IJETST- Vol.||03||Issue||01||Pages 3422-3430||January||ISSN 2348-9480 2016

Open access Journal International Journal of Emerging Trends in Science and Technology

Assessment of Trace Elements Concentration in various Aquatic Ecosystems of Nedumangadu and Neyyatinkara Taluk of Thiruvananthapuram District in Kerala, India

DOI: http://dx.doi.org/10.18535/ijetst/v3i01.01

Authors

Ancy Mol.P[1], PaulRaj.K[2], Shaji.E[3]

[1]Research Scholar, Department of Botany, NMCC, Marthandam,Tamil Nadu

[2]HOD, Department of Botany, NMCC, Marthandam, TamilNadu

[2]Proffesor, Department of Geology, University of Kerala, Karivattom

Email: *ancymol2001@gmail.com*

Correspondence Author

Ancy Mol.P

Email: *ancyol2001@gmail.com*, phone-09497681892

Abstract

In the present study an attempt has been made on trace element analysis on various ponds connected to Neyyar river basin in Thiruvananthapuram District of Kerala. The study was carried out for two years i.e. January 2012 to December 2013. For the study period ten sites were selected and was conducted to determine the seasonal changes of trace elements (Cu, Cd, Cr, Fe, Mn, Zn, Co and Pb). The concentration of Cadmium in pond ecosystem ranges from 0.001 mg/l to 0.028 mg/l. The trace element concentrations are below the permissible limit in all ponds except Cadmium. The concentration of cadmium is higher in one pond (Thavalayilakulam). Co was not found in any of the ponds during the study period. The trace elements were determined by atomic Absorption Spectrophotometer, Thermo ICE-3500 series. All the data were analysed statically using one-way ANOVA to investigate the seasonal significant relationship in the ponds.

Keywords: *AAS, trace elements, ANOVA.*

1.0 Introduction

The term 'trace elements' is used widely in the literature and has different meanings. It designates a group of elements that occur in natural system in minute concentration. The discharge of trace elements into aquatic ecosystem has become a matter of concern over a last couple of decades. The rapid industrialization has resulted in accelerating the flux of trace elements into the environment. Industrial effluents, agricultural runoff, transport, burning of fossil fuel, animal and human excretion, geochemical weathering and domestic wastes could contribute trace elements into the water bodies (Vermani and Narula, 1989). Surface waters depend mainly on the topography of the area, weather as well as seasonal conditions (Canh. and At., 2003). The presence of any trace elements in the ecosystem interferes the beneficial use of water bodies because of toxity (Hunter *et al.*, 1987).

Trace metals, industrial pollutants, in contrast with organic materials cannot be degraded and therefore accumulate in water, soil, bottom sediments and living organisms. Occurrence of toxic metals in pond, ditch and river water affect the lives of local people that depend upon these water sources for their daily requirements (Rai *et al.*, 2002). Metals enter the aquatic environment from a variety of sources. Although most metals are naturally occurring through the biogeochemical cycle (Garret, 2000), they may also be added to environment through anthropogenic sources, including industrial and domestic effluents, urban runoff, landfill leachate, atmospheric sources and boating activities (Furstner and Wittmann, 1979). The main natural sources of metals in waters are weathering of minerals.

2.0 Study Area

2.1 Materials and Methods

The study area falls in Trivandrum district, is located between Southern parts of Western Ghats. It has distinct tropical climate. There are number of surface water bodies (*i, e*., ponds *etc*) both in the rural and urban areas of the city but unfortunately there is a lack of sufficient information of the water quality of these water bodies. Ten ponds including Neyyar river basin water was analysed during the study. The sites are 1. Neyyar River water (N/08º37', E/077º15'),2.Valiyakualam (N/08º31´483'', E/077º08'748"), 3.Thopinkulam (N/08º29´081'', E/077º07'889"), 4.Myparambukulam (N/08º28´ 916'', E/077º07'796") ,5.Vattakulam (N/08º 23´183'', E/077º08'440"), 6.Choodukulam (N/08º23´146'', E/077º08'679"), 7.Ponnankulam (N/08º21´799'', E/077º08'246"), 8.Thavalayil-lakulam (N/08º20´763'', E/077º09'025"), 9. Puthukulam (N/08º20´239'', E/077º09'475"), 10.Puliankulam (N/08º19´951'', E/077º 09'744").

