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Seasonal Variations on physico- Chemical Parameters of Thoubal River, Manipur

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ABSTRACT

In the present study the physico-chemical parameters such as Water Temperature, pH, Alkalinity, Turbidity, Free CO_2, Dissolve Oxygen, Total Hardness, Calcium, Magnesium, Sodium, Potassium, and Chloride of Thoubal river water were analysed from Jan 2016 to Dec, 2017. The water Temperature of the River ranged between 15^{o}C-26.3^{o}C with an average of 21.8^{o}C; pH ranged between 7.3-8.2 (7.6); Alkalinity 19.2 – 176 mg/l (148.8 mg/l); Free CO_2 2.3-7.6 mg/l (3.6 mg/l); DO 8.3-13.68 mg/l (10.8 mg/l); Turbidity 0- 609.9 (315.2); Total hardness 17.2 – 85.2 mg/l(71.5mg/l); Calcium 13.76 -22.4 mg/l (18.9mg/l); Magnesium 2.16- 16.46 mg/l (12.4mg/l); Sodium 10.6–15.06 mg/l (12.1mg/l); Potassium 1.46-2.3 mg/l (1.9mg/l); Chloride 0-47.98 mg/l (26.5mg/l) respectively. The concentrations of physico-chemical parameters were within the permissible limits of WHO except dissolved oxygen. The river water is suitable for drinking, best for the growth of plankton population and good for fish growth and productivity**.** The study also reveals that the water quality changes as the seasonal changes and anthropogenic activities of the surrounding environment. Therefore, to maintain the water ecosystem regular survey and organise awareness program by concerned authority is needed.

KEYWORDS: Physico-Chemical, Thoubal River, Anthropogenic, Environment.

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INTRODUCTION

The water quality depends on the chemical, physical and biological properties of water. The changes of seasons and geographical area the water quality also changes. The current speed is a key factor of organisms living in river water. The speed gradually decreases from upstream to downstream of the river. Normally, the water parameters of upstream and downstream are different[1]. It inhabits variety of aquatic organisms such as microscopic plankton, aquatic plants, large aquatic animals, fishes etc. A certain mass of water stay about ten days in the atmosphere, it will remains few weak in the rivers and reside years or centuries in lakes and several centuries in ground water[2]. Fish health and management of other biodiversity are practical applications of limnology and aquaculture environment[3]. It is important to study the interrelationship between the physico-chemical aspects and phyto-zooplankton and effect of agricultural effluent on the biota.

Due to the rapid growth of population and industrialization the consumption and demand of fresh water is increasing. As water demand increases the water pollution is also increasing day by day in our environment. Depletion and pollution of water leads to endanger of human health, aquatic biodiversity and surrounding environment. Human health is threatened by most of the agricultural development activities particularly in relation to excessive application of fertilizers and unsanitary conditions[4]. The water quality describe the condition of water, including its chemical, physical and biological characteristics, usually with respect to its suitability for a particular purpose i.e., drinking, household activities and fishing etc[5,6,7].

METHODOLOGY

The present study, the water samples were collected from five different site of Thoubal River and were analysed for every month. The parameters like pH, Dissolved oxygen, free carbondioxide, water temperature, transparency or turbidity and total alkalinity, total hardness were studied. The nutrients contents like Na, Ca, Mg, K and Cl were study. The water temperature of the surface water was measured by maximum and minimum thermometer. The pH of water was detected by P^H meter (Systronics) or with litmus paper. The transparency or turbidity of water was measured by using Sacchi disc of 20 cm diameter or with microprocessors turbidity meter (Systronics). DO_2 concentration was determined by following Winkler's methods and azide modification[8]. Free CO_2 content in water was estimated by titration method[8] with Sodium carbonate to form Sodium bicarbonate. Determination of total alkalinity was estimated by titration method with Sulphuric acid. The elements like Ca, Mg and Chloride was detected by titration method[8]. Sodium and Potassium was detected by Flame Photometer.

