International Journal of Research in Advent Technology, Vol.3, No.8, August 2015
E-ISSN: 2321-9637

Assessment Of Heavy Metals Pollution From Ground Water Samples In And Around Sipcot Industrial Complex, Cuddalore District, Tamilnadu

Inbanila.T, Arutchelvan.V
Department of civil Engneering, Annamalai university,Chidambaram, India.

Abstract: A Study was carried out to assess the concentration of Heavy metals namely Zn, Ni, Cr ,Cd, Cu, and Pb collected from different locations of study area and analyzed by using Atomic absorption spectrophotometer (1983 – 400 HGA 900/AS 800 Perkin Elmer) The results obtained were compared with Indian Standards of drinking water to check out their pollution level. From the test results Zinc concentration in all sources were below the permissible limit, but the remaining metals concentration are exceeding the permissible limit in some location of the study area, which is recommended by various National agencies.

Keywords: Heavy Metals, Ground water ,SIPCOT Area.

1. INTRODUCTION

Water is one of the most essential substance needed to sustain human life animals, plants, and other living beings comprising over 71% of the Earth's surface, water is unquestionably the most precious natural resources that exists on our plant, ground water has historically been considered as reliable and safe source of water protected from surface contamination by geological filters that remove pollutants from water as it is percolate through the soil still Ground water is not absolutely free from pollutants. In our country fresh water wealth is under threat due to its influence of naturals and Human activities. By the term '' Heavy Metals '' are usually refer to any metallic element that certain a relatively high density and applies to the group of metals and metalloids with atomic density greater than 4g/cm^3. Heavy metals are environmentally stable, non – biodegradable and tend to accumulate in plants and animals causing chronic adverse effects on human health. The risk of heavy metals contamination is pronounced In the environment adjacent to large industrial complexes.

However some of the metals like Cu, Fe, Mn and Ni are essential as microorganism while other metals like Pb, Cd, and Cr, are proved detrimental beyond a certain limits (Marschnur 1995,Bruins et al 2000) The objective of this study is to analyse the concentration of heavy metals in of SIPCOT effluents.

Due to rapid growth of industrialization, much sewage is disposed off that generates fair changes of ground water pollution. Safe drinking water is the primary need of every human being. All ground water sources are not always safe.Physico-Chemical characteristics of ground water of different parts of countries studied by many authors. [2-5,7,10]

Newcomb [8] Trace elements are contributed to groundwater from a variety of natural and anthropogenic sources. Once liberated to groundwater, element distributions are continually modified by complex geochemical and biological processes

Nouri et al. [9] evaluated regional pattern of heavy metal concentrations and agricultural activities in the southern Iran. Anlysed with the flame atomic absorption spectrometry and Cu, Zn and Ni concentrations have been shown below the EPA standards respectively, but Cd concentrations of all the samples were recorded higher than EPA standards. The heavy metals concentrations is more pronounced in the south part than northern part of the studied area. Absent confining layers, proximity to land surface, excess agricultural and industrial activities in the south part and ground water flow direction that is generally from north to south parts in this area makes south region of Shush plain especially vulnerable to heavy metals pollution and other contaminants.

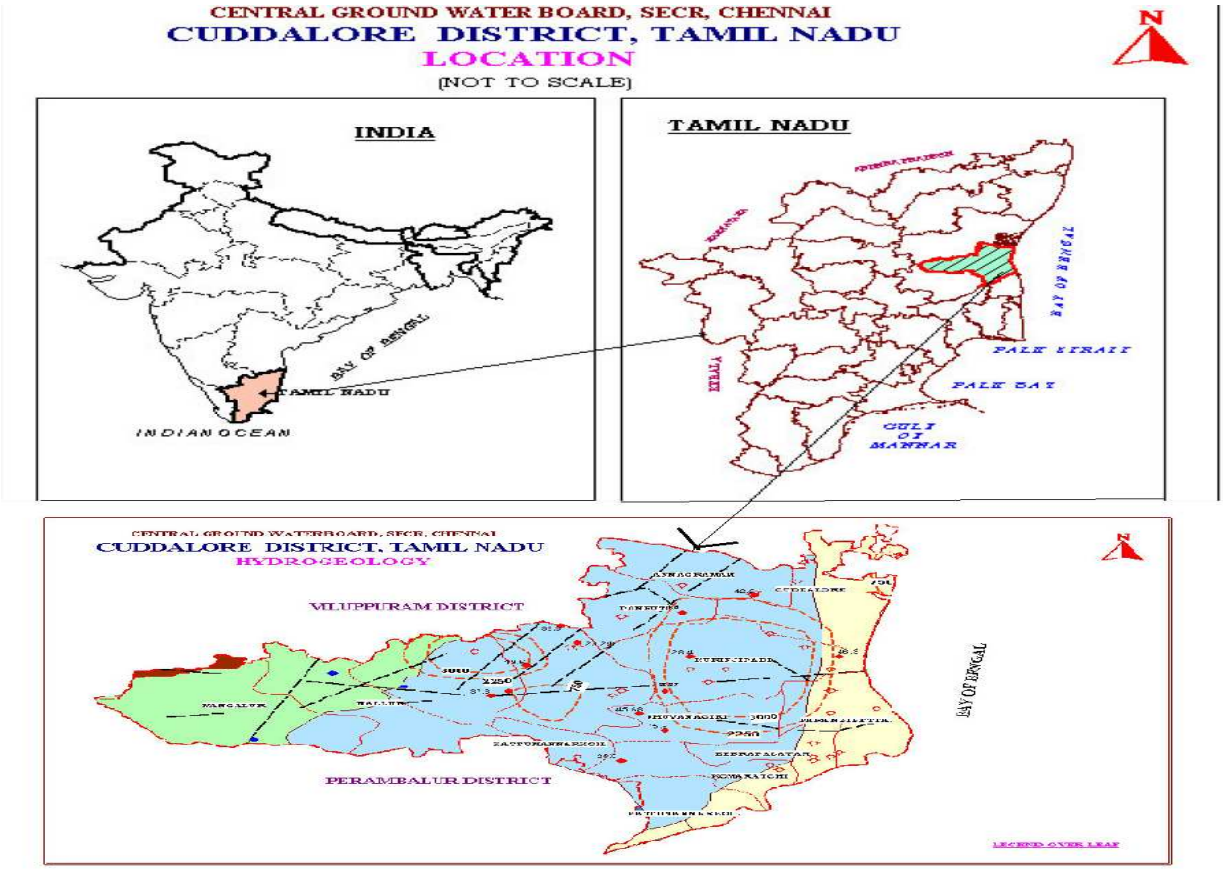
Milenkovic et al.[6] have studied the heavy metal pollution in sediments from Danube River, Serbia and they observed higher concentration of Ni, Zn, Cu, Cr and Pb that indicate the risk to the ecosystem. It has been recognized that aquatic sediments absorb persistent and toxic chemicals to levels many times higher than the water column concentration. The authors concluded that the increase in heavy metal contamination of the Iron Gate is cause for concern as these metals have the ability to bioaccumulate in the tissues of various biota, and may also affect the

