SEASONAL VARIATION OF THE HEAVY METAL CONTAMINATION OF GROUND WATER IN AND AROUND OF INDUSTRIAL AREA OF KAKINADA, EAST GODAVARI DISTRICT, ANDHRA PRADESH

1SRINIVAS J., 2PURUSHOTHAM A.V., 3MURALI KRISHNA K.V.S.G.

1Department of Civil Engineering, JNTU Kakinada, -533 003, Andhra Pradesh, INDIA
2MSN Degree College, Kakinada-533016, Andhra Pradesh, INDIA
3Department of Civil Engineering, JNTU Kakinada, -533 003, Andhra Pradesh, INDIA
E-mail: srinivas.msc18@gmail.com, 2dravp59@yahoo.com, 3kvsg.muralikrishna@gmail.com

Abstract- Ground water samples were collected from in and around industrial area of Kakinadaduring monsoon, and post monsoon season during the year of 2010-2011 and 2011-2012. The concentration of trace metals such as Copper, zinc, Iron and Manganese were determined using atomic absorption spectrophotometer and the results were compared with the World Health Organization (WHO 2003) standard values. This study revealed the presence of some heavy metals in few ground water samples and hence refers heavy metal contamination of water sources. This study suggests that the preventive measures which are to be adopted to control the contamination of excess Copper, Zinc, Iron and Manganese present in the water samples collected on either sides of the channel.

Keywords- Atomic Absorption Spectro Photometer, Ground water, Heavy Metal Contamination, Industrial Area, and Seasonal Variation.

I. INTRODUCTION

All livings things of this earth are largely dependent on water. Even 70% of living body is constituted with water [1]. However, water has a substantial role in industry, agriculture and other human affairs. Though it is precious, it is very much neglected and the least cared resources of the earth. In Nigeria, a study of industrial effluents prevailed that inorganic pollutants are above the recommended limits [2]. Water quality is being deteriorated day by day throughout the world through improper disposal of industrial wastes and effluents [3]. If the effluents and wastes are not treated properly; the ground water will be polluted [4]. Water is required by all living things for cell metabolism. Water is also a vital resource for agriculture, manufacturing, transportation and many other human activities. Despite its importance, water is the most poorly managed resource in the world. Groundwater is the water that percolates downward from the surface through the soil pores.

The higher concentration of their presence in industrial effluents percolates down to sub-surface water bodies and gets absorbed in the course as a result of various geochemical processes. Higher concentration of trace metals can also be found in ground water near contaminated sources posing serious health threats [5]. Though some metals like Fe, Cu and Zn are essential micronutrients, they can be detrimental to the physiology of the living organisms at higher concentrations [6, 7]. Trace metals can be toxic and even lethal to humans even at relatively low concentrations because of their tendency to accumulate in the body [8]. Several investigations have been made to identify the source of contaminants in ground water, and in most of the cases source are industrial wastes [9]. The study area is one of the contaminated areas identified by the Central Pollution Control Board, New Delhi and frequently referred to as an area of ecological disaster, and has been studied by many authors [10,11,12,13]. The above studies though provided a base line however, environmental issues needs to be monitored regularly.

II. STUDY AREA

The Kakinada city is the capital of East Godavari District of Andhra Pradesh on the central east coast of India. The area under study Kakinada is located at 16°56′N 82°13′E. It has an average elevation of 2 metres (6 ft) and many areas of the city are below sea level. The present study deals with the Heavy Metal Contamination of Groundwater Due to Industrial Solid Waste Disposal in Kakinada, Andhra Pradesh, India.

Figure - 1: Location Map of the Study area
III. MATERIAL AND METHODS

The Ground water samples were collected from Open wells and Hand Bore. Ground Water samples were collected from industrial areas of Kakinada, East Godavari district. Then the sample bottles were rinsed two to three times in the field using the representative groundwater samples. Samples were collected in 1 lt. sterilized bottles using the standard procedure for grab (or) catch samples in accordance with standard methods of APHA (1995). The analysis of heavy metals was done with atomic absorption spectrophotometer. All the chemicals and reagents used were of analytical grade. D.D water was used for the preparation of solutions (APHA 1998). The results obtained were compared with WHO (1973) and Indian standards (1991) for drinking water.