STUDY SITE

In the present study of Thoubal River, the river is one of the important water ways in the valley of Manipur. The Thoubal River originates in the hill range of Ukhrul and is an important tributary of Imphal River. The river passes through Yairipok and Thoubal before joining the Imphal River at Irong near Mayang Imphal and finally flow to Manipur River. Thoubal district is another thickly populated municipal area of the state. People surrounded the Thoubal river mostly consumes water for all most all the house-whole activities. Not only consuming water they also used to throw the solid as well as liquid garbage's on the river bank so the river is becoming polluted day by day due to irresponsibility and unaware. The sampling sites are given below on table no. 1 and figure no.1.

Table 1: Study sites of Thoubal River

Sl. No.	Thoubal River	Latitude	Longitude
1	Kiyam Khonghanbi (Site I)	24˚39′38.5″N	93˚58′17.6″E
2	Thoubal Wangmataba Parking (Site II)	24˚38′44.2″N	93˚59′46.5″E
3	Thoubal Achouba (Site III)	24˚38′35.1″N	93˚59′44.3″E
4	Thoubal Khekman (Site IV)	24˚38″44.2″N	93˚57′04.9″E
5	Thoubal Wangmataba (Site V)	24˚38.50.6″N	93˚59′56.7″E

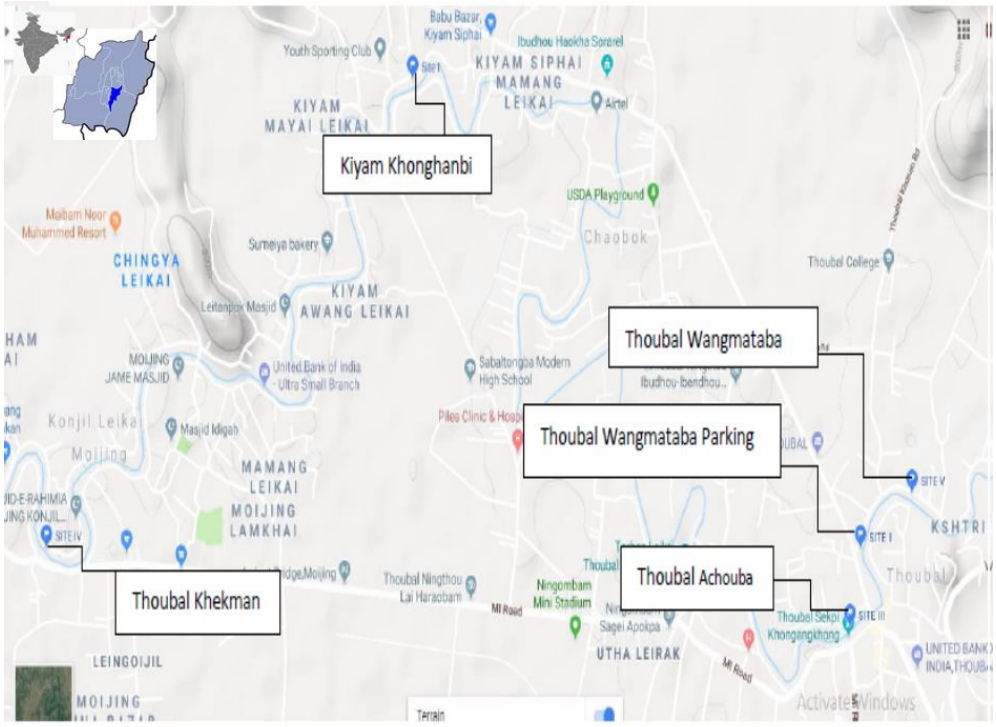

Fig 1: Demography of sampling site of Thoubal River

RESULT AND DISCUSSION

Water temperature

The results of the study were given below at table number 2 and 3. In the present study the temperature ranged from 15^0C -26.3 ^{0}C with an average of 21.8^0C. During January 2017 the temperature was recorded 15^0C which may be due to winter season and the attribution into the different depth of the river and presence of bmacrophytes in the water bodies[9]. It affects the metabolic activities, growth, reproduction, distribution and migratory behaviours of aquatic organisms[10, 11, 12].

