

Study of Micro – Nutrients and Secondary Elements of Sediment Soil of Lakhota Lake, Jamnagar, Gujarat (INDIA)

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Abstract: This study deals with the determination of various characteristics of micro nutrients and secondary elements of soil sample existing in the Lakhota Lake. Soil samples collected from different locations of the Lakhota Lake and were analyzed for their micro nutrients (copper, iron, manganese and zinc) nutrients and secondary elements (calcium, magnesium and sulphur). The soil of Lake containing all the above mentioned micro nutrients and secondary elements affects the productivity of the Lake. This paper deals to study the effects of these nutrients and elements on the water of lake and also its effects on the aquatic plants and animals. The soil samples were collected from the Lake in every month during the study year from January 2012 to December 2012.

Keywords: micro nutrients, secondary elements and Lakhota Lake.

Introduction

The Lakhota lake is a lake in Jamnagar built by Jam Ranjit Sinhji, the Ruler princely of Jamnagar, Saurashtra, Gujarat, India. We can also say Lakhota Lake is the Heart of the Jamnagar City. Ponds represent the smallest lentic fresh water system, unlike the lakes and reservoirs. [6]. Ponds are temporary water bodies and can be perennial (or) non perennial depending on the source of water. Most of the pond water is stagnant, it is essential to study the characteristics of sediments as the contaminants is bonded either organically (or) inorganically to the sediment.

Anthropogenic activities may cause eutrophication in pond ecosystem. The nutrient enrichment of the fresh water due to surface run off also determines the quality of pond water. Nutrients, trace metals, and synthetic organic compounds from runoff can accumulate in the sediments and biota of receiving waters. In an aquatic environment, sediments have a high contamination capacity especially for trace elements.

Nutrients are continuously being deposited and incorporated in water, sediment and aquatic organisms, and these can't be degraded thus causing metal pollution in water bodies^[8]. Micronutrients (Fe, Mn, Zn, and Cu) are important soil elements that control its fertility. Top soil confine humus, an important food resource for plants, which increase biological activity, soil fertility and control the air and water content of soil.^[15]

The main purpose of this study is to determine the distribution of micro nutrients and secondary elements in perennial pond core sediments, to identify and assess the status with contaminated soil. The present study determines whether the water lying above the contaminated sediments of the selected pond is fit for the aquatic life and also affects the ground water level of the surrounding areas.

2. Materials and Methods"

2.1 Study area

The Lakhota Lake, a artificial lake in Jamnagar city, entirely surrounded by vegetable market and residential area. The different canals of city opens directly into the Lakhota Lake. (Fig.1).

The Jamnagar city experiences a semi-arid climate that has three seasons viz. summer, winter and monsoon. Summers are moderately hot and dry and the monsoon is accompanied by moderate rainfall. The weather condition of the city is that summer temperature ranges between 24 °C to 42 °C, winter temperature ranges between 10 °C to 24 °C. and rainy season stretches from the month of July to the month of September. Location of Lakhota Lake.

Coordinates: 22°27'54" N, 70°03'57" E, Area covered :6 km²

2.2 Selection of Sampling Sites

Sampling points were decided by keeping in mind that the considered sampling points must include shallow and deep regions of the lake, and human activities. For sampling, the samples were collected after digging some centimeters of upper

layer of soil from the part where water is in very little amount in the water body.



Fig. 1: View of Lakhota lake

2.3 Collection of Soil Samples

Soil samples were collected during morning hours (i.e. 9.00 am to 11.00 am) on 3rd Monday of every month throughout the study period from the selected sites to determine the micro - nutrients and secondary elements.

The sediment samples were stored in deep freeze until analysis was performed. One gram of the sample, for metals analysis was dried in an air oven at 80 °C and then made into fine powder using a mortar and pestal.

2.4 Analytical Procedure

Available macro and micronutrients P, K and some trace metals (Fe, Mn, Cu Pb, Ca, Mg and S) were extracted according to the method of DTPA Extraction for Fe, Zn, Cu, Mn and DTPA - Sorbital Extraction for Fe, Zn, Cu, Mn given by DTPA Extraction Method^[7,13].

3. Results and Discussion"

To study the quality of sediments in Lakhota Lake sample were selected depending upon the anthropogenic input and also the catchment sources as it was observed in the study that the lakes are prone to major sources of harmful factors like road runoff, sewage, urban runoff, canals runoff, etc.,^[2] The following metals were analyzed in the lake sediment soil samples like Cu, Mn, Zn, Fe. Also the secondary elements such as Ca, Mg, S were also analyzed.

Iron, Mn, Cu and Zn are most soluble under acid conditions. Organic matter and manure applications affect the immediate and potential availability of micronutrient cations^{[5] [11]}.

