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Studies on heavy metal pollution of ground water in and around Trichy town, Tamilnadu, India

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ABSTRACT

The concentration of heavy metal present in the ground water in and around Trichy town was analysed with four ground water samples. The Heavy metal analyses of Cu, Fe, Cr, Pb, Mn and Cd were performed for the water samples. It is known that heavy metal with higher concentration present in the ground water are highly toxic to human beings and living organisms.

Keywords: Heavy metals, Groundwater, Human Health, Trichy.

INTRODUCTION

Ground water is the water that percolates downward from the surface through the soil pores. Heavy metals are present in both surface water and ground water. Heavy metals come out from industrial, municipal and urban runoff waste which is harmful to human beings[1]. In India ponds, rivers and ground water are used for the domestic and agricultural purposes[2]. Increased urbanisation and industrialisation are the major cause of heavy metal concentration in ground water. Chemical elements if released in to environment accumulate in the soil and sediment in water[3]. Heavy metals have a marked effect on the aquatic systems which enters through the food chain process and affects the human beings[4]. Heavy metals are playing a vital role in the normal functioning of body. Higher concentration of heavy metal in water affects the central nervous function leads to irregularity in blood composition, kidney and liver[5]. The present study mainly aims to study the impact of six heavy metals present in the ground water.

Iron is the most commonly available metal on planet earth[6]. Iron is chemically active and it forms two major series of chemical compounds namely bivalent Iron and trivalent Iron. Iron is very essential for living things. It is found in meat, vegetables, potatoes and whole meal products. It is an essential part of haemoglobin which transports oxygen through our body. The deficiency of Iron causes anaemia in human beings.

Manganese is a hard metal but it is easily oxidised. It is found in grains, rice, soya beans, eggs, nuts, olive oil, and green beans. Manganese is absorbed by the human body and it is transported through the blood to the liver, kidneys, pancreas and endocrine glands. Higher concentration of manganese in human body mainly affects the respiratory system and brain.

Copper is a very common substance that occurs naturally in the environment. It is widely used in industries and agriculture. Long-term exposure to copper can cause irritation of the nose, mouth and eyes which causes headache, stomach pain, dizziness, nausea and diarrhoea. The source Copper may be due to the intrusion of domestic and industrial waste[7].

Cadmium is a very malleable metal and it can be cut with a knife. It is soluble in acids but not in alkalis. Human intake of Cadmium takes place mainly through food. Higher concentration of Cadmium in water causes the

excretion of essential protein and sugar from the body and it produces kidney damage. The disease Itai itai is caused by Cadmium contamination associated with a diet which is low in Calcium and Vitamin D.

Chromium is a lustrous, brittle, hard metal. It is present in small quantities in nature. It is maximum present in rocks than in Silica type. Chromium is released from mining, industrial coolants and leather tanning industries.

Lead is a bluish-white lustrous metal. It is present in food such as fruits, vegetables, meats, grains, seafood and soft drinks. Lead can enter into water through corrosion of pipes. It is also released from fuel combustion, solid waste combustion and industrial process.

