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ASSESSMENT OF HEAVY METAL IN AND AROUND THE INDUSTRIAL ZONE TUTICORIN BY USING GIS

S. Meenalosini[1], K. Soundhirarajan [2], A. Dinesh Kumar 3, P. Sivakumar[4]

[1]P.G student, Dept. of Civil Engineering, Gnanamani College of Engineering, Namakkal, Tamilnadu, India
[2] Assistant Professor, Dept. of Civil Engineering, Gnanamani College of Engineering, Namakkal, Tamilnadu, India
[3, 4] Assistant Professor, Dept. of Civil Engineering, Master of Simulation Technology, Tamilnadu, India,

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Abstract - *The heavy metal contamination were investigated in groundwater and lake in the industrial zone in tuticorin. The hazardous ill effect of heavy metals on environment and public health is a matter of serious concern. Heavy metals in water resource are one of the most important environmental problems of countries. The chief part of the sources of drinking water in the area are to make moist which udder up to the distance below the surface of 10-15m in almost taken separately house. The study consist of the determine parameters quality in heavy metals properties of drinking water. The act of comparing on the results of groundwater samples with WHO guild lines make known divulge that most of the groundwater samples are highly toxic contaminated with like Ar, Se, Pb, Al, Ze, Hg,....etc. The selenium level was taller than 0.01mg/l in 61% of the try hard region and the arsenic 0.01 mg/l in 30% of the region. The result make known of the heavy metals contamination in the region is mainly due to the discharge effluents from industries. We can hint that the government should adopt nearly the process of treating anything technologies in the following try hard regions to minimize these heavy metals in groundwater & surface water for providing a protected from danger of drinking water for all the people.*

Key Words: Heavy Metal, Industrial, Tuticorin, Water …

1. INTRODUCTION

Water pollution is the most serious environmental quality issues in India. It is caused by the disposal of solid and liquid wastes on land and surface water. The most significant waste is sewage, industrial effluent, agricultural residues and chemicals. Today the cry of "Environmental Pollution" is heard from all corners of the world. Pollution has now become a distinct threat to the very existence of mankind on this earth. It is now a major challenge of our times.

Water is the important resource which influence the human life. Generally water which influences the human life. Generally water obtained from two types of natural sources surface water (lakes, ponds, rivers, streams etc..,) &ground water (bore holes & well waters). Water plays an important role domestic, industrial supply, irrigation in all over the world. But increase of population industrialization & urbanization are causes contamination of the ground water. The contamination ground water is not easy to restore. In view of high pollution potential & human health implication of heavy metal contamination, the government has taken various preventive measures for restricting their in to the natural ecosystem, especially in groundwater. Ground water often spreads the effects of dumps & spills for beyond the site of the original contamination.

1.1 Scope And Objective

Physical and chemical analysis of surface water and groundwater has been performed with regards to:

1. To determine the various physical, chemical characteristics of water quality parameters present in the water and also the ground water
2. To assess the quality of the ground water and its suitability for portable purposes.
3. To carry out the studies variation of WQP and to find out the pollution potential of the ground water
4. To analyze of the sample variations of selected physico-chemical parameters in the water together in the selected heavy metals in the surface water.
5. To estimate and analyze the correlation between the selected physico-chemical parameters in the water.

2. LITRATURE REVIEW

Husam Malassa et.al, "Assessment of Groundwater Pollution with Heavy Metals in North West Bank/Palestine by ICP-MS" Groundwater of North West Bank in Palestine was assessed for pollution with trace metals by ICP/MS. In general, 82% of all samples analysed contained one or more of the 12 metals studied each in varying concentration. Results of this study suggest a possible risk to the people of the study area given the toxicity of heavy metals, and the fact that for many people in the study area, groundwater is a main source of their water supply.

Ravisankar Tadiboyina et.al, "Trace Analysis of Heavy Metals in Ground Waters of Vijayawada Industrial Area" One of the major source of contamination of ground water is improper discharge of industrial effluents these effluents contains so many heavy metals which are because more effects the human life. The present study about contamination of ground water due to trace metals in and around the Vijayawada. 60 samples are collected industrial area around the Vijayawada. The study area divided into five zones depending on the nature of industries are present in the study area .The following trace metals are analyzed Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Se, and Zn were analyzed in all the sample. In some ground water sample are found to be more concentration of metals are exceeds maximum limits

values of WHO, ISI standards. The result gives important information of ground water quality.

