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Assessment of Heavy Metals in Ground Water Samples of Certain Location Situated around Duggavathi Village

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ABSTRACT: Groundwater constitutes about 3% of the total available fresh water resources on the earth. The ever-increasing demand for fresh water against the limited potential has resulted in a stress on the fresh groundwater resources. The quality of groundwater varies in space and time, depending upon the geological and, meteorological factors, besides anthropogenic activities. Groundwater is a renewable resource of the earth crust and it is a part of the hydrological cycle. Water quality is affected by: physical characters, chemical characters and biological characters. Total dissolved solids are made up of Magnesium and Sodium salts namely sulphates and chlorides dissolved in water. The presence of these salts, decides the hardness of water and it devoid the taste and higher concentration leads to itching in skin, used for bath and other disease connected to urinary tract etc.

Groundwater pollution arising due to industrial effluents, waste disposal, indiscriminate usage of agrochemicals including fertilizers and pesticides are the major concerns. The study area consists of Duggavathi Halla (Lake) and surrounding villages in which we have studied 12 samples. Duggavathi village located in Harpanahalli Taluk, Davanagere District, Karnataka State, India. The manganese ore deposition is quite frequent in the north-east part of the district. Hematite iron ore is deposited in the east of Harpanahalli town. Economically workable deposition of quartz is found at Harpanahalli, Kanchikeri and Chetnihalli regions in addition ferruginous quartz are more frequent in and around Shantisagara lake of Channagiri taluk. A small out crop of high calcium lime stone is found in the east of Harpanahalli. Data indicates that in all the water samples the values of parameters such as pH, copper, zinc, lead, chromium, cadmium and manganese are well within the BIS Permissible limits of drinking water. Except few instances where some parameters such as, EC, Iron and Nickel bore well water is beyond the permissible limit this may be due to geological condition. Most of the samples in Duggavathi village fall in the suitable range for irrigation purpose and industrial purpose. The result also suggests that the contamination in the water samples require periodic monitoring of groundwater in the study area.

KEYWORDS : Ground Water, Pollution, Duggavathi village

I. INTRODUCTION

Ground water is present beneath the earth's surface and it is generally found within zone of saturation. The zone of saturation is a kind of geological formation which not only contains ground water but also transmits it from one end to another, depending upon hydraulic gradient, known as 'Aquifer'. The upper most surface of the zone of saturation is known as 'Water Table'. Hydrogeology studies the ground water, the water i.e., held in pores of rocks and sediment beneath the land surface. Groundwater is quantitatively much more significant than surface water. Its pollution prevention, monitoring and restoration are more difficult than for surface waters, due to its inaccessibility. Groundwater being a limited and fast depleting vital resource, because of exponential growth in agriculture, industry, mining activities, waste disposal, land use change and the extensive demand caused by urbanization, causing a lot of stress on aquifer system. The depletion of groundwater the pollution concentration is also rising day by day.

Rain water though purest one, while percolating through soils and rocks acquires some constituents and assumes a new entity while reaching zone of saturation (aquifer). Geology of the area influences the occurrences of total dissolved solids (TDS) and hardness, by dissolving the salts present in the hard rock's like granites and gneisses.

Groundwater can be contaminated in many ways like industries, agricultural activities. Contamination of groundwater takes place through the contamination of surface water. This can, in turn, affect the quality of surface water at discharge areas. Groundwater can also be contaminated by liquid hazardous substances (or solids that can dissolve in water) that filter through the soil into groundwater, by salt water moving in from the ocean, or by minerals that are naturally present in the area

The study area consists of Duggavathi Halla and surrounding villages in which we have studied 12 samples. Duggavathi village located in Harpanahalli Taluk, Davanagere District, Karnataka State, India.



The area has geographical positioning $75^{\circ}51'38.4''$ towards East longitude and $14^{\circ}37'28.5''$ towards North latitude and it Elevation 553m above mean sea level. Duggavathi receives average annual rainfall of about 560 mm. The study area has semi- arid climate. Duggavathi Halla is a non-perennial and it flows from east to west of total length of 19 km. During pre-monsoon season the halla flows at maximum level and after pre-monsoon till the rainy season the halla will be almost dry. Rain fed agriculture is very intensive and great amount of chemical fertilizers such as nitrogen, phosphorous and potash are being used for growing crops like maize, jowar, cotton, mulberry, groundnuts and other oil seeds and cereals.