2.2 Sampling and Analysis

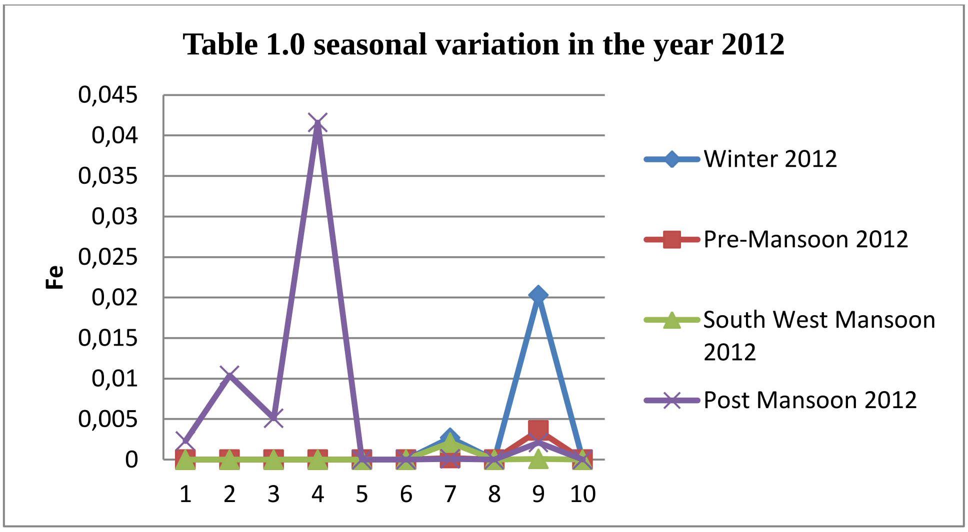
The study was carried out during the year 2012 and 2013. The seasons and months were adopted as per Indian Meteorological Department, Kerala and were constituted as follows: Winter season (January- February), Pre-Monsoon season (March – May), Southwest Monsoon season (June- September) and Post Monsoon season (October- December). Samples were collected and stored following the Standard Methods for the Examination of Water and Wastewater (APHA, 2005). The metal concentration was estimated using Atomic Absorption Spectrophotometer, Thermo ICE-3500 series.

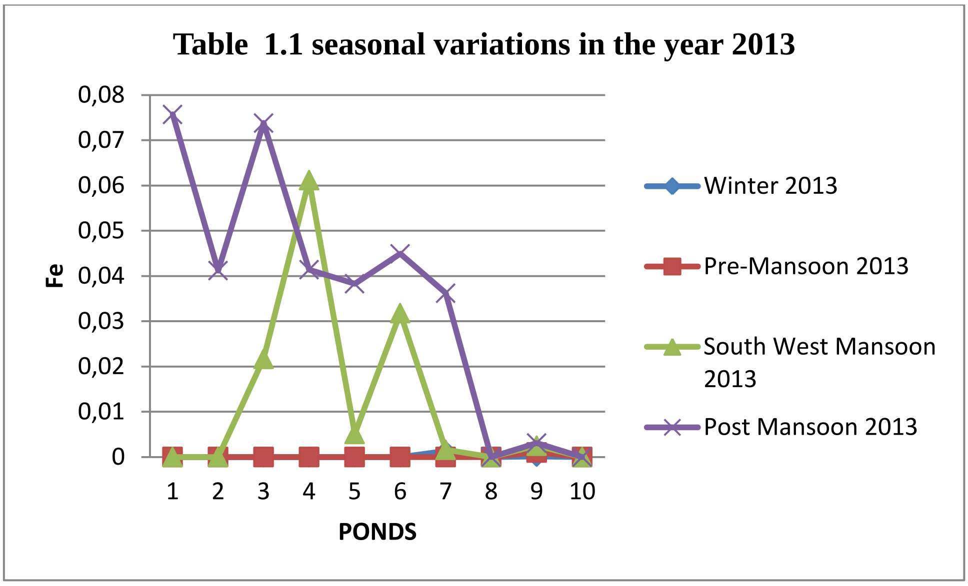
3.0 Results and Discussion

To study the seasonal variation in heavy metals, ten water bodies were designated as p1, p2, p3, p4, p5, p6, p7, p8, p9, p10. Groups were compared by one factor analysis of variance (ANOVA). Analysis of correlation was performed on SPSS (version 16.0).