S.Selvam et.al, "Assessment of heavy metal and bacterial pollution in coastal aquifers from SIPCOT industrial zones, Gulf of Mannar, South Coast of Tamil Nadu, India**"** Heavy metals and microbiological contamination were investigated in groundwater in the industrial and coastal city of Thoothukudi. The study consists of the determination of physic- chemical properties, trace metals, heavy metals and microbiological quality of drinking water. Heavy metals were analyzed using Inductively Coupled Plasma Mass Spectrometry and compared with the (WHO in Guidelines for drinking water quality, 2004) standards. The organic contamination was detected in terms of most probable number (MPN) test in order to find out faecal coliforms that were identified through biochemical

Santhanakrishnan et.al, "Heavy metal distribution in the salt pans of tuticorin, tamil nadu, **india"**In Tuticorin (Thoothukudi), salt is being produced by solar evaporation of brine in ponds. Its industrial environment warrants a heavy metal pollution potential assessment. During the process of solar evaporation, brine is conveyed through reservoir and condenser, to crystallize salt in crystallizer ponds and eventually exit as bittern. In this process, it deposits heavy metals on the pond floors which in turn may adhere to the crystallized salt. Thus, heavy metal quantification and path analysis becomes imperative in terms of pollution potential. The enrichment of heavy metals in salt pan sediments and salt potentials biological risk for the salt pan ecosystem and the consumers of salt. Hence heavy metal distribution was estimated in 16 samples from different pond floors of four salt pans viz.

3. MATERIALS & METHODOLOGY

Fig -1: Methodology

3.1 Study Area

Tuticorin is the one of the major city in tamil nadu. The city located at 8.7642°N, Latitude 78.1348°E Longitude in the southern part of Tamil Nadu, India. Thoothukudi city and surrounding areas have considerable presence of industries in several industrial sectors. The large industries (other than infrastructure providers, i.e. the Port and the Tamil Nadu Electricity Board Power Plant) are Sterlite (copper), Southern Petrochemical Industrial Corporation (fertilisers and chemicals) and Kilburn Chemicals (titanium dioxide). There are also several textile mills in the district. The presence of these large industries can lead to the establishment of industries that have product synergies with these units.b). Several medium and small industries, including traditional ones, are situated in Thoothukudi and its neighborhood. The major segments include salt—industrial and domestic, marine products, minerals dry flower exports, edible oil extraction, readymade garments and senna (medicinal herbs) exports. This study reports the levels of dissolved trace elements and heavy metals in the groundwater system. The coastal study area supports a rapidly growing population and there are concerns regarding the water quality of the groundwater system. A large number of researchers have also worked on trace element contents of groundwater in Indian subcontinent and along its coastal area.

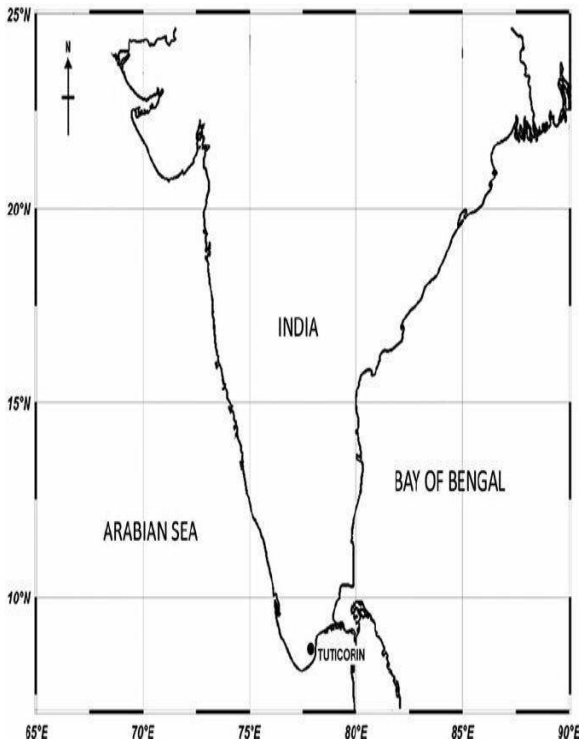

Fig -2: Study Area

3.2 Collection of Water Samples

In the present investigation of 13 groundwater samples and 5 lake water samples were collected from seven wells of different rural areas of Tuticorin. Monomer cans of 1 L