Samples were collected at 12 different sites which are show above in the toposheet. Ingalagundi, Duggavathi village, Hattiganahalli, Duggavathi halla, Kurubarahalli, Karalahalli, Karala halla, 2.5km from karalahalli near sarathi, Kenchanahalli. Bullapura. Dittur, Ganganarsi.

II. MATERIALS AND METHODS

Materials

Water samples were collected from different sites around Duggavathi village of Harapanahalli taluk. Samples were collected in good quality screw capped high density pre-sterilized polypropylene bottles, each of 1liter, labeled properly and analyzed for trace metals by Atomic Absorption Spectrometer(AAS). Preservations and analysis of water samples were based on standard methods.

The selected heavy metals (Cd, Cr, Cu, Fe, Ni, Pb, and Zn) were analyzed. The detection of trace metals in the environment are accomplished by various methods but here the AAS technique was used, which is relatively simple, versatile, accurate and free interference. Heavy metals readily from complexes with organic constituents, therefore, it is necessary to destroy them by digestion with strong acids. Digestion destroys the organic matter, removes interfering ions and brings metallic compounds in suspensions to solution.

Acid Digestion

Acid digestion is a method of dissolving sample into solution, by adding acids and heating, until the complete decomposition of the matrix. Anywhere that you need to decompose a sample for release of the analyte, or for analysis of trace metals, acid digestion is much recommended.

Methods of digestion

Samples were accurately weighed (0.5g each) and placed in a 100 ml PTFE beaker. The samples were subjected to three different acid digestion methods, as will be explained, to identify the most appropriate digestion method to determine the contents of As, Pb, Cd, Ni, Zn, and Fe in TM samples by AAS.

Nitric-perchloric acid digestion, Nitric acid digestion, Nitric-hydrochloric acid digestion

In these 3 digestions, we use nitric acid digestion for the analysis of sample

Nitric Acid Digestion

To ensure the removal of organic impurities from the sample and thus to prevent the interference in analysis, the sample were digested with concentrated Nitric acid. 5ml of concentrated nitric acid is added to 100ml of sampling water into the 250ml conical flask then heated on a hot plate and evaporated till 20ml was left. After cooling the flask again 5ml of concentrated nitric acid is added and heated the flask on a hot plate. The digestion is continued till 10ml was left and finally filtered and diluted with distilled water into 100ml of volumetric flask and stored in refrigerator.

Methods

Analysis of Water Parameters: Analysed in the Water Sample

pH, Electrical conductivity Iron, Nickel, Zinc, Lead, Copper, Chromium, Cadmium, Manganese

Physical Tests:

1. Electrical conductivity: Conductivity Meter

Numerous conductivity cells are commercially available and using the specific conductance of the sample can be recorded.



2. pH: pH meter

Follow the manufactures instructions to operate the pH meter and standardize the pH meter with the standard buffer solution of pH that is near to that of the sample, Then take a known aliquot of the sample in a thoroughly cleaned and rinsed beaker. Allow the value to stabilize. Note the pH value from the read out.



Chemical Tests:

In chemical tests concentration of heavy metals which are presented in collected water samples is determined by the Atomic Absorption spectrometer (AAS) after Nitric acid digestion.



1. Atomic Absorption Spectrometer(AAS)

Atomic Absorption spectrometers use the absorption of light to measure the concentration of gas phase atoms. The light that is focused into the flame is produced by a hollow cathode lamp, inside which is sample and an anode.

Atomic absorption spectroscopy is a technique used to determine the concentration of particular metal in a sample. It usually involves the use of a flame to atomize the sample, but other methods such as a graphite furnace are also used.



