International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 01 | Jan-2018 www.irjet.net p-ISSN: 2395-0072

Assessment of Heavy Metals in Water samples of Singanamala Tank, Singanamala, Anantapuramu District, Andhra Pradesh, India

Venkatararamanaiah Kolala [1], Jayaram Naik V N [2], Philip G. H[3*]

[1,2,3] *Dept. of Zoology, Sri Krishnadevaraya University, Anantapuramu, Andhra Pradesh, India.*

Abstract - *Aquatic ecosystem is the ultimate recipient of almost everything including Heavy metals. This paper deals with the analysis of heavy metals concentration of like Li, Al, V, Fe, Co, Ni, Cu, Zn, As, Ag, Cd, Cs, Ba, Ti, Pb, U etc., in the water samples collected from Singanmala tank, Anantapur district AP, during May, 2011 to April, 2013. They were measured by A Perkin Elmer SCIEX®, Model ELAN 5000 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS), is most advanced technique for the determination of trace metals concentrations up to 1 part per billion (ppb). The concentration of these metals in the study area was above desirable limits given by the Indian Standard Specification for Drinking Water IS 10500: 2012.*

Key words: Heavy metals- ICP-MS- Singanamala.

1. INTRODUCTION

Environmental pollution is a worldwide problem, heavy metals belonging to the most important pollutants. Aquatic ecosystem is the ultimate receipt of almost everything including heavy metals. This has long been recognized as a serious pollution problem (1). By the term "heavy metals" we usually refer to any metallic element that contain a relative high density and applies to the group of metals and metalloids with atomic density greater than 4 g/cm3. There are about fifty heavy metals that are of special concern for their toxicological importance to human health and many of them, like Zn, Cu, Ni and Mn are also essential trace elements for living organisms. However, if these accumulated at high levels, or ingested in greater amounts than the required concentration, then they cause health problems (2).

Heavy metals enter the environment by natural and anthropogenic means. Such sources include: natural weathering of the earth's crust, mining, soil erosion, industrial discharge, urban runoff, sewage effluents and pest or disease control agents applied to plants, air pollution fallout (3). For the past few decades the concern over the studies on different pollutants such as trace metals, pesticides, oil and fertilizers and their impacts on environmental compartments such as soil, plants and water have attained a great importance (4). In recent years, the contamination of aquatic systems has become a problem of great concern throughout the world (5). The main purpose of the study was to obtain basic and simple information for a better understanding of environmental impact of some of the heavy metals contaminates the aquatic life. Monthly variations and year wise variations of metals like Li, Al, V, Fe, Co, Ni, Cu, Zn, As, Ag, Cd, Cs, Ba, Ti, Pb, U etc., and assess the level of concentrations.

In India much research has been carried out with regards to assessment of Heavy metal concentrations in different tanks like Ureje water Reservoir (6), Hussainsagar lake water (7), River Noyyal (8), Ground water of Goa mining region (9), Drinking water contaminated with Heavy Metals (10). Andhra Pradesh has good number of Reservoirs, Ponds and Tanks. Qualitative and quantitative heavy metal investigations had been carried out in water bodies like Kolleru lake (11), water samples of Tirupathi region (12), In ground water of SPSR Nellore district (13), Surface and ground water of rural and urban areas of Kakinada, East Godavari district (14), Fish pond in around Bhimavaram, West Godavari district (15), Surface and Ground water in and around Tirupati (16).

2.METHODOLOGY

Study area: Singanamala Tank (Sri Rangarayalu Cheruvu) located at Singanamala, Anantapuramu District of Andhra Pradesh. It is about 3 km from Singanamala village and 20 km from Anantapuramu Town. It is largest tank in the district and geographically is located at 14°48'00" N Latitude and 77°43'00" E longitude. Elevation of this tank is 287 meters (944 fts) the Catchment area is 3436.00 acres and existing ayakut is about 5000 acres. The storage capacity of this tank is 0.5 TMC with the depth of 5-9 fts. The main source of water for this tank is rain fall and receives through surface run off during monsoon from Tadakaleruvagu, Erravanka, Vadiyampeta canal and Narasapuramvanka.

