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Monitoring and Assessment of Water Quality of Iril River, Manipur, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The present study can be concluded that the analysis of the physio chemical parameters of Iril River revealed that most of the values are within the permissible limit of water quality standards. Water quality is suitable as per Standards norm of BIS and CPCB based on the determined values of pH, EC, TDS, DO, BOD, Chloride, Total Hardness, Total Alkalinity and Sulphate was monitored during the period of January 2023 to May 2023. The value of water pH recorded between 7.4- 8.34, EC ranged between 179.6 ms/cm-254 ms/cm, TDS ranged between 90.2 mg/l-126.8 mg/l, dissolved oxygen between 6.0-7.7 mg/l, BOD between 3.0 mg/l-3.9 mg/l, chloride between 28.9 mg/l-36.9 mg/l, total hardness between 112mg/l-170 mg/l, total alkalinity between 115 mg/l-174 mg/l and sulphate between 14.4 mg/l-39.3 mg/l. Hence, these rivers and hold to provide uninterrupted supply of drinking water to Iril River of Manipur without any major treatment.

Keywords: Physio-chemical; Iril River; water quality; pollution.

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1. INTRODUCTION

Water is the prime natural resource. Water is the first need of all vital life processes, hence called "Liquid of Life." According to Greek medieval philosophy, matter consists of four elementary substances namely water, air, stone, and fire. Indian medieval also opines that the matter is composed of five Panch Mahabhut (Five elementary substances) namely water, air, light (fire), earth (stone) and sky (space). Among the all-known plants only earth is blessed by these all five elements [1].

Iril river with its basin lying between the Latitude 24°40'N to 25°25'N and the Longitude 93°55'E to 94°20'E passes mainly through sub-urban areas of Imphal-east district suffer pollution due to urbanization and agricultural runoff, domestic waste, municipal waste, sewage and over fishing into the river. The wastes running through the water may be hazardous and infectious (Jameel, 1998). The total length of the Iril river from its head to the point of its confluence with the Imphal River is 144.5 km. The river originates from the south eastern slope of Hougdu Ching range in Ukhrul district at a height of 2473 m above MSL and flows through the hill tract of Ukhrul and Senapati districts and descends to the almost tracts of Imphal and Thoubal districts in the Manipur valley. It debounces its water into Manipur River (known as Imphal river in its upper past before it confluence with Khuga river) a tributary of the Chindwin-Irrawady system [2].

Many of the major problems that humanity is facing in the twenty-first century are related to water quantity and/or water quality issues. These problems are going to be more aggravated in the future by climate change, resulting in higher water temperatures, melting of glaciers, and an intensification of the water cycle, with potentially more floods and droughts. With respect to human health, the most direct and most severe impact is the lack of improved sanitation, and related to it is the lack of safe drinking water, which currently affects more than a third of the people in the world [3].

Water quality is defined in terms of the chemical, physical and biological contents of water. The water quality of rivers and lakes changes with the seasons and geographic areas, even when there is no pollution present. Water quality guidelines provide basic scientific information about water quality parameters and ecologically relevant toxicological threshold values to protect specific water uses. Important physical and chemical parameters influencing the aquatic environment are temperature, rainfall, pH, salinity, dissolved oxygen, and carbon dioxide. Others are total suspended and dissolved solid, total alkalinity and acidity and heavy metal contaminates [4].

The aim of the study is to analyzed physio-chemical properties of water of Iril River of Manipur. Iril River is one of the main sources of water for the people of Manipur. It has a large population of endangered indigenous fish called Ngaton and Meitei Sareng.

2. MATERIALS AND METHODS

The experiment was conducted during month of January to May 2023 at 10 different sites of Iril River, the name of sites are Sawombung (S1), Kangla (S2), Moirang Kampu (S3),Top Khongnangkhong (S4), Naharup (S5), Bamon Kampu (S6), Irilbung (S7), Keirao (S8), Arapti (S9) and Lilong (S10) respectively are given in the Table: 1. The samples was collected thrice in a month and collected in the morning hours

Table 1. Location details of sampling site, distance, and population at different site