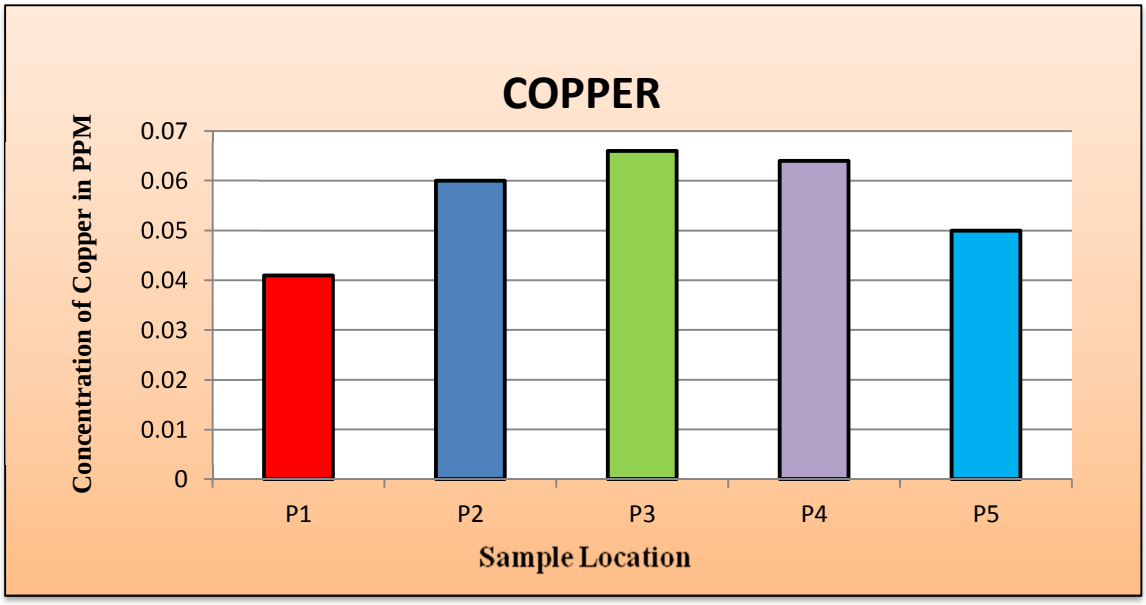
MATERIALS AND METHODS

Four Ground water samples of - in and around Trichy town area were collected in a clean one litre polythene bottle. Samples were protected from sunlight and 1% dil HNO_3 was added to each bottle to protect any contamination of the ground water. Six metals such as Pb, Cr, Cu, Fe, Mn and Cd for each water sample were analysed as per the standard procedure[8] by using Atomic Absorption Spectrophotometer.