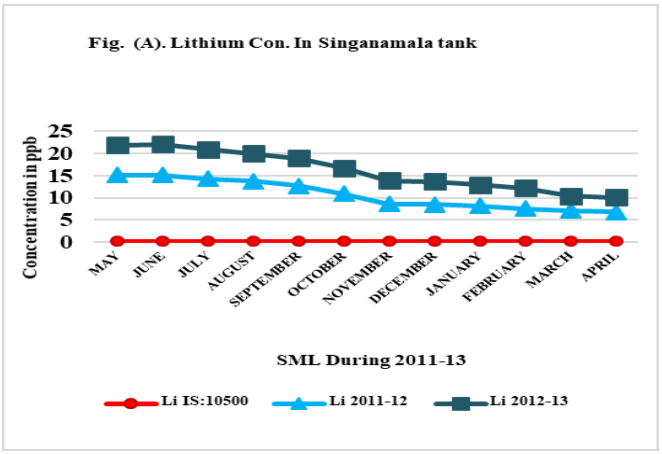
Methodology: The water samples were collected and stored in 1liter capacity clean plastic bottles. Before collection of samples, the bottles were washed with double distilled water. All the samples were filtered using Whattman 42 filter paper and were diluted to bring down the TDS 200 ppm for further analysis by ICP-MS. The trace element samples were treated with 0.6N HNO3. The elements were analyzed by Inductive Coupled Plasma-Maas Spectrophotometer (ICP-MS). A Perkin Elmer SCIEX®, Model ELAN 5000 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) (Concord, Ontario, Canada) was used throughout. Acidified water samples were directly fed into the instrument nebulizer after proper dilution and filtration. Calibration was performed using the certified reference material NIST 1640a (National Institute of Standards and Technology, USA) to minimize matrix and other associated interference effects and

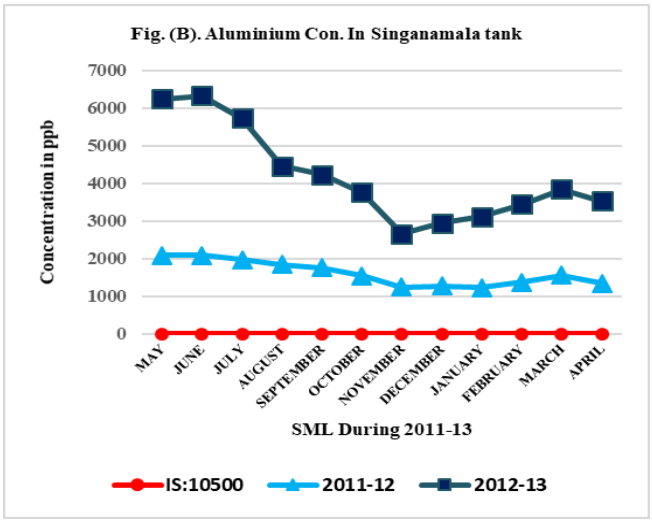
accuracy was better than 6% RSD. Relative standard deviation (RSD) was found to be better than 6% in the majority of the cases, which indicates that the precision of the analysis is reasonably good. Trace elements analyses were carried out at Department of Geophysics, Andhra University, Vishakapatnam, AP, India.

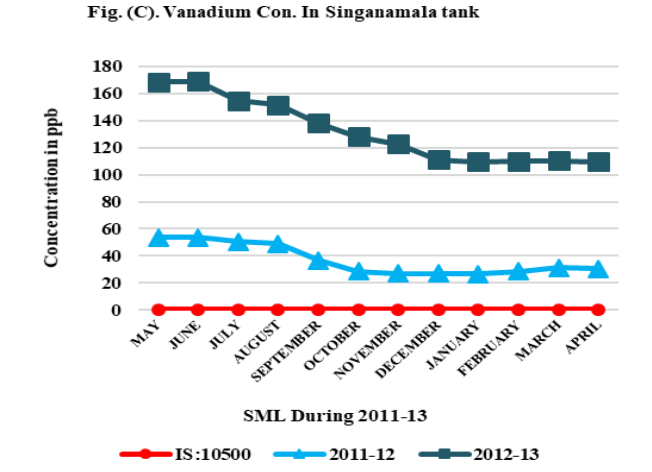
3. RESULTS AND DISCUSSION:

