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Seasonal Variation of Heavy Metal Contamination of Groundwater in and Around Karur District, Tamil Nadu

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Abstract
The study was carried out to determine the concentration of heavy metal ions in and around Karur district. Ten ground water samples were collected from in and around Karur district during pre-monsoon, monsoon and post monsoon seasons and analyzed in order to find out pollution impact. The heavy metal analyses such as copper (Cu), chromium (Cr), iron (Fe), lead (Pb) and zinc (Zn) were determined using atomic absorption spectrophotometer and the results were compared with the World Health Organization (WHO). It reveals the presence of some heavy metals in few ground water samples and hence refers heavy metal contamination of water sources. The result shows that most of the groundwater is deteriorated less than the permissible limit of WHO.

Keywords
Groundwater, Heavy metals, WHO.

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INTRODUCTION
Ground water has been used as a source of drinking water for millions of rural and urban families in India. The problem of ground water pollution due to trace metals has now raised concerns all over the globe and results reported by various researchers have been alarming. Ground water is an important resource and is the elixir of life. But peoples are not aware of disease caused due to water contamination. Drinking water with good quality is very important to improve the life of people and prevent disease.

Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells. Increased industrialization, urbanization and agricultural activities during the last few decades have deteriorated the surface water and groundwater quality. Groundwater contamination can often have serious ill effects on human health. Water pollution is the contamination of water bodies such as lakes, rivers, oceans, and groundwater. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful constituents.

Heavy metal pollution is therefore, of major concern to environment. It is caused by various industries such as foundries, electroplating, petrochemicals, battery manufacturing, tanneries, fertilizers, dyeing, textile, metallurgical and metal finishing and many more. These industries discharge effluents containing toxic heavy metals such as copper, iron, nickel, zinc, lead,

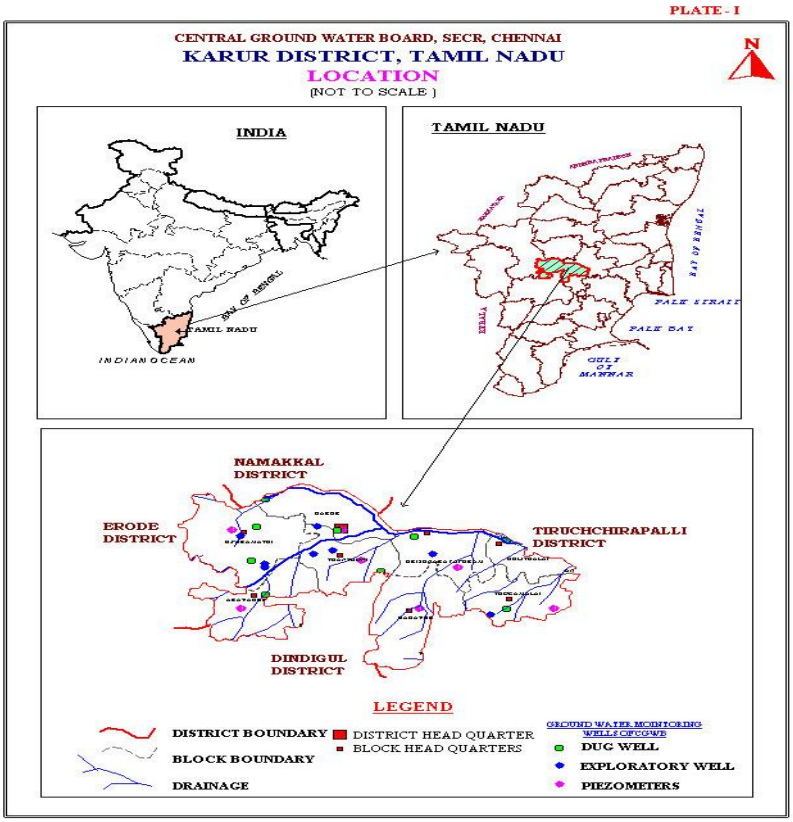
arsenic, cadmium and chromium. Owing to the toxicity and ill effects of heavy metals on living being, the present-day scientists and researchers have developed interest in the origin and fate of these elements in the environment.

Heavy metal pollution represents an important environmental problem due to its toxic effects and accumulation throughout the food chain. The main sources of water pollution are chemical fertilizers and pesticides getting in an untreated sewage, dumping of waste and industrial effluents into rivers and streams running close in to the cities and to the low lands. Precipitation is accompanied by flocculation or coagulation and one major problem is the formation of large amounts of sediments containing heavy metal ions. The aim of the present research is to study the status of heavy metal concentrations. The results obtained from this study will provide information on the level of concentration of heavy metals in water and sediment, contributing to the effective monitoring of environmental quality and ecosystem health.