RESULTS AND DISCUSSION

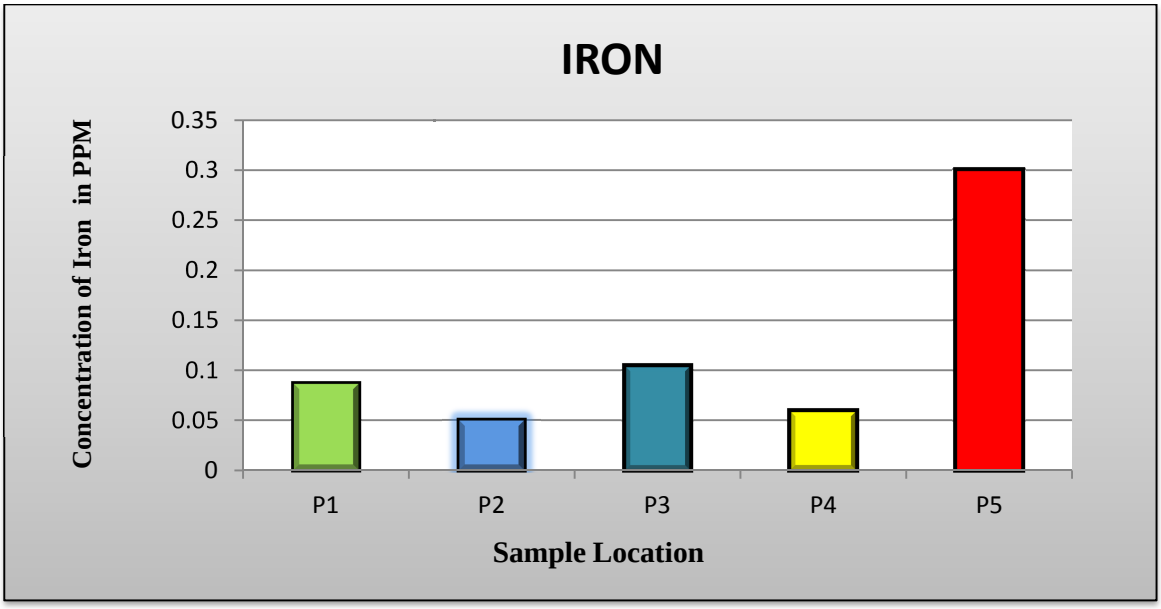
Copper

It is one of the essential elements for human beings. It can exist in aquatic environment in three forms namely- soluble, colloidal and particulate. It is found in less quantity as an essential element for organisms. In our study, the concentration of Copper ranged from 0.041 – 0.064 ppm. The values are slightly higher when compared with the permissible limit of Copper (0.05 ppm) except at Sembattu station. High level of Copper in the drinking water can cause vomiting, abdominal pain, nausea, diarrhoea in human beings. Copper may enter into drinking water from copper pipes[9].



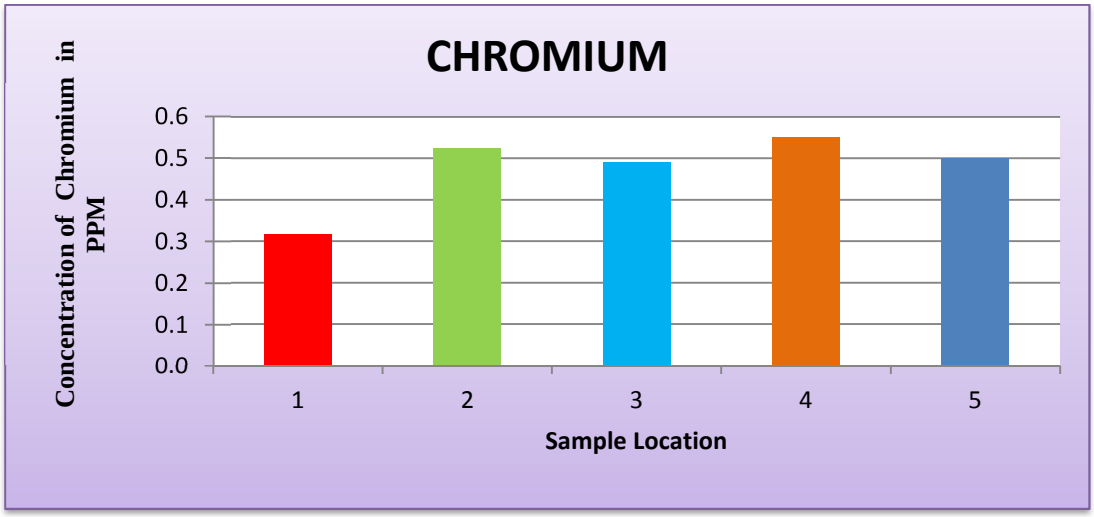
Iron

In the present study, the concentration of Iron is ranged between 0.051 – 0.087 ppm. All the ground water sample values are within the permissible limit of Iron (0.3 ppm). The presence of Iron is responsible for the brownish – red colours of the water when it is allowed to stay for some minutes[10]. Excess of Iron will also influence the presence of bacteria in the groundwater[11]. In drinking water, Iron may be present as Fe^{2+}, Fe^{3+} and $Fe(OH)_3$ in suspended or filterable forms[12].