3.1 Iron (Fe)

In the year 2012 & 2013 the amount of iron concentration was found all seasons in two ponds (Ponnankulam & Puthukulam). Iron concentration is not detected in Choodukulam in any seasons. In post monsoon season Iron is detected in Neyyar River water, Valiyakualam, Thopinkulam, Myparambukulam, Vattakulam in both years. However, during post monsoon the concentration of iron was found maximum in Puthukulam pond (0.0757 mg/l) and minimum in Ponnankulam (0.0001mg/l) during winter season. Seasonal variations are shownin Table (1.0 &1.1)





3.2 Manganese (Mn)

In the year 2012 & 2013 the amount of manganese concentration was found all seasons in two ponds (Ponnankulam & Thavalayilakulam). Manganese concentration is not detected in Valiyakualam, Thopinkulam, Myparambukulam, Vattakulam, Choodukulam and Puliyankulam in pre-monsoon season (2012). However, during south west monsoon the concentration of manganese was found maximum in Valiyakualam pond (0.086 mg/l) and minimum in Myparambukulam (0.0001mg/l) during winter season. Seasonal variations are shownin Table (1.2 &1.3)

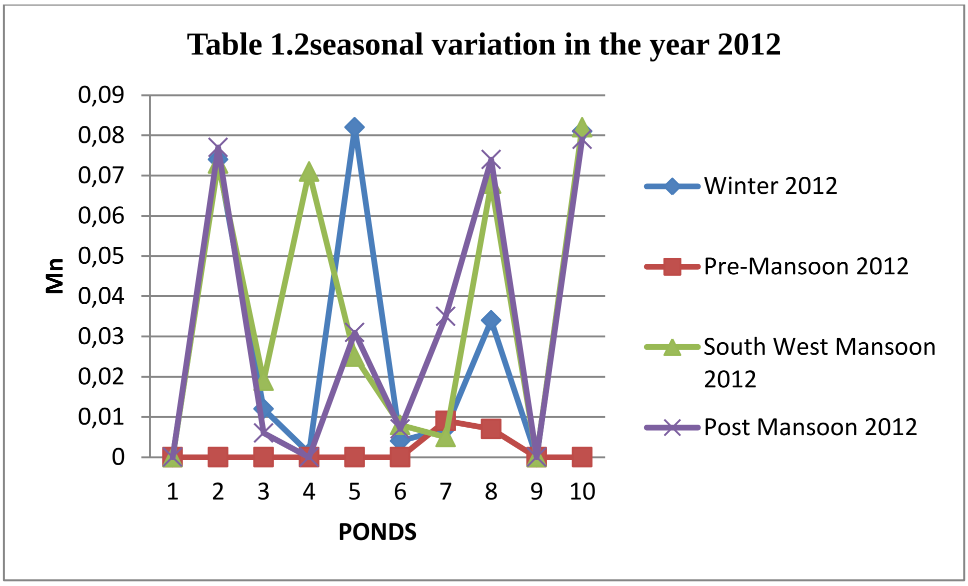
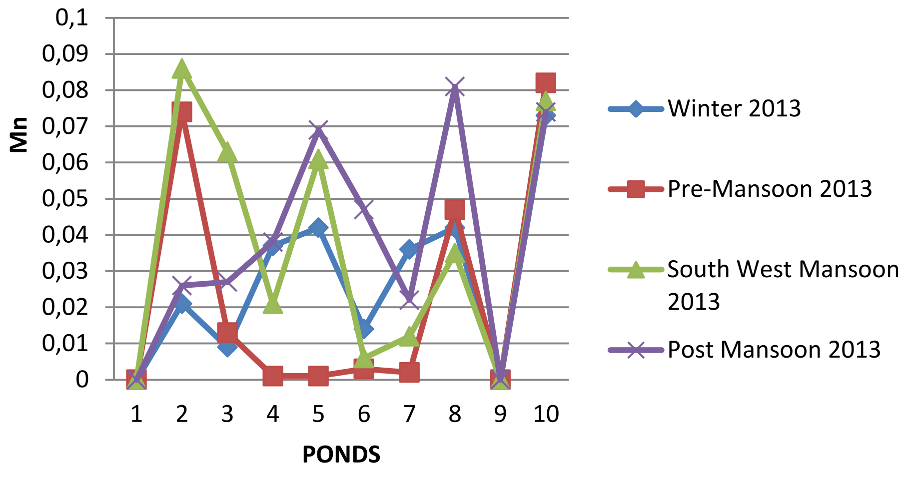


