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TRACE ELEMENT ANALYSIS OF GROUNDWATER FROM RASIPURAM TALUK, TAMILNADU, INDIA

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ABSTRACT

Groundwater is an important source of water for many municipalities, industries and for irrigation, which needs careful and critical assessment of its quality. The groundwater samples collected from Rasipuram Taluk, Which is located in southern part of India, have been used for the trace element analysis. The main reason behind this analysis is based on the fact that, the industrial wastewater contributes to the groundwater pollution. The samples were analyzed for trace elements such as cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn) and zinc (Zn) using Atomic Absorption Spectrometer (AAS) and other associated equipments. It was found that the concentrations of trace elements in groundwater of the study area are well within the prescribed limit.

Keywords: Rasipuram Taluk, Groundwater Quality, Trace Elements.

INTRODUCTION

The seepage of pollutants into the groundwater happens from leaking of septic tanks, underground tanks, cesspools, land disposal of industrial wastewater, adjacent polluted surface water bodies and landfills. Pesticides and fertilizers used on farmlands and lawns, and industrial effluents can find their way into groundwater. Sources of contaminants can be very near to a well, or distance away. Because of slow movement of contaminants into the groundwater, continued leakage from single source at a point will lead to gradually growing levels of contaminant concentrations. Groundwater is the major source of water for many municipalities, industries and for irrigation, which needs careful and critical assessment of its occurrence. Currently, groundwater is the source of drinking water for 53% of the nation's population and more than 97% of its rural population (Kudesia, 1998). Groundwater is also the source for about 44% of the average annual stream flow in India, even though during long time of small or no rainfall, groundwater discharges provide nearly all of the base stream flow (Todd, 1980). This hydraulic connection between aquifers and drainages implies that if a determined pollutant gets into an aquifer, it eventually could be discharged into a stream (Hem, 1985).

MATERIALS AND METHODS

Well inventory survey was carried out in the field. Type of well, depth of the well, diameter of the well, usage and depth of water table etc were collected during the survey. Groundwater samples were collected from 20 locations (Figure 1) comprising of open wells and tube wells in the study area during pre-monsoon (May 2012) and post-monsoon (January 2013) seasons. Samples were collected and stored in clean polythene containers of one liter capacity. These containers were rinsed with double distilled water before taking to the field. All the samples were collected by rinsing the containers with the respective waters from various locations and finally the containers filled with the samples. The samples were later acidified with nitric acid for trace element analysis. Concentrations of such trace elements as cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn) and zinc (Zn) in groundwater samples were determined using Atomic Absorption Spectrometer and associated equipments. Direct air-acetylene flame method was adopted for the determination of these elements.

RESULTS AND DISCUSSION

The most important and natural cause of trace elements is weathering of rocks, from which the metals find their way into the water bodies and groundwater. Domestic, industrial and agricultural activities are also responsible for the higher concentrations of trace elements in groundwater (Umar 2001). Due to the high importance of heavy metals, a study was carried out in 20 observation wells spread over the study area to know the levels of important heavy metals in groundwater such as Cd, Cr, Cu, Mn, Pb and Zn. The summary of the analytical results is given in Table 1.

The concentration of lead in natural water increases mainly through anthropogenic activities (Goel 1997). Pregnant women exposed to lead were found to have high rates of still births and miscarriages (WHO 1973). Lead causes mental retardation among children. Lead poisoning is along with symptoms of intestinal cramps, peripheral nerve paralysis, anaemia and fatigue (Umar 2001). In the study area, there are very small traces of lead in the samples analyzed. Cadmium is highly toxic to humans and animals (Friberg et al 1974). There are no traces of cadmium and manganese was found in the Rasipuram taluk during both the seasons. Hexavalent chromium (Cr^{6+}) is highly toxic and, in higher concentration had been found to be carcinogenic (Sawyer and McCarty 1967). During the pre-monsoon period, the concentration of chromium was found in only minimum samples with an average of 0.009 mg/l and 0.004 mg/l was the average during post-monsoon.. Copper and zinc are essential for plant and animal metabolism, but their limited occurrence in groundwater is useful from the point of view of water quality. The concentration of copper was found only in four wells during May 2012, and the values were within the permissible limit of 1.5 mg/l as per the ISI Standard. Zinc concentration varied from zero to 0.012 mg/l, and the values are within the permissible limits for drinking.

