



Studies on Heavy Metal Pollution of Ground Water Analysis in And Around–Udayarpalayam Taluk at Ariyallur District- Tamilnadu

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Abstract

The study assessed in comparison the concentrations of heavy metals in water samples collected from ground water analysis at Udayarpalayam taluk in Ariyalur district areas. Sixteen ground water samples were collected in and around Udayarpalayam areas during summer and monsoon seasons during the year 2015. Five trace elements Copper, Zinc, Iron, lead and Nickel (Cu, Zn, Fe, Pb and Ni) analysis was summer and monsoon seasons in determined using atomic absorption spectrophotometer and the results were compared with the World Health Organisation (WHO 2011) standard values. The heavy metals are toxic to human health. Heavy metals are playing a vital role in the normal functioning of body. This study suggests that the preventive measures which are to be adopted to control the contamination of excess lead and nickel present in the water.

Keywords

Seasonal variation, Ground water, Heavy metal pollution, Ariyalur district.

INTRODUCTION

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore, it is

necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases ^[1]. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Natural water contains different types of impurities are introduced in to aquatic system by different ways such as weathering of rocks and

leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including mining, processing and the use of metal based materials^[2]. The quality of ground water depends on various chemical constituents and their concentration, which are mostly derived from the geological data of the particular region. Industrial waste and the municipal solid waste have emerged as one of the leading causes of pollution of surface and ground water. In many parts of the country available water is rendered non- potable because of the presence of heavy metal in excess. The situation gets worsened during the summer season due to water scarcity and rain water discharge^[3]. Contamination of water resources available for household and drinking purposes with heavy elements, metal ions and harmful microorganisms is one of the serious major health problems.

The environmental pollution as a result of cement industry could be defined as an undesirable process that is responsible to pollute, air and land through its various activities, right from the mining activity of the raw material, (limestone, dolomite etc.) to its crushing, grinding and other association processes in cement plant. Air pollution has become a serious problem in recent times due to rapid growth of thermal power stations, cement factories, steel and coal industries. In which the cement dust contains different particulate pollutants which effects vegetation, soil microbial population and other soil properties^[4]. Cement industry is a constituent gas such as SO₂, CO₂, CO and

SiO₂ adversely affect the drinking water resources like wells, ponds and mine pits. Heavy metals in water refers to the heavy dense metallic elements that occur in trace levels, but are very toxic and tend to accumulate, hence are commonly referred to as trace metals. The major sources of heavy metals are industrial wastes from mining sides, domestic waste water and run off from roads. The main source for the heavy metals entry in to the human body is through water resources. Hence the present study mainly aims to study the impact of Udayar palayam taluk on the heavy metal contamination of ground water sources.

MATERIALS AND METHODS

Udayarpalayam is a panchayat town in Ariyalur district in the Indian state of Tamil Nadu. According to the 2001 Indian census, it had a population of 29,698, with an equal number of males & females. Its total literacy rate is 77% but higher for men than women. Here males are highly educated rather than females^[5]. Census declares that main corporations slightly higher than female's corporation. Main occupation of this town is agricultural, fishing, handlooms etc.. The soil type found here is predominantly while red loam, clay loam & black cotton varieties are widely common in the outer edge of the city. The major crop is Paddy, includes millet, pulses, oil seed, sugarcane & cotton and some other common crops. Its temperature in summer reach, 40c max and 26.3c min; although temperature more than 42c is very common. Winder temperature lies from 29.6°C to 18°C^[6].

STUDY AREA

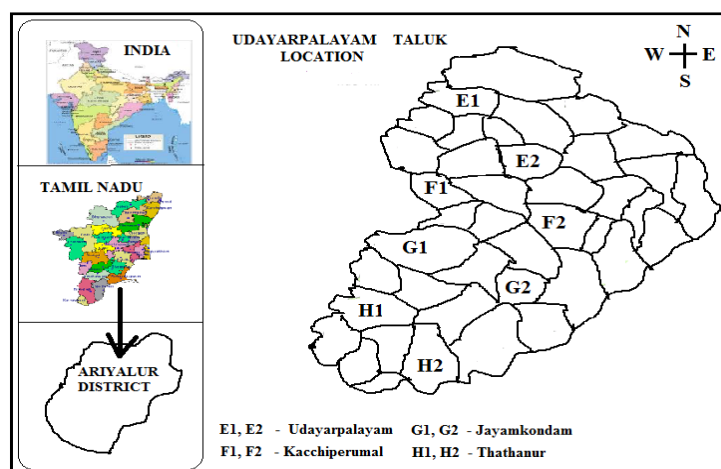


Fig (1): LOCATION MAP OF THE STUDY AREA

RESULTS AND DISCUSSION

The result of the AAS analysis of all the samples.

The heavy- metal characteristics were determined. The obtained results are presented in table 1 and 2 and the results are discussed.