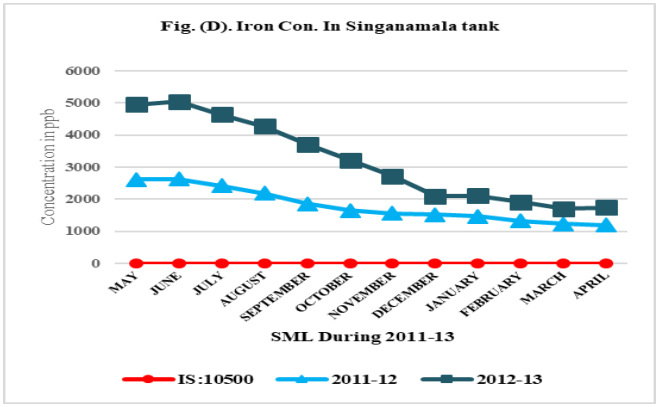
The mean Lithium levels in water sample were ranged from maximum 14.87 ppb in the month of June, 2011 and minimum 3.26 ppb in the month of April, 2013 (Fig A). The concentration of Lithium was above desirable limit i.e., 0.2 mg/L according to the Drinking water specifications IS 10500:2012. The mean Aluminium ranged from the maximum value of 4245.3 ppb in the month of June, 2012 and a minimum of 1234.4 ppb in the month January, 20112 (Fig B). The concentration of Aluminium was above desirable limit i.e., 0.3 mg/L according to the Drinking water specifications IS 10500:2012. The range of Aluminium in the present study was also observed by (17 2008) in the study of Impact of metals on Aquatic Ecosystems. On the observation of the results of Vanadium were ranged from the maximum 115.3 ppb in the month of June, 2012 and minimum 26.31 ppb in the month of January, 2012 (Fig 6 C). The concentration of Vanadium was above desirable limit i.e., 0.3 mg/L according to the Drinking water specifications IS 10500:2012. Iron (Fe) is an essential metal for most living organisms and humans. It is a constituent of proteins and many enzymes, including haemoglobin and myoglobin (18, 19). The mean value of Fe ranged from a maximum value 2636 ppb in the month of June, 2011 and a minimum 471.7 ppb in the month of March, 2013 (Fig D). The concentration of Iron was above desirable limit i.e., 0.3 mg/L according to the Drinking water specifications IS 10500:2012. The high concentration of Iron in the study area is due to the presence of Iron by washing vehicles, which was also mentioned by (14). Cobalt is beneficial for humans because it is a part of vitamin B12 which is essential for human health. Cobalt is used to treat anaemia with pregnant women, because it stimulates the production of red blood cells. The concentration of Cobalt tank ranged from 6.61 ppb in the month of May, 2011 and BDL (below detective level) in the months of March and April, 2013 (Fig E). The desirable limit of Cobalt was not mentioned according to the Drinking water specifications IS 10500:2012. In fresh waters it is generally low and higher concentrations are generally associated with industrialized or mining areas. The concentration range of Nickel was found between 115.1 ppb in the month of June, 2011 and 11.26 ppb in the month of April, 2013 (Fig F). The concentration of Nickel was above desirable limit i.e., 0.05 mg/L according to the Drinking water specifications IS 10500:2012. It was found maximum in rainy season. It can be deposited in the sediment by such process as precipitation, complexation and adsorption on clay particles (20). Copper is one of the earliest known metals. The range of Copper was found from 59.46 ppb in the month of June, 2011 and 10.6 ppb in the month of November 2011 (Fig G). It was noticed that the desirable limit of Copper in water is 0.05mg/L. The higher values of Cu may be attributed to the huge amounts of raw sewage, agricultural discharge in to the water bodies (21). Zinc involved in the nucleic acid synthesis and participates in a variety of metabolic processes involving