Copper (Cu) is the common element that occurs naturally in the environment and spreads throughout the environment and remains for a long period because it settles when it starts to rain Cu compounds bound to either water segment solid particles. Cu

strongly attaches to organic matter and minerals.^[12] The Cu level of soil sediments varied between 8.03 to 11.11 ppm. (Table 1).^[3] had reported that metals deposited in the sediments come out during heavy rainfall and flow into the water system.(Fig. 2)^[3]

Table 1: Micro – nutrients of soil in lakhota lake – Jan-2012 to Dec-2012

Months	Cu (ppm)	Fe (ppm)	Mn (ppm)	Zn (ppm)
January	9.24	13.95	10.92	0.74
February	9.35	14.94	11.53	0.86
March	9.9	10.26	12.91	1.32
April	10.12	12.42	12.39	0.66
May	11.11	16.38	11.63	0.4
June	9.68	20.7	12.94	1.52
July	8.36	16.65	13.32	0.38
August	8.14	16.2	12.94	2.08
September	8.03	20.52	12.97	1.82
October	8.8	14.76	12.23	1.16
November	9.7	18.99	12.9	0.84
December	8.95	14.22	10.03	0.52

Manganese (Mn) is an essential micronutrient and does not occur naturally as a metal in aquatic ecosystems.^[1] Manganese is not a toxic metal, but occurs in the domestic waste waters, canals effluents and thereby enters water bodies. The Mn contents of this soil sediment ranged between 10.03 to 13.32 ppm.(Table 1). Enrichment of Mn in the ponds may be attributed to the inflowing water and also due to deposition of atmospheric particulates. Manganese is considered as mobile element because it can be exchanged between water and sediments when physico chemical changes. Manganese has not been considered to be too much hazardous and toxic but the concentration of it in a particular spot may vary the taste and even causes turbidity. The maximum permissible limit for manganese is 0.1 mg/L was set by World Health Organization WHO (2003).(Fig. 5)

Zinc (Zn) is the essential element for human, plants, animals and micro organism. They can accumulate considerable amount of zinc in their system without any damaging effect. The zinc level of sediment soil in Lake ranged between 0.4 to 2.08 ppm. (Table 1). Zinc occurs in the form of silicates and oxides.^[9] A small amount of zinc is considered to be an essential nutrient but proves to be toxic at its higher level of concentration to the aquatic organisms.(Fig. 40).^[14]

Iron (Fe) is essential for humans, plants and animals. It accumulates naturally as well as in the form of natural and industrial waste. The iron level in the soil sediment ranged from 10.26 to 20.7 ppm. (Table 1). The excess amount of iron in the soil sediment harms the aquatic plants and it also affects the productivity of the Lake ecosystem. (Fig. 3)

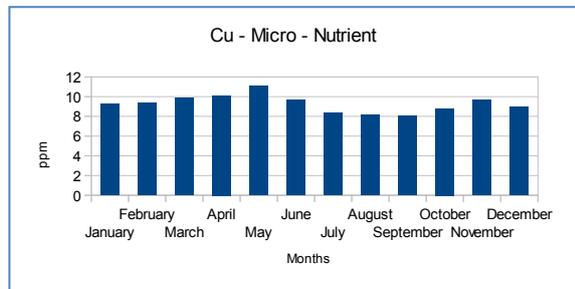


Fig.2: Graph of copper in soil during the year 2012

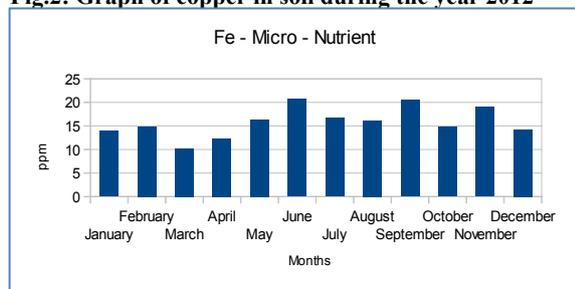


Fig.3: Graph of iron in soil during the year 2012

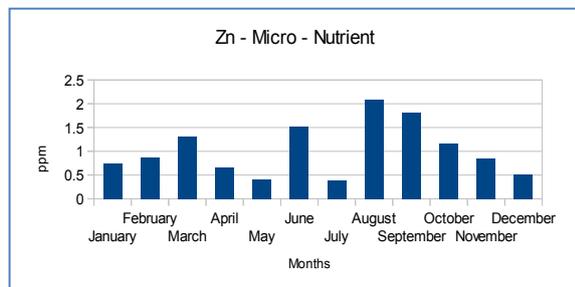


Fig.4: Graph of zinc in soil during the year 2012

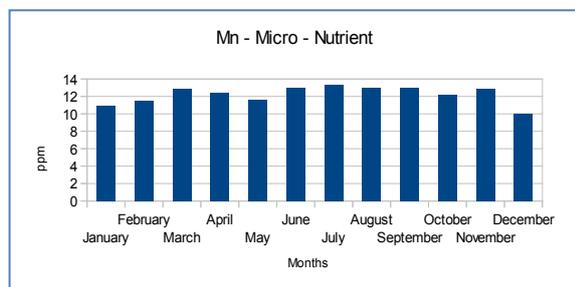


Fig. 5: Graph of manganese in soil during the year 2012

Calcium (Ca), Magnesium (Mg) and Sulphur (S) are the secondary elements observed in the soil. The amount of **Calcium (Ca)** varies in the soil sediments from 8 to 13.5 ppm, (Table 2), that of **Magnesium (Mg)** lies between 4.5 to 6.2 ppm.