STUDY AREA

A Karur district is located in Tamil Nadu. Karur district lies between 10°63' and 11°14' north latitude and 77°90' and 78°61 east longitude. It has become an important city because of the natural resources available around it. Karur town is located on the bank of Amaravathi River. There are various existing industries, factories and industrial estates. The district has rich and varied culture heritage.

Fig: 1 The Study area of the map



MATERIALS AND MEATHOD

The samples were collected in polyethylene bottles (1.5 litres capacity) which had been thoroughly washed, and filled with distilled water, and then taken to the sampling site. The bottles were emptied and rinsed several time with the water to be collected. Also, the sample bottles were partially filled with the collected water and vigorously shaken to note the odour. The sample bottles were tightly covered immediately after collection and the temperature taken. They were then stored in a refrigerator at 40°C to slow down bacterial and chemical reaction rates. The above said heavy metals have been analyzed in soil and water laboratory, using atomic absorption spectrometer.

The heavy metals analyses for the ground water samples are performed during Pre-Monsoon, Monsoon and Post Monsoon. The heavy metal such as Copper (Cu), Chromium (Cr) Iron (Fe), Lead (Pb) and zinc (Zn) were analyses. The samples were taken in and around Karur district. The samples were collected at various stations such as 1) Parametric(S1) 2)Thennilai(S2) 3)Thalapatti(S3) 4)Pugalur(S4) 5)Panjapatti(S5) 6)Kattalai(S6) 7)Velliyanai(S7) 8) Thoranakkalpatti(S8) 9)Thogamalai(S9) 10)Kulithalai(S10).

RESULTS AND DISCUSSION

Table: 1 Heavy Metal Analysis of Groundwater Samples Collected in and Around Karur District in the Month of May 2014 (Pre-Monsoon)

STATION	Cu	Cr	Fe	Pb	Zn
S1	0.18	0.08	0.22	NIL	0.08
S2	0.16	0.08	0.33	NIL	0.09
S3	0.17	0.08	0.43	NIL	0.08
S4	0.19	0.09	0.24	NIL	0.08
S5	0.18	0.08	0.16	NIL	0.09
S6	0.19	0.06	0.13	NIL	0.08
S7	0.18	0.07	0.16	NIL	0.07
S8	0.19	0.07	0.24	NIL	0.08
S9	0.15	0.07	0.26	NIL	0.07
S10	0.16	0.06	0.36	NIL	0.09

Table: 2 Heavy Metal Analysis of Groundwater Samples Collected in and Around Karur District in the Month of August 2014 (Monsoon)

STATION	Cu	Cr	Fe	Pb	Zn
S1	0.16	0.06	0.19	NIL	0.06
S2	0.14	0.06	0.31	NIL	0.07
S3	0.15	0.07	0.41	NIL	0.06
S4	0.17	0.07	0.22	NIL	0.06
S5	0.16	0.06	0.14	NIL	0.07
S6	0.17	0.05	0.11	NIL	0.06
S7	0.16	0.06	0.14	NIL	0.05
S8	0.17	0.05	0.22	NIL	0.06
S9	0.13	0.05	0.24	NIL	0.05
S10	0.14	0.04	0.34	NIL	0.07

Table: 3 Heavy Metal Analysis of Groundwater Samples Collected in and Around Karur District in the Month of November 2014 (Post Monsoon)

STATION	Cu	Cr	Fe	Pb	Zn
S1	0.14	0.04	0.17	NIL	0.04
S2	0.12	0.04	0.29	NIL	0.05
S3	0.13	0.05	0.39	NIL	0.04
S4	0.15	0.05	0.19	NIL	0.04
S5	0.14	0.04	0.12	NIL	0.05
S6	0.15	0.03	0.09	NIL	0.04
S7	0.14	0.04	0.12	NIL	0.03
S8	0.15	0.03	0.19	NIL	0.04
S9	0.11	0.03	0.22	NIL	0.03
S10	0.12	0.02	0.32	NIL	0.05

Table: 4 Mean Values of Metal Ions Concentrations of Groundwater Samples Collected in and Around Karur District.

STATION	Cu	Cr	Fe	Pb	Zn
S1	0.16	0.06	0.19	NIL	0.06
S2	0.14	0.06	0.31	NIL	0.07
S3	0.15	0.06	0.41	NIL	0.06
S4	0.17	0.07	0.21	NIL	0.06
S5	0.16	0.06	0.14	NIL	0.07
S6	0.17	0.04	0.11	NIL	0.06
S7	0.16	0.05	0.14	NIL	0.05
S8	0.17	0.05	0.21	NIL	0.06
S9	0.13	0.05	0.24	NIL	0.05
S10	0.14	0.04	0.34	NIL	0.07

Fig.2 Seasonal Variation of Copper Values Collected from Different Sampling in Karur District

