

Heavy Metal Analysis in Ground Water of Industrial Area of Sirgitti in The Bilaspur District

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Abstract:

Water is the most abundant compound that supports all forms of plants and animal life. Ground water the store house of fresh water has become vital, reliable and one of the renewable resource which is available for human consumption, irrigation purposes and livestock watering. Industrial effluents is one of the major source of ground water contamination. Some heavy metals are released by many industries. Industrial solid waste is being dumped near the industries, which react with percolating rain water and reaches the ground water. A large number of heavy metal picks up from percolating water and contaminates the ground water which are cause toxic effects to the human life. The water samples were collected from Six different sampling stations of Sirgitti industrial area in the Bilaspur District. The present study was aimed to assess the heavy metal concentration of various water samples of Sirgitti industrial area in July 2022 and also to determine their suitability for drinking purposes. The following trace metal Copper, zinc, manganese, cobalt, lead, Arsenic, cadmium and mercury were analysed in all water samples. Heavy metal of water samples were analysed using Atomic Absorption Spectrometry (AAS) method. Result of in the present investigation indicates that all these heavy metal content in the ground water of six sampling stations are well below the maximum permissible limit as per WHO standards. From the present study we are getting clear information that the metal concentration is not at the level which could be harmful.

Keywords:- Heavy metal, Industrial area Sirgitti, ground water

INTRODUCTION

Water is most abundant natural resource which influences the human life because life is impossible without water. Surface water (streams, rivers, lake etc) and ground water (bore, springs and well water) are two types of natural resources. Ground water is defined as fresh water which present beneath earth's surface in rock and soil pore spaces and in the fractures of rock and other geological formations. It is the store house of fresh water has become vital reliable and one of the renewable resource which is available for human consumption, irrigation purposes and livestock watering¹. Now a days increase of population, pollution pressure, industrialization, unplanned urbanization, unrestricted exploration policies are causes of contamination of ground water. Today most significant environmental issue in the current world is ground water contamination. According to WHO 80 percentage of diseases are arises due to contamination ground water². Heavy metal are not bio degradable and its constituents a natural component of the earth crust. Heavy metals join the rivers from several natural or anthropogenic sources and also may come from leached from rocks and soils³⁻⁴.

Heavy metals are ubiquitous, persistent and important environmental toxic pollutants which increased by human activities like discharging industrial waste from factories, mining, tailings, treated timber, over usage of fertilizers which containing heavy metals in agriculture are the main reason to contaminate the ground water⁵. Some heavy metals such as Zn, Cu, Fe, Mn etc are essential to health where as other heavy metals like As, Cd, Pb, Hg have no biological function and have toxic effects means these trace metal contamination in ground water shows serious health issues⁶. Certain metals such as copper, zinc and Iron are crucial micronutrients at higher levels, they could be harmful to the living organisms⁷⁻⁸.

Heavy metals are relatively scarce in the earth's crust but are present in many aspects of modern life. Heavy metals are relatively high densities, atomic weights and also toxic or poisonous even at low concentration⁹. Ground water may contain heavy metals such as copper, zinc, iron, chromium in such quantities which are responsible for better growth of plants and animals but higher concentrations of these heavy metals may harmful and then the water become polluted and also produce health problems in human life¹⁰.

Heavy metals in drinking water pose a threat to human health. Populations are exposed to heavy metals primarily through water consumption but few heavy metals can bio accumulate in the human body and may

induce cancer and other risks¹¹. The writing purpose of present work is to increase the awareness about heavy metals in drinking water and its high concentration effect on living things. This study will help to remove excess amount of heavy metal in drinking water.

STUDY AREA

Bilaspur is the second one largest city of Chhattisgarh state and is bounded by East longitudes 81.14⁰ to 83.15⁰ and by North latitudes 21.47⁰ to 23.08⁰. It is surrounded by Gaurela-Pendra-Marwahi district in North, Baloda Bazar district in the South, Korba and Janjgir Champa district in the East, Mungeli district in the West. It is the district head zone and spread over an area of approx. 338 hectares. Bilaspur city on national highway no. 200 and it is of the mumbai howrah on main railway line. Many industries are situated in and around Bilaspur. Sirgitti is one of the major industrial ground water contamination resource of bilaspur district which in the newly formed of Chhattisgarh state. Due to huge industrialization of bilaspur city and improper drainage systems, solid waste disposal and sewage from industrial and residential area of Sirgitti are causes of ground water contamination. So it is essential to evaluation of the water quality of ground water in and around Sirgitti industrial area.

MATERIALS AND METHOD

The ground water samples are collected from the bore wells in the study area during the month of July-August 2022. The samples were collected from Six sampling sites in which four industrial area and two residential area of Sirgitti. The selecting sites, sample name, source and corresponding habitats ground water type are in given table 1.

S.N.	Sample Name	Sampling Sites	Habitat	Source
1	S-1	BEC Fertilizers	Industrial area	Bore well
2	S-2	Premier Pump Industries	Industrial area	Bore well
3	S-3	Mahamaya Calcination	Industrial area	Bore well
4	S-4	Jai Durga Oil Extraction	Industrial area	Bore well
5	S-5	Bannak Chowk	Residential area	Bore well
6	S-6	Purani Basti	Residential area	Bore well

Table 1: Site Specifications Of Ground Water Samples

During sampling and analysis of heavy metals special precautions were taken. Before collecting the samples the containers are washed with laboratory detergent and rinsed with deionized water. All the samples were collected in one litre polythene bottles and immediately treated with 1.5 ml of HNO₃. All the samples were transported to the laboratory and preserved in refrigerator at 4C until analysed. The samples were protected from any out side contamination. The heavy metal concentration of ground water copper, zinc manganese, cobalt, lead, arsenic, mercury and cadmium in the filtered and digestive samples are determined in ppm or mg/l by using Atomic Absorption Spectrophotometer (AAS)¹².

