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Research Article

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Assessment of heavy metal contamination in Chemberambakkam lake water, Chennai, Tamil Nadu, India

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ABSTRACT

Water is an important component of living organisms, especially for human beings. The current study of Chemberambakkam lake gave a lot of information about quality of the drinking water. The present paper showed the concentration of trace elements (Cd, Cr, Pb, Fe, Mn, Co, Ni, Zn, Cu) and cations like (Na, K, Ca, Mg) in the Lake water of the Chemberambakkam. The heavy metal concentration of Cd, Pb, Fe, co, and Ni were observed in high concentration than the WHO recommend level in the water, it means the Chemberambakkam lake water is highly contaminated from its surrounding industries. The analysis of date gave normal concentration of cations.

Key words: Water quality, heavy metal, contamination, pollution, Drinking Water

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INTRODUCTION

There is no life without water; water is most necessary resources of the all biological lives and their nutrition too. Water quality has become a most important global problem due to increasing human developmental actions. Water pollution is a severe problem as almost 75% of India's surface water resources have been polluted by biological and chemical. Increasing human population and their activities creates more pressure on the provision of safe drinking water especially in developing nations [1]. Surface water resources like a river and lake pollution is severe and serious problem due to the large amount of pollutants released by urban activities in India [2, 3]. Thus, water pollution requires serious action and continuous monitoring of pollution level in order to prevent the water because of its importance in maintaining the plants, agriculture and also human health. Without fresh water sustainable development will not be possible.

The world's water resources are under stress and must be managed for human survival. It is, therefore, required to have most appropriate information for arriving at rational decisions that will result in the maximum benefit to human beings. Precise and reliable information on the water resource system can, therefore, be a vital aid to strategic management of the resources. Lakes and Ponds have been used since time immemorial as a traditional source of water supply in India. Though, the water of the ponds, lakes and river are contaminated mainly due to release of waste water from residential and industrial areas, sewage outlets, solid wastes, detergents, automobile oil wastes, fishing facilities and agricultural pesticides from farmlands [4]. Pollution of surface and ground water is largely a problem due to rapid urbanization and industrialization.

Lakes play an essential role in the, ecology and environmental aspects of the area. Climatic factors are modified by water body by influencing relative humidity and vegetation of the region. It also acts as a re-charger for aquifers. A complex web of fauna and flora is supported by the macroclimatic complex of the lake. These include aquatic well

as terrestrial flora and fauna including birds. Several bird sanctuaries are basically supported by lakes and wet land ecosystems providing niche for food web of organism in the ecosystem. The aim of this study was to evaluate the composition and quality of Chemberambakkam lake water.

Study area

The water samples were taken from Chemberambakkam Lake in Chennai, located in the Kanchipuram district of Tamil Nadu, India, about 40 km from Chennai the lake lies between 13° 0' 22" North, 80° 3' 35" East. It is one of the two rain-fed reservoirs from where water is drawn for supply to Chennai City (Fig.1). The Adyar River originates from this lake. A part of water supply of the metropolis of Chennai is drawn from this lake. The Full Tank Level is 85.40 ft (26.03 m) and the Full Capacity (mcft) of the lake is 3,645 million ft³ (103 million m³), The Level of the tank in feet is 75.60 ft (23.04 m) .