capacity were made use for collection of water samples. These polythene cans were first washed with tap water, soaked in chromic acid solution for about 10-15 minutes to remove any impurities, again washed with tap water. Finally, they were rinsed with de-ionised distilled water. Then the polythene cans were taken for sample collection. The samples were collected in one liter high density monomer bottles pre washed with dilute hydro-chloric acid and rinsed 3 times with the water sample before filling and labeled accordingly.

Table -1: Details of the sample locations-1

SL.NO	SAMPLE CODE	LOCALITY
1	G.W-1	VEERAPANDIAPURAM
2	G.W-2	KORAMPALLAM
3	G.W-3	MADATHUR
4	G.W-4	SHANMUGAPURAM
5	G.W-5	RATHANAPURAM
6	G.W-6	POLPETTAI
7	G.W-7	RAJIV NAGAR
8	G.W-8	MUTTAYYAPURAM
9	G.W-9	KOTHALARIVILAI
10	G.W-10	MELUR
11	G.W-11	MATTAKADAI
12	G.W-12	MUNIASAMY NAGAR
13	G.W-13	MATHA KOIL
14	L.W-1	KORAMPALLAM
15	L.W-2	KORAMPALLAM
16	L.W-3	KORAMPALLAM
17	L.W-4	KORAMPALLAM
18	L.W-5	KORAMPALLAM

4. RESULT & DISCUSSION

The various physical & chemical parameters including statistical measures such as minimum, maximum, average and standard deviation analysed groundwater samples from the study area. TDS values ranges from 256 to 6643 mg/l, with an average value of 2157 mg/l. the high concentration of TDS in ground water samples in due to leaching of salts from soil and also by anthropogenic activities. The EC value is measured in micro -semen's per centimeter and is measure of salt content of water in the form of ions. The EC values range from 400 to 10380 µs/cm with an average value 3370 µs/cm. To determine the suitability of ground water of any purposes, it is essential to classify the groundwater depending upon their hydro chemical properties based on their EC values. the negative logarithm of hydrogen ion concentration (pH) ranges from 7.6 -8.12 with an average value 8.00 the pH value as low as 7.6 was recorded in Sipcot and the highest was found in mappilaiurani near siluvaipuram with a value of 8.12. This shows that the groundwater of the study area dominantly alkaline in nature. The slight alkalinity may be due to presence of bicarbonate ions, which are produced by the free combination of CO_2 with water to form carbonic acid, which affects the pH of the water. Almonst the cations, the concentration of Na, Ca, Mg and K ions range from ,5.6-1475,22-880,13-366and 2-839 mg/ l. The order of abundance of chemical concentrations is $Na^+ > K^+ > Mg^{2+} > Ca^{2+}$, respectively.

4.1Heavy metal distribution

For the protection of human health, guidelines for the presence of heavy metals in water have been set by different International Organizations such as United States Environmental Protection Agency, World Health Organization (WHO) and the European Union Commission. Thus, heavy metals have permissible limits in water as specified by these organizations. The summary of the heavy metals results of laboratory analyses conducted on the samples. The concentration of lead in groundwater varies from 0.000 to 0.018 mg/l with an average concentration of 0.004 mg/l, which is beyond the desirable limit of 0.001 mg/l as recommended by WHO (2004). The lead concentration in groundwater of the study area is within the maximum allowable limit in all the sample locations. The main sources of lead contamination are industrial discharges from smelters, battery manufacturing units, run off from contaminated land areas, atmospheric fall out and sewage effluents. Arsenic concentration in the groundwater varies from 0.000 to 0.083 mg/l with an average concentration of 0.015 mg/l. The maximum allowable limit of arsenuc ion concentration in groundwater is 0.001 mg/ l as per WHO 2004 classification. According to WHO standards, 42% of the samples have exceeded the permissible limits and 58 % of the samples are within the permissible limit. Not permissible limit of arsenic was observed towards North West, North East and central portion. A higher concentration of Arsenic in the study area is due to industrial waste leaching or percolating through the sub-surface. The study area STERLITE is one of the copper industries located near Thoothukudi town which produces copper from copper concentrates. Arsenic trioxide is obtained as a byproduct from dusts and residues that are produced during the treatment of other metal ores such as gold and copper. The high arsenic concentration is due to the

anthropogenic activities like poultry waste, brick making and agricultural practices.