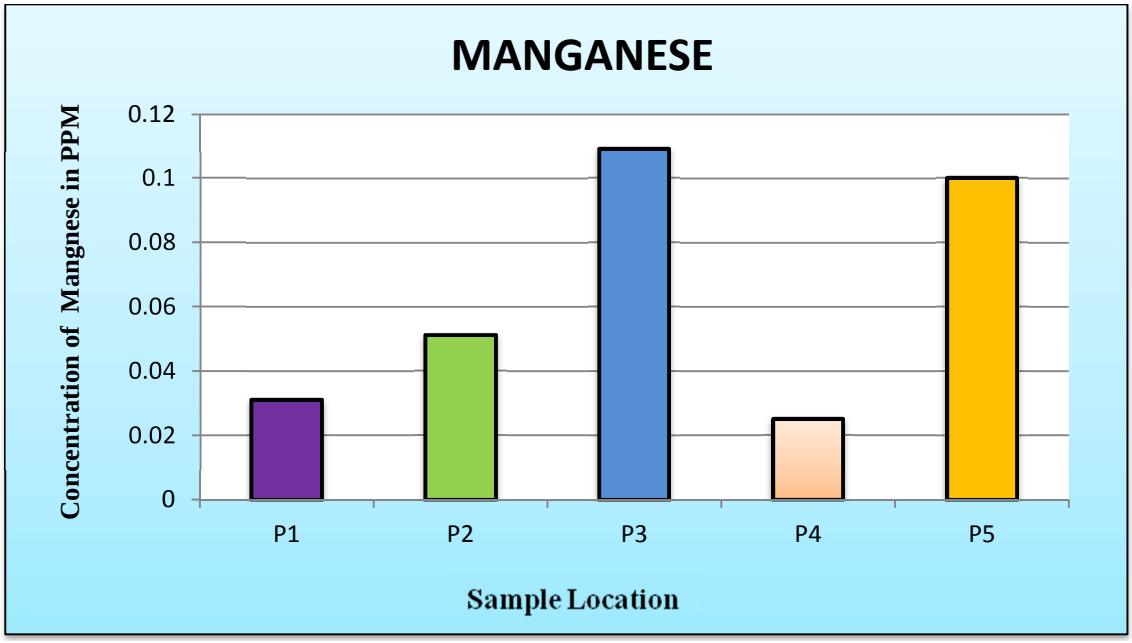
Chromium

The Chromium values are recorded in the range of 0.317 – 0.551 ppm. All the ground water sample values are above the permissible limit of Chromium (0.05 ppm). A Hexavalent salt of Chromium is the most dangerous to human beings[13]. The presence of Chromium in soaps and detergents used for washing and bathing could be responsible for the high Chromium level in the water samples[14]. Excess of Chromium present in human body causes bronchial cancer in humans[15].