Site Notation	Site	Distance from S1	Latitude & Longitude	Population as per 2021 census
S1	Sawombung	0	24.8727° N, 94.0146° E	111,287
S2	Kangla	3.6	24.8459° N, 93.9934° E	2075
S3	Moirang Kampu	11.6	24.7959° N, 93.9808° E	1626
S4	Top Khongnangkhong	13.6	24.8097° N, 93.9591° E	2474
S5	Naharup	15.6	24.7584° N, 93.9687° E	2394
S6	Bamon Kampu	19.5	24.7706° N, 93.9772° E	3401
S7	Irilbung	21.4	24.8063° N, 93.9481° E	1014
S8	Keirao	24.7	24.7479° N, 93.9796° E	6489
S9	Arapti	28.9	24.6908° N, 93.9483° E	1824
S10	Lilong	30.2	24.6821° N, 93.9452° E	34,100

between 5 am to 11am, in clean plastic bottles without any air bubbles and closed tightly after collection and labeled in the field and preserved for physio-chemical analysis in laboratory. The water sample was immediately be brought into the laboratory for the estimation of all the physio chemical analysed in the laboratory of Directorate of Environment and Climate Change, Government of Manipur. All the parameters were analysed as per the standards method of APHA/AWWA (1991).

2.1 Sampling Sites

The river water samples were collected at different site starting from Site1 at reference sites and covered upto to river stretch 30.2km and details of population near by the river stretch also given in the tabular form in Table 1.