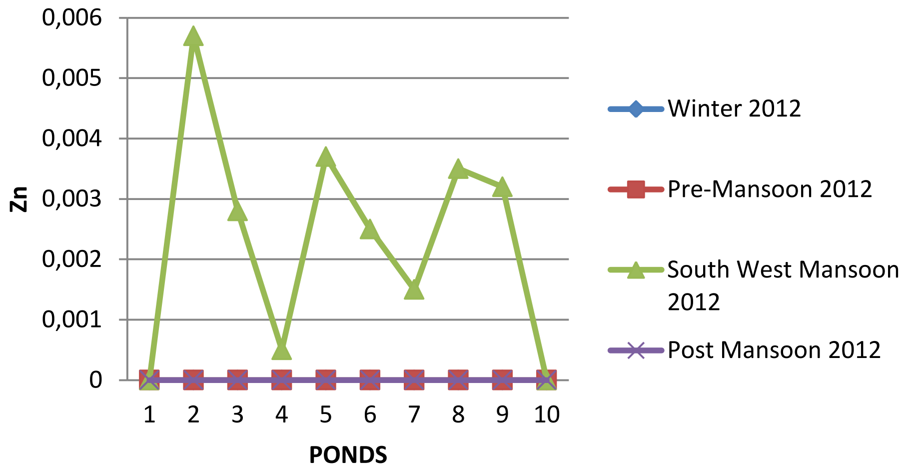
Table 1.3 seasonal variations in the year 2013



3.3 Zinc (Zn)

Zinc is not detected in Neyyar river basin and Puliyankulam in any seasons. In south west monsoon season of 2012 &2013, zinc was detected in Valiyakualam, Thopinkulam, Myparambukulam, Vattakulam, Choodukulam, Ponnankulam, Thavalayillakulam and Puthukulam. The maximum concentration was detected in Valiyakualam (0.0057mg/l) and minimum concentration was detected in Myparambukulam and Thavalayillakulam (0.0005mg/l). Seasonal variations are shown in Table (1.4 &1.5).

Table 1.4 seasonal variations in the year 2012



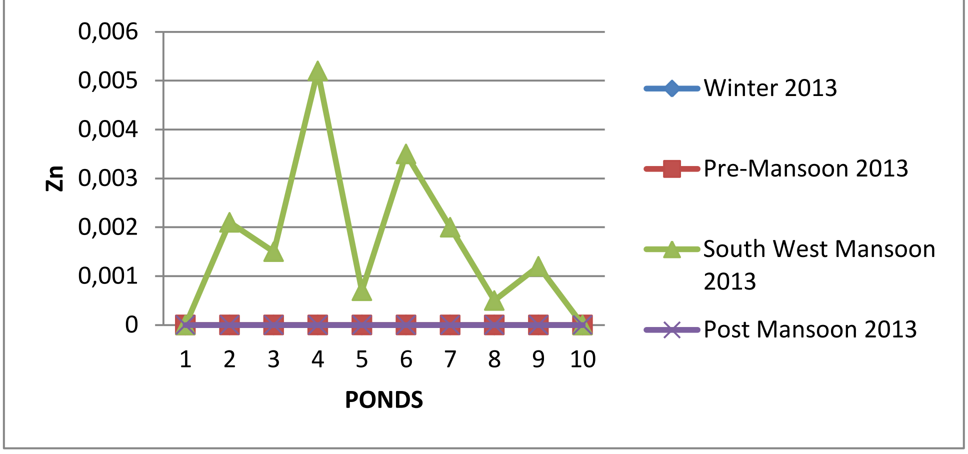


Table 1.5seasonal variations in the year 2013

3.4 Lead (Pb)

Lead was detected in all the seasons in Puthukulam. Lead is not detected in Neyyar river basin and Puliyankulam. Lead was detected in southwest monsoon in 2012 & 2013. Lead was detected in post monsoon (2013). The maximum concentration of lead was detected in Valiyakulam (0.062mg/l) and minimum concentration was detected in Puthukulam(0.001mg/l). Seasonal variations are shown in Table (1.6&1.7)

