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Assessment on the Physico-chemical and Biological Characteristics and Accumulation of Heavy Metals in Muthannan Pond of Coimbatore City (Tamil Nadu), India

R. Priya[1], M. Lekeshmanaswamy[2]
[1]*Ph.D research scholar, PG and Research Department of Zoology, Kongunadu Arts and Science College(Autonomous), Coimbatore, Tamil Nadu, India.*
[2]*Associate Professor and Head of the Department, PG and Research Department of Zoology, Kongunadu Arts and Science College(Autonomous), Coimbatore, Tamil Nadu, India*

***Abstract:** A trial was experimented to assess the water quality of the pond located in Coimbatore city. Physico-chemical and biological parameters of the pond water were analysed and the quality was determined. In addition to that studies were also made on the accumulation of heavy metals .*
The results attributed that the pond water samples collected from Muthannan pond of Coimbatore city was appeared above the limit of WHO standards and its quality was discussed in detail.
***Keywords:** Physico-chemical, heavy metals, microbial isolates, Muthannan pond, WHO*

I. INTRODUCTION

A man-made or natural water body is designated as a pond. Fresh water is elixir of life required for agriculture, industry and even human existence.

The quality of water depends on physico-chemical and biological characteristics which reflect on biotic status of the ecosystem. A series of investigations were carried out on physico-chemical characteristics of water earlier by many researchers and environmentalists.

Since Coimbatore is a second largest city of Tamil Nadu and Manchester of Southern India lead to urbanization and industrialization exhibit pollution of water sources.

Enormous effluent from textiles, dying, automobiles industries etc. in addition human interference by dumping waste (sewage waste, faecal waste, religious waste , building waste, chemical wastes and so on), life stock cleaning leads to changes in the quality of water (Rajiv et al., 2012).World Health Organization (WHO, 1995) reported that contaminated water, inadequate sanitation and poor hygiene cause over 80% of diseases in developing countries.

Chemical quality is a measure to guide its suitability for usage. Heavy metals are dangerous because they tend to bioaccumulate. Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers, and groundwater.

Heavy metal toxicity can result in damaged or reduced mental and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Long-term exposure may result in slowly progressing physical, muscular, and neurological degenerative processes that mimic Alzheimer's disease, Parkinson's disease, muscular dystrophy, and multiple sclerosis.

Allergies are not uncommon and repeated long-term contact with some metals or their compounds may even cause cancer (International Occupational Safety and Health Centre1999).

A regular physico-chemical, biological and analysis of heavy metal in water was made at the source for determining the effectiveness of water quality.In the present investigation, a screening was carried out in the water quality of Muthannan pond to evaluate the contamination of the water.

II. MATERIALS AND METHODS

A. Study Area And Collection Of Samples

The pond selected for the investigation is Muthannan Kulam (Kumarasamy lake). It is situated on the left side of the Coimbatore to Thondamuthur road and eastern side of Selvampathy lake and receives excess water from the Selvampathy lake and drains its surplus water to Selvachintamani lake. This wetland is located at the latitude of 10° 59.457' N and longitude of 76° 56.701' E. The pond water was polluted with bloomed of pollution indicator species Eichhornia crassipes. The sample water was collected in a bottle between 10 am -11am at a depth of 50 cm below the surface and then transported to a laboratory. The analyses on the physico-chemical parameters as Temperature, Turbidity, Odour, Colour, Total solids Electrical conductivity, pH, dissolved oxygen, alkalinity BOD and COD were determined. The presence of heavy metals such sulphate, silica, copper, zinc and manganese were studied using standard procedure of APHA(1998).Microbiological characteristics of pond water is also studied using the standard procedures.

III. RESULTS

Table 1: showing the physic-chemical, biological and heavy metals concentrations in the Muthannan pond water sample

Physical Parameters	Quantity
Temperature	22 o C
Turbidity	8.7 NTU
Odour	Rubbish sewage smell
Colour	Brownish black
Total Solids	1280.0mg/l
Electrical conductivity	1950.0µmhos/cm
Phospate	13.87mg/l
Faecal Coliform (FC)	69cfu/100ml
pH	8.95
Dissolved O2	2.0 mg/l
Alkalinity	525.0mg/l
BOD	40mg/l
COD	160mg/l
Sulphate	58.0mg/l
Iron	0.58 mg/l
Copper	0.08mg/l
Zinc	0.78
Manganese	0.38

A. Temperature, Odour And Colour

Temperature of the pond water is 22^0 C**.** The optimum range of pond water is 20 to 34 ^{0} C. This pond maintains the optimum temperature. The colour of the water is brownish black which looks like highly contaminated with sewage and faecal waste. This was proved with the odour of the water. The odour of the water is rubbish sewage smell.

B. Turbidity

Drinking water turbidity is commonly used as a proxy measure for the risk of microbial contamination and the effectiveness of the treatment of public drinking water. It can interfere with disinfection process and provides an ideal medium for microbial growth and a few documented water borne disease outbreaks which were associated with increased turbidity levels. The WHO maximum permissible limit of turbidity is 5 NTU. Turbidity value of the pond is 8.7 NTU which is more than the permissible limit.