distribution and density of benthic organisms, as well as the composition and diversity of infaunal communities.

Abdulrahman[1] studied about the trace Metals in Groundwater Sources Used for Drinking Purposes in Riyadh Region. The author indicated the presence of iron in all sampled wells. Its concentrations exceeded the maximum contaminant level (MCL) in 46.5% of the samples. Manganese, Al, Se, Ba and Hg exceeded the MCL in 18.0, 2.5, 8.5, 0.5 and 19.5% of the total samples respectively. It is recommended that an adequate and suitable treatment must be applied to the wells having elevated concentrations of the metals and supplying drinking water to the consumers.

2. STUDY AREA

SIPCOT Industrial complex, Cuddalore phase I has established in 1984 at an extent of 518.79 acres. It is located at 8 km from cuddalore on the seaward of side of the cuddalore Chidambaram road, stretching from Pachaiyan kuppam in the North to Semmankuppam in the south, cuddalore is the heart land of Tamilnadu, located at 250 km south of Chennai and less than 25km south of pondichery in a industrial city, lying between lattitute of $11^0 43''$ North and longitude of $79^0 49''$ East. Bore well water is generally using for drinking and irrigation purpose in this district. The SIPCOT Industries manufacture pesticides and intermediates, Pharmaceuticals and intermediates, Chemical. Dyes, paints, plastics and textiles. Chemical industries have been 2.discharging effluent illegally in to the canal of the nearby villages. These alarming pictures of the water quality and there continuous consumption have the potential of poising serious health hazard to the local population. Recognizing the enormity and severity of the problem, analysis of heavy metal concentration was under taken.



3. METERIALS AND METHODS

The ground water samples were collected from the various sources in separate container for heavy metal analysis and analysed by Atomic absorption spectrometer (1983 – 400 HGA /AS 800 Perkin Elmer) technique with ICP multi – element standard (MERCH) No – 112837.

The AAS Method is based up in the fact that atoms in their ground state can absorb light of a particular everge (i.e, frequency) This of a process s the reverse of the emission of light of atoms excited by being exposed to energy (e.g,thermal energy in flame photometry) In AAS, light of a definite wave length radialis through the atomizer system (flame or graphite tube cuvetle) and is absorbed there by atoms in the ground state. The quantity of absorbed light is proportional to the concentration of non – excited atoms. It is measured as selection resonance in a detector.

Atomic absorption spectrophotometer consists of a hollow cathode lamp, a nebulizer, acetylene gas cylinder, monochromatic system, photomultiplier tube and amplifier and readout system. The working condition of AAS are listed below

Model **:** Perkins – Elimer 800
Carrier gas : Acetylene gas
Oxidants : Compressed Air
Flame Temp : 2500 0 c
Lamp : Hollow cathode lamp (HCL)
Lamp type : Neon HCL
Gas flow : 2.5 L/min
Air flow : 5 L / min
Gas pressure : 80 PSI

4. RESULT AND DISCUSSION

In the present study, concentration of toxic metals were analysed in ground water in and around SIPCOT area in order to evaluate its quality. The results are tabulated below.

Table – 1 Permissible limits of Heavy metals of Drinking water set by WHO.

S.No	Parameters	WHO's Permissible Limit (Mg / l)
1	Zinc	3.00
2	Nickel	0.02
3	Chromium	0.003
4	Iron	0.3
5	Cadmium	0.02
6	Copper	1.0
7	Lead	0.05