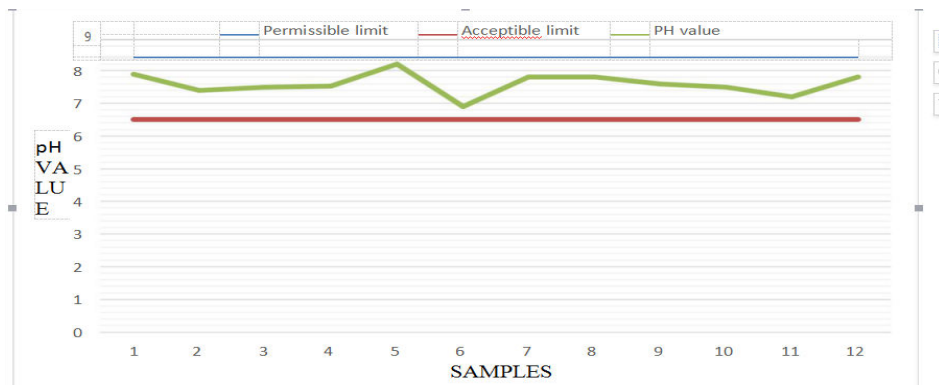
III.RESULTS AND DISCUSSIONS

1.pH:

Results obtained on Concentration of pH in samples are as follows:

Sample No.	pH
1	7.9
2	7.4
3	7.5
4	7.53
5	8.2
6	6.9
7	7.8
8	7.8
9	7.6
10	7.5
11	7.2
12	7.8

Graphical Representation of pH Values in Samples



2. Electrical Conductivity:

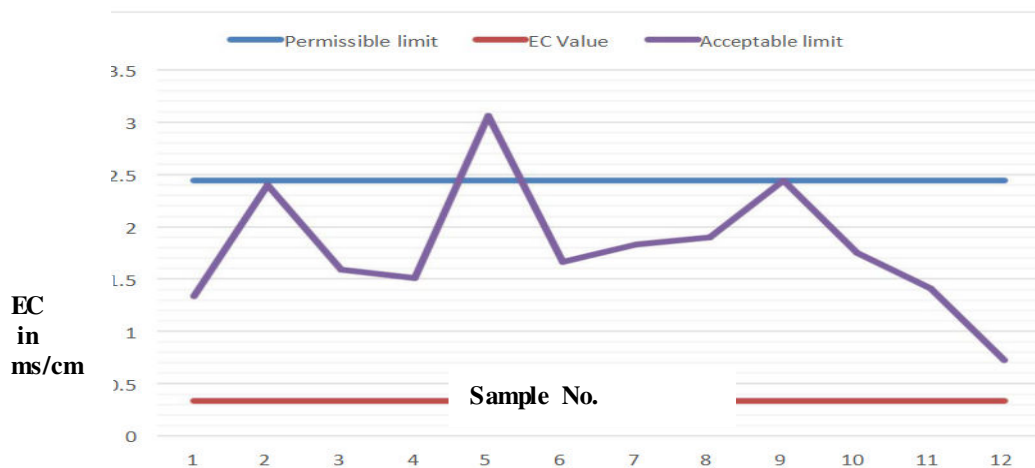
Results obtained on Concentration of Electrical Conductivity in samples are as follows:

Sample No.	Electrical Conductivity in ms/cm
1	1.34
2	2.4
3	1.594
4	1.510
5	3.06
6	1.665
7	1.828
8	1.899
9	2.44
10	1.750
11	1.412
12	0.724