Table:1 Concentration of heavy metal ions in the ground water samples collected during summer season 2015.

Sampling stations	Cu	Zn	Fe	Pb	Ni
E1	0.03	0.06	0.13	0.02	0.02
E2	0.03	0.06	0.12	0.02	0.02
E3	0.04	0.05	0.11	0.01	0.02
E4	0.04	0.06	0.13	0.01	0.02
F1	0.02	0.04	0.07	0.01	0.01
F2	0.01	0.04	0.07	0.01	0.02
F3	0.02	0.03	0.06	0.01	0.01
F4	0.02	0.03	0.05	0.01	0.01
G1	0.02	0.04	0.09	0.01	0.01
G2	0.03	0.04	0.09	0.01	0.02
G3	0.03	0.04	0.10	0.01	0.01
G4	0.02	0.05	0.10	0.01	0.01
H1	0.03	0.05	0.17	0.01	0.02
H2	0.03	0.04	0.16	0.01	0.02
H3	0.04	0.04	0.16	0.01	0.02
H4	0.04	0.05	0.15	0.01	0.02

Table :2 Concentration of heavy metal ions in the ground water samples collected during monsoon season 2015.

Sampling stations	Cu	Zn	Fe	Pb	Ni
E1	0.03	0.05	0.12	0.01	0.02
E2	0.02	0.04	0.11	0.01	0.02
E3	0.02	0.04	0.11	0.02	0.01
E4	0.03	0.04	0.08	0.01	0.01
F1	0.02	0.02	0.06	0.01	0.02
F2	0.01	0.01	0.04	0.01	0.01
F3	0.02	0.02	0.05	0.01	0.01
F4	0.02	0.02	0.03	0.01	0.01
G1	0.02	0.02	0.08	0.01	0.02
G2	0.02	0.02	0.06	0.01	0.02
G3	0.01	0.01	0.07	0.01	0.02
G4	0.01	0.01	0.06	0.01	0.02
H1	0.03	0.03	0.15	0.03	0.01
H2	0.01	0.02	0.08	0.02	0.02
H3	0.02	0.02	0.09	0.02	0.02
H4	0.02	0.02	0.10	0.02	0.02

Copper

It is the one of the essential elements for human beings. It can exist in aquatic environment in three forms namely soluble, colloidal and particulate [7]. Copper acts as a catalyst in the formation of haemoglobin and is also involved in haemopoiesis, maintenance of vascular and skeletal integrity, structure and function of central nervous system [10]. The mean copper values are within the range of 0.01-0.04 and 0.01-0.03 for ground water samples in both summer and monsoon season respectively (table 1 and 2). The copper values are within the permissible limit of WHO (2ppm) in all the

stations for ground water samples in both summer and monsoon seasons [8].

Zinc

Zinc is noncumulative, and the amount absorbed is thought to be inversely to the amount ingested. Zinc was first demonstrated to be essential element for mammals over 45 years ago. Zinc is an essential and beneficial element in body growth [9]. The clinical symptoms of zinc deficiency are anorexia, pica, impaired taste acuity, menstrual lethargy and disturbances, dry skin, impaired wound healing and increased susceptibility to infection, and delay of sexual maturation (Casey, 1980) [10]. The mean zinc

values are within the range of 0.03-0.06ppm and 0.01-0.05ppm for ground water samples in both summer and monsoon seasons respectively (table 1 and 2). zinc values are within the permissible limit of WHO (3.0ppm) in all the stations for ground water samples in both summer and monsoon seasons^[11].

Iron

Iron is the most commonly available metal on planet earth. Iron is an essential element for human health but the presence of excess iron in ground water astringed taste to drinking water. Iron present as Fe^{2+} , Fe^{3+} and $Fe(OH)_3$ in suspended are filterable forms^[12]. The mean values are recorded within the range of 0.05-0.17 and 0.03-0.12 for ground water samples in both summer and monsoon seasons respectively (table 1 and 2). The iron values are found to be within the permissible limit of WHO (1.0ppm) in all the sampling stations for ground water samples. There are slightly changes in both seasons.

Lead

Lead is practically not occurring in any natural water. It may be present due to the corrosion reactions and wastes contamination. Mine water, electroplating waste and lead paint wastes contribute lead to raw waste supplies. Water in contact with lead piping or lead bearing joining compounds usually contains lead^[13]. The mean values are recorded within the range of 0.01-0.02 and 0.01-0.03 for ground water samples. High values recorded in summer and monsoon season. The lead values of both seasons are higher than the permissible limit of WHO 0.01 ppm. The higher concentration of lead in drinking water has adverse effect on central nervous system, blood cells and may cause brain damage^[14].