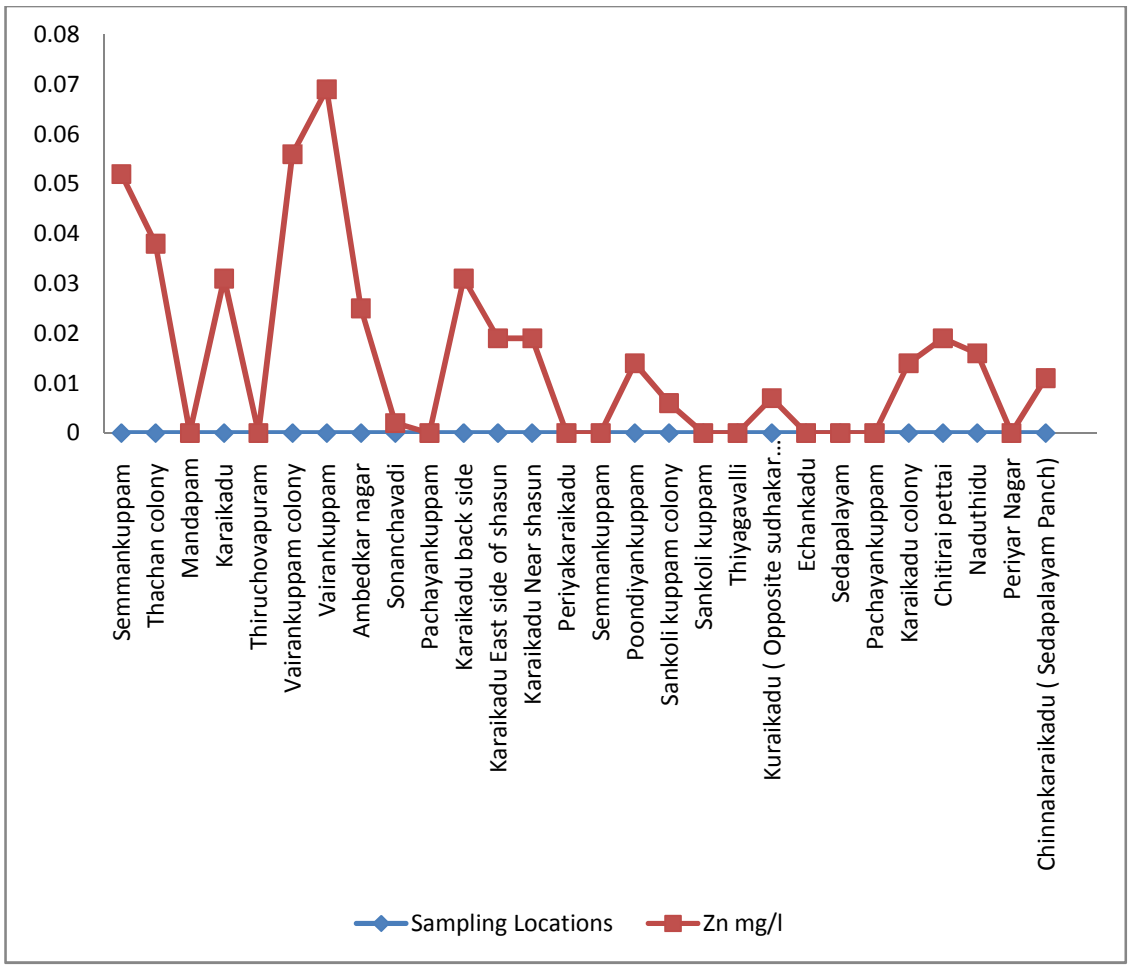
Table – 2 : Heavy metals concentration (mg/l) of ground water in and around SIPCOT area

S.No	Sampling Locations	Zn	Ni	Cr	Fe	Cd	Cu	Pb
1	Semmankuppam	0.052	0.0172	0.009	0.065	0.058	0.085	0.273
2	Thachan colony	0.038	0.000	0.094	0.100	0.000	0.124	0.188
3	Mandapam	0.000	0.113	0.063	0.000	0.000	0.050	0.239
4	Karaikadu	0.031	0.000	0.163	0.000	0.000	0.034	0.225
5	Thiruchovapuram	0.000	0.000	0.000	0.350	0.000	0.042	0.251
6	Vairankuppam colony	0.056	0.081	0.000	0.000	0.000	0.000	0.253
7	Vairankuppam	0.069	0.000	0.000	0.000	0.000	0.000	0.258
8	Ambedkar nagar	0.025	0.000	0.000	0.000	0.000	0.019	0.286
9	Sonanchavadi	0.002	0.000	0.000	0.000	0.000	0.134	0.223
10	Pachayankuppam	0.000	0.000	0.000	0.000	0.000	0.027	0.225
11	Karaikadu back side	0.031	0.000	0.000	0.000	0.000	0.013	0.243
12	Karaikadu East side of shasun	0.019	0.000	0.294	0.225	0.000	0.093	0.291
13	Karaikadu Near shasun	0.019	0.256	0.038	0.000	0.000	0.070	0.268
14	Periyakaraikadu	0.000	0.000	0.000	0.000	0.000	0.005	0.298
15	Semmankuppam	0.000	0.000	0.000	0.000	0.000	0.051	0.322
16	Poondiyankuppam	0.014	0.000	0.000	0.028	0.000	0.106	0.323
17	Sankoli kuppam colony	0.006	0.000	0.000	0.000	0.000	0.000	0.359
18	Sankoli kuppam	0.000	0.000	0.000	0.000	0.000	0.129	0.372
19	Thiyagavalli	0.000	0.000	0.000	0.000	0.000	0.106	0.349
20	Kuraikadu (Opposite sudhakar chemicals)	0.007	0.000	0.000	0.000	0.000	0.036	0.307
21	Echankadu- (HP)	0.000	0.000	0.000	0.041	0.000	0.017	0.345

22	Sedapalayam	0.000	0.000	0.000	0.000	0.000	0.000	0.347
23	Pachayankuppam	0.000	0.000	0.013	0.000	0.000	0.019	0.341
24	Karaikadu colony	0.014	0.000	0.056	0.000	0.000	0.028	0.321
25	Chitirai pettai	0.019	0.000	0.017	0.000	0.000	0.000	0.343
26	Naduthidu	0.016	0.116	0.016	0.000	0.000	0.013	0.278
27	Periyar Nagar	0.000	0.000	0.000	0.021	0.000	0.000	0.163
28	Chinnakaraikadu (Sedapalayam Panch)	0.011	0.000	0.000	0.000	0.000	0.000	0.200