(Table 2), and that of **Sulphur (S)** ranged from 19.8 to 34.9 ppm. (Table 2). Limited amount present in soil helps in the growth and development of aquatic plants. Sometimes some little amount of Calcium and Magnesium in water and forms their respective salts. These salts help in increasing the productivity of the Lake ecosystem.

Calcium (Ca), Magnesium (Mg) and Sulphur (S) are the secondary elements observed in the soil. Calcium is a very important cation in soil. It depends on the parent rocks. The presence of calcium increases depth wise in most of the soil profile. (Fig. 6) [10]

The reason for low exchangeable magnesium content in these soils may be due to heavy leaching losses of Magnesium in well drained soils due to heavy rainfall. (Fig. 7) [10]

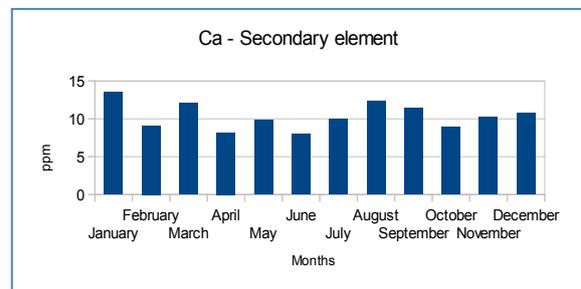
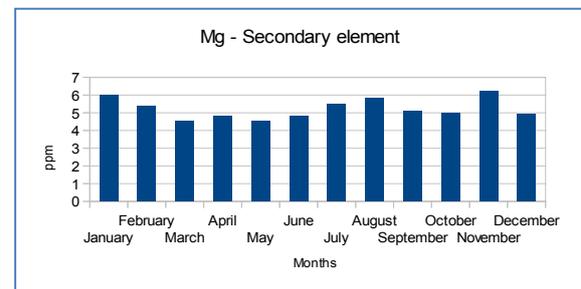


Fig.6: Graph of calcium of soil during the year 2012



Sulphur exists in the form of sulphate ions in combination of the other cations. Present in the form of elemental sulphur it will oxidize in aerobic condition and convert quickly into sulphate ions. Under anaerobic conditions in sulphite or hydrogen sulphide, because most of the sulphur salt is soluble and sulphate is expected to be lost rapidly by leaching. (Fig. 8) [10]

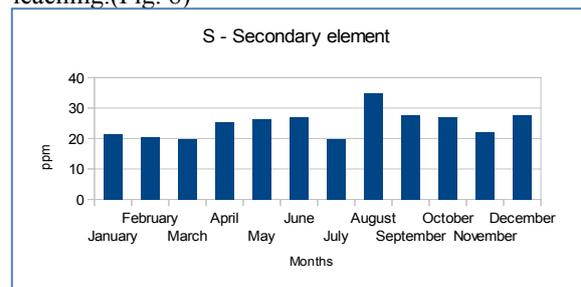


Fig. 8: Graph of sulphur in soil during the year 2012

Table 2: Secondary elements of soil in lakhota lake Jan-2012 to Dec-2012

Months	Ca (ppm)	Mg (ppm)	S (ppm)
January	13.5	6	21.4
February	9.1	5.4	20.6
March	12.1	4.5	19.8
April	8.2	4.8	25.4
May	9.8	4.5	26.2
June	8	4.8	27
July	10	5.5	19.8
August	12.3	5.8	34.9
September	11.4	5.1	27.8
October	8.9	5	27
November	10.2	6.2	22.2
December	10.8	4.9	27.8

Soil Organic matter concentration is difficult to assess because of its varied origins like decomposing plant matter and contribution from different micro organisms. Balanced ecosystem and better production state of the reservoir leads to flourish wide variety of biota.^[4]

4. Conclusion

Micro – nutrients and secondary elements of pond sediments depend not only on industrial, sewage discharge, and urban runoff but also on the geochemical composition of the area. The probable source of the pollutants is anthropogenic influences, practically from industrial wastes and other activities. The excess amount of micro nutrient shows a bronzing of leaves with tiny brown spots on the leaves. The amount of Secondary elements of Calcium and Magnesium as the lake is surrounded by some residential area therefore due to their anthropogenic activities and sewage water and gets deposited into the soil sediment of the Lake. The micro – nutrients like iron, manganese, zinc and copper also gets deposited in to sediment soil of Lakhota lake because of canal waste. Nutrients are ever present in lakes and ponds systems and are the food source for plant and algae. The major nutrients that limit the presence and /or potential of algae cell formation. The more nutrients present in the pond, the more algae can be expect to see. There are also handfull of important micro - nutrients like manganese and zinc and that play a role.

The micronutrient cations react with certain organic molecules to form organometallic complexes. These micro nutrients may be

synthesized by the plant roots and released to the surrounding soil.

5. References

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