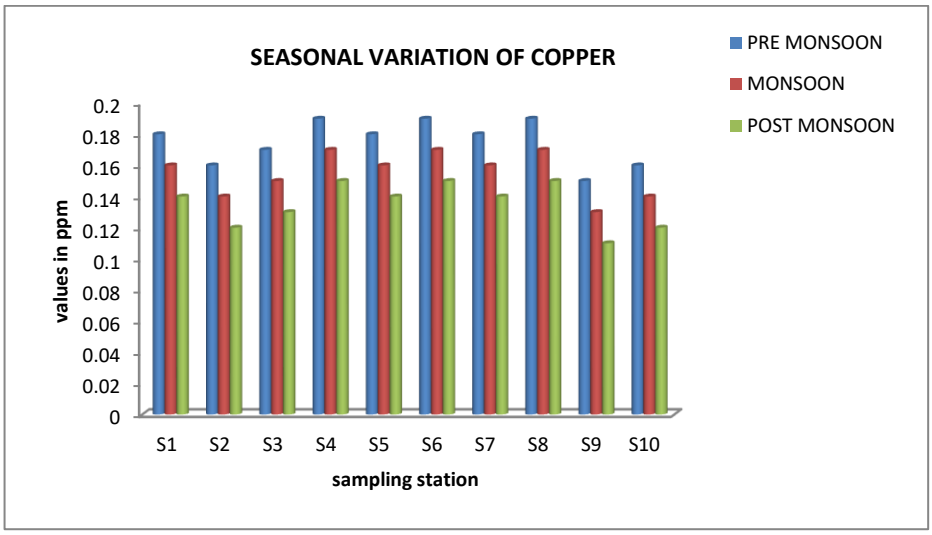


Fig.3 Seasonal Variation of Chromium Values Collected from Different Sampling in Karur District

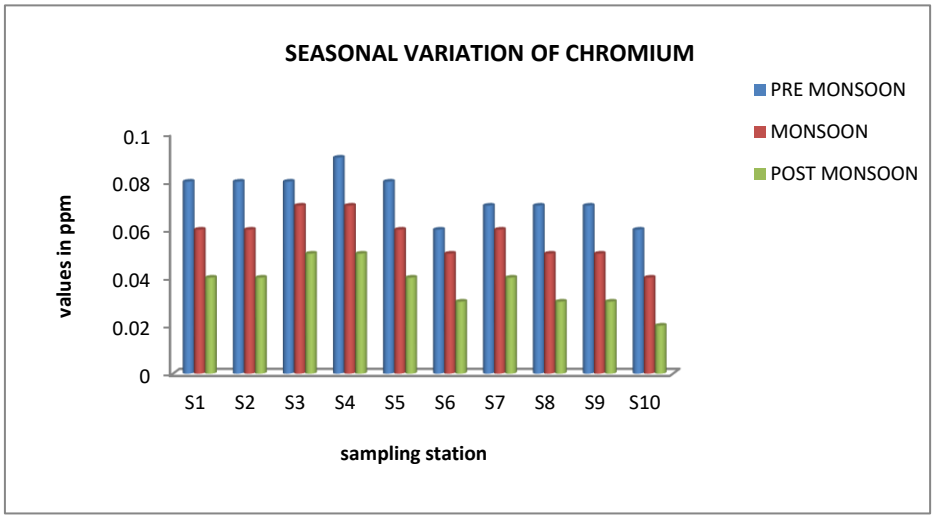


Fig.4 Seasonal Variation of Iron Values Collected from Different Sampling in Karur District