P^H

The ranged of P^H during the study period was from 7.3- 8.2 with an average of 7.6. It is indicating the alkalinity nature throughout the study period. The higher range of P^H indicates high productivity of water[13].P^H value below 7 and above 8.5 is not suitable for the aquatic organisms[14].

Table 2: Elements of Thoubal River

Month	Total Hardness	Calcium	Magnesium	Sodium	Potassium	Chloride
Jan-Mar 2016	85.2	17.6	16.46	15.06	2.18	47.98
April-June	17.2	13.76	2.16	12.78	2.3	nil
Jul-Sept	79	20.84	13.8	11.72	2.1	36.78
Oct-Dec	83.2	22.4	14.78	11.12	2	26.06
Jan-Mar 2017	72.8	18.17	13.15	11.76	1.92	15.05
April-June	71.2	15.78	12.14	12	1.46	28.16
Jul-Sept	79.2	21.08	13.92	12.22	1.78	34.02
Oct-Dec	84.6	21.72	13.38	10.6	1.98	24.2

Alkalinity

The value of alkalinity ranged from 91.2-170 mg/l with an average of 148.4 mg/l was found during study period. The high alkalinity may be due to high concentration of domestic sewage. The alkalinity between 30 – 500 mg/l is generally acceptable to fish and shrimp production[15,16,].

Free CO_2

During the study period the value of Free CO_2 was ranged 2.3-7.6 mg/l with an average of 3.6 mg/l. The maximum was recoded on January 2016 which may be due decrease in photosynthetic activity and high rate of respiration by aquatic organisms and addition of drainage[17,18]. Free CO2 is essential to water plant's growth. It is the basic carbon source from which plant produced sugar and more complex organic matter. When CO2 reacts with H2O it forms carbonic acid.

Dissolved Oxygen

Dissolved Oxygen during the study period was ranged from 8.3-13.68 mg/l with an average of 10.8 mg/l. The highest value of was found during the month of January 2016 which may be due to high photosynthetic rate, clear weather and monsoon rain. The increase in DO_2 concentration in winter and autumn may be due to the fall in water temperature and phytoplankton blooming[19]. The depletion of DO_2 depends on the waste added, the size, velocity and turbulence of the stream and temperature of the water[20].

Turbidity

The value of turbidity ranged from 0-609.9 with an average of 315.2. During winter season the turbidity remains almost zero while higher value was due to mass carry down of slit, clay and suspended solid particles in the Thoubal River may be due to Dam construction at Maphou area (Maphou Dam). But in winter, water actually settles down all the sediment and turbidity value remains low. Low value of transparency disturbed the normal exchange of oxygen and carbondioxide and consequently inhabiting in photosynthesis of phytoplankton[17].

Total hardness

The total hardness ranged from 17.2-85.2 mg/l and with an average of 71.5 mg/l. The value may be due to present of salt and anthropogenic activities as farming[21]. The higher amount of calcium and magnesium present in water has high total hardness. The recommended hardness for fish culture is at least a range of 30-180 mg/L. The principal hardness-causing cations are the divalent calcium, magnesium, strontium, ferrous iron and manganous ions[22].

Calcium

The value of Ca during study period was 13.76-22.4 mg/l and an average of 18.9 mg/l. similar value of 4.80-25.0 mg/l were recorded in Ikpoba River [23] and value of 0.40-19.24 mg/l was also recorded in Utro River[24]. Fish can absorb Ca either from water or from food. For fish culture the recommended range of Ca is between 25-100 mg/l. most important divalent salt in fish culture. Calcium and Magnesium are always related to hardness of water and essential for metabolic process in living beings.