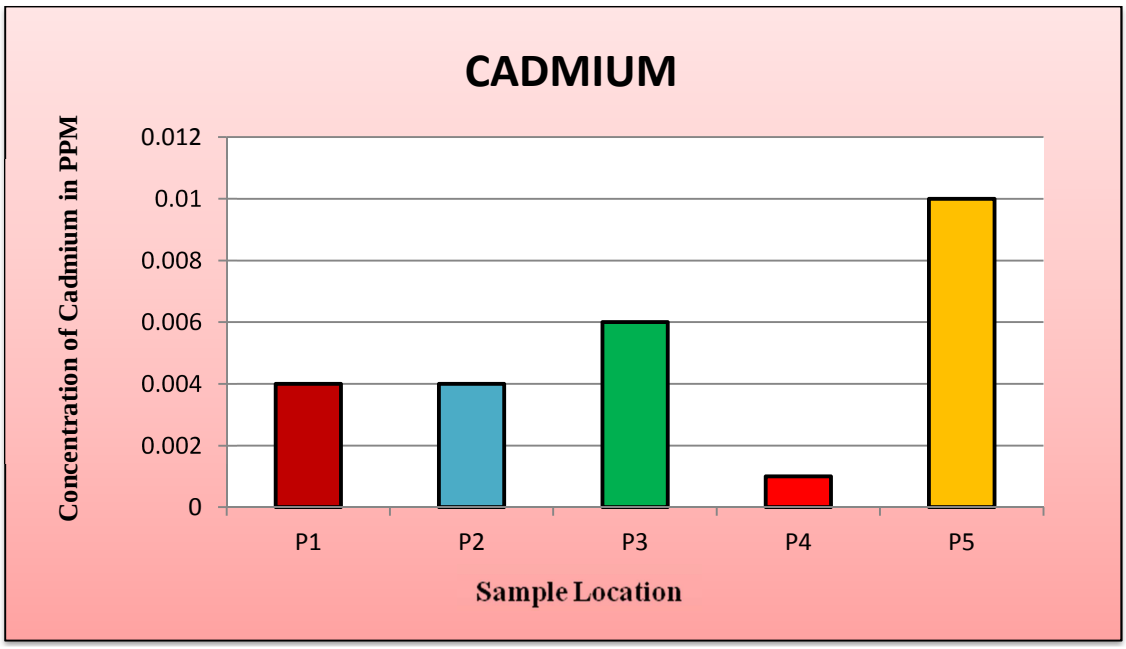
Manganese

The Manganese values are found in the range of 0.025 – 0.109 ppm. All the ground water sample values are within the permissible limit of Manganese (0.1 ppm). Slight increase in Manganese in the ground water may be by the influence of domestic waste, natural geological rocks and industrial effluents[16].



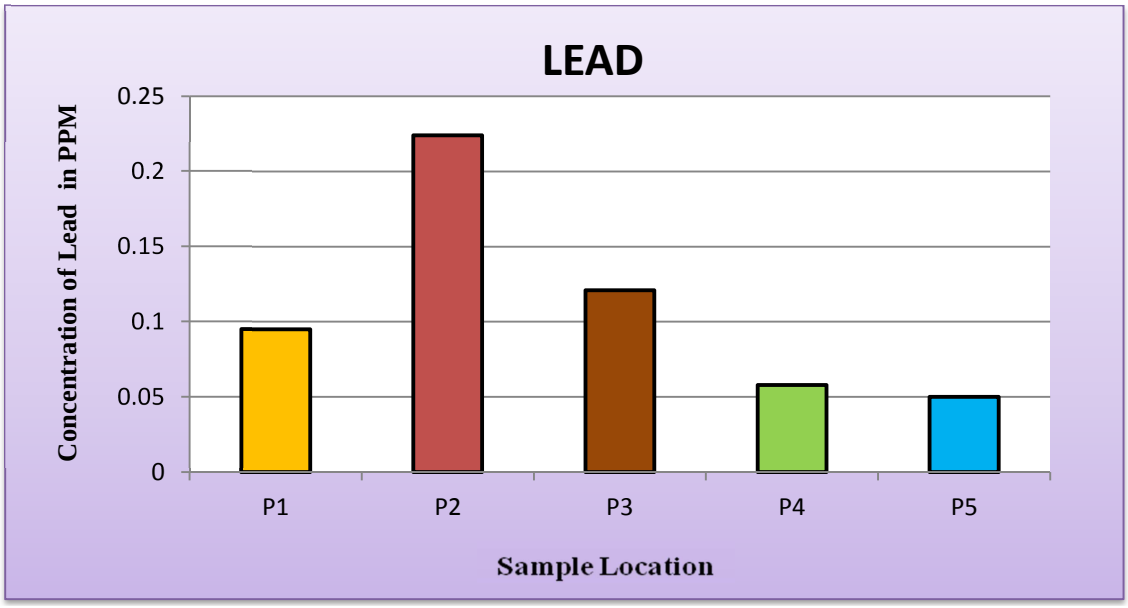
Cadmium

The value of Cadmium is ranged between 0.001 – 0.004 ppm. In this study, all the ground water sample values are within the permissible limit of Cadmium (0.01 ppm). Therefore the ground water studies in the areas do not present any Cadmium hazards to human beings.



Lead

In the present study, the value of Lead is ranged between 0.058 – 0.224 ppm. From the given data, it is observed that the values of Ariyamangalam and Valavanthankottai areas are higher than the desirable limit of 0.05 ppm. The contamination of Lead in the ground water may be due to the entry from industrial effluents, old plumbing, household sewages, agricultural run off containing phosphatic fertilizers and human and animal excreta[17]. Lead is generally toxic and it accumulates in the kidney and Skelton children up to the age of six years and in pregnant women it is more susceptible to its adverse effects[18]. The Higher concentration of Lead in drinking water has adverse effect on central nervous system, blood cell and may cause brain damage[19].