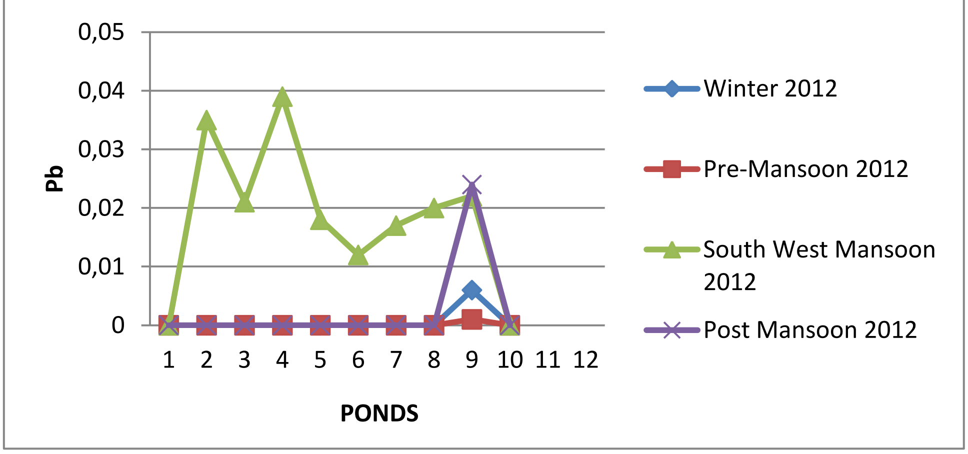


Table 1.6 seasonal variations int he year 2012

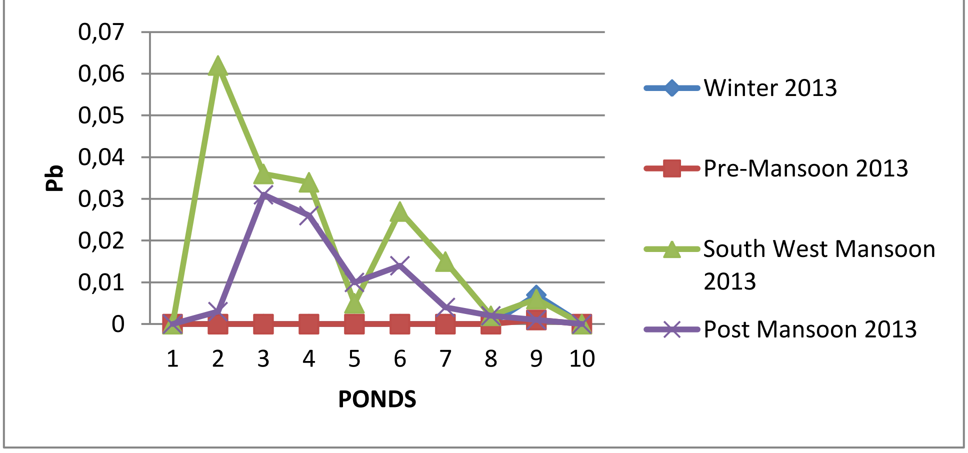
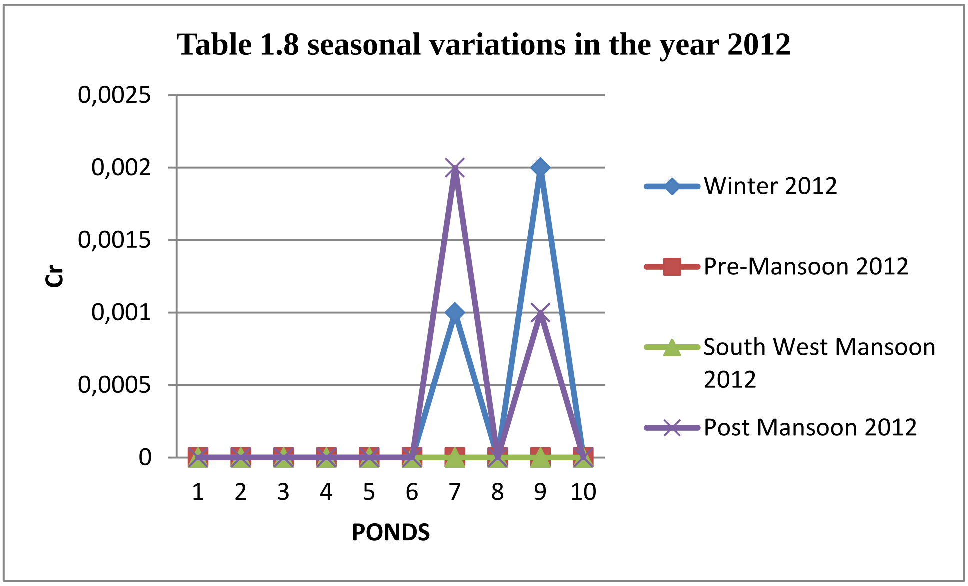
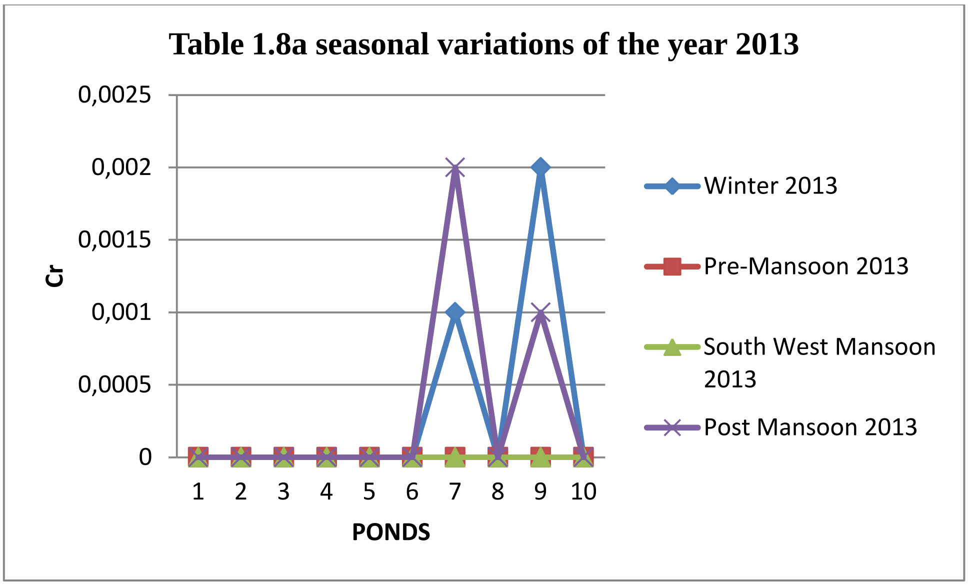


