkere, Somanahalli, Somajjanpalya and Tirumalapura although it is shrinking rapidly due to various climatic, environmental and anthropological factors. Hence, determining the potability of water from this reservoir is important.

Materials and Methods

The study was carried out at the reservoir for a span of one year from July 2018 - June 2019. The surface water sampling was done at an interval of every 30 days in pre-treated, dried and labelled polythene containers of two-litre capacity with necessary pre-

cautions (APHA, 1995). The water samples were collected from three different stations, that is S-1 (Inlet), S-2 (Mid-point) and S-3 (Outlet) of the reservoir in the early morning hours between 07.00 a.m. to 10.00 a.m. throughout the study period. The collected samples were then tested for various parameters like pH, Turbidity, EC, Total Alkalinity, Total Hardness, TDS, Calcium, Chloride, Fluoride, Nitrate and Sulphate. The above mentioned parameters were tested as per the standard methods (APHA 2012 & 2017, IS 10500:2012, IS 3025 by BIS).

Results and Discussion

The present study brought to our knowledge a significant raise in the values of parameters like pH, Electrical conductivity and Turbidity of water making it not potable enough. Whereas, it is observed that the other parameters were found to be within the permissible limits given by IS (Table 1). The resultant fluctuations in the pH, EC and turbidity could be owing to various factors such as in-situ soil, deposition of sediments transported by streams over the years or by current stagnation and evaporation losses due to lack of heavy rains during water storage period.

pH

The pH value of the reservoir ranged between 8.6-10.1 indicating highly basic water type. Both the lowest and the highest pH values were recorded at station-1, which is the inlet of the reservoir. The pH was found to be minimum in the month of October 2018 when light rains were observed. However, the mean±SD values as shown in the table clearly indicate the pH variations to remain in the highly basic pH range.

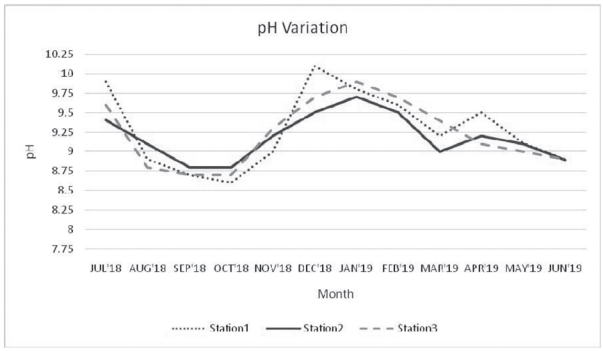

Fig. 1(a). Variations in pH of water on monthly basis during the study period.

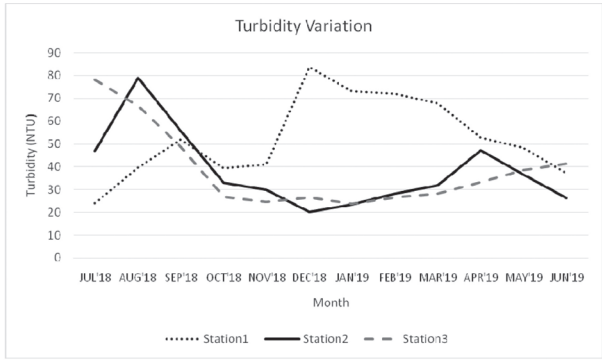

Fig. 1(b). Variations in Turbidity of water on monthly basis during the study period.

Table 1. Parameters and their Mean±SD values of one year from stations1,2 and 3.

Parameters	Units	Results S-1 (INLET) Mean±SD	S-2 (MID-POINT) Mean±SD	S-3 (OUTLET) Mean±SD	Requirement acceptable Limits (As per IS 10500:2012)	Permissible Limit In The Absence At Alternate Source (As per IS 10500:2012)
pH	——	9.28±0.49	9.18±0.29	9.23±0.42	6.5-8.5	No relaxation
Turbidity	NTU	52.52±17.90	38.27±16.69	38.58±17.75	1	5
EC	µmhos/cm	1265.08±535.72	1159.67±248.37	1149.67±205.46	N.S	N.S
TotalAlkalinity	mg/L	291.42±62.94	279.42±63.96	324.50±59.94	200	600
Total Hardness	mg/L	132.33±38.52	133.83±23.19	127.50±21.02	200	600
TDS	mg/L	794.75±360.89	713.25±188.25	717.17±159.21	500	2000
Calcium	mg/L	31.50±9.16	30.00±5.22	26.92±4.70	75	200
Chloride	mg/L	194.83±57.74	170.83±40.46	172.00±28.90	250	2000
Fluoride	mg/L	0.76±0.44	0.74±0.41	0.81±0.45	1.0	1.5
Nitrate	mg/L	22.83±9.91	20.33±9.75	18.83±5.61	45	No relaxation
Sulphate	mg/L	63.25±21.81	48.00±17.06	44.83±17.14	200	400

Turbidity

It is a resultant of suspended matter like clay, silt or various organic matters. Turbidity measures the clarity of water, if more the turbidity then more the cloudiness or haze in water. The permissible limit is mentioned to be 5 NTU as per the IS. But, it was astonishing to see that the results obtained were ranging between 23.5 NTU to 83.6 NTU, which is way above the given permissible limit making the water of the reservoir highly turbid.