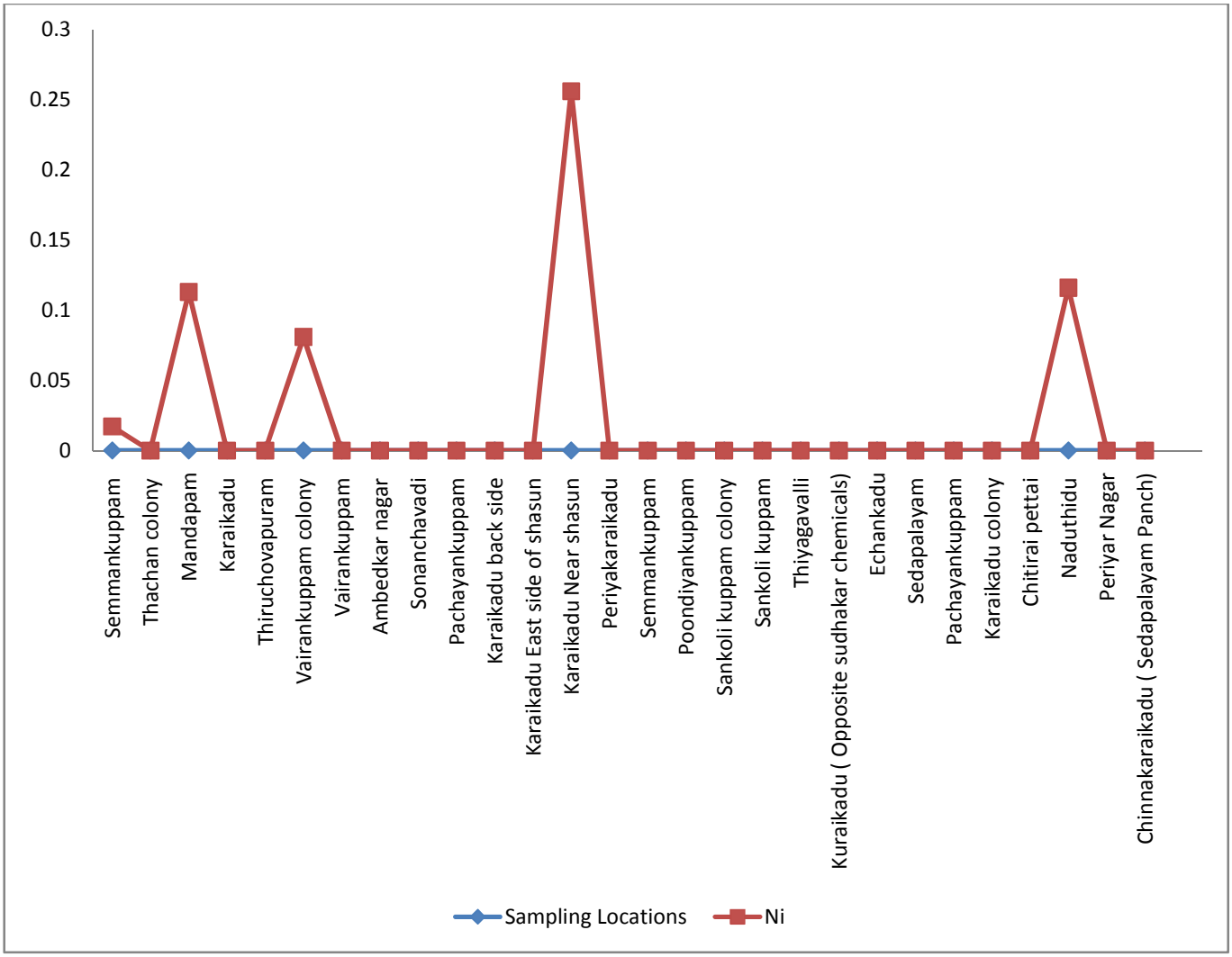
ZINC:

Zinc is very essential micronutrient in Human being and only at very high concentration,G.Patil et al(2011),it may cause some toxic effect.In nature the surface water concentration of Zinc is usually below 10 mg/l and in ground water between 10 – 40 mg/l. In tap water the Zinc concentration can be much higher as a result of the leaching of Zinc from piping and fittings reported by Elinder (1986),Sher ALikhan et al(2011).The result of that concentration of Zinc in the water samples were ranges from 0.002 to 0.069 and it is below the permissible limit of 3.0 mg/l reported by WHO (2003)