Table 1.7 seasonal variations in the year 2013

3.5 Chromium (Cr)

Chromium was detected in winter and post monsoon seasons in top ponds (Ponnankulam and Puthukulam) in 2012 & 2013. Lead was detected in lower concentration (0.001 & 0.002mg/l) However, lead was not detected in other ponds in any of the seasons. Seasonal variations are shown in Table (1.8 &1.8a)





3.6 Cadmium (Cd)

Cadmium was detected in three ponds (Ponnankulam, Thavalayilakulam and Puthukulam) in all seasons. The maximum concentration of cadmium was detected in Ponnankulam (0.028mg/l) and minimum concentration was detected in Puthukulam (0.001). Lead is not detected in other ponds in any of the seasons. Seasonal variations are shown in Table (1.9&2.0).

Table 1.9 seasonal variation of the year 2012

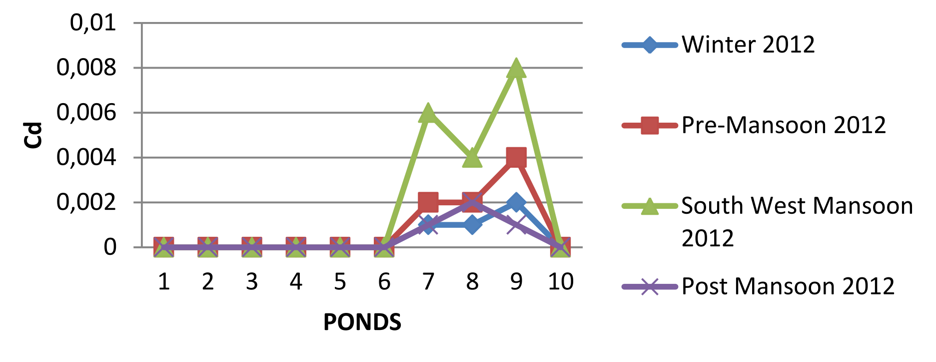
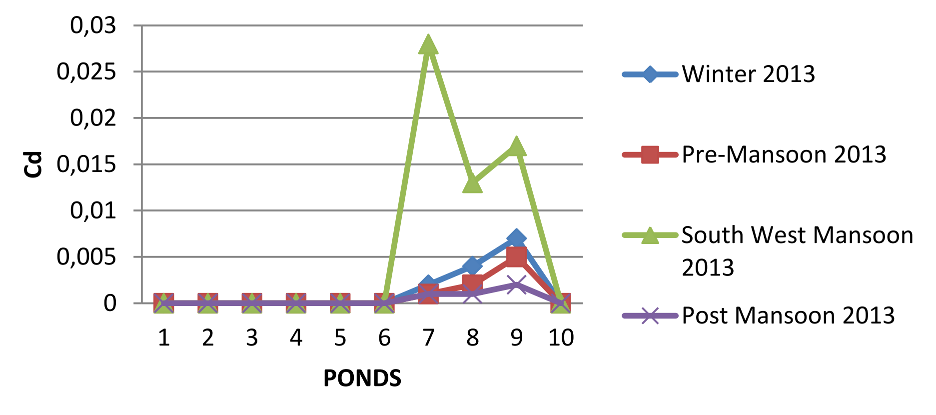