2.2 Map of Study Area

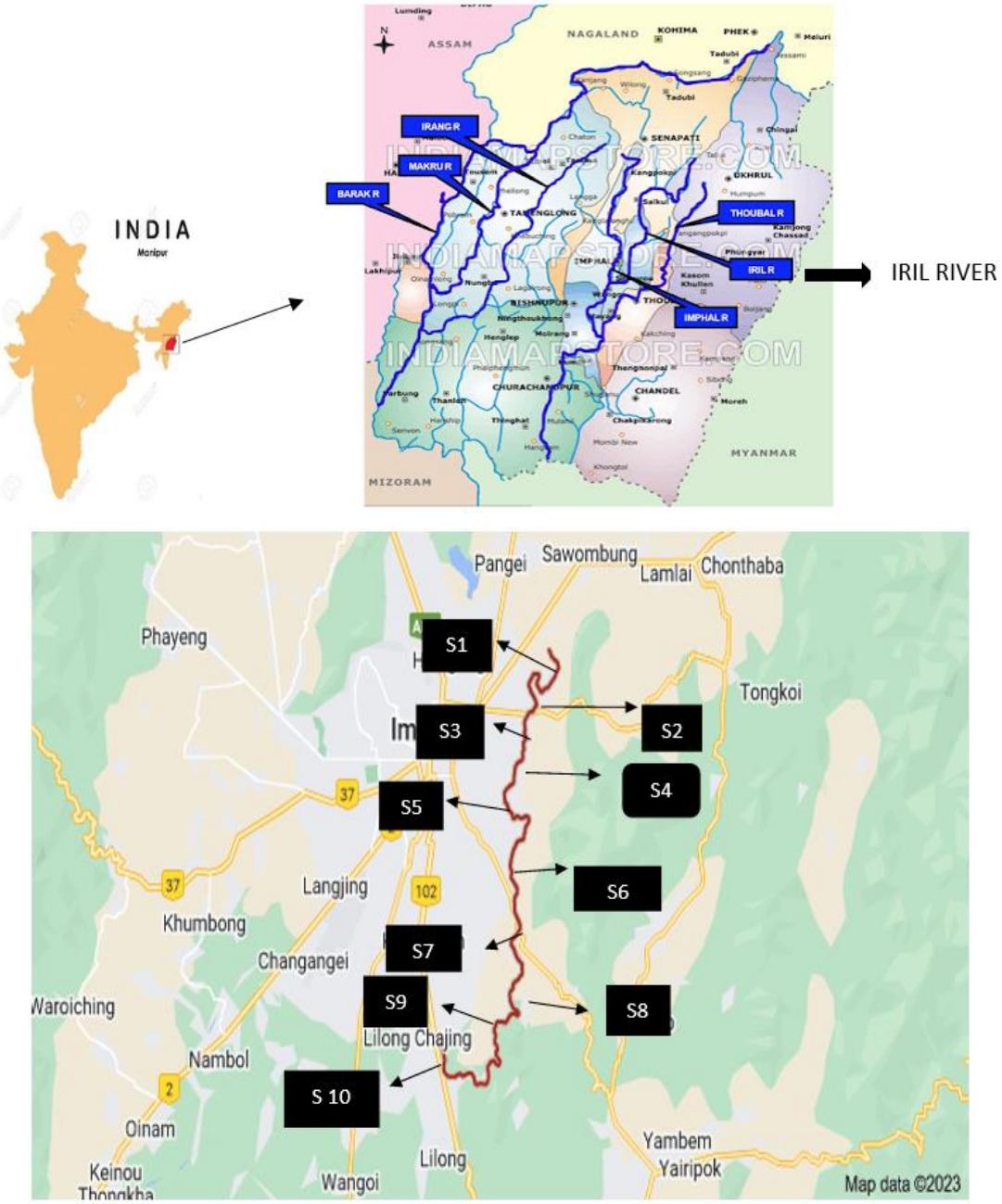

Fig. 1. Map of the study area along with sampling sites

Table 2. Water parameters analysed

S.No	Parameter	Methods
1	pH	Digital pH meter (Jackson,1958)
2	EC (Ms/cm)	Digital conductivity meter (Jackson,1958)
3	Total Dissolved Solid(mg/l)	TDS Meter (Trivedi and Goel,1984)
4	DO (mg/l)	Winker method (Trevedi and Goel, 1984)
5	BOD (mg/L)	Winker method (Trevadi and Goel, 1984)
6	Chloride(mg/l)	Argentometric method (MC Farland,1983)
7	Total Hardness (mg/l)	Tritration Method (Moser, 1976)
8	Total Alkalinity(mEq/l)	Tritration Method (Moser, 1976)
9	Sulphate (mg/l as SO_4)	AAS (Alan Walsh, 1950s to 1960s)

3. RESULTS AND DISCUSSION

The results of physio-chemical parameters of the Iril River are given in the Table 2. The value of water pH recorded between 7.4- 8.34, EC ranged between 179.6 ms/cm-254 ms/cm, TDS ranged between 90.2 mg/l-126.8 mg/l, dissolved oxygen between 6.0-7.7 mg/l, BOD ranged between 3.0 mg/l-3.9 mg/l. Chloride ranged between 28.9 mg/l-36.9 mg/l, total hardness ranged between 112mg/l-170 mg/l, total alkalinity ranges between 115 mg/l-174 mg/l and sulphate ranged between 14.4 mg/l-39.3 mg/l.

pH: pH is a measure of how acidic/basic water is a measure of the hydrogen ion concentration. pH during study period ranged from 7.4- 8.34. The maximum value of 8.34 was recorded at Irilbung (S7) during the month of February. The value recorded is within BIS/CPCB standard and which was alkaline in nature. The minimum value of 7.4 recorded at Keirao (S8) in January. The pH value ranges from 6.5 – 8.5 are prescribed for drinking and pH ranges from 6.5 – 9.0 are most suitable for fish production as proposed by BIS [5].

Electrical Conductivity: The EC is a measurement of capacity of water to transmit electric current in water bodies. EC during study period ranged between 179.6 ms/cm-254 ms/cm. The maximum EC was 254 ms/cm recorded at Lilong (S10) during the month of March and minimum was recorded 179.6 ms/cm at Top Khongnangkhong (S4) during the month of January 2023. The EC value of all the sites of Iril River were under the permissible limit given by the Standards. Other all the reference that the value of conductivity higher in the mouth of rainy season due to higher value of dissolved solids**.** [6].