carbohydrates, lipids, proteins and nucleic acid (22). The fluctuations of Zinc were found maximum with the value 9674.6 ppb in the month of July, 2011 and the minimum value 732.45 ppb in the month of March, 2012 (Fig H). The concentration of Zinc was above desirable limit i.e., 5.0 mg/L according to the Drinking water specifications IS 10500:2012. The higher values of Zn may be attributed to the huge amounts of raw sewage, agricultural discharge into the water bodies (21). The high level of Arsenic was found in the month of June, 2011 (33.71 ppm) and the low level was found in the month of March, 2013 (5.01 ppm) (Fig I). The concentration of Arsenic was above desirable limit i.e., 0.05 mg/L according to the Drinking water specifications IS 10500:2012. High values of Arsenic are mainly due to discharge of effluents from industries like paints, pharmaceutical, fertilizers and pesticides (23). The presence of minimum range of Silver in our food is very much essential for human beings, but the higher presence causes many abnormalities, especially the salts of Silver like $AgNO_3$ causing bluish or black pigmentation. The variation in the concentration of Silver was ranged between 57.5 ppb in the month of November, 2011 and 0.88 ppb in the month of November, 2012 (Fig J). The range of Cadmium value was found between 1.89 ppb in the month of June, 2012 and 0.41 ppb in the months of March and April, 2013 (Fig K). The concentration of Cadmium was above desirable limit i.e., 0.01 mg/L according to the Drinking water specifications IS 10500:2012. The high levels of Cd in water were known to be attributed to the agricultural discharge (24). The concentration of Caesium was assessed in water sample ranged between 0.3 ppb in the month of June, 2011 and 0.05 ppb in the month of November, 2011(Fig L). Barium is one of the 14 abundant element found in earth's crust. The fluctuations of Barium values were ranged between 1846.3 ppb in the month of July, 2012 and 241.2 ppb in the month of May, 2012 (Fig M). The concentration of Barium was above desirable limit i.e., 0.7 mg/L according to the Drinking water specifications IS 10500:2012. Titanium was detected in the water sample ranged between 0.05 ppb in the months of May and June, 2011 and BDL (below detectable level) in the months of May, 2012 to January, 2013 (Fig N). The concentration of Titanium was within desirable limit i.e., 0.05 mg/L according to the Drinking water specifications IS 10500:2012. The analysis of the concentration of Lead was found in the water sample varied from 109.3 ppb in the month of June, 2011 and 12.13 ppb in the month of April, 2013 (Fig O). The concentration of Lead was above desirable limit i.e., 0.1 mg/L according to the Drinking water specifications IS 10500:2012. The high levels of Pb in water can be attributed to the agricultural discharge (25). Uranium is the radioactive trace element occurring naturally in soil and rocks. The concentration of Uranium in water is typically very small, but varies from region to region. The variation in the concentration of Uranium in the water sample ranged between 34.74 ppb in the month of March, 2013 and 5.93