CONCLUSION

Naturally, Earth's crust contains the heavy metal components. To a small extent, they enter human bodies via food, water and air. As trace elements, some heavy metals are necessary to keep up the metabolism of our body. On the other hand, at elevated concentrations, they can be poisoning. Heavy metals are dangerous because they may be likely to bioaccumulate. Traces of heavy metals can come into a water supply from industrialized and end user waste, or from breaking down of soils by acidic rain and discharging heavy metals into surface water bodies and groundwater. It seems that the concentrations of heavy metals in groundwater of the study area are well within the allowable limits as prescribed by WHO and ISI for drinking.

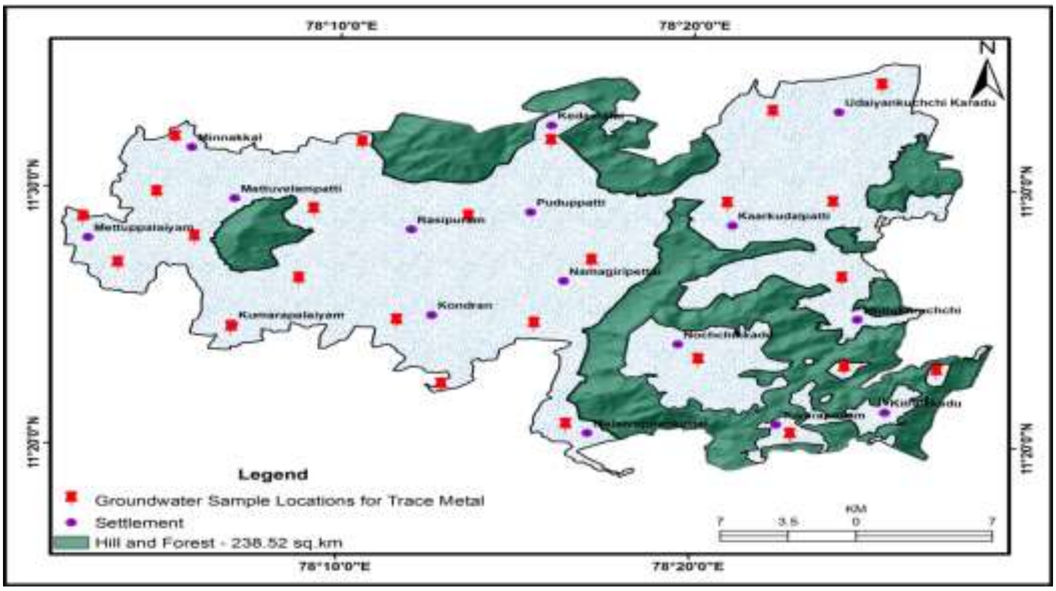

Fig 1: Sampling locations for trace element analysis

Table 1: Trace element concentrations in groundwater with statistical parameters

Parameters	Units	Minimum		Maximum		Average		Standard Deviation	
		May 2012	Jan 2013	May 2012	Jan 2013	May 2012	Jan 2013	May 2012	Jan 2013
Cd	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	mg/l	0.000	0.000	0.024	0.023	0.009	0.004	0.007	0.006
Cu	mg/l	0.000	0.000	0.072	0.054	0.022	0.015	0.019	0.012
Mn	mg/l	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pb	mg/l	0.000	0.000	0.088	0.018	0.045	0.031	0.040	0.024
Zn	mg/l	0.000	0.000	0.012	0.010	0.005	0.002	0.004	0.003

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