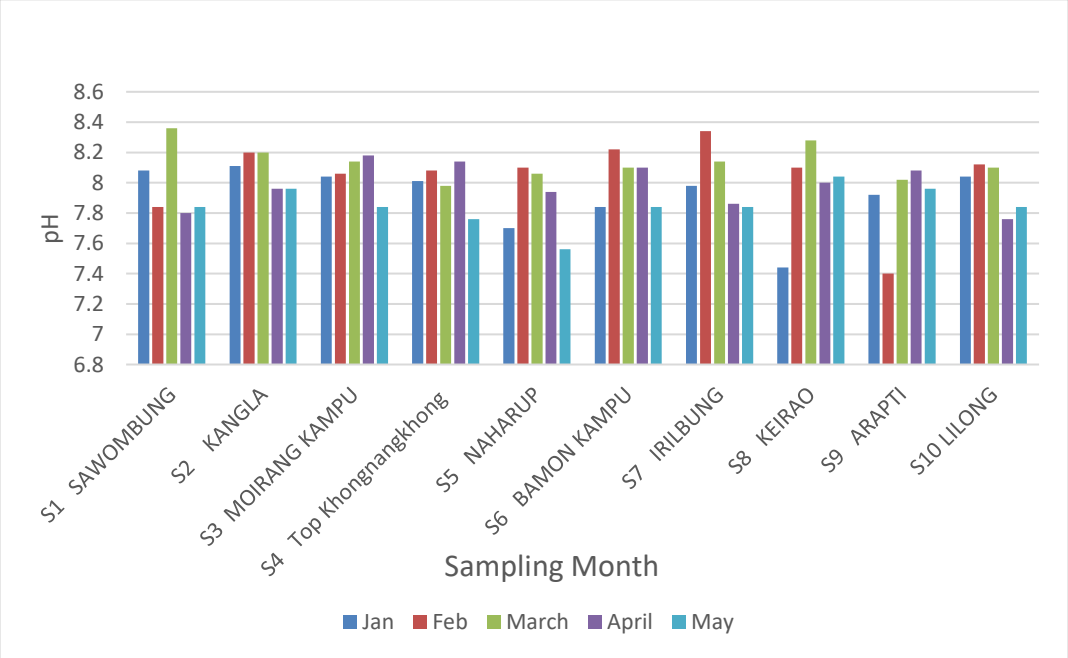

Fig. 2. pH value at different sites of Iril River during sampling months

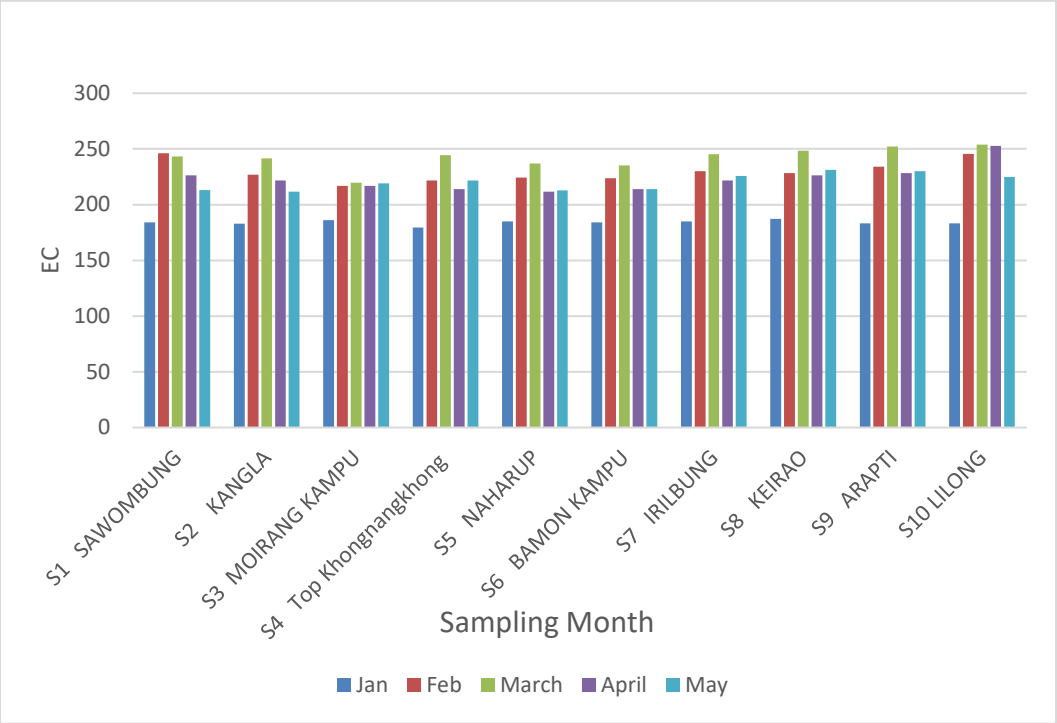

Fig. 3. EC (ms/cm) of Iril River at different sites of month

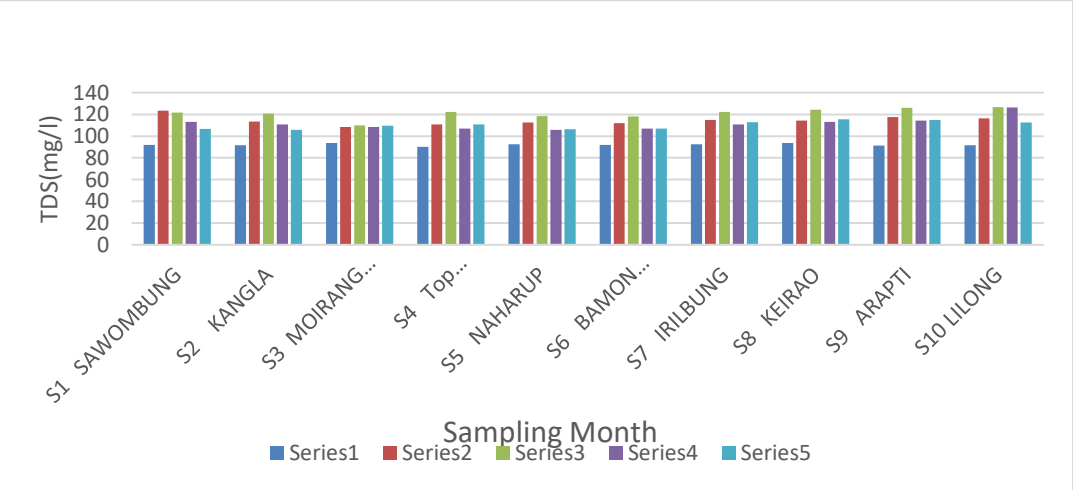

Fig. 4. TDS (mg/l) of Iril River at different sites of month

Total Dissolved Solids: Total dissolved solids are the term used to describe the inorganic salts and small amounts of organic matter present in the water. TDS value during investigation period was ranged between 90.2 mg/l-126.8 mg/l. The maximum TDS was recorded at 126.8 mg/l at Lilong (S10) during month of March and minimum was observed at 90.2 mg/l at site Top Khongnangkhong (S4) during the month of January. The TDS value of all the sites of Iril River were under the permissible limit. The palatability of drinking water with a TDS level less than 600 mg/L is generally considered to be good [7].

Dissolved oxygen: The DO content in the water body indicates the physical and biological processes prevailing in the water and is very important because it directly affect the survival and distribution of flora and fauna in an ecosystem. The dissolved oxygen value during investigation period was observed between 6.0 to 7.7 mg/l. The maximum value was recorded at site Bamon Kampu (S6) during the month of

March and minimum value was observed at Moirang Kampu (S3) and Top Khongnangkhong (S4) during the month of April. Other author reference that the highest value of dissolved oxygen in the river may due to heavy rainfall and few of water [5].

Biochemical Oxygen Demand (BOD_3): BOD value was recorded between 3.0 mg/l-3.9 mg/l during the study periods. The maximum BOD_3 was observed 3.95 mg/l at site Moirang Kampu (S3) during the month of April, Bamon Kampu (S6) and Irilbung (S7) during the month of May and minimum was 3.04 mg/l recorded at Kangla (S2) during the month of April. The BOD_3 value of all the sites of Iril River were under the permissible limit. The variation of BOD value due to domestic waste water discharge into the river affect the quality of water. The similar result was found by the author Singh et al. [8].