4.2 Termination Characteristics

Physical characteristics of the groundwater from various localities of Thoothukudi city such as temperature, pH, conductivity, turbidity, dissolved oxygen, total dissolved solids and salinity are within acceptable limits as prescribed by IS 10500: 2012 and the WHO guidelines for drinking water.

Except for the sample from Muttayyapuram all the other samples do not have any microbiological contamination. At Muttayyapuram the coliform count is 300 MPN which is above the prescribed limit of <2 MPN.As far as the major element concentrations in the groundwater samples of the Thoothukudi city is concerned, it is observed that Ca is above the IS 10500: 2012 prescribed desirable limit of 75 ppm in 8 of the 13 localities. However, the Ca concentrations are below the permissible limit of 200 ppm. Among the heavy metals measured, as at 0.012 ppm and 0.017 ppm.The Korampallam Lake covers an area of about 4.48 sq. km which serves as a source of drinking water and for other domestic purposes for the surrounding areas. From Table 3, it can be inferred that the physical characteristics of the Korampallam lake waters such as temperature, pH, conductivity, turbidity, dissolved oxygen, total dissolved solids, and salinity are within acceptable limits as prescribed by IS 10500 : 2012 and WHO guidelines for drinking water.

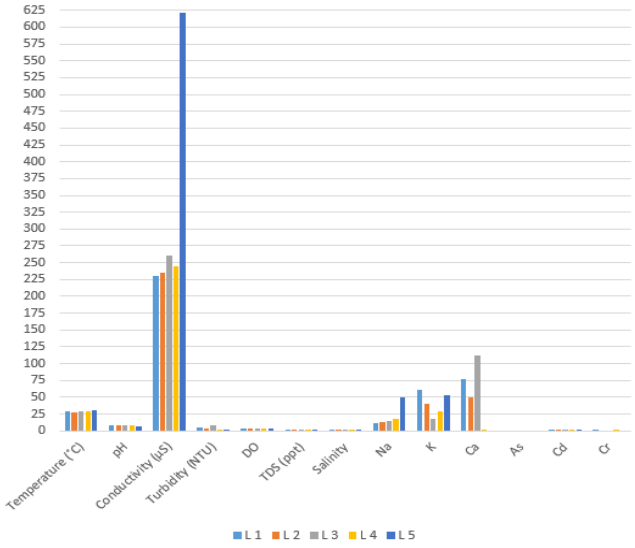

Chart -1: Graph Shows The Results Of The Physical, Chemical, And Microbiological Analyses Of Lake Water Samples.

5. CONCLUSION

This study shows that the tuticorin city of Tamilnadu has been affected by trace elements in groundwater. In view of these findings, there is a need to monitor more closely the environment under review and put in place appropriate checks and balances to preserve the health of communities within the vicinity areas, as the effects of heavy metals are bio- accumulative and pose great dangers to the health of humans, animals and plants. Since all the groundwater and lake samples have been contaminated and are not suitable for human consumption it is recommended that the local government issue advisories against the consumption of these waters to the local people. Suitable alternative water supply must be provided immediately. Appropriate studies for the identification of the sources of contamination and measures to eliminate those are required on an urgent basis.

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BIOGRAPHIES

S. Meenalosini, P.G student, Dept. of Civil Engineering, Gnanamani College of Engineering, Namakkal, Tamilnadu, India.

K. Soundhirarajan, Assistant Professor, Dept. of Civil Engineering, Gnanamani College of Engineering, Namakkal, Tamilnadu, India.

A. Dinesh Kumar, Assistant Professor, Dept. of Civil Engineering, Master of Simulation Technology, Tamilnadu, India.

P. Siva Kumar, Assistant Professor, Dept. of Civil Engineering, Master of Simulation Technology, Tamilnadu, India.