3.1 Ground Water Samples

The Ground Water samples were collected from industrial areasof Kakinada, East Godavari district. The Ground Water samples are collected in Monsoon, Post Monsoon, summer and Winter Seasons at different industrial areas of Kakinada. These samples were tested for water analysis to identify the heavy metals.

3.2 Sampling And Collection

Samples from the container made up of borosilicate should be transferred to well rinsed, appropriately labelled. Proper labelling precautions made on each sample as follows. After labelling, immediately the samples sent to the laboratory for analysis to avoid any change/deterioration in its quality due to chemical activity. The heavy metals were estimated using Atomic Absorption Spectrophotometer. The standard solutions for calibration and all other required solutions were prepared with distilled water. These samples were tested for heavy metals like Arsenic (As), Lead (Pb), Selenium (Se), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Manganese (Mn), Mercury (Hg), Nickel (Ni), Silver (Ag) and Zinc (Zn).

IV. RESULTS AND DISCUSSION

4.1 Physical Characteristics Of Ground Water

The ground water sample in industrial area of Kakinada of Physical parameters like, Odour is Un objectionable, Taste - Agreeable, Colour <5 (Hazen units).

4.2 Chemical Characteristics Of Ground Water

The ground water sample of Chemical parameters like, Copper 2.3 to 2.5 mg/lit, Zinc 20 to 23 mg/lit, Iron 1.7 to 2.0 mg/lit and Manganese 0.80 to 0.90 mg/lit were reported in different seasons like Monsoon, Post Monsoon, Summer and Winter of industrial area of Kakinada.

4.3 Heavy Metals

4.4 Copper

The desirable limit for copper is 0.05 mg/L and the permissible limit in the absence of alternate source is 1.5 mg/L. The undesirable effect beyond the desirable limit is astringent taste, discoloration and corrosion of pipes, fittings and utensils will be caused. The present water samples are having copper ranging from 2.3 mg/L to 2.5 mg/L. Hence, all water samples are contaminated due to copper and not suitable for drinking.

Figure- 1 Heavy Metal Concentration in Industrial Ground Water 2010 - 2011
4.5 Zinc
The desirable limit for Zinc is 5 mg/L and the permissible limit in the absence of alternate source is 15 mg/L. The undesirable effect beyond the desirable limit is astringent taste, discoloration and corrosion of pipes, fittings and utensils will be caused. The present water samples are having Zinc ranging from 20 mg/L to 23 mg/L. Hence, all water samples are contaminated due to Zinc and not suitable for drinking.

4.6 Iron
The desirable limit for Iron is 0.3 mg/L and the permissible limit in the absence of alternate source is 1.0 mg/L. Beyond this limit taste and appearance are affected and has the adverse effect. The present water samples are ranging from the 0.80 to 0.90 mg/L.

4.7 Manganese
The desirable limit for manganese is 0.1 mg/L and the permissible limit in the absence of alternate source is 0.3 mg/L. Beyond this limit taste and appearance are affected and has the adverse effect. The present water samples are ranging from the 0.80 to 0.90 mg/L.

V. RESULTS AND DISCUSSIONS
Seasonal variations are evident in all the heavy metals examined during the year 2010-2011 and 2011-2012 of the study. Heavy metal contents towards left and right of the channel indicate the variations at different sampling sites in different seasons. Heavy metals, if present beyond permissible limits in water are toxic to human beings, aquatic flora and fauna. In the present study, we found that Cu, Zn, Fe and Mn are present in relatively higher concentrations as compared to their permissible limits of WHO. Whereas Cu, Zn, Fe and Mn are crossed permissible limit prescribed by WHO and IS 10500:20011.

CONCLUSION
The case study of ground water pollution due to uncontrolled industrial effluent discharges. Ground water samples showed that all the heavy metals in either sides of channel were not within the safe limit. It is quite evident that these heavy metals may enter the food chain, and through bioaccumulation and biomagnifications. Regular monitoring of the water quality is thus required to assess the heavy metal contents in water so that remedial measures can be adopted to save the ground water from heavy metal pollution.

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REFERENCES
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