Graphical Representation of EC in Samples

3. Toxic Metal:

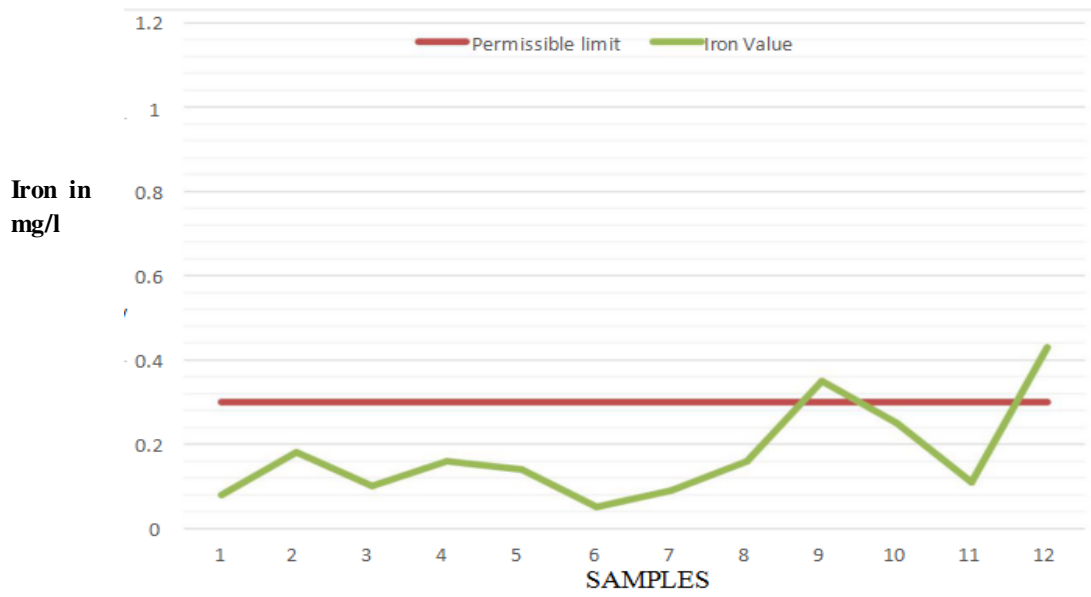
Various toxic metal concentrations obtained are as follows:





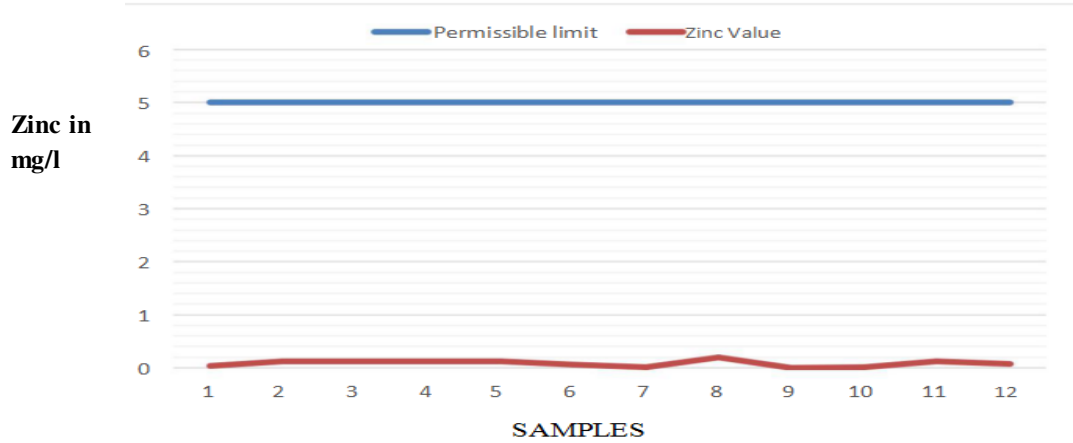
Sample No.	Iron in mg/l	Zinc in mg/l	Manganese in mg/l	Lead in mg/l	Copper in mg/l	Nickel in mg/l
1	0.08	0.03	0	0.03	0.989	0.01
2	0.18	0.12	0.10	0.05	0	0.05
3	0.1	0.13	0	0.03	0	0
4	0.16	0.13	0	0.02	0	0
5	0.14	0.12	0	0.04	0	0
6	0.15	0.06	0.12	0.02	0	0
7	0.09	0.02	0	0	0	0
8	0.16	0.2	0	0.03	0.015	0
9	0.35	0	0	0	0	0.01
10	0.25	0.02	0	0	0	0
11	0.11	0.12	0	0	0	0
12	0.43	0.08	0	0	0.003	0