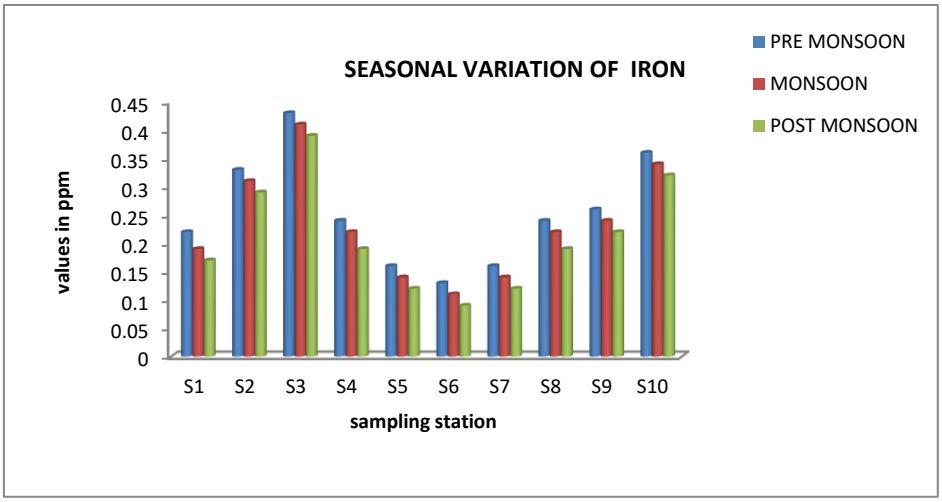
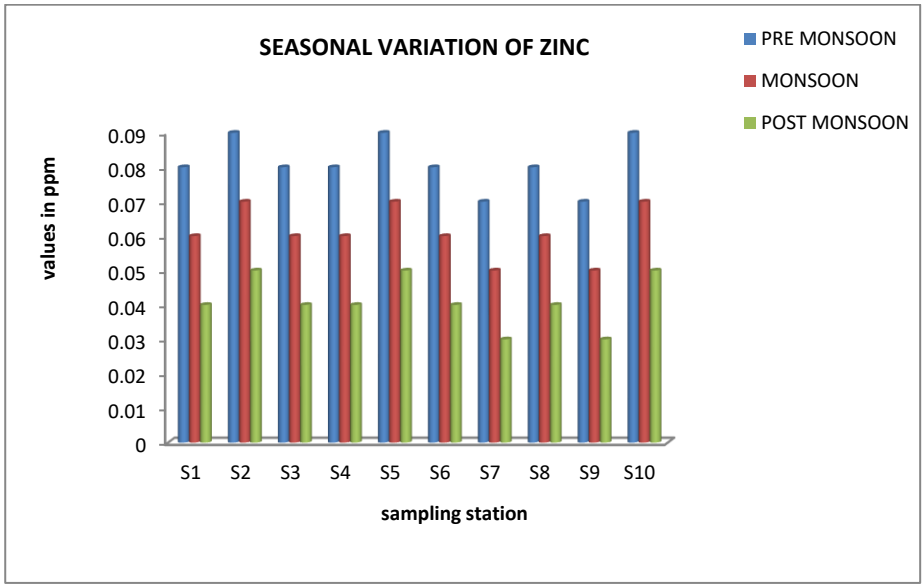


Fig.5 Seasonal Variation of Zinc Values Collected from Different Sampling in Karur District



COPPER (Cu)

The maximum permissible limit for Copper in ground water is 2 mg/l recommended by WHO. In ground water samples concentration of copper ranged between 0.13 to 0.17mg/l. In all the collected water samples concentration of copper was recorded below the permissible limit. Copper contamination results in development of anemia, liver and kidney problems. Concentration of copper in all the samples was found below the permissible limit set by WHO.

CHROMIUM (Cr)

Chromium is an essential micronutrient for animals and plants and is considered as a biological and pollution significant element. The maximum permissible limit for Chromium in ground water is 0.05mg/l recommended by WHO. In ground water samples concentration of chromium is ranged between 0.04 to 0.07mg/l. In very few water samples concentration of chromium was recorded below the permissible limit. In most of the water samples concentration level of chromium is found to be slightly above the permissible limit. Due to High content of chromium may be due to various anthropogenic activities, industrial effluents, tanneries, old plumbing and household sewages.

IRON (Fe)

The groundwater sample values of iron in the ranges from 0.11-0.41ppm. All the values are found to be within the permissible limit of WHO (1.0 ppm). Iron is

the fourth most abundant element by mass in the earth crust. In water it occurs mainly in the ferrous and ferric state. Shortage of iron causes a disease called anemia.

LEAD (Pb)

In all the water samples values of lead are not found and below dectable. The permissible limit set by WHO (0.01 ppm). Lead contamination of the ground water may be the result of entry from industrial effluents, household sewages containing phosphate fertilizers, human and animal excreta. In this case, high concentrations of lead in the body can cause death or permanent damage to the central nervous system and brain which the effects can be in memory. Other effects are high blood pressure, hear hearing problems, headaches, slowed growth, reproductive problems in men and women, digestive problems, muscle and joint pain.

ZINC (Zn)

Zinc is one of the important trace elements that play a vital role in the physiological and metabolic process of many organisms. Nevertheless, higher concentrations of zinc can be toxic to the organism. The permissible limit of zinc set by WHO (3.0 ppm). Concentration of zinc in groundwater samples ranged between 0.05 to 0.07 mg/l. In all the collected ground water samples concentration of zinc was found to be below the permissible limit of WHO.

CONCLUSIONS

Water is one of the abundantly available substances in nature and also called an elixir of life. The ground water quality assessment helps to identify the significant parameters of getting better information about source of pollution. From the obtained results it is evident that, at present the metal ion concentration is not at the levels which could be hazardous for humans. But still the study clearly points out that the concentrations of toxic metals like Chromium are present in slight excess in few stations. Even though, the condition is not very bad at present, there may be problems if the same continues in future that the ground water source will be completely polluted and become unfit for drinking and other purpose. Hence, this is high time to preserve and protect this precious resource.

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