Magnesium

The value of Mg ranged from 2-16.46 mg/l and an average of 12.4 mg/l. due to climate and seasonal variations, different biogeochemical activities in water, human activities, water used and addition of surface run-off from agricultural and other catchment area[25]. The upper limit of calcium magnesium concentration for drinking water is specified as 75 mg/l and to 50 mg/l (WHO, 1984)[26]. For fish culture the recommended range of Ca is between 25-100 mg/L.

Table 3: Physico-chemical properties of Thoubal River

Month	Temperature ^{0}C	Free CO_2 mg/l	DO_2 mg/l	Alkalinity mg/l	pH	Turbidity
Jan-16	20.5	7.6	13.68	169	8.2	nil
February	20.8	4.2	12.8	147	8	nil
March	21.7	4.2	12.2	153	8	88
April	22.6	4.04	12.7	143	7.8	137.2
May	21.56	4.68	11.76	96	7.5	348.8
June	22.14	7.24	10.16	91.2	7.5	588
July	20.38	3.26	10.56	159.6	7.8	607
August	25.9	3.5	10.8	163	7.6	592
September	26.3	4	11.36	172	7.6	455
October	22.94	4	11.58	176	7.7	345
November	20	3.5	13	170	7.6	280
December	17.8	2.8	12	148	7.5	184
Jan-17	15	2.3	12.12	138	7.3	206
February	16.54	2.8	12.46	143.2	7.4	164.8
March	20	3.08	10.5	141	7.4	184
April	21.44	2.92	9.92	137.4	7.6	199.6
May	23.88	2.76	8.96	137	7.5	297.6
June	25.56	3.12	8.36	159.6	7.7	370
July	24.66	3.24	8.68	164	7.7	557.2
August	25.98	2.84	8.34	163.4	7.5	609.4
September	24.94	2.64	8.3	163.2	7.6	526
October	24.3	2.88	9	143.4	7.9	415
November	19.4	2.5	9.46	147	7.4	267
December	19.18	3.32	10.88	141	7.6	144.2

Sodium

Na ranged from 10.6-15.06 mg/l and an average of 12.1 mg/l. Depending on geographical area Na in water contain less than 1 mg/l or may exceed 300 mg/l. According to National Academy of Science, the high concentrations of sodium can be related to cardiovascular diseases and in women toxaemia associated with pregnancy. The salts of Na are highly soluble in water and impact softness. Many industrial waste and sewage are rich in sodium and increases its concentration after disposal.

Potassium

Potassium value ranged from 1.46-2.3mg/l with an average of 1.9mg/l. The K was within the permissible limit of WHO. Potassium is found freely in nature and is insoluble mineral. It found lower as compared to Ca, Mg and Na concentrations during the study period. The higher value of K in the late winter and in the early summer may be due to decomposition and rapid turnover of the potassium through nutrients cycle. The potassium content in water is mainly due to use of potash fertilizer and is abundant in animal waste. The main source of potassium is weathering of rock and the quantity increases with the increase of pollution in water.

Chloride

Chlorides occur naturally in all types of water. The Chloride concentration ranged from 0-47.98 mg/l and an average of 26.5 mg/l. The maximum was found in the month of Jan-Mar 16. The permissible limit of Cl for drinking water is 250 mg/l. Chloride increases with the increase in eutrophication. The permissible limit of chloride in drinking water is 250 mg/L WHO[26]. Chlorides are troublesome in irrigation water and also harmful to aquatic life[27].

CONCLUSION

The above data obtained clearly shows that it support aquatic biodiversity. The various physico-chemical parameters of Thoubal River lie within the permissible limit of WHO except dissolved oxygen. This shows the condition of the River is becoming unhealthy through the effects of anthropogenic activities exist. So, the aquatic living things which are important to mankind may find difficult and many other species which may causes toxicity may evolved. In-order to maintain the river eco- system the state Government or concerned department should take-up conservative programs of Thoubal River.

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