Graphical Representation of Concentration of Iron in Samples

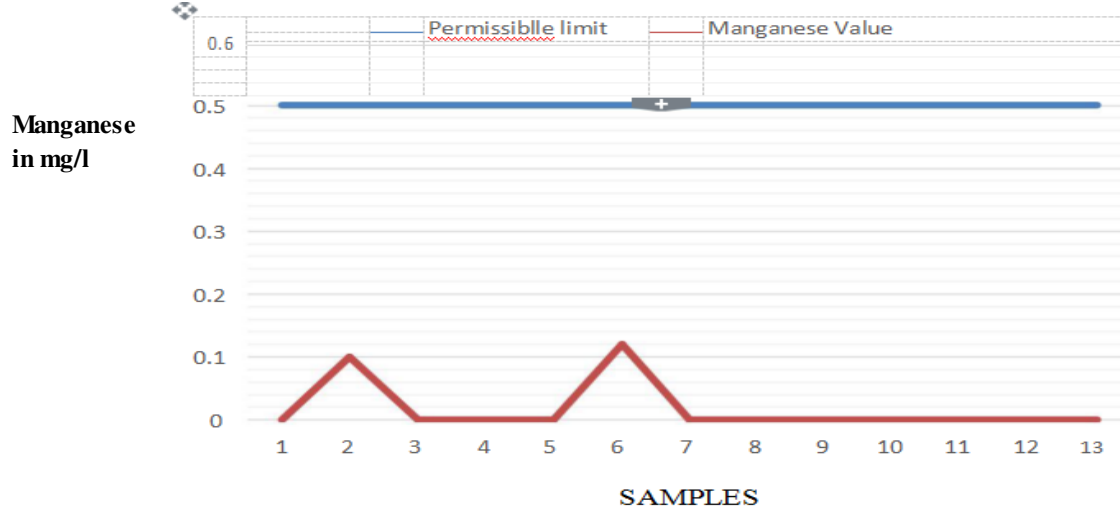




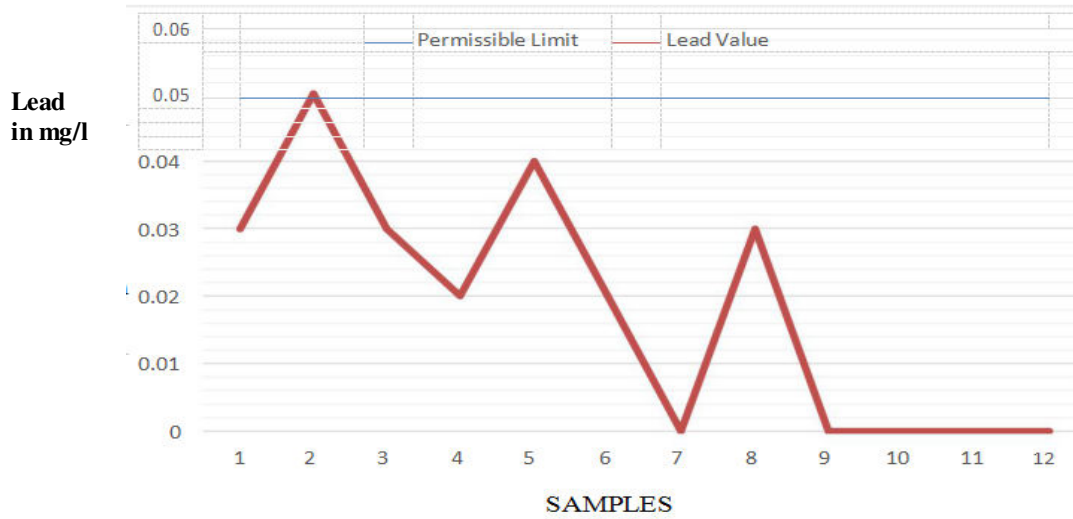
Graphical Representation of Concentration of Zinc in Samples