C. Total Solids and Total Alkalinity

Total solids may be organic or inorganic but precisely, the dissolved solids are composed mainly of carbonates, bicarbonates, chloride, sulphate, calcium, magnesium, phosphate, nitrate, sodium, potassium and iron. The TDS in muthannan Lake is 1280.0mg/l. Chloride is one of the most important parameter is assessing the water quality.Total Alkalinity in water is due to the salts of weak acids and bicarbonates of highly alkaline water. Large amount of alkalinity imparts a bitter taste, harmful for irrigation as it damages soil and hence reduces crop yields. Total alkalinity showed at the lake was 525.0mg/l.

D. Electrical Conductivity, BOD and COD

Electrical conductivity of water is a direct function of its total dissolved salts and is used as an index to represent the total concentration of soluble salts in water. Excess of electrical conductivity led to scaling in boilers, corrosion and quality degradation of the product. In the present study the electrical conductivity of water sample is 1950 µs/cm. Biochemical oxygen demand (BOD) depends on aquatic life; variation in BOD indicates dynamism in aquatic life present in the lake. BOD refers to the oxygen used by the microorganism in the aerobic oxidation of organic matter. Therefore with the increase in the amount of organic matter in the water level, the BOD increases. In the present study the BOD of water sample is 40mg/l. The BOD value above the range of 5mg/l demonstrates the poor water quality. Higher BOD values indicate organic contamination and high nutrient loading decomposition and mineralisation of organic matter reduces the oxygen content in the water. The COD value in the Lake was 160mg/l. This could be associated with higher levels of inorganic wastes being discharged into the lake.

E. pH, Dissolved oxygen and Faecal Coliform

The pH value of drinking water is an important index of acidity or alkalinity. A number of minerals and organic matter interact with one another to give the resultant pH value of the sample. The rise in the pH indicates the increased level of pollution in the lakes. In the present study the pH of water sample is 8.95 which slightly exceed the permissible limits (6.5-8.5). The existence of faecal coliform bacteria in drinking water indicates the presence of pathogens responsible for the communication of water borne diseases17-18. In the present study, the faecal coliform present in the water sample was 69 cfu/100ml.The feacal coliform value above the range of 10cfu/100ml demonstrates the poor water quality. Higher FC values indicate free flow of sewage in to the lake. Dissolved oxygen levels in lakes vary according to their trophic levels, and depletion of DO in water probably is the most frequent result of water pollution14. It fluctuates seasonally and also daily with variations in water temperatures mainly due to consumption of DO owing to respiration by aquatic animals, decomposition of organic matter, and various chemical reactions15-16. In the present study the DO of water sample is 2.0mg/l as this lake is surrounded by many domestic waste pumps. The sewage from the vicinity flows down, and would have led to low DO content.

F. Nitrate, Phosphate and Sulphate

Nitrate ion is the most important nutrient in an ecosystem. Generally water bodies polluted by organic matter exhibit higher values of nitrate. The high concentration of nitrate in drinking water is toxic. In the present study, the nitrate concentration is 6.75mg/l, which may be due to the mixing of surplus domestic waste and sewage discharges. Major Sources of sulphur in fresh water are in the form of sewage and fertilizers. High sulphate values makes the water unfit for domestic utilities. Phosphate enters the lakes through domestic wastewater, accounting for the accelerated eutrophication and the augmented concentration of PO_4–and NO_3– ions in lakes resulted in enhanced phytoplankton productivity. The values of phosphate and sulphate were in the range of 13.87mg/l and sulphates is 58.0mg/l respectively.

G. Heavy Metals

Metals are introduced in aquatic systems as a result of the weathering of soils and rocks, from volcanic eruptions, and from a variety of human activities involving the mining, processing, or use of metals and/or substances that contain metal pollutants. some metals, such as manganese, iron, copper, and zinc are essential micronutrients. They are essential to life in the right concentrations, but in excess, these chemicals can be poisonous. At the same time, chronic low exposures to heavy metals can have serious health effects in the long run. Iron is the most commonly available metal on planet earth. The iron content of the water sample is 0.58 mg/l which is more than the permissible limit of WHO(0.30mg/l. The level of iron could be the result of clay deposits in the area. The high concentration of iron is also of concern as large amount of ground water is abstracted by drilling waterwells both in rural and urban areas for drinking and irrigation purposes. Also the presence of iron is responsible for the brownish – red colour of the water when allowed to stay for some minutes. Excess of iron will also influence the presence of bacteria (iron-reducing) in water. Other sources

of iron are drinking water, iron pipes, and cookware. It affects target organs which are the liver, cardiovascular system and kidneys. The value of Manganese is within the permissible limit of WHO(0.50mg/l), but according to ISI for drinking water,permissible limit for manganese is 0.30mg/l and it is said that the water is 0.38mg/l.However, slight rise in its level may be accounted for by the influence of domestic waste, natural and industrial effluent. Sometimes manganese containing water is not suitable for domestic purpose. Copper is a reddish metal that occurs naturally in rock, soil, water, sediment, and air. It is an essential element for living organisms, including humans, and-in small amounts-necessary in our diet to ensure good health. However, too much copper can cause adverse health effects in the living organisms. The permissible level of copper is 1.30 mg/l. the presence of copper in the sample is 0.08 mg/l which is less than the permissible limit. Zinc is an essential trace element required by many aquatic organisms. The permissible limit of zinc is 5.0 mg/l and it is found that the zinc within the permissible limit.