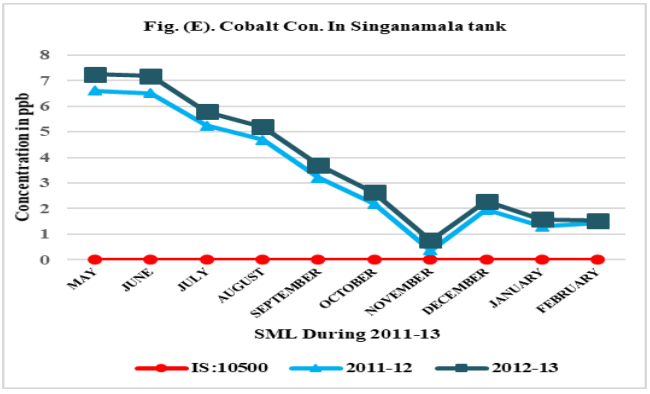
ppb in the month of November, 2011 (Fig P). The concentration of Uranium was above desirable limit i.e., 0.1 mg/L according to the Drinking water specifications IS 10500:2012 in both the tanks. Kidney injury is the most sensitive end point for Uranium, which means that the kidney is the organ that is most susceptible to the effect of Uranium.

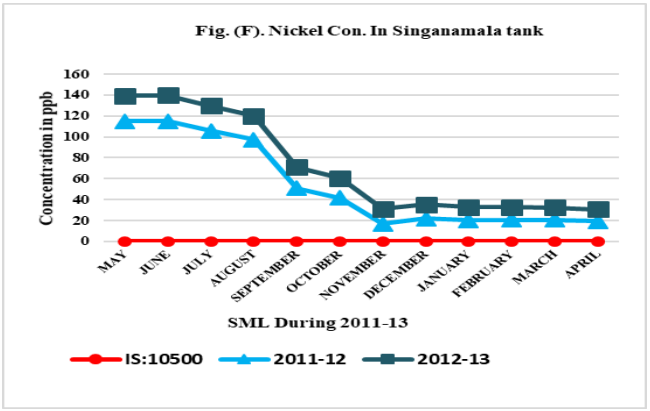












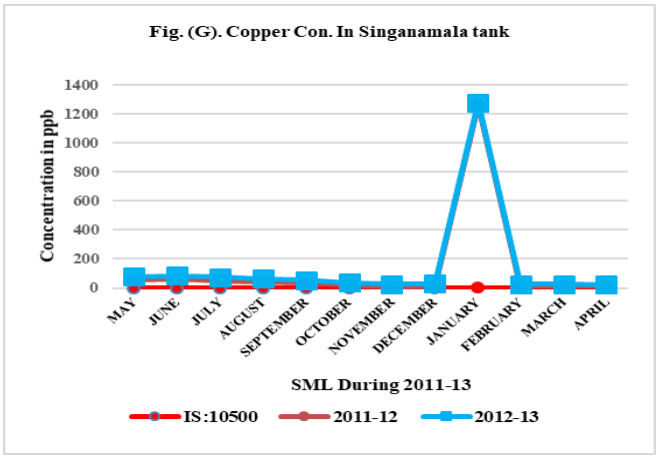


Fig. (H). Zinc Con. In Singanamala tank

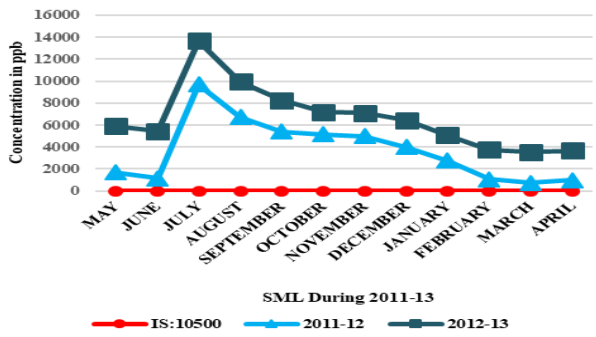


Fig. (L). Caesium Con. In Singanamala tank

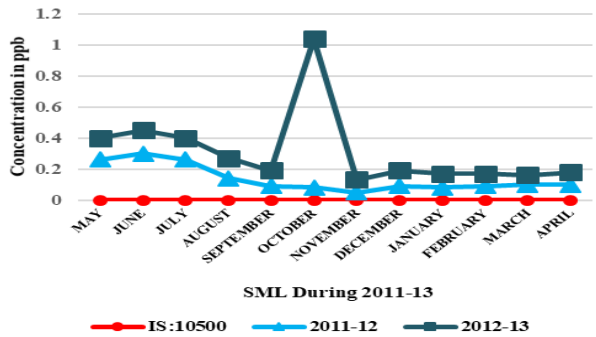


Fig. (I). Arsenium Con. In Singanamala tank

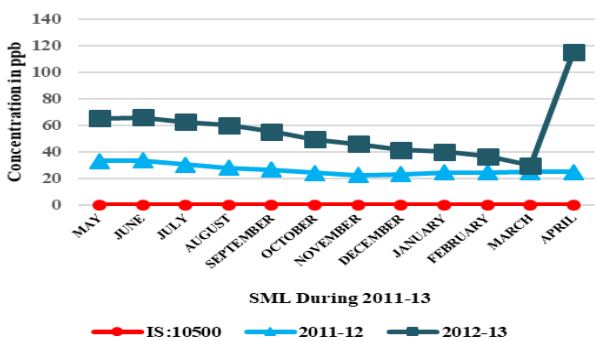


Fig. (M). Barium Con. In Singanamala tank

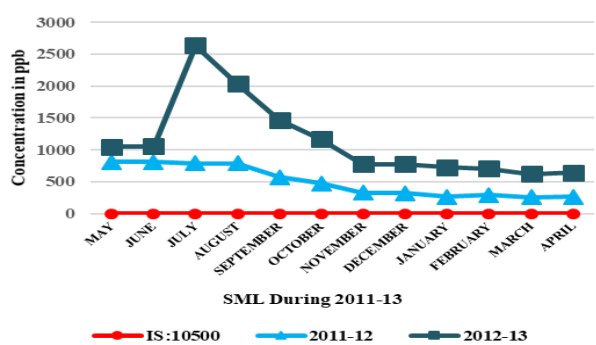


Fig. (J). Silver Con. In Singanamala tank

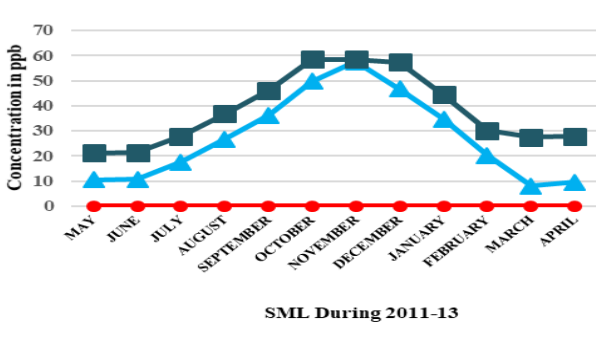


Fig. (N). Titanium Con. In Singanamala tank

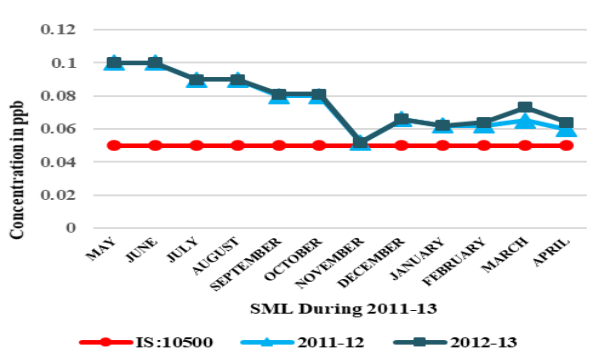


Fig. (K). Cadmium Con. In Singanamala tank

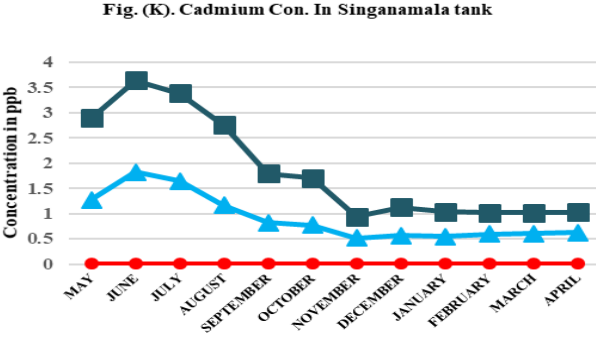
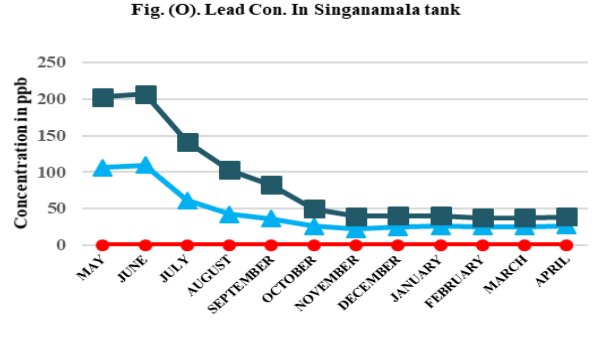
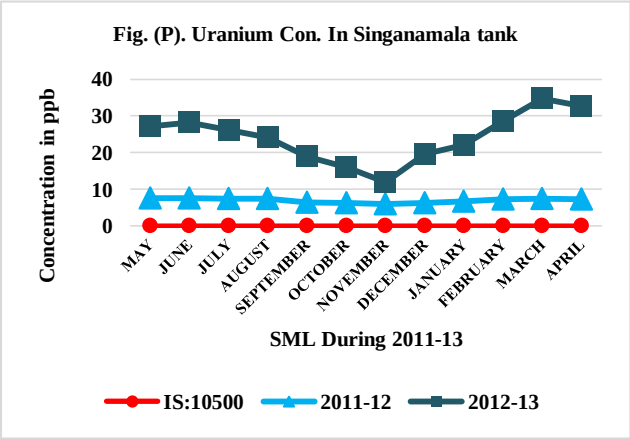