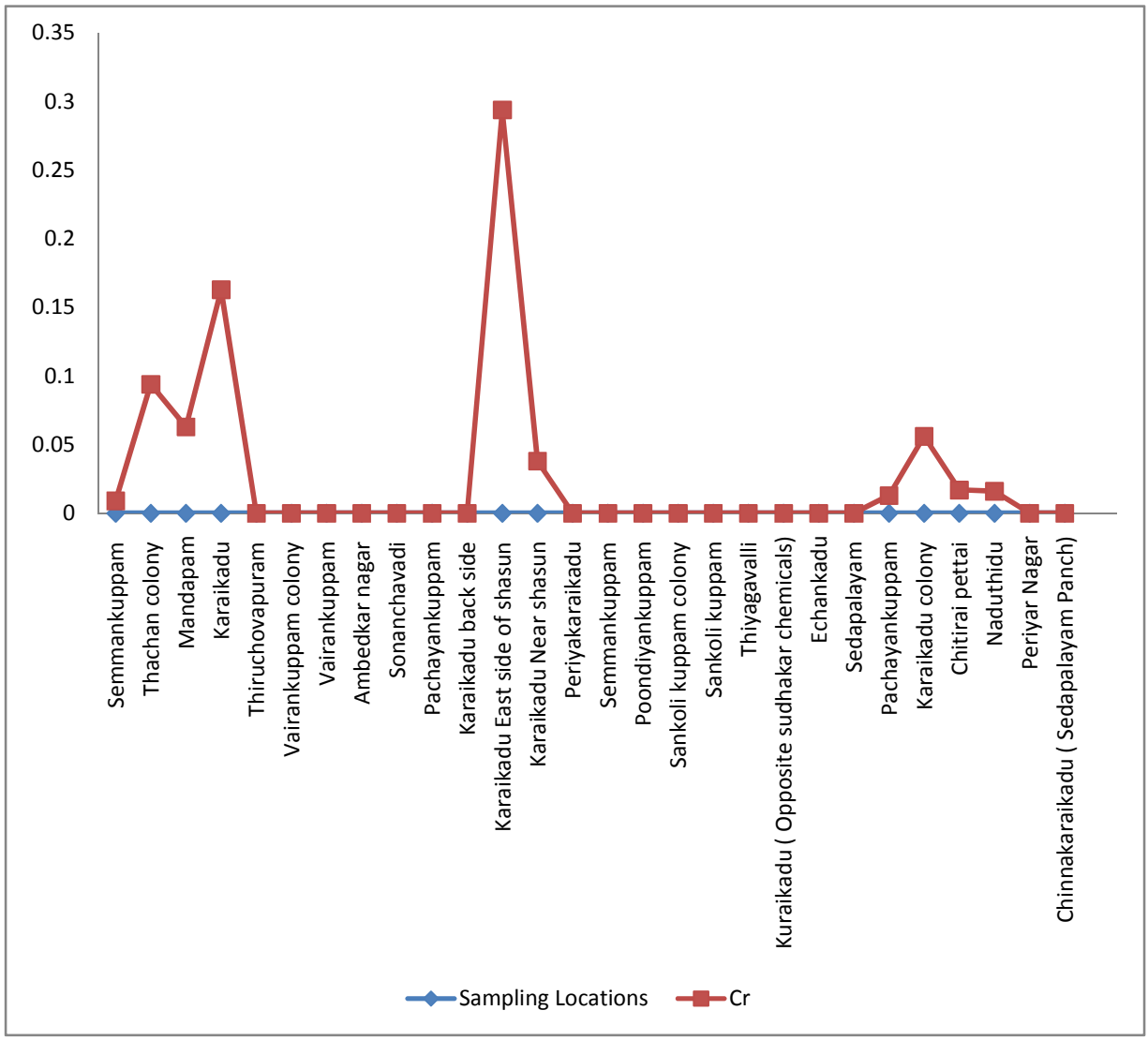
NICKEL:

The primary natural source of nickel in drinking water is leaching from rocks and the soil which is derived from these rocks. It is found primarily combined with oxygen (oxides) or sulfide Nickel compounds are also used for nickel plating, to color ceramics, to make some batteries and as catalyst in different chemical process. These may be the possible means for water contaminated Sher Ali khan et al(2011). A small amount of nickel may be essential for human, although a lack of nickel has not been found to effect peoples health (EPA 2002) The anlaysis should that the area has a significant effect on the Ni concentration of ground water samples. The values are ranges from 0.081 – 0.256 mg/l. The highest concentration of Nickel (0.256 mg/l) was found in the sample collected from kudikadu near M/S Shasun chemicals while the lowest level of Nickel (0.08 mg/l) in the sample collected from varainkuppam colony. The nickel concentration of the samples colletcted in varainkuppam colony, Mandabam, semankuppam, Naduthittu, and kudaikadu are higher than the permissible limit (0.02 mg/l) defined by WHO.



CHROMIUM:

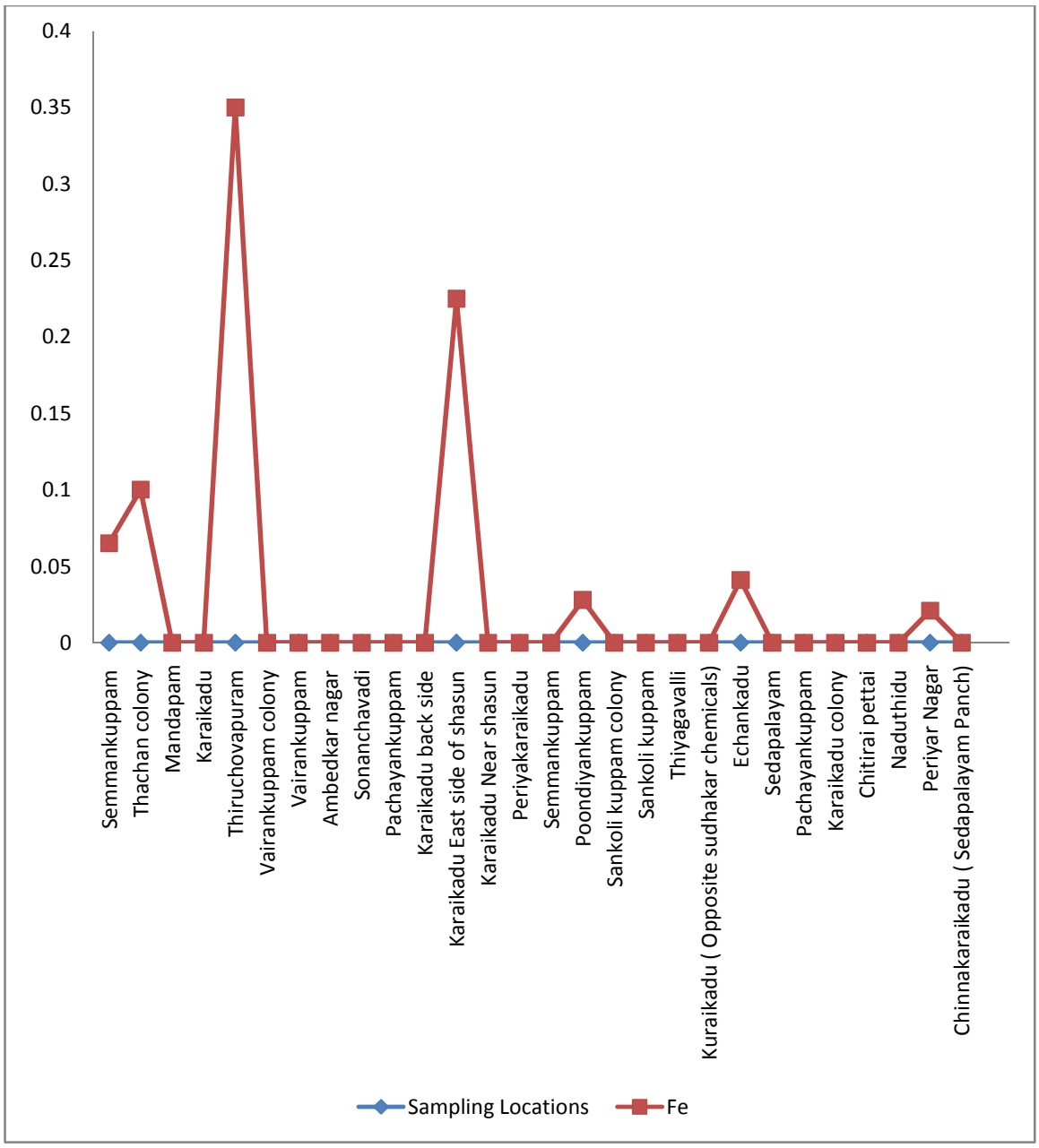
Chromium is also essential for organism as a micronutrient is traces from fat and carbohydrate metabolism. Chromium is also harmful in its lower oxidation state. Chromium and chromates are potential carcinogens, Gautam Patil et al(2011). Chromium is used in the leather tanning industry,the manufacturing of catalyst, pigment and paints(Sher Ali Khan (2011)).The concentration of chromium (0.294) was observed in the sample from kudikadu while the lowest concentration of chromium (0.013 mg/l) was observed in pachayankuppam. The chromium concentration which is observed in the locations Thachan colony, Mandabam, karaikadu, kudikadu Eastern side of M/s Shasun chemicals limit (0.05mg/l) WHO - 2003