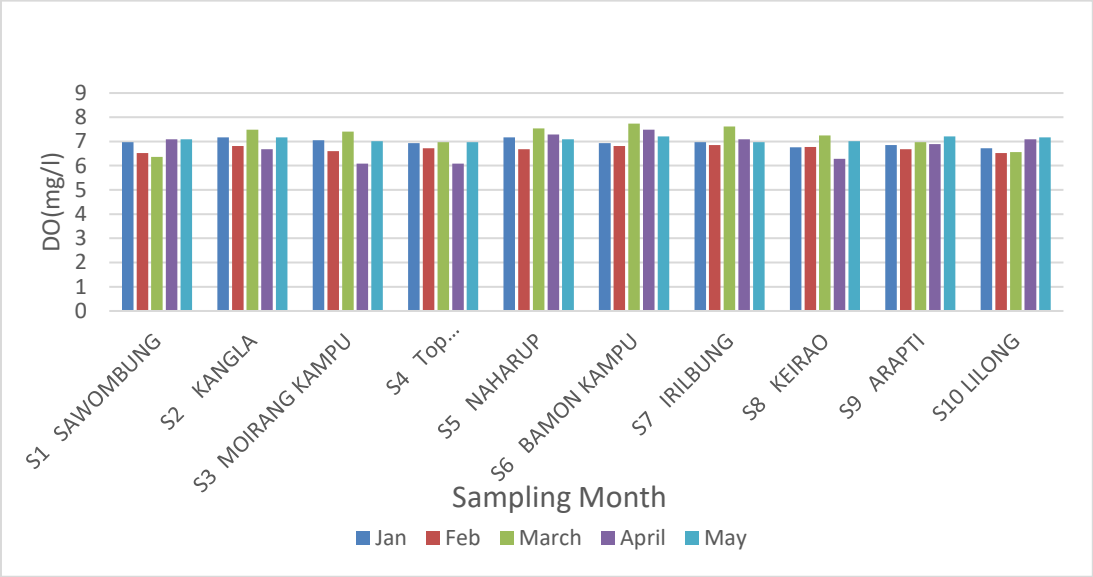

Fig. 5. DO of Iril River at different sites of month

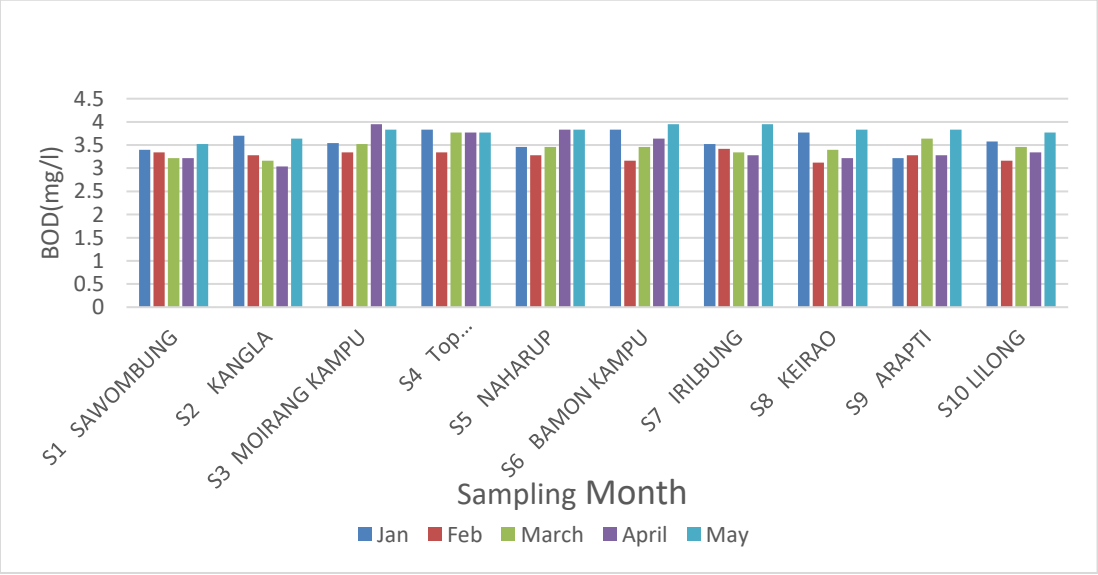

Fig. 6. BOD_3 of Iril River at different sites of month

Chloride: The value of chloride during estimation period ranged between 28.9 mg/l-36.9 mg/l. Chloride in water also act as an indicator of pollution by sewage. Higher value of chloride was recorded in Lilong (S10) during month of March and lower value of chloride was recorded in Bamon Kampu (S6) during the month of April, which may be due to high domestic sewage discharge at river water. The chloride concentration in the river water below 250mg/l and safe for uses and fall under the permissible limit. Similar finding was also reported by [9].

Total Hardness: Total hardness of water is generally caused by the nutrients like calcium and magnesium ions present in water. During study period the total hardness of water was estimated between 112mg/l-170 mg/l. The maximum value was recorded at Lilong (S10) during the month of March and minimum was recorded at Naharup (S5) during month of May. The value was non-uniform throughout the season. Similar result was conducted by another author [8,10,11].