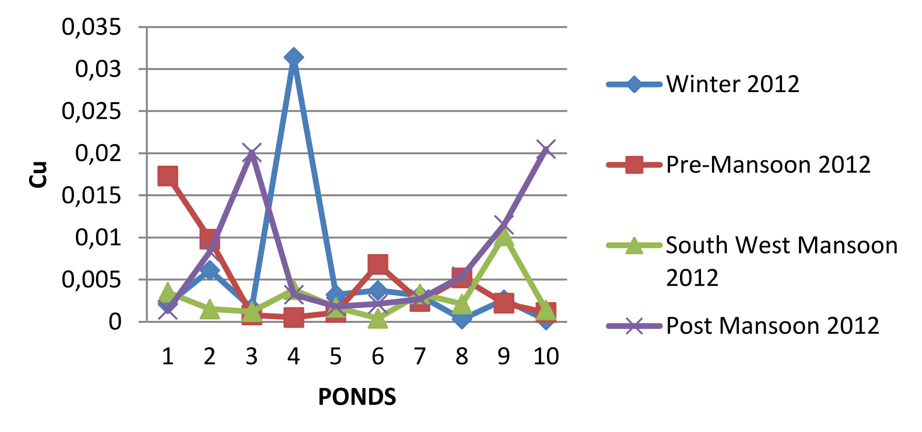
Table 2.0 seasonal variations of the year 2013

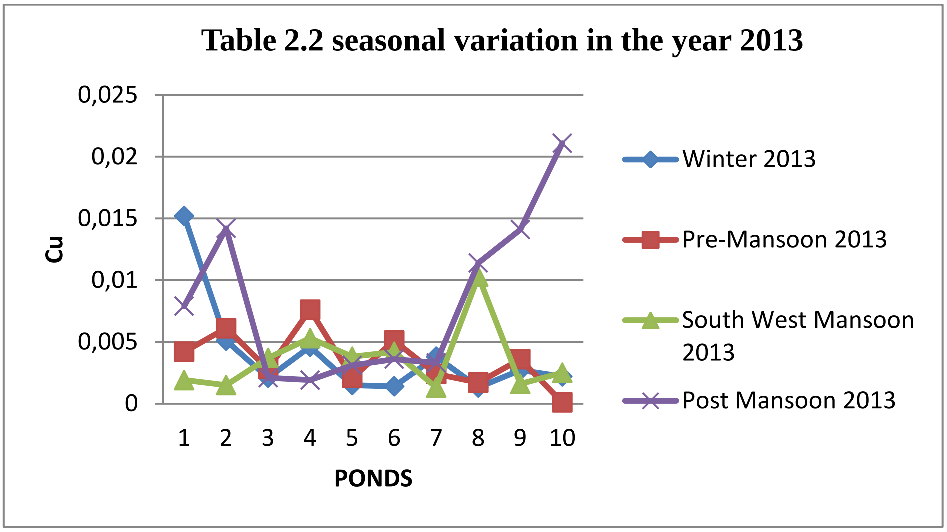


3.7 Copper (Cu)

It was recorded that copper was detected during all the seasons in all samples. However, maximum amount of copper was detected during Myparambukulam (0.0314 mg/l) during south west monsoon and minimum concentration was detected during winter in Puliyankulam (0.0002mg/l). Seasonal variations are shown in Table (2.1 &2.2)

Table 2.1 seasonal variation in the year 2012





1-Neyyar River water, 2-Valiyakualam 3-Thopinkulam 4-Myparambukulam.5-Vattakulam, 6-Choodukulam, 7-Ponnankulam, 8-Thavalayillakulam, 9-Puthukulam 10-Puliankulam. P-ponds.

During the study period, in southwest monsoon season cadmium was detected above the permissible limit in Ponnankulam (0.028mg/l). Cadmium is contributed to the surface waters through paints, pigments, glass enamel, deterioration of the galvanized pipes *etc*. The wear of studded tires has been identified as a source of cadmium deposited on road surfaces. It is less toxic to plants than Cu, similar in toxicity to Pb and Cr. It is equally toxic to invertebrates and fishes(Moore,1984). Setia *et al*. (1998) concluded that sewage water contain 4 to 10 times more cd content than tube well water. Lead was also detected above the permissible standards in Valiyakulam(0.062mg/l). Bordoloi *et al*.(2002) had reported the metals deposited in the sediments come out during heavy rainfall and flow into the water system. Roberto *et al*. (2008) had also reported that rainfall infiltrate the soil and underlying geologic formations, dissolve metals like Fe causing them to seep into acquifers and finally water system thus increasing their concentrations. Fe,Cu, and Zn form substantial part of the wastes and effluents from workshops, industries and markets around the ponds may have been carried to the ponds during the rains and runoff resulting in the presence of trace elements during monsoon season. Shivkumar and Biksham (1995) analyzed the industrial effluents, surface water and subsurface ground water for Cu content. The concentration of copper is within the permissible limits in all the samples.