Fig. (O). Lead Con. In Singanamala tank





4. CONCLUSIONS

From all the above mentioned research findings, it is finally concluded that Singanamala Tank (Sri Rangarayalu Cheruvu), water was contaminated by effluents coming from runoff through the fields and canals during rainy season, fishing cleaning vehicles, washing cloths etc. So the metal concentrations were beyond the permissible limits of Drinking water specifications IS 10500:2012 which may cause harmful effects on cultured fish. Consuming this water by animals affect their health and using this water for agriculture may drastically affects the Agricultural produce.

ACKNOWLEDGEMENT

I am very thankful to Prof. G. H. PHILIP, my Research Supervisor and Head, Department of Zoology for his valuable guidance throughout my research work and providing the necessary Lab Facilities.

REFERENCES

[1]. E.O. Farombi, O. A. Adelowo and Y. R. Ajimoko, "Biomarkers of oxidative stress and heavy metal levels as indicator of environmental pollution in African Catfish (Clarias gariepinus) from Nigeria Ogun river". International Journal of Environmental Research and Public Health. 2007. 4:158-165.

[2]. B. L. Vellee and D. D Ulmer, "Biochemical effect of mercury, cadmium and lead". Ann Rev Biochem,1972. 41:91-128.

[3]. R. Vinodhini and M. Narayanan, "Bioaccumulation of heavy metals in organs of fresh water fish Cyprinus carpio (Common carp)", Int. J. Environ. Sci. Tech., 2008. 52(1).

[4]. L. Yanina Idaszkin, Julio L. Lancelotti, Pabl J. Bouza, Jorge E. Marcovecchio, "Accum,ulation and distribution of trace metals within soils and austral cord grass Spartina densiflora in a Patagonian salt marsh",Marine Pollution Bulletin. 2015. 101:457-465.

[5]. Honggang ZHANG, Baoshan CUI, Rong XIAO, Hui ZHAO, "Heavy metals in water, soils and plants in riparian wetlands in the Pearl River Estuary, South China". Procedia Environmental Sciences, 2010. 2:1344-1354.

[6]. I. A. Adebayo, "Determination of Heavy Metals in water, Fish and Sediment from Uree water Reservoir". Journal of Environmental and Analytical Toxicology, 2017.7(4):486-90.

[7]. N. Sreenu, C. Venkateswar, B. Reddya Naik and J. Avinash Kumar, "Evaluation of CV Technology for reducing levels of heavy metals in polluted Hussainsagar lake water, Hyderabad, Telangana state, India", 2017. 7(9):18-23.