.

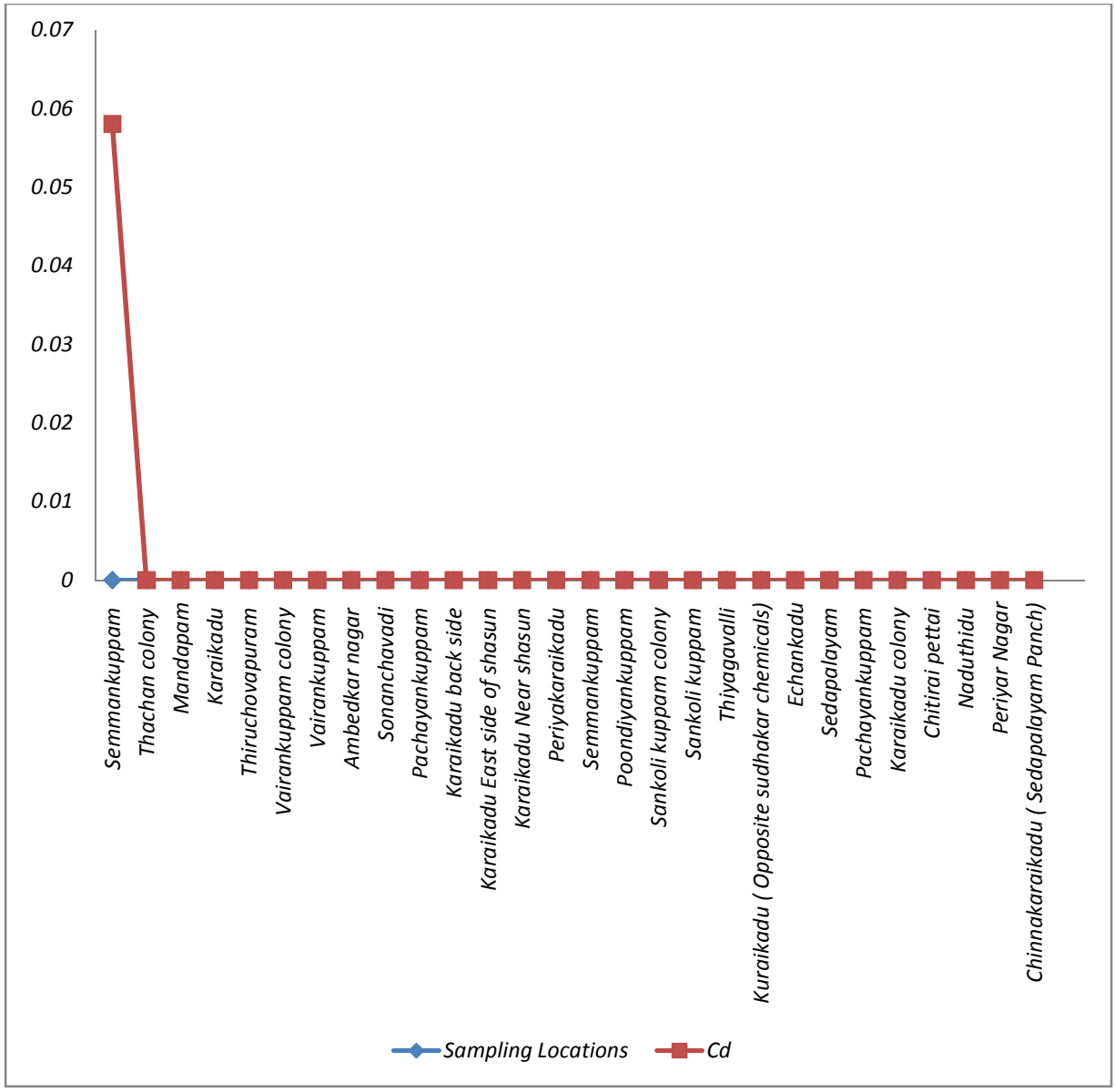
IRON:

Iron is drinking water is present as Fe 2+ or Fe 3+ in suspended from. It causes staining in clothes and in parts a bitter taste. Excess amount of iron(more than 10mg/kg) causes rapid increase in pulse rate and coagulation of blood in blood vessel, hypertension and drowsiness,G.Patil et al(2011). It was found that the concentration of samples are below the permissible limit except the sampling location. Thiruchovapuarm (0.350mg/l)