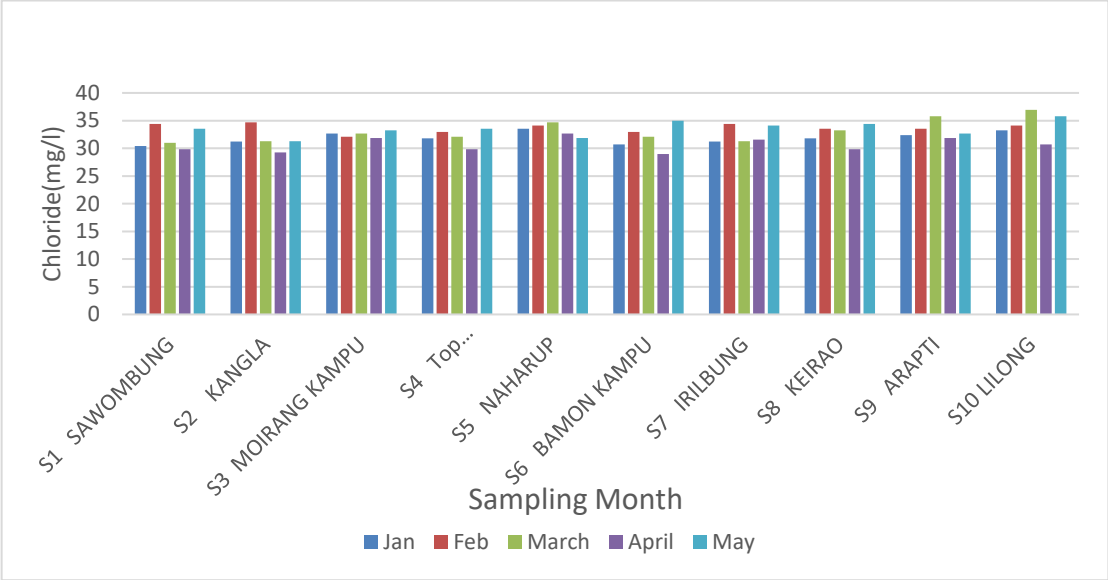

Fig. 7. Chloride of Iril River at different sites of month

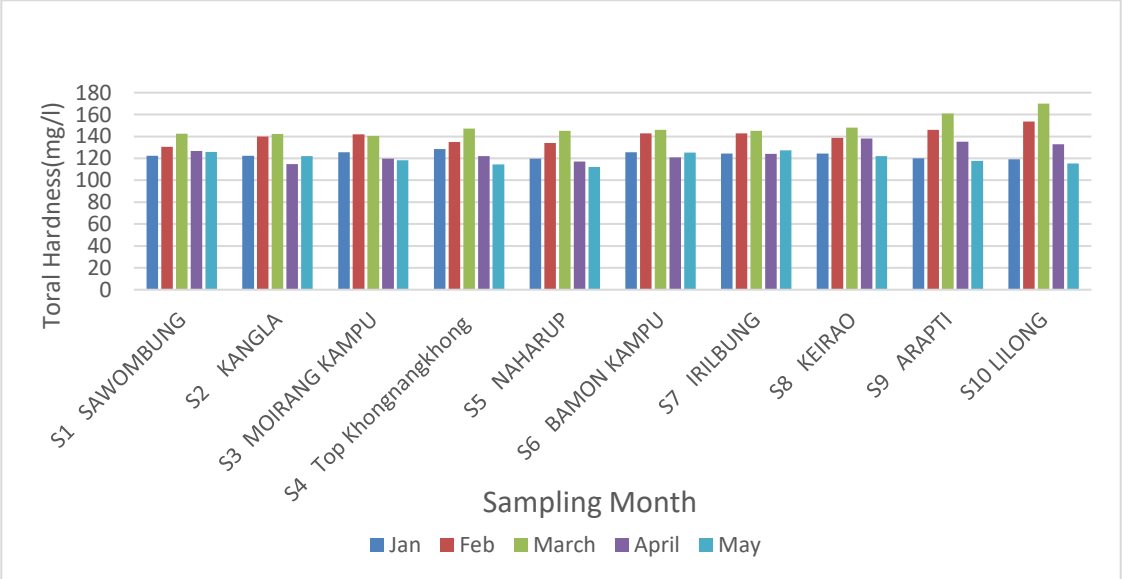

Fig. 8. Total Hardness of Iril River at different sites of month

Total Alkanity: The total alkalinity of water neutralized a strong acid which may be due to presence of carbonates, hydroxide and bicarbonates. The value of alkalinity during the study period was ranged between 115 mg/l-174 mg/l. The maximum value was recorded at Kangla (S2) in March may be due to sewage decomposition and use of detergent by the surrounding and minimum value was recorded at Naharup (S5) and Bamon Kampu (S6) itself in January. Higher Alkalinity was possible due to greater human activities including washing and bathing [12]. revealed that the concentrations of total alkalinity were observed higher in the pre-monsoon.

Sulphate: The value of sulphate during study period was between 14.4 mg/l-39.3 mg/l. The maximum sulphate was 39.3 mg/l recorded at Sawombung (S1) during the month of May and the minimum was 14.4 mg/l recorded at Arapti (S9) during month of January. The sulphate value of all the sites of Iril River were under the permissible limit given by BIS and CPCB [8,13] found concentration of sulphate were low during monsoon and higher during pre-monsoon [14-18].