[8]. R. Babunath and G. John, "A study on Physico Chemical and Heavy Metals Characteristics of River Noyyal,Tamilnadu, India". Environmental Science: An Indian Journal, 2017. 13(1):1-9.

[9]. Gurdeep Singh and Rakesh Kant Kamal, "Heavy metal contamination and its indexing approach for groundwater of Goa mining region, India", 2016.7:1479-1485.

[10]. Q. A. Malik and M. S Khan, "Effect of Human Health due to Drinking Water Contaminated with Heavy Metals", Journal of pollution Effects and control, 2016. 5(1):1-2.

[11]. B.B.R.G. Vijalakshmi and P. Brahmaji Rao, "Assessment of Heavy Metal distribution of Water and Sediments in Kolleru Lake A.P". IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS), 2017. 12(4):40-46.

[12]. P. Latha, B. Gangadhar and G. Ramakrishna Naidu, "Trace Metal Analysis in Soil and Plant Samples of Tirupati Region, Andhra Pradesh". International Journal of Engineering Science Invention, 2016. 5(60):15-18.

[13]. O. Venkata Subbaraju, P.M.N. Prasad, V. Varalakshmi and V. Rami Reddy Y, "Determination of heavy metals in ground water by ICP-OES in selected coastal area of SPSR Nellore district, Andhra Pradesh, India. International journal of innovative research in Science, Engineering and Technology, 2014. 3(2):9743-9749.

[14]. J. Srinivas, A. V. Purushotham and K.V.S.G. Murali Krishna, "A study of heavy metals contamination in surface and ground water of rural and urban areas of Kakinada, East Godavari District, A.P". International journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD), 2013. 3(5):231-236.

[15]. Priyamvada Devi, D. Sirisha and N. Gandhi, "Study on the Quality of water and soil from Fish pond in around Bhimavaram West Godavari District, A.P",India. International Research journal of Environmental Sciences, 2013. 2(1):58-62.

[16]. Y.V. Ramireddy, V. Hanuman Reddy, P.M.N. Prasad and A. V. Ramanareddy, "Determination of heavy metals in

surface and groundwater in and around Tirupati, Chittoor District, Andhra Pradesh, India". Den Pharma Chemica, 2012. 4(6):2442-2448.

[17]. Frances Solomon, "Impacts of Metals on Aquatic Ecosystems and Human Health". Environment and Communities, 2008. pp 14-19.

[18]. R. Yip, Dallman PR. Iron. "In Present Knowledge in Nutrition", 7th ed.; Ziegler, E.E., Filer, L.J., Eds.; (ILSI Press: Washington DC., USA); 1996. pp. 277–292.

[19]. T. Brody, "Nutritional Biochemistr"y, 2nd ed.; Academic Press: San Diego, CA, USA, 1999.pp. 697–730.

[20]. I.D. Barałk and J. Siepak "Chromium, nickel and cobalt in environmental samples and existing legal norms". Polish J. Environ. Studies, 1999. 8: 201.

[21]. M. A. Abdel-Moati and A. A. El-Sammak. "Man-made impact on the geochemistry of the Nile Delta Lakes. A study of metals concentrations in sediments". Water, Air and Soil Pollution, 1997. 97: 413-429.

[22]. L. R. Mc Dowell, "Minerals in animal and human nutrition. In: Cunha, T.J. (Ed.). Animal feeding and nutrition, A.P". Inc. Lond., N.Y, 1992. 265-275.

[23]. Mushtaq Hussein and T.V.D. Prasad Rao, "Multivariate statistical analysis of heavy metals in ground water- A case study of Bolaram and Patancheru Industrial Area, Andhra Pradesh, India". International journal of Advanced Research. 2014. 2(2):876-883.

[24]. C. F. Mason, "Biology of freshwater pollution". 4rd ed. Essex Univ. England, 2002. 387 pp.