International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

pH, CONDUCTIVITY, NITRATE, PHOSPHATE AND HEAVY METAL LEVELS IN THE SEDIMENT OF LAKKAVALLI TANK, CHIKMAGALUR, KARNATAKA: A CASE STUDY

THIRUMALA S[1], NANDESHWARAPPA BP[2] AND B.R.KIRAN[3*]

1: Department of Environment Science, Government First Grade College, Anubhavamantapa, Davangere-577004, India

2: Department of studies in Chemistry, Davangere University, Shivagangothri, Tholahunase - 577 007, Karnataka, India

3: Research & Teaching Assistant in Environment Science, DDE, Kuvempu University, Shankaraghatta-577451, India

*Corresponding Author: B.R.Kiran: E Mail: drbrk2003@gmail.com

ABSTRACT

Lakkavalli tank in Chikmagalur district was studied for Physico-chemical and trace metal parameters at five sites, for a period of six months (March to August 2017). This water body has been subjected to human activities periodically and water quality is deteriorated intensely. Agriculture, human activities and discharging of sewage creates serious threat to the biota of the tank by altering the water quality. Different parameters studied were pH, electrical conductivity, nitrogen, phosphorus, zinc, copper, iron and manganese content. The results obtained from the current study indicated that the water pH of Lakkavalli tank was alkaline in nature, EC, nitrate and phosphate contents were in moderate concentrations. Manganese and iron levels of sediment sample in Lakkavalli tank shows maximum level of pollution and ecological balance is totally disturbed. One-way ANOVA was calculated to know the significant difference between the samples.

Keywords: pH, Electrical conductivity, nitrate, phosphate, trace metals

INTRODUCTION

Top soil erosion is the main worldwide reason for diffuse water pollution, because of the impacts of the abundance residue streaming into the world's water way. The silt themselves go about as contaminations, just as being transporters for different pollutants, for example, connected pesticide molecule or trace metals. The impact of expanded silt stacks on aquatic environments can be calamitous. Silt can cover the bringing spawning beds of fish, by occupying in the space between rock on the stream bed [1].

Sediment contamination is an inescapable natural issue that undermines aquatic biological systems around the world. Once discharged into surface waters, numerous poisonous and persistant contaminants become adsorbed to residue and can get fused into aquatic food networks. As such, polluted silt can have harmful and bio aggregate impacts on aquatic life contaminants in biological systems.

Heavy metal toxicity has a serious concern all over the world as these heavy metals pose adverse effects on all forms of living organisms in the biosphere. Biomagnification of heavy metals along the food chains occur leading to various health hazards to both humans and other living organisms. Heavy metals affect the structural, biological

functioning of biomolecules [2]. Heavy metals are also known to interfere with synthesis and metabolism of the hormones [3-5].

Trace metals are extremely unsafe poisons because of their bioaccumulation and harmfulness which legitimately impacts the biological procedures. The issue of overpowering metal toxicity may remain as a legacy of mass mechanical development for certain ages and is most likely going to rise further in future. In such way, the accumulation of past and the present files of generous metal fixation is an activity of phenomenal criticalness. Overpowering metal sullying is a quickly creating issue for our surface water resources. As of now it may not be the best sullying issue, yet basically keeping things under control for it to leave or to light up itself won't help. We should think about the issues follow metals make, so we in general, in our own one of a kind little ways, can add to the arrangements. Clean water is our movement into an ideal future. We need to exhort people about how follow metal contamination gets into our condition so they can be progressively aware of the risks of these poisons [6].

The main aim of the present study is to know the physico-chemical and heavy

metal concentration in the sediment of Lakkavalli tank, Chikmagalur district, Karnataka.

MATERIALS AND METHODS

Study area

Lakkavalli tank is perennial one as it receives the water from Bhadra canal and waste water from Lakkavalli residential areas. This water body is situated nearly 5 Kms away from Rangaenahalli village. The total area of the tank is about 1 square Km but due to human encroachment the water spreads area of the tank is nearly 0.8 Square Km with an average depth of 2-4 mts. Tank water is used for washing of clothes, vehicles, domestic animals, anthropogenic activities and also for fish culture. Lakkavalli tank is amongst the few larger ponds of the city. This is surrounded by human population. Lakkavalli is situated in Chickmagalur District, Karnataka. It is situated with $13^O.64'29''N$ Latitude and $75^O.62'25''E$ Longitude.