Nickel

Nickel has been considered to be an essential trace element for human and animal health^[15]. The mean values are recorded within the range of 0.02-0.01 and 0.02-0.01 for ground water samples in summer and rainy seasons respectively (table 1 and 2) in the present study the values of nickel are found above the permissible limit of WHO (0.01ppm) for ground water samples in rainy and summer seasons. In this study were related to contaminant essential trace metal but toxic in large amount to human health. It is considered as carcinogenic to human.

Figure:1 seasonal variation of Copper

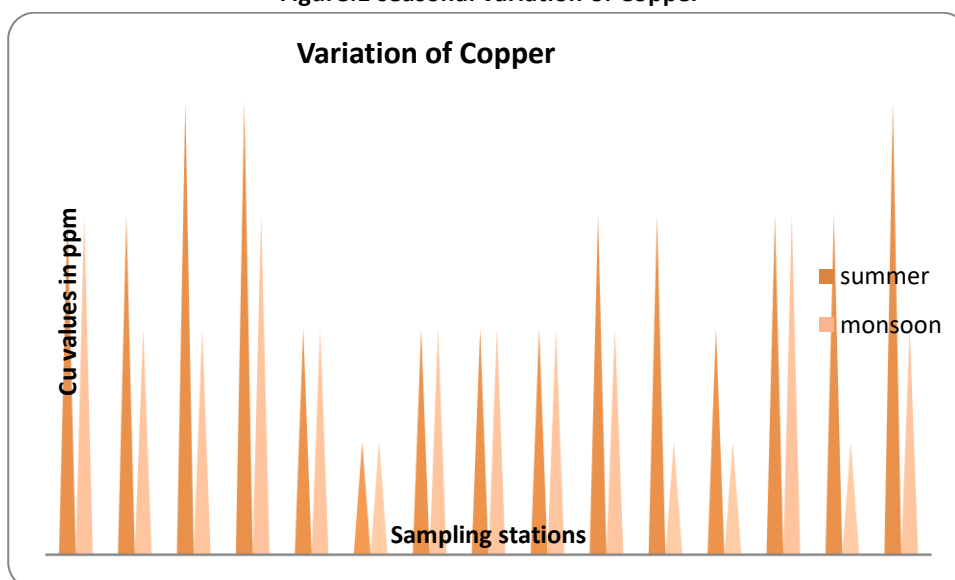


Figure:2 seasonal variation of Zinc

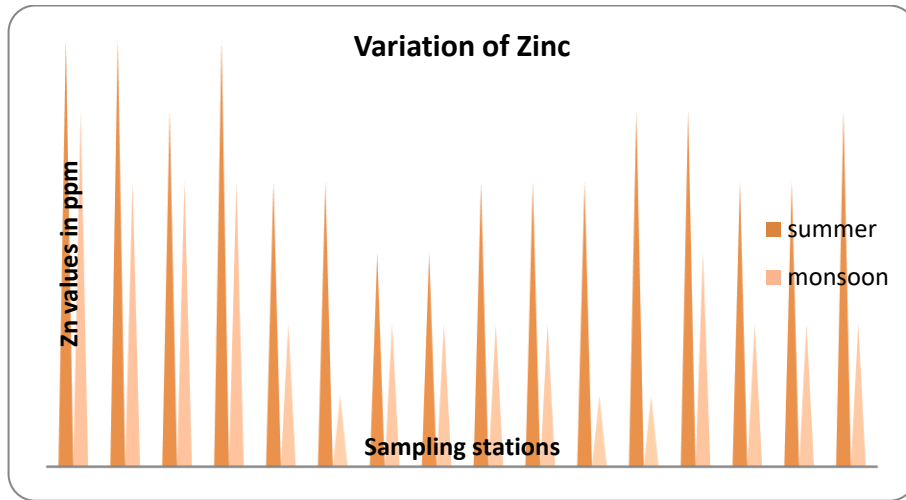


Figure:3 seasonal variation of Iron

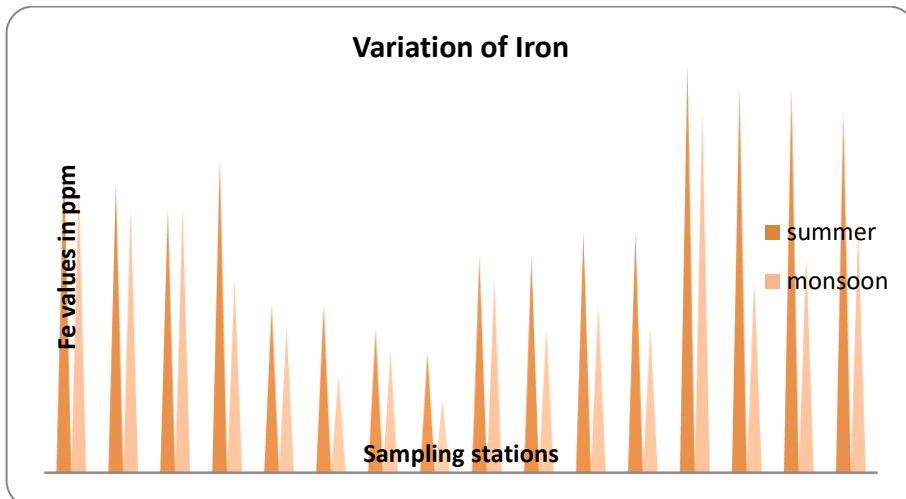


Figure:4 seasonal variation of Lead

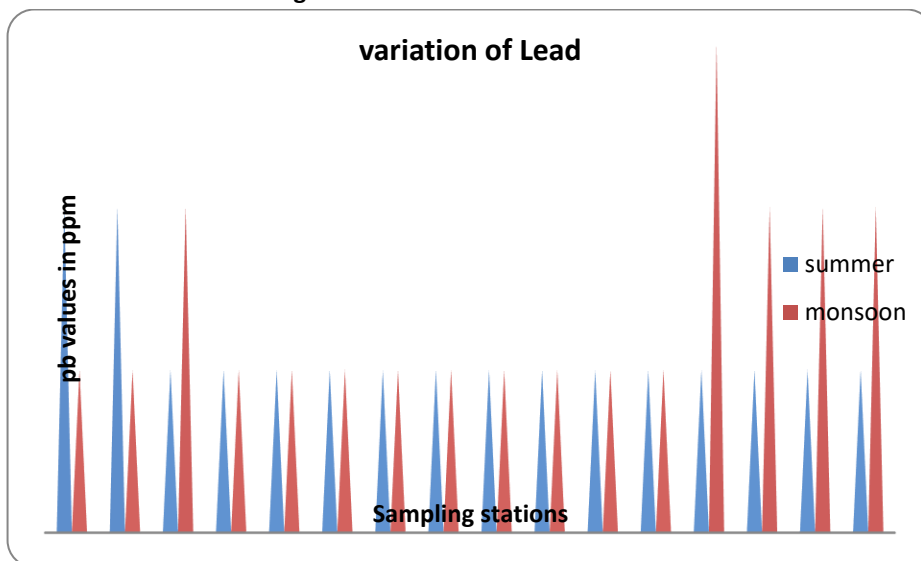
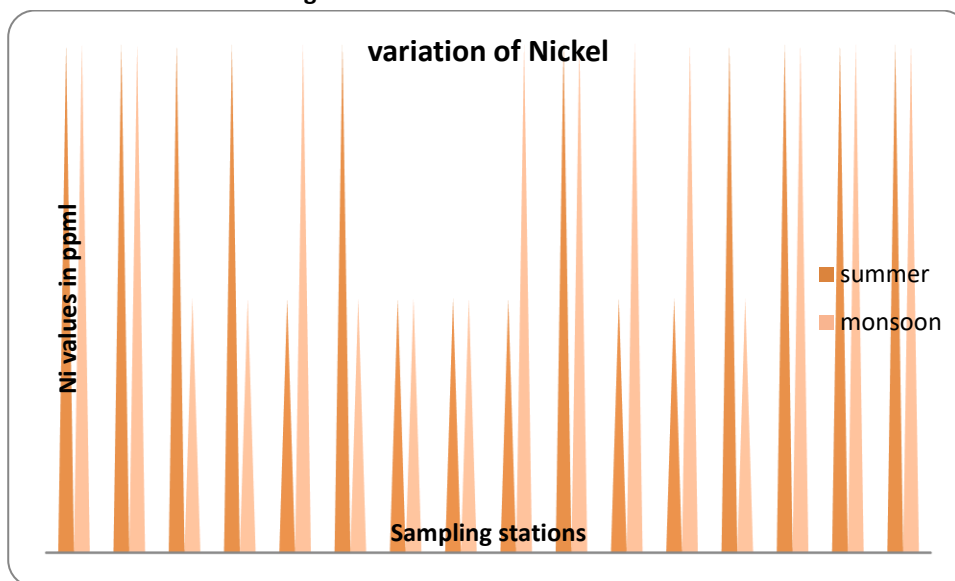


Figure:5 seasonal variation of Nickel



CONCLUSION

Total of 16 ground water samples were collected and analyzed for various heavy metal parameters. The results of the above work show that heavy metal parameters like Lead and Nickel are above the acceptable limit in both summer and monsoon seasons. This also shows that water source is not protected properly in this region. Even though at present the condition is not very bad but if the same continues in future, the ground water source will be completely polluted and become unfit for drinking and other purposes. People should be made aware of the water quality importance on sanitation and economical water treatment like filtration and boiling of water would prove beneficial to avoid human health disease. Hence the ground water samples require treatment for Lead and Nickel before it is used.

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