Table

S.No	Sample Location	Copper	Iron	Chromium	Cadmium	Manganese	Lead
1.	Sembattu	0.041	0.087	0.317	0.004	0.031	0.095
2.	Ariyamangalam	0.060	0.051	0.523	0.004	0.051	0.224
3.	Vaalavanthankottai	0.066	0.105	0.490	0.006	0.109	0.121
4.	Panjappur	0.064	0.060	0.551	0.001	0.025	0.058
5.	Permissible Limit in PPM	0.05	0.3	0.05	0.01	0.1	0.05

CONCLUSION

The heavy metal analysis values of all the ground water samples are within the permissible limit except Lead and Chromium. Hence it is recommended that suitable water quality management is essential to avoid further Lead and Chromium contamination in the ground water. Otherwise the ground water will be completely polluted and will become unfit to drink and for other purposes. Hence the ground water samples require treatment for Lead and Chromium before it is used.

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REFERENCES

[1] Seema Sing1,Swati Lal ,Jeena Harjit, Sulbha Amlathe and H.C.Kataria, Vol.3,**2011**,no.5,239-246 33-40.
[2] Pramod N Kamble1, Viswas B Gaikwad , Shashikant R Kuchekarl, *Der Chemica Sinica* **2011,** 2 (4):229-234.
[3]Abida Begum, Harikrishna and Irfanullah Khan *International Journal of Chem Tech* Research.CODEN(USA):IJCRGG ISSN :0974 - 4290. Vol .1, NO.2, pp245-249, April-June **2009.**
[4] Ram S .Lokhande, Pravin. U.Singare, Deepali S.Pimple Resources and Environment **2011**;1(1):13-19 DOI:10.5923/j.re.20110101.02
[5] Sher Ali Khan, Zahoor Ud Din, Ihsanullah and Ahmad Zubair I.J.S.N., Vol.2(3)**2011**:648-652 ISSN 2229-6441
[6] Moscow S, Jothivenkatachalam K , Subramani P, *Der Chemica Sinica* , **2011,** 2 (2): 199-206
[7] Aggarwal TR, Singh KN, Gupta AK , **2000**, *Poll. Res*. 13 (3): 491-494.
[8] APHA (American public Health Association), Standard method for examination of water and waste water, Newyork, 20th Ed ; **1918**
[9] Aggarwal TR, Singh KN, Gupta AK , **2000**, *Poll. Res*. 13 (3): 491-494.
[10] Elinge CM, Itodo AU, Peni IJ, Birnin – Yauri UA, Mbongo AN, *Advances in Applied Science Research*, **2011**, 2 (4):279-282.
[11] DANIDA *Hydrochemistry Orissa drinking water supply project-Hydrogeological investigations WI, Carl Bro.International a/s*, **1993**, Chap. 8.

[12] Adak: M.D; Purohit K.M; Assessment of the water quality in Rajgangpur Industrial Complex – II : metallic parameter, pollution Research,**2001**, 20(4), 575
[13] Elhoussine, Derwich, *Impact of urban waste waters on groundwater quality in the water shed of middle sebou. J. Black sea.* Volume 15:157-164, **2009**.
[14] Mohammed Asef Iqbal, Gupta Studies SG, *African journal of Basic & Applied Sciences*, **2009,** 1(5-6) : 117-122.
[15] Ponnusamy thillaiarsu, Arumugam murugan and Jeslin Kanaga inba **(2014).** *Chemical science transaction*, 3(2), 00-00.
[16] Senthil kumar RD, Narayanaswamy R, Ramakrishnan K, **2001**, *Poll. Res*. 20 (1): 93-97.
[17] Sirajudeen J, Abdul Jameel A, *J.Ecotoxicol.Environ.Monit*, **2006**,16(5) 443-446.
[18] Abdulrafiu, Majolagbe O, *Advances in Applied Science Research*, **2011**,2(1): 289-298.
[19] Ponnusamy thillaiarsu, Arumugam murugan and Jeslin Kanaga inba **(2014).** *Chemical science transaction*, 3(2), 00-00.