RESULT AND DISCUSSION

All six samples are lebeled properly and analysed the metal content. The results are presented in the following tables:-

S.N.	Test Parameters	Measurement Unit	Locations (Sampling Sites)					
			S-1	S-2	S-3	S-4	S-5	S-6

1	Copper	mg/l	BDL	BDL	BDL	BDL	BDL	BDL
2	Manganese	mg/l	BDL	BDL	BDL	BDL	BDL	BDL
3	Zinc	mg/l	0.11	BDL	0.11	BDL	BDL	0.28
4	Cobalt	mg/l	BDL	BDL	BDL	BDL	BDL	BDL
5	Arsenic	mg/l	BDL	BDL	BDL	BDL	BDL	BDL
6	Cadmium	mg/l	BDL	BDL	BDL	BDL	BDL	BDL
7	Lead	mg/l	BDL	BDL	BDL	BDL	BDL	BDL
8	Mercury	mg/l	BDL	BDL	BDL	BDL	BDL	BDL

Table2: Levels of heavy metals in water samples of Sirgitti industrial and residential area. BDL- Below detection limit (mg/l=ppm)

Copper

It is common heavy metal found in environment and also essential element of human body but excessive concentration of copper may damage to central nervous system. It enters into ground water due to agriculture pesticides, textiles and industrial effluents. In drinking water high concentration of copper had been found to cause liver and kidney damage in some people¹³. All of the locations the content of copper was below the detection limit (0.03 mg/l) in the instrument.

Manganese

Manganese present in the form of oxides and hydroxides in the earth crust. It is also one of the most abundant metal. In some areas industrial and volcanic emissions, soil erosion, human activities are responsible for higher concentration of manganese in ground water. It is also responsible for growth of unwanted bacteria. In our present study all water samples are under the maximum permissible limit.

Zinc

Zinc is an essential trace metal for both humans and animals. It is also necessary for various enzyme systems. Low concentration of Zn results growth retardation, wound healing, infantilism, anaemia and immaturity. These symptoms known as "Zinc deficiency syndrome". The higher concentration of zinc may be causes vomiting colics, diarrhoea in children and the toxicity leading to stomach aches¹⁴. In our present study none of the samples of Sirgitti industrial area are exceeds maximum permissible limit.

Cobalt

Cobalt is a hard ferromagnetic and brittle element in the earth crust. It produced as byproduct of nickel and copper. It is get in ores form can't get in free form and usually not mined particularly. It is also abundant element for human being because it is part of Vitamin B12 which is important for human health. It the situation of anaemia with pregnant women cobalt is used as treatment. The high concentration of cobalt in water samples may harm human health and also cause lung effects such as asthma and pneumonia, vomiting and nausea, heart problems etc. In our present study cobalt found below the detection limit in the water samples.

Arsenic

Arsenic is odourless and tasteless naturally occurring element which is available in inorganic form in the environment. It is discharged into nature by the manufacturing of glasses and chemicals and it enters into ground water underground rocks, soil and industrial human activities. Arsenic contamination in drinking water can cause

damage to the skin, liver, eyes circulatory and nervous systems and may also causes neural disorders and cancer. In our present study none of the samples are exceeds the WHO and ISO standards.

Cadmium

Cadmium is the one most commonly found metal with carbonate and sulphide ores. It is also found as a byproduct of the mining and smelting of lead and zinc. It enters the water supply from plastic industries, ingestion of grown foodstuffs especially grain and leafy vegetables, sewage sludge, mining and industrial effluents¹⁵. In our present study all samples are under the maximum permissible limit.

Lead

Lead is one of the toxic metal which occurs naturally in the earth crust. It is used in many products like roofing material, manufacturing of acid accumulators, pigments and paints, insecticides & rubber etc found in and around homes. The contamination of lead occurs through the exhaust of cars and the corrosion of pipes. Small amount of lead it causes many health problems in children and also anaemia disease. Higher level of lead can cause disruption of the biosynthesis of haemoglobin, kidney damage, adverse effect on central nervous system¹⁶. The permissible limit of lead in drinking water is 0.05 mg/l. The lead content in study area 0.001mg/l at such levels no lead toxicity problems from these all water samples and values are well with in limits prescribed for drinking water. Therefore the ground water of Sirgitti industrial area can be safely used for drinking and domestic purposes.

Mercury

Mercury is one of the metal which found in the liquid state. It is a rare element in the earth crust and present in soil and water in several forms like elementary, inorganic and organic mercury. Mercury released into the environment through the leaching of soil because of burning of coal in power plants, acid rain, industrial disposal of waste containing mercury, breaking mercury products, producing chlorine. High concentration of mercury in drinking water can cause skin discoloration, swelling and desquamation profuse sweating, high blood pressure, damage to the nervous systems and kidneys. In our present study none of the sample are exceeds the WHO and ISI standards.

CONCLUSION

The experimental data of heavy metals concentration from Six water samples in different locations of Sirgitti industrial area is analysed. The analytical result of sample sites monitored in this study irrespective of pollution source and it signalling that the ground water from all sampling sites the value of heavy metal are well with in limit prescribed for drinking water so the ground water of Sirgitti industrial area can be safely used for drinking and domestic purposes. From the present study we are getting clear information that the metal concentration is not at the level which could be harmful. We found that the ground water of Sirgitti industrial areas does not contain significant amount of some metals. The regulatory measures to contain and prevent ground water contamination by industries undertaken by Chhattisgarh police control board may have lead to absence of heavy metal contamination in the industrial area of Sirgitti, Bilaspur district.

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