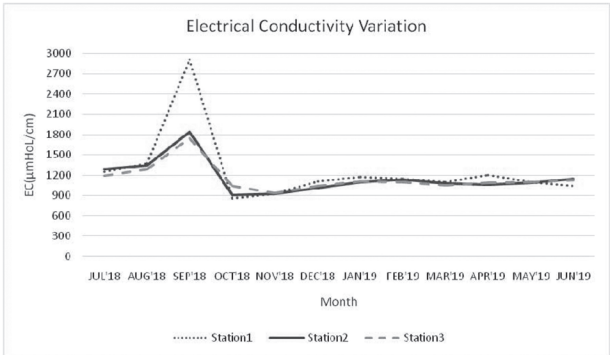

Fig. 1(c). Variations in EC of water on monthly basis during the study period.

EC

Conductivity of water is the measure of waters capacity to carry or conduct the electrical current and is represented numerically. This capacity depends on the presence and total concentrations of ions, their mobility and valence. The studied reservoir showed the EC values ranging from 859 - 2910 µmhos/cm. higher conductivity values reflect on water body's tropic level as well as their pollution status (Rawson, 1956).

Total Alkalinity

The acid neutralizing capacity of water is measured as total alkalinity. Majorly, alkalinity in natural waters is caused by carbonates and bicarbonates along with hydroxides in association with the pH values of water. Present study exhibited total alkalinity values between 213 mg/L to 441 mg/L, which is within the permissible limit of 600 mg/L according to IS. Estimating values of total alkalinity make way for application of proper required water treatment procedures for issues like softening, coagulation or operational control of anaerobic digestion by dosing appropriate chemicals (NEERI, 1988).

Total Hardness

The measure of polyvalent cations in water is its total hardness. The total hardness of the collected water samples during the study ranged from 100 mg/L to 200 mg/L. As per the IS the permissible limit of total hardness is 600 mg/L. Here the values of total hardness was found to be within the limits, however, higher levels of water hardness can lead to various adverse health conditions like heart diseases and kidney stone formations in humans (Freeda Gnana Rani *et al.,* 2003).

TDS

Total Dissolved Solids are nothing but the unfilterable solids which end up as remnants post the evaporation process. The present study showed the TDS values to be ranging between 525 mg/L to 1905 mg/L, which is within the permissible limit of 2000mg/L by IS. Water with higher TDS value is known to be of lesser palatability and induces unfavourable physiological conditions like constipation or laxative effects (Kumaraswamy, 1989).

Calcium

Excessive calcium content can prove fatal (Dasgupta and Purohit, 2001) Calcium in the study area ranges from 19-53 mg/L, the lowest was found at station-3 in the month of August and highest at station-1 in September. According to IS the permissible limit of Calcium being 200 mg/L, our study exhibits the calcium content value to be lower than the permissible limit.

Chloride

Chloride can prove to be an essential anion as it is one of the parameter to estimate the total salinity of water. The permissible limit for chloride is 2000 mg/L as mentioned by IS, the reservoir had chloride content within the permissible limits as the highest level to be detected was 365 mg/L in the month of September as a result of raining and lowest being 122 mg/L in December.

Flouride

Estimation of fluoride content in water samples is important as it concerns with human bone development. The permissible limit for fluoride being 1.5 mg/L, if it exceeds 3.0 mg/L it happens to cause conditions like skeletal and non-skeletal fluorosis (Park, 1997). In this reservoir the highest and lowest

levels of fluoride were found to be as 1.4 and 0.02h/L respectively.

Nitrate

It is a resultant product derived from the aerobic decomposition of organic nitrogenous matter in natural waters. As excessive nitrate levels indicate eutrophication, it is essential to determine its levels in water samples. Here, it was observed that the nitrate contents were ranging between 7 to 35 mg/L, the required acceptable limit given by IS being 45 mg/L it can be clearly inferred that the nitrate levels were within the required limits.

Sulphate

Sulphate ions are usually found in natural waters. High sulphate contents are associated with respiratory illness and also said to cause diarrhoea in humans. The mentioned required acceptable limits by IS for sulphate is 200 mg/L and in the reservoir the highest and lowest levels were tested to be in the range of 19 to 90 mg/L. Hence, it is clear that the highest value for sulphate observed here is way below that the required acceptable limit.

Conclusion

Interpretations of the procured data reveals that the water from the reservoir is very alkaline due to its elevated pH, it is highly turbid and also holds considerable values of EC owing to its dead storage over the years. Though slight reduction in the pH values were observed during the months of August to October due to very light showers received in the study area, it was still remarked that the pH values continued to be on the basic range as seen in Fig. 1. The turbidity and EC values of water at the same time were exhibiting a high peak as shown in Fig. 1 b & c and it can be inferred that the water bodies tend to go through a turnover process during rainfalls owing to which the sediments containing various salts and ions might have come into play contributing to the higher EC and turbidity of water. Though the overall analysis of the investigation conducted discloses that the other parameters analysed such as TDS, total alkalinity and hardness along with calcium, chloride, fluoride, nitrate and sulphate remain within the permissible limits. But, the high elevations in the vital parameters like pH, turbidity and EC of water clarifies its non-potability. Hence, it can be concluded that the water from the Boranakanive reservoir is unfit for direct consumption by humans.

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