Figure 1: Karnataka map and a view of Lakkavalli tank

METHODOLOGY

In this study tank sediment samples has been collected during March to August 2017 and analyzed as per standard methods prescribed by APHA [7] and Trivedy and Goel [8]. For trace metal analysis the samples were collected in good quality polypropylene bottles, each with 2 liter capacity, properly labeled and estimated for trace metals by Atomic Absorption Spectrophotometer (AAS). A cleaned Ekman grab sampler was used to collect the lake sediments. To prevent contamination, of the sediment, it was scoped and transfer to pre-cleaned polythene bags and then freezed. The sediments dried at 105^0 C and crushed to a powdered form and passed through a 63 μm sieve. 1gm powder was digested using 10 ml of Aqua Regia for 30 minutes at 60^oC using aluminium block. The solutions were diluted in 50 ml flasks, together with reagent blanks. Sediment extracts were analysed for trace metals using an atomic absorption spectrophotometer with

appropriate standards and several blanks prepared similar to the samples [7]. Any element introduced into the blank digests was subtracted from the element concentration in the sample digests that were analyzed. One-way ANOVA was calculated by using AtoZmath soft ware

A quantitative measure of the extend of pollution in Bhadra river was calculated from the metal concentration. The geo-accumulation index proposed by Muller [9] for quantification of trace metal accumulation in sediments is given as:

$$I\ geo = \log_2 (Cn\ /\ 1.5\ Bn)$$

Where, Cn is the measured concentration of heavy metal 'n' of the sediments and Bn is the geochemical background data value in fossil argillaceous of elements 'n'. The factor 1.5 is used for possible variations in background data due to lithogenic effect.

RESULTS AND DISCUSSION

In this study, pH of the sediment ranged between 7.15 (S1) in the months of March, August and 8.1(S5) in the month of June. Electrical conductivity fluctuated from 0.15 µmhos/cm (S1,S4) in the months of March, July and 0.65 µmhos/cm (S3) in the month of July. While, nitrate content varied from 16.8 mg/g (S1, March) and 29.8 mg/g (S3, June). Phosphate levels ranged between 0.25 mg/g

(S1, March) and 1.5 mg/g (S3, S5, June, August).

Iron metal ranged from 6.7 mg/g (S2, April) to 18.4 mg/g (S5, August). However, zinc content varied from 0.14 mg/g (S2, S3-March,April) to 6.4 mg/g (S5,March). Manganese fluctuated from 9.3 mg/g (S2, S4-March, May) to 31.7 mg/g (S3-April). Nevertheless, copper content deviated from 0.02 mg/g (S4-August) to 7.95mg/g (S5-April). **Table 1-3** shows the One-way ANOVA for physico-chemical and trace metal sediment samples.

Most of the trace elements are also used to estimate the level of pollution in a region [10-14]. The study area is dominated by anthropogenic activities. The generated wastes are sometimes disposed in nearby place by surface run off. The fluctuated water and sediment concentration in a samples is clearly indicates its part of anthropogenic, sewage and industrial activity in a surrounding area, due to this activity wastes were leached from soil or carried through water leads to contamination of lake.

Present water body was considered polluted with respect to sediment Mn,Fe and Cu contents, which were comparatively higher than unpolluted sediments and geochemical background values. This supports results on water trace metal levels. Most of the sites of

the tank drain areas of almost similar lithological characteristics. Therefore, apart from the direct waste input into Lakkavalli tank from humans and industrial wastes, lack of specific point sources indicates lithological metal origins with localized variations.