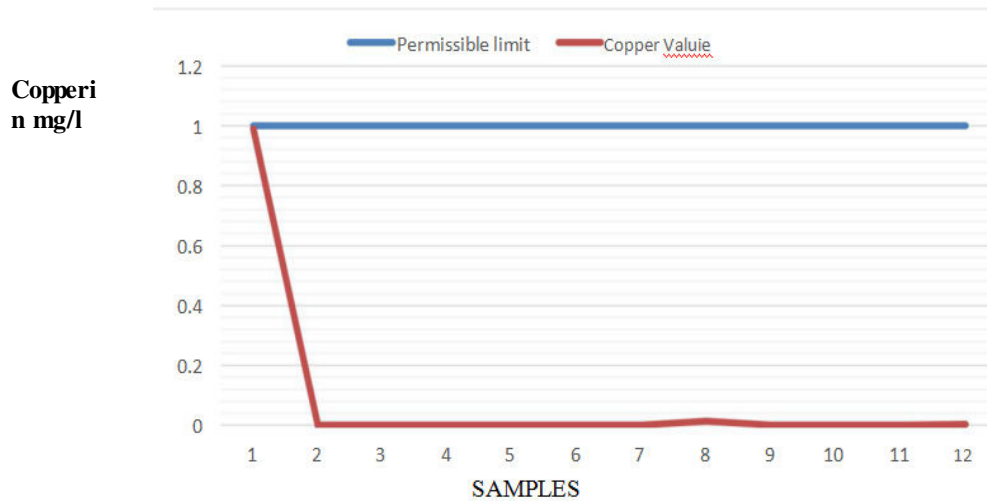
Graphical Representation of Concentration of Manganese in Samples



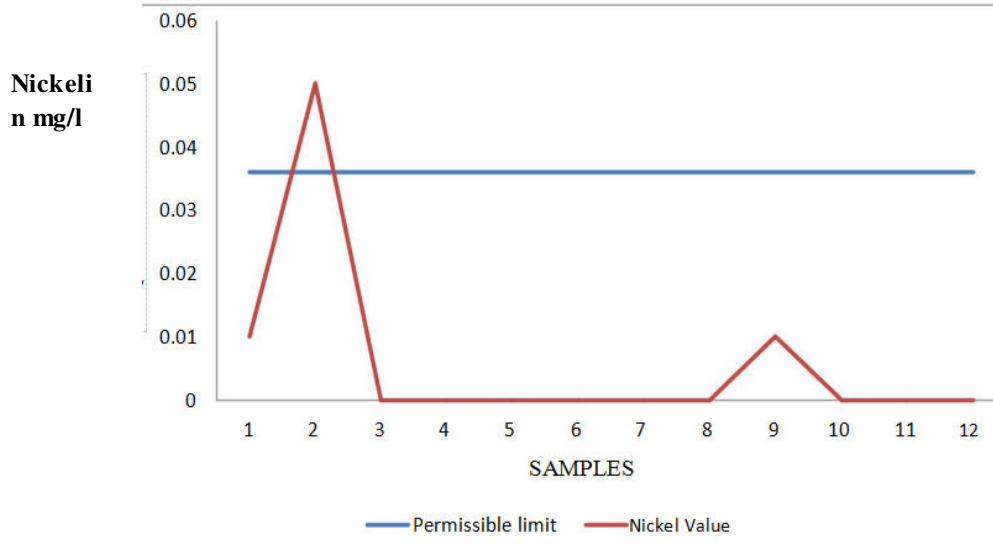
Graphical Representation of Concentration of Lead in Samples



Graphical Representation of Concentration of Copperin Samples



Graphical Representation of Concentration of Nickelin Samples



IV. CONCLUSIONS

Following conclusions can be drawn based on the study analysis:

- Data also indicates that in all the water samples the values of parameters such as pH, copper, zinc, lead, chromium, cadmium and manganese are well within the BIS Permissible limits of drinking water.
- Except few instances where some parameters such as, EC, Iron and Nickel bore well water is beyond the permissible limit this may be due to geological condition.
- Most of the samples in Duggavathi village fall in the suitable range for irrigation purpose and industrial purpose.
- The result also suggests that the contamination in the water samples require periodic monitoring of groundwater in the study area.
- On the basis of the present study, analysis of groundwater of Harappannahalli taluk in Davangere district, Karnataka state, the values of physical and chemical properties of collected and tested samples are within the permissible limit. In general groundwater quality of this region is not harmful to human being.

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