IV. CONCLUSION

In the present study, natural resources of water bodies such as pond which is facing serious pollution due to increased invading human and animal wastes which inturn lead to dense population of Eichhornia crassipes and depletion of the water quality. The results of the study revealed that the selected pond is found to be highly polluted and not suitable for use of mankind. Therefore, conservation of this pond water is the need of hour by eliminating pollutant indicator species using innovative strategies.

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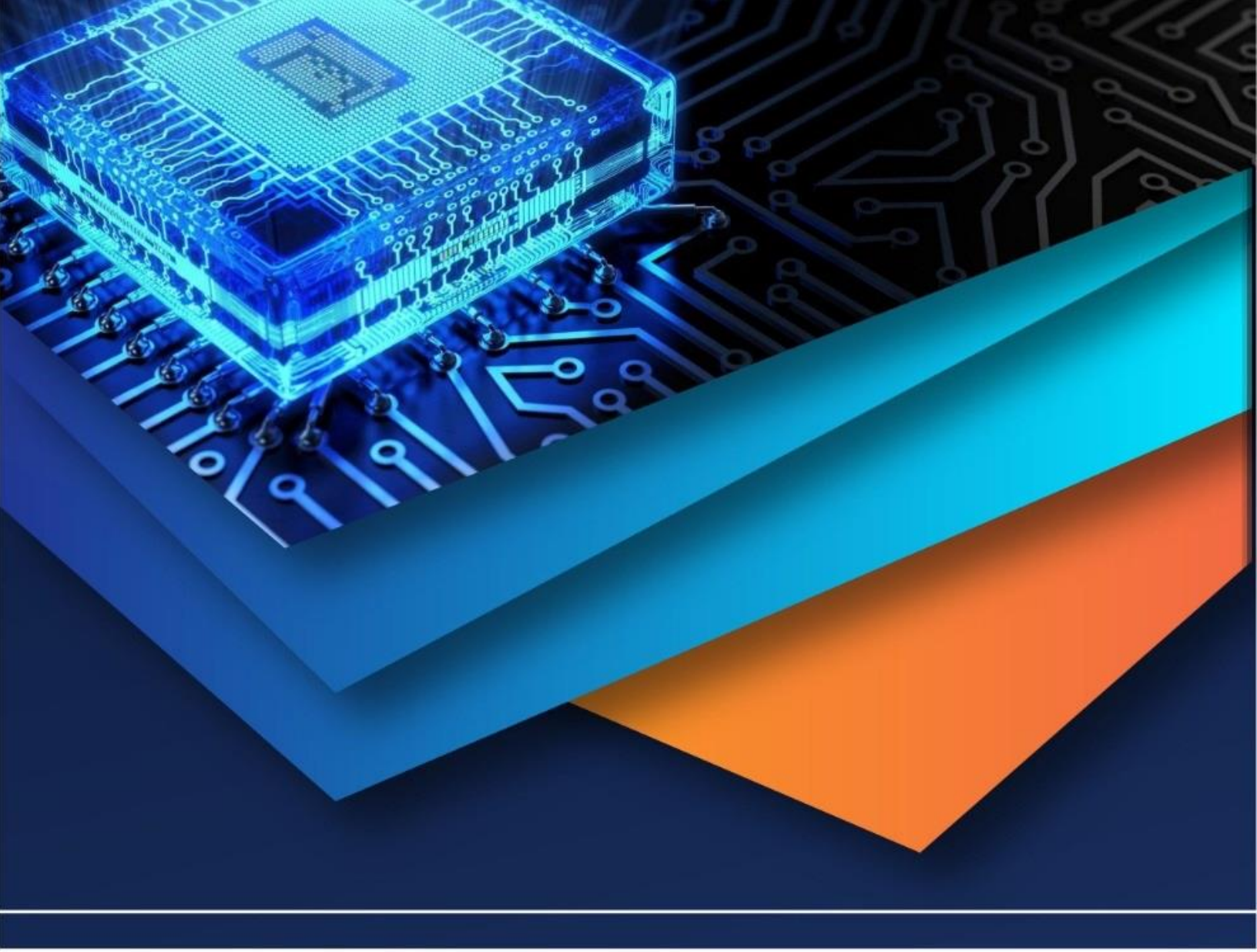

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