Table 4 shows geo-accumulation index at different segments of sediment collected from Lakkavalli tank and it can be concluded that the geo-accumulation index [I geo] of all the trace metals in tank sediments are practically uncontaminated with a geo-accumulation index (I geo) of class - 0. The higher concentration of Fe and Mn are due to the discharge of human wastes. By and large, these trace metals in tank sediments are well within the limits of shale standards.
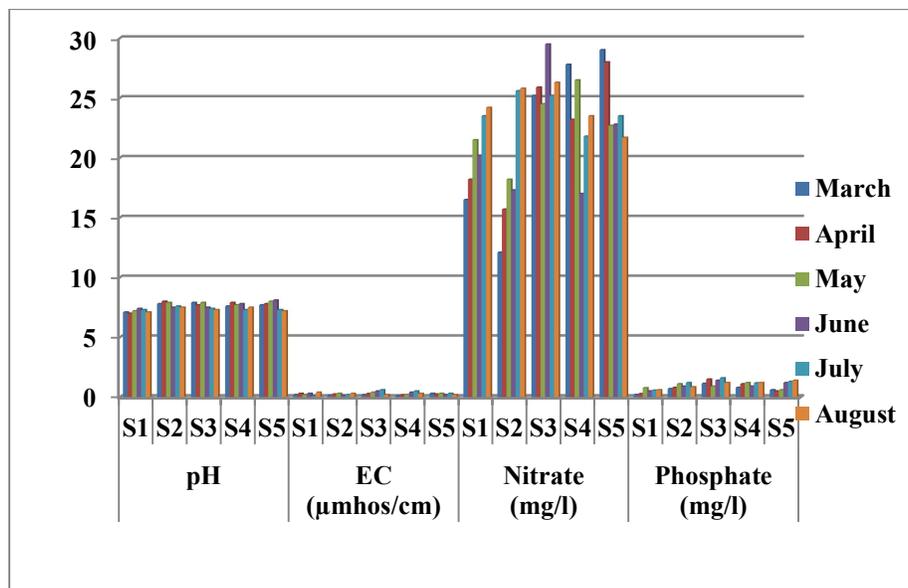

Figure 2: pH. EC, Nitrogen and phosphorus levels in the sediment of Lakkavalli tank, Chikmagalur
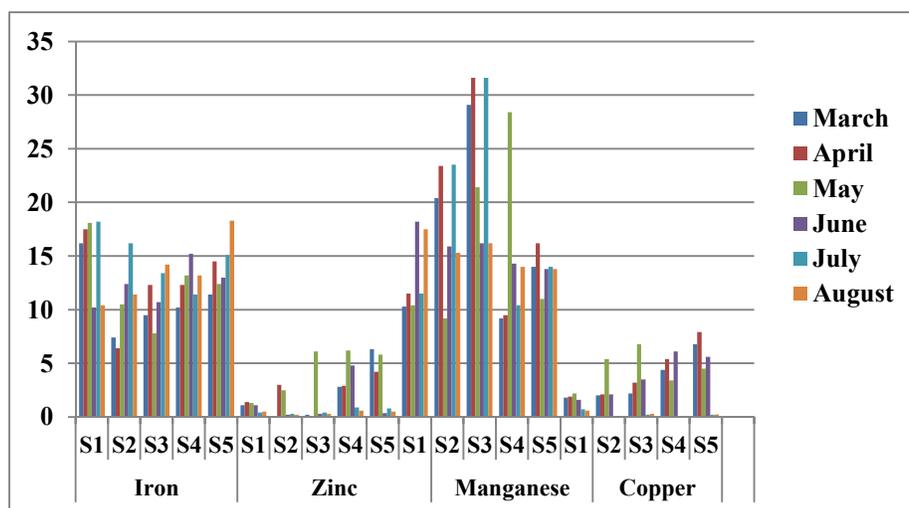

Figure 3: Trace metal profile in the sediment (mg/g) of Lakkavalli tank, Chikmagalur

Table 1: One –way ANOVA data for pH and EC parameters

Source of Variation	Sums of Squares SS	Degrees of freedom DF	Mean Squares MS	F	*p*-value
Between samples	SSB = 0.4004	*k*-1 = 5	MSB = 0.0701	0.005	1
Within samples	SSW = 800.1	*n-k* = 54	MSW = 14.91		
Total	SST = 800.5	*n*-1 = 59			

H1 :There is significant differentiating between samples ;F(5,54) at 0.05 level of significance =2.3861 ;As calculated F=0.005<2.3861
So, H0 is accepted, Hence there is no significant differentiating between samples.

Table 2: One–way ANOVA data for Nitrate and phosphate parameters

Source of Variation	Sums of Squares SS	Degrees of freedom DF	Mean Squares MS	F	*p*-value
Between samples	SSB = 19.4	*k*-1 = 5	MSB = 3.90	0.030	0.99
Within samples	SSW = 7656.2	*n-k* = 54	MSW = 141.80		
Total	SST = 7675.5	*n*-1 = 59			

H1 : There is significant differentiating between samples ;F(5,54) at 0.05 level of significance =2.3861; As calculated F=0.03<2.3861
So, H0 is accepted, Hence there is no significant differentiating between samples

Table 3: One–way ANOVA data for trace metals in the sediment samples of Lakkavalli tank,

Source of Variation	Sums of Squares SS	Degrees of freedom DF	Mean Squares MS	F	*p*-value
Between samples	SSB = 390.70	*k*-1 = 17	MSB = 22.99	0.420	0.993
Within samples	SSW = 10836.83	*n-k* = 162	MSW = 66.94		
Total	SST = 11227.42	*n*-1 = 179			

H0 : There is no significant differentiating between samples;H1 : There is significant differentiating between samples
F(17,162) at 0.05 level of significance =1.687; As calculated F=0.420 <1.6862
So, H0 is accepted, Hence there is no significant differentiating between samples

Table 4: Geo accumulation index (I geo) for Lakkavalli tank sediments.