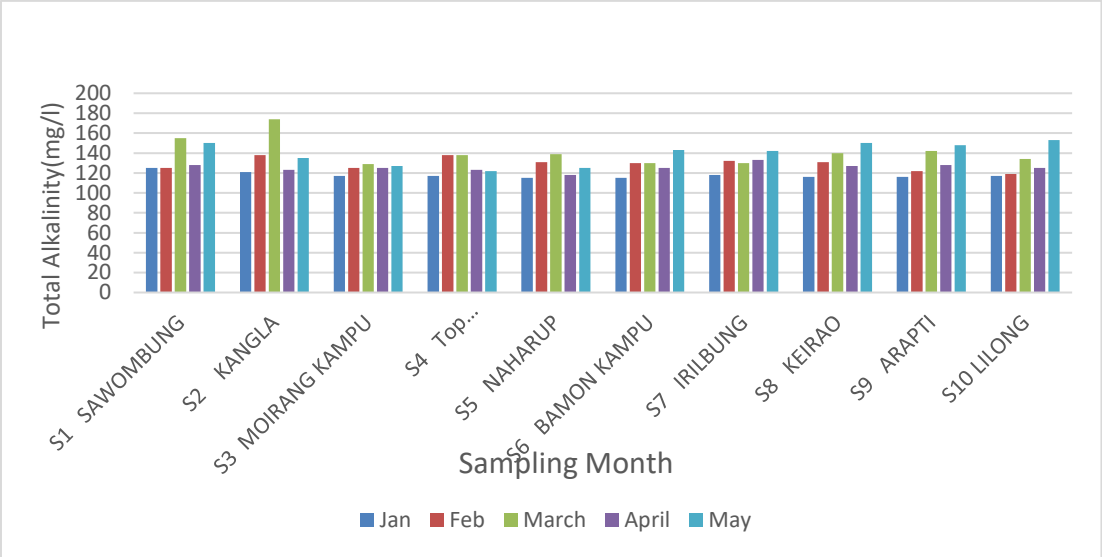

Fig. 9. Total Alkalinity of Iril River at different sites of month

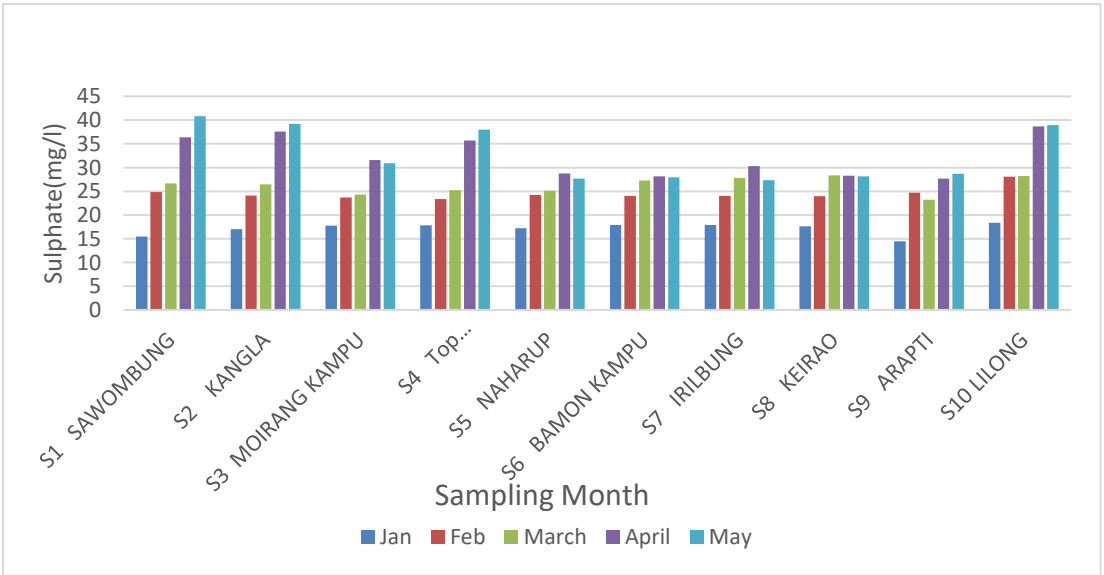

Fig. 10. Sulphate of Iril River at different sites of month

4. CONCLUSIONS

All the parameters are under the acceptable limit. The present study can be concluded that the analysis of the physio chemical parameters of Iril River revealed that most of the values are within the permissible limit of water quality standards. Water quality is suitable as per Standards norm of BIS and CPCB.

The water quality is suitable for drinking and aquacultures activities. Even though the water quality manageable for fish culture, the quality of the water is degrading gradually due to the anthropogenic activities of the human population. There is need to monitor periodically in order to maintain the changes in the water system as the anthropogenic activities is increasing day by day. So, the State Government and other NGOs must address the issue in time to prevent further degradation of the river.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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