Manganese, although is not a toxic metal, it imparts objectionable and tenacious stains to laundry plumbing fixtures. It is found to occur in the domestic waste water. The concentration of manganese does not show much significant changes in any seasons. The trace metal concentration may originate from anthropogenic sources such as waste incineration, vehicle operation, combustible consumption, and fertilizers use (Councell *et al*,2004), which likely come from the upper basin of the lotic systems that flow into the wetland. Zinc was found in eight ponds in south west monsoon season and there was not much significant variation, however, the ponds recorded significantly less concentration in south west season. Though zinc is involved in nucleic acid synthesis and participates in a variety of metabolic processes involving carbohydrates, lipids, proteins and nucleic acid (Mc. Dowell.1992), it can be toxic also when present in excess amount as changes in blood parameters a nd tissues structures have been reported on exposure to zinc (Gupta and Chakraborty, 1995; Banerjee, 1998).

4.0 Conclusion

The concentration of trace elements in different aquatic ecosystem depends on the geographical characteristic of the area, weather as well as seasonal conditions (Heath, 1987). The purpose of this study was to determine concentrations of selected trace elementsin the aquatic ecosystems connected to Neyyar River. Neyyar River are within the permissible limits. The city sewage discharge, agriculture and urban runoff and continous dumping of waste materials especially sanitary waste are affecting the water quality of these urban water bodies. There is considerable need for better understanding of these small impoundments so that they can be managed effectively.

Acknowledgment

The author would like to thank the Soil Survey Directrate for the analysis of heavy metals Vazhuthacaud,Thiruvananthapuram. Kerala.

References

1. APHA (2005). Standard Methods for the examination of water and waste water, 21st edition. American Public Health Association DC, USA.
2. Banerjee, V.(1998): Influence of zinc and mercury on blood parameters of the fish Heteropneustes fossilis.*Environ.Ecol.*,16: 79-84.
3. Bordoloi , R.K., Kotoky,P., Haque,L. Borah, G.C. (2002): Heavy metals in the sediments of Tokial River, Assam. *IJEP*, 22: 779-784.
4. Canh., and Ath, G. (2003). Environmental Pollution. 121 (1): 129-136.
5. Councell, T.B., Duckenfield, K.U., Landa, E.R. and Callender, E.(2004):Tire-Wear particles as a source of zinc to the environment.*Env. Sci. Tech.,* 38:4206-4214.
6. Frustner, U. and Whittman, G.T.W. (1979): Metal pollution in the aquatic environment. Springer-Verlag, Berlin, Heidelberg, New York.
7. Garret, R.G. (2000): Natural sources of metals to the environment. *Hum. Ecol. Risk assess.*, 945-963.
8. Gupta, A.k. and Chakraborty, P(1995): effect of zinc on the testes of Notopterus notopterus and its subsequent recovery by EDTA. *J.Inland Fish.Soc.India*, 27:57-59.
9. Rai, U.N., Tripathi, R.D., Vajpayee, P., Vidyananth, Jha. And Ali, M.B. (2002): Bioaccumulation of toxic metals (Cr, Cd, Pb and Cu) by seeds of Euryale ferox Salisb (Makhana). *Chemosphere*, 46: 267-272
10. Roberto, G.L., Hector,R.A., Ray, O., Juan, A,O. and Menda, G. (2008): Heavy metals in water of the San Pedro river in Chihuahua, Mexico and its potential health risk. Internet. *J. of Environ.Res.*, 5: 91-98.
11. Setia ,K., Kawatra, B.L., Hira, C.K., Mann, S.K., Bennink, M., Dhaliwal, G.S., Arora, R., randhawa, N.S and Dhawan, A.K. (1998): Consumption of Heavy metals by adult women in sewage and tube well irrigated areas. *Ecological agriculture and sustainable development*, 2:677-683.
12. Shivkumar, K. and biksham, G (1995): statistical approach for the assessment of water pollution around industrial areas. *Environ.Monitoring and Assess.*, 36: 229-249.
13. Vermani, O. P., and Narula. A. K.,(1989). *Applied Chemistry*. Theory and Practice, Wiley Eastern Limited, New Delhi, pp.34.