I geo	I geo Class	Lakkavalli tank
>5	6	Nil
4-5	5	Nil
3-4	4	Nil
2-3	3	Nil
1-2	2	Nil
0-1	1	Fe, Cu,Mn
>0	0	Zn

CONCLUSION

Few physico-chemical and trace metal parameters in the studied tank showed temporal and spatial variations throughout the study. Lakkavalli tank receives maximum pollution load from the surroundings areas and the sediment is highly contaminated and if the similar condition continues for longer time and the Lakkavalli tank may eutrophic. The levels of the manganese and iron was found to be varying in this tank due to

fluctuation of pollutant load entering into the water body.

REFERENCES

[1] Vidya .BR, Suresh S. Sediment quality assessment of Lakkavalli tank, Davanagere city: A Case Study. International Journal of Innovative Research in Advanced Engineering. 2016; 10(3): 1-7.

[2] McCormick SD., O'Dea MF, Moeckel AM, Lerner DT, Bjornsson BT. Endocrine disruption of parr-smolt transformation and seawater tolerance of Atlantic Salmon by 4-nolyphenol and 17ß estradiol. General and Comparative Endocrinology, 2005; 142, 280-288.
http://dx.doi.org/10.1016 /j.ygcen.2005.01.015

[3] Manjappa S, Puttaiah ET. Evaluation of trace metals in the sediments of river Bhadra near Bhadravathi town, Karnataka, India. Journal of Industrial Pollution Control, 2005; 21(2), 271–276.

[4] Riddell DJ, Culp JM, Baird DJ. Behavioral response to sub lethal cadmium within an experiment aquatic food web. Environmental Toxicology and Chemistry, 2005; 24, 431–441.
http://dx.doi.org/10.1897/04-026R.1.

[5] Gupta A, Rai DK, Pandey RS, Sharma B. Analysis of some heavy metals in the riverine water, sediments and fish from river ganges at Allahabad. Environmental Monitoring and Assessment, 2009; 157, 449-458. http://dx.doi.org /10.1007/s10661-008-0547-64.

[6] Thirumala S, Shashi Shekar TR, Kiran BR. Trace metal levels in the sediment and water of river Bhadra, Karnataka, India. Int J Pharma Bio Sci 2019; 10(3): (B) 144-150.

[7] APHA. American Public Health Association Standard Methods for examination of water and waste water specifications. 2012; Washington D.C., 6. 22nd edition.

[8] Trivedy RK, Goel PK. Chemical and biological methods for water pollution studies. Environmental publication, 1984, Karad, India.

[9] Muller G. Index of geo-accumulation in sediments of the Rhine River, Geo. J., 1969; 2:108-118.

[10] Thomas M, Petit D, Lamberts L. Pond sediments as historical record of heavy metals fallout; laboratory of analytical chemistry and mass spectrometry, faculties universities notre-dame de la paix, rue de

bruxelles, 61, b-5000 Namur, Belgium; water, air, and soil pollution1984; 23 :51-59.

[11] Emmanuel I, Adeyeye. Determination of trace heavy metals in illisha Africana fish and in associated water and soil sediments from some fish ponds. Int. jour. of Envi. Stu., 1994; Vol. 45: 231-238.

[12] Sarika PR, Chandramohankumar N. Geochemistry of heavy metals in the surficial sediments of mangroves of the south west coast of India; Jour. Che. Eco., 2008; 24, no. 6:437 – 447.

[13] Jayaram GN, Chandrashekarappa KN, Anantha Murthy KS. Heavy metal distribution in sediments around Kallur Mandli and Sagar road Industrial estate Shimoga, Karnataka, India. International Journal for Innovative Research In Multidisciplinary Field, 2016; 2(10) 360-365.

[14] Ravikumar R, Purushothama R, Kiran BR. Physico-chemical and trace metal profile of Lakkavalli tank, Sivamogga District, Karnataka. Journal of Xidian University 2020; Vol 14(5): 2295-2301.

.