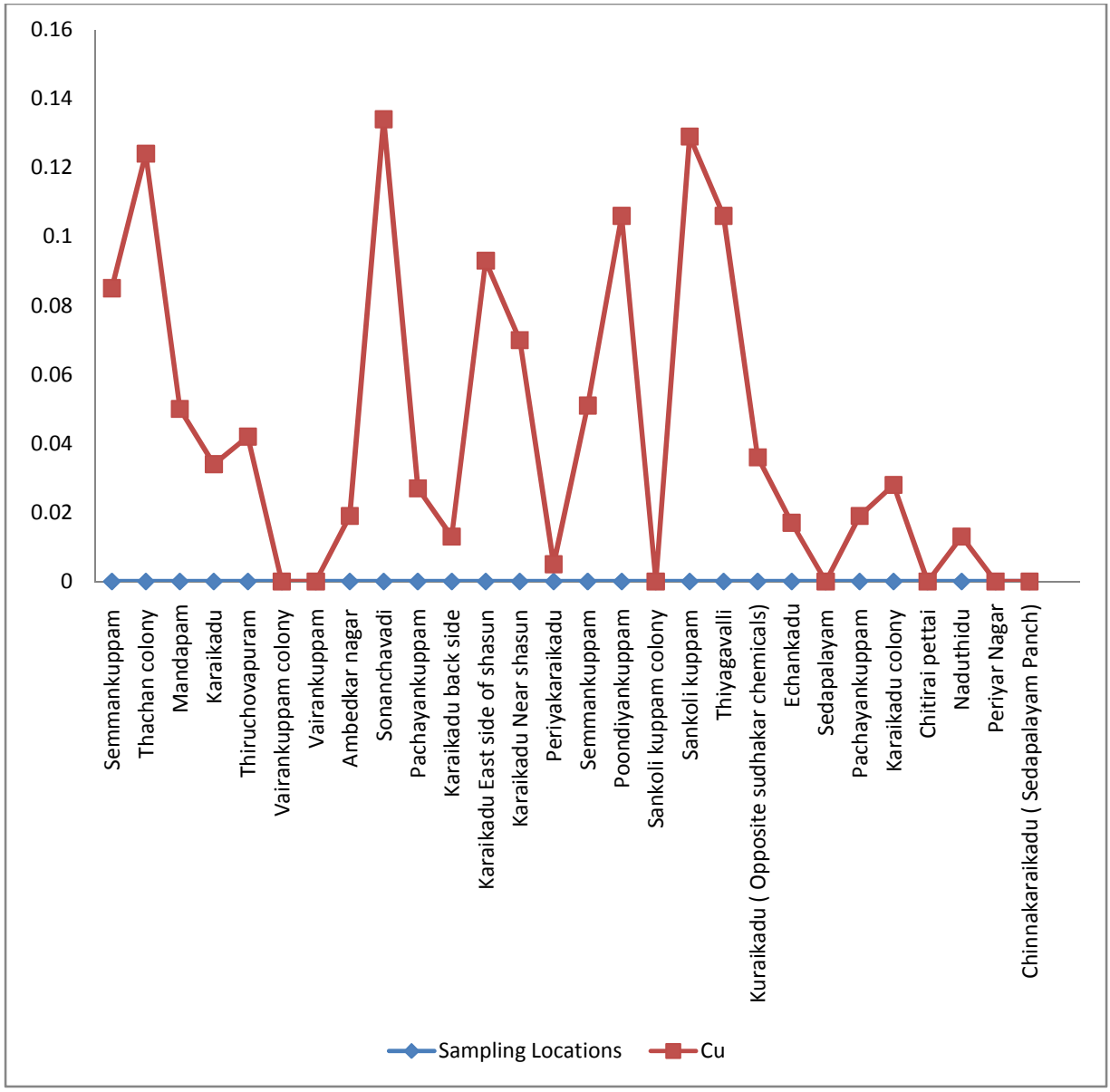
CADMIUM:

Cadmium occurs naturally in Zinc, lead, copper and other ores, which acts as source to ground and surface waters.The analysis shows that the cadmium can be released in drinking water from the corrosion of some galvanized plumbing and water main pipe materials.The values of cadmium concentration in all the samples are below the permissible limit except semmankuppam. The concentration of cadmium in semmankuppam village was found that 0.058 mg/l which is above the permissible limit (0.01 mg/l)