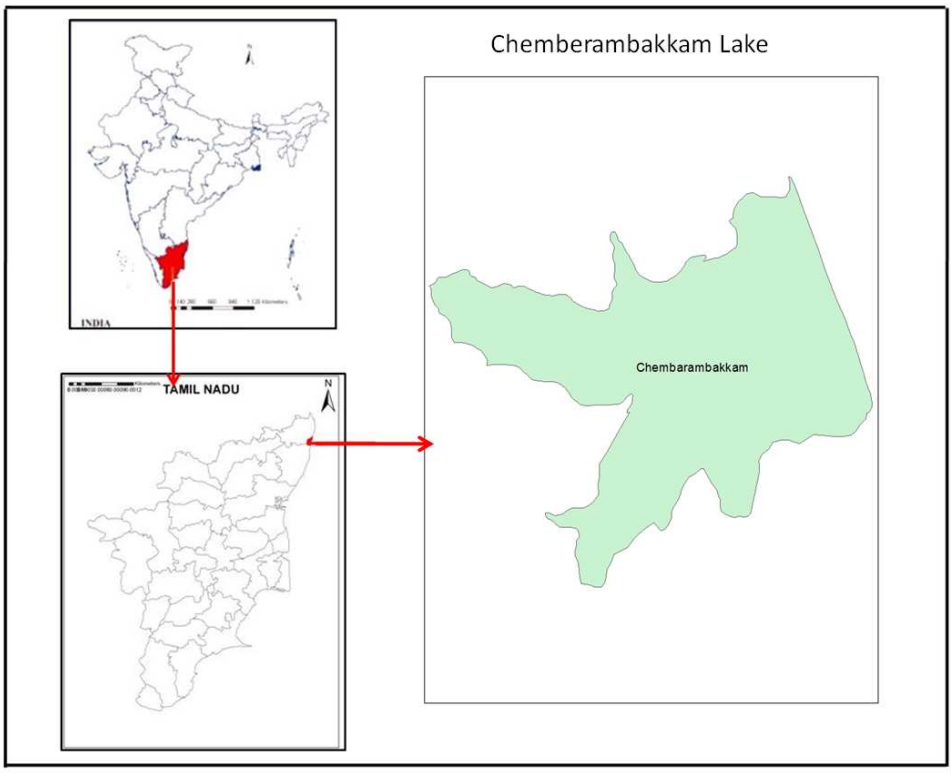

Fig. 1 Map of the Study area

Fig. 2 Sampling Location of the Study area

EXPERIMENTAL SECTION

The water samples were collected from three different locations within the lake in a plastic bottle and transported immediately to the laboratory in bottles to avoid unpredictable changes in different chemical parameters, the sample locations are shown in fig. 2. The selected parameters of including cations (Na, K, Ca, Mg) were analysed with help of flame photo meter while the heavy metals including Cd, Cr, Pb, Fe, Mn, Co, Ni, Zn, Cu, were determined by the standard literature method using Atomic Absorption Spectrophometer [5]. The observed values of various physicochemical parameters of water samples were compared with standard values recommended by World Health Organization (WHO) for drinking purposes.

RESULTS AND DISCUSSION

Table 1 shows the standard value of trace metals in potable water and table 2 shows the trace metals values in Lake water.

Table 1. WHO Standard for heavy metals in potable water

Metal	Symbol	Permissible Limit (mg/L)
Cadmium	Cd	0.003
Chromium	Cr	0.05
Lead	Pb	0.05
Iron	Fe	0.3
Manganese	Mn	0.1
Cobalt	Co	0.05
Nickle	Ni	0.02
Zinc	Zn	3
Copper	Cu	0.05

The amount of Cadmium present in water samples was given in table 2. According to Who standards, the permissible limit for cadmium in drinking water 0.003mg/l cadmium concentration in all the water samples was higher than the permissible limit ranged from 0.147 -0.187 mg/l [6]. The chromium concentration in water samples ranged from 0.019-0.035 mg/l as shown in table Chromium concentration in all the water samples was within the permissible limit. The chromium permissible limit is 0.05mg/l [7]. According to WHO standards the permissible

limit for Pb is 0.05 mg/l [8]. The concentration of lead in water samples ranged from 0.02-0.296 mg/l. lead concentration in all the water samples was higher than the permissible limit it shows the alarming condition of the water.

The Iron concentration in samples ranged from 0.208-0.40 mg/l. The permissible limit for the iron is 0.30 mg/l it show only one sample high concentration and other two samples are within the permissible limit. The concentration of cobalt ranges between 0.015-0.099mg/l the permissible limit for the cobalt is 0.05mg/l. The nickel permissible limit is 0.02 [9] whereas the nickel concentration of the water sample ranged0.030-0.084mg/l, nickel concentration is higher than the permissible limit. The concentration of Manganese, Zinc and Copper are with the WHO recommended permissible limits it shows in the Table 2.

Table 2. **Heavy metals levels in the examined Lake Water Samples**

Serial No	Metal	Sample 1	Sample 2	Sample 3
1	Cadmium	0.152	0.187	0.147
2	Chromium	0.021	0.019	0.035
3	Lead	0.296	0.057	0.02
4	Iron	0.4	0.284	0.208
5	Manganese	0.013	0.052	0.017
6	Cobalt	0.05	0.099	0.015
7	Nickle	0.084	0.03	0.038
8	Zinc	0.019	0.018	0.026
9	Copper	0.02	0.015	0.019

Table 3. Cations concentrations of examined Lake water samples

Sample	Na ppm	K ppm	Ca mg/l	Mg mg/l
1	7.5	99.7	160	12
2	8.2	103.5	320	10.8
3	9.1	84.9	100	9.6

Table 3 shows the level of cations in water. Sodium is present in most natural waters, and may be found fairly high concentrations when water is softened by process in which ca and Mg is exchanged for Na. The values of sodium were given in table 3 showing the range between 7.5-9.1 ppm. The WHO permissible limit for sodium is 200 ppm [10]. The calculated values of all the samples were below the permissible limit.

The Maximum tolerable limit of K for drinking purpose is 10ppm. In comparison to Na content the samples under investigation had relatively high concentration of K which ranged from 84.9-103.5 ppm. According to WHO the permissible limit for K is 75 ppm [11]. The values of Ca concentrations were given in table 3. The table shows that the ca concentration of water samples ranged from 100-320mg/l that were below the WHO maximum permissible level of Ca 250 mg/l [12]. However, only one sample has higher concentration than the permissible limit of the sample. The concentration of Mg in the samples was given in table 3, which shows that these values were ranging from 9.6-12 mg/l. The WHO maximum permissible level of Mg is 50 mg/l [13].

CONCLUSION

The present study aimed to determined heavy metals concentration in Chembarambakkam lake water and also the level of sodium, potassium, calcium and magnesium but the water of Chembarambakkam lake was contaminated with the heavy metals pollution and all the analyses were found to be some metal were within the permissible limit some metals beyond the permissible limits so it is clearly shows that the lake water affected by surrounding industrial effluents and should take necessary step to prevent future contamination of the lake and water body.

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