Copper (Cu), Zinc (Zn) and Cadmium (Cd) Contamination of Groundwater in Dikrong River Basin, Paumpare District, Arunachal Pradesh, India

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Abstract: Ground water pollution causes adverse damage to soil, plants, human and animals at the same time spreads serious diseases. Ground water pollution can also cause biochemical effects such as inhibition of enzymes, genetic damage, and hypertension etc due to higher concentration of trace metals in the ground water. The present investigation is directed towards analysis of major metal ion concentration in the Groundwater sources at the Dikrong River Basin. The study revealed that the level of Cu ranged between 0.01 ppm to 0.13 ppm, for Zn are in the range of 0.01 ppm to 0.13 ppm and for Cd it was from 0.001 ppm to 0.010 ppm. It was found that the levels of Cu were exceeding the standard BIS limits for drinking water at certain sampling stations.

Keywords: groundwater, contamination, copper, zinc, cadmium, AAS.

I. Introduction:

In the present environmental conscious world ground water pollution is also a matter of great concern. As it leads to adverse damage to soil, plants, human and all other organisms, and at the same time spreads serious diseases. Trace elements can cause diseases through deficiency, imbalance, or toxicity. Trace mineral deficiencies usually occur when dietary intake is inadequate or result from metabolic imbalances produced by antagonistic or synergistic interactions among metals. Ground water pollution can also cause biochemical effects such as inhibition of enzymes, genetic damage, and hypertension etc due to higher concentration of trace metals in the ground water. Dikrong River Basin is one of the major basin inhabitants by a large number of people and shelter of diverse plantation. People depend on it for various activities such as agriculture and others. So presence of Copper (Cu), Zinc (Zn) and Cadmium (Cd) can lead to adverse effects. Therefore, a survey was conducted to analysis the major metal ion concentration in the groundwater sources at the Dikrong River Basin.

II. Material And Methods

In the present survey 32 groundwater samples were collected randomly from different locations in the district and are analyzed for concentrations of Copper (Cu), Zinc (Zn) and Cadmium (Cd) using Atomic Absorption Spectrophotometer.

III. Discussion

Copper (Cu):- Copper (Cu) is essential to all living organisms as a trace mineral because it is a key constituent of the respiratory enzyme complex cytochrome oxidase. In molluscs and crustacea copper is a constituent of the blood pigment hemocyanin, which is replaced by the iron-complexed hemoglobin in fish and other vertebrates. The main area where copper is found in humans is liver, muscle and bone. Copper compounds are used as bacteriostatic substances, fungicides, and wood preservatives. Copper does not react with water but it does slowly react with atmospheric oxygen to form a layer of brown-black copper oxide which, unlike the rust which forms when iron is exposed to moist air, protects the underlying copper from more extensive corrosion Copper is synthesized in massive stars and is present in the Earth's crust at a concentration of about 50 parts per million (ppm) where it occurs as native copper or in minerals such as the copper sulfides chalcopyrite and chalcocite, the copper carbonates azurite and malachite, and the copper(I) oxide mineral cuprite. Zinc absorption in small intestine is decreased by calcium, phosphate, and copper. On the other hand, excess zinc ingestion is a cause of copper deficiency. A small part of copper supply is used in production of compounds for nutritional supplements and fungicides in agriculture. Copper is an essential trace element in plants and animals, but not some microorganisms. The human body contains copper at a level of about 1.4 to 2.1 mg per kg of body mass stated differently; the RDA for copper