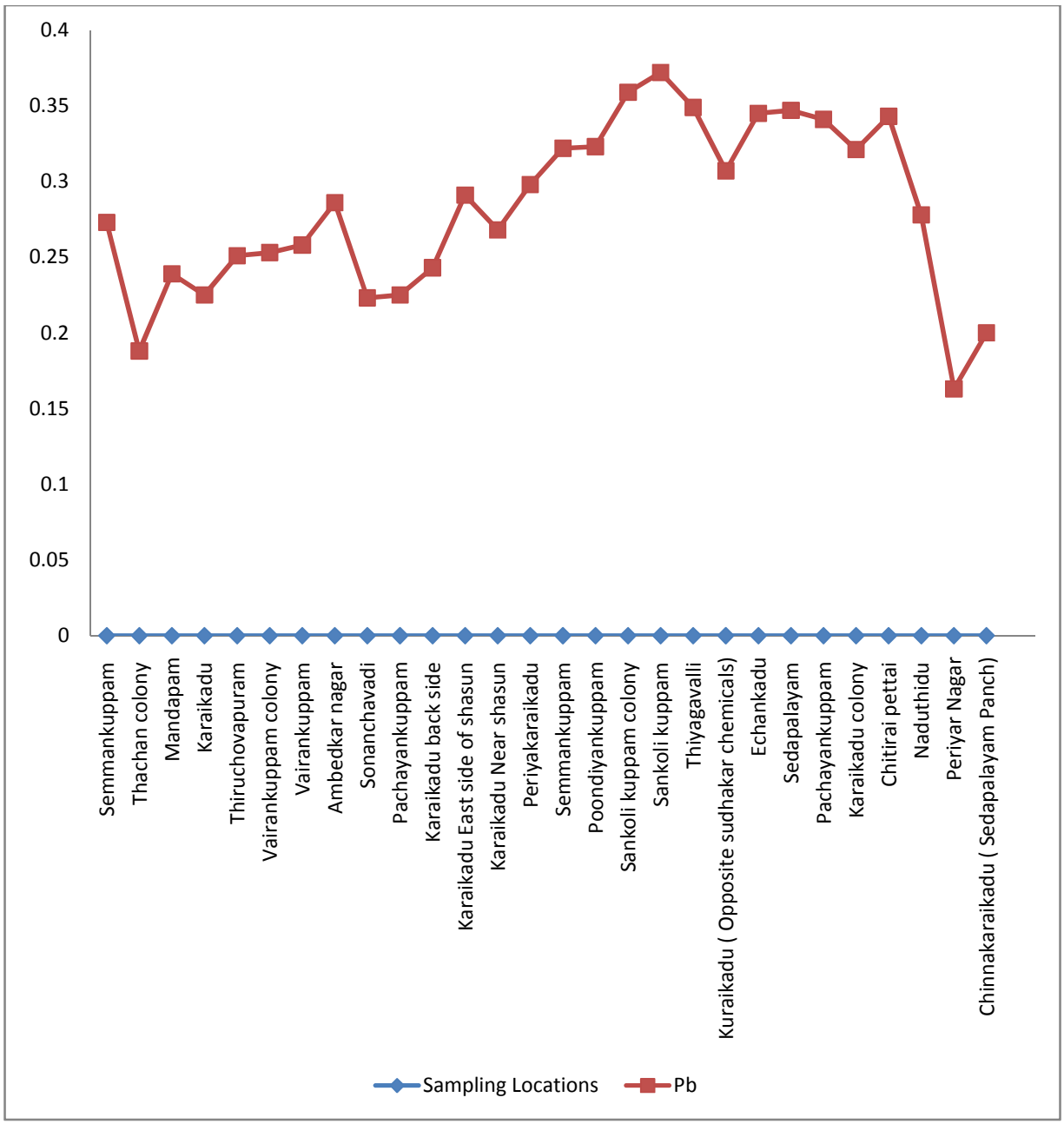
COPPER:

The source of copper may be due to the intrusion of the industrial and domestic waste.The corrosion of brass and copper pipes also contributes to copper level in water, A.Abdul Jamed et al(2012).The copper levels were found in the range of 0.005 mg/l to 0.139mg/l. The maximum permissible limit of copper concentration for drinking water is 0.05 ppm according to WHO The analysis shows that all the samples are within the permissible limit



LEAD:

Lead enters in drinking water from industrial effluents, different wastes and household waste. Toxic level of lead in the human body causes anemia, brain damage, and vomiting,G.Patil et al(2011). The possible sources of Pb are from the combustion of gasoline,usage of lead arsenate as pesticide as well as its usage in lead paint,pigments and lead storage batteries, O.Venkata Subba raju et al(2014).The concentration of lead in all samples were higher than the maximum permissible limit (0.05 mg/l) according to WHO.



5. CONCLUSIONS

From the above result and discussion it may be concluded that most of the ground water samples collected from SIPCOT Complex area were polluted since some of the sources certain maximum amount Nickel, Chromium, Cadmium, and also found that the concentration of lead are higher than the maximum permissible level according to WHO norms. So it is concluded the SIPCOT complex area was polluted due to the presence of various individual effluents municipal wastes and sewage disposal.

It is suggested that ground water should be regularly monitored for heavy metals in order to prevent the entry of heavy metals in the human food chain. Heavy metals pollution is a growing environmental problem, which requires immediate attention. It is recommended to adopt some kind of economical treatment to reduce

the levels of trace metals in areas supplying water directly to consumers without any type of treatment.

REFERENCES

[1] Abdul Rahuman I,Alabdula'aley,Abdullah l,al zarah and Mujahid.A.Khan. Assessment of Trace metals in ground water sources used for drinking water purpose in Riyadh region,International journal of water resources and arid environment 1(1) 2011
[2] Aher.H.A, D.G.Zinjad, P.S.Gunjal and S.R.Kuchekar, J.Chem.Envi.Res, 11 (1 and 2), 101 (2002).
[3] Avci.H, I. Akdeniz and M, Yaman, Asian J.Chem, 20 (4), 2827 (2008).
[4] Bhagat P.R., Rasayan.J.Chem, 1 (1), 195 (2008).
[5] Chaturvedi.S, Dinesh Kumar and R.V.Singh, Res. J.Chem.Environ., 7 (3), 78 (2003).
[6] Milenkovic, N., M. Damjanovic, and M. Ristic. "Study of Heavy Metal Pollution in Sediments from the Iron Gate(Danuae River), Serbia and Montenegro."Polish Journal of Environmental Studies 14.6 (2005): 781-787.
[7] Naveen Kumar Singh and D.S.Kadam, Int.J.Chem.Sci, 5 (2), 2007, 549-554.
[8] Newcomb, W.D. and J.D. Rimstidt, 2002. Trace Element Distribution assessment Using Public Domain Data, Applied Geochemistry, 17: 49-57.
[9] Nouri, J.; Mahvi, A.H.; Jahed, G.R.; Babaei, A.A. (2008). Regional distribution pattern of groundwater heavy metals resulting from agricultural activities. Environ. Geo., 55 (6), 1337-1343 (7 pages).
[10] Rani D.F.G, Geeta S and Ebanazar, J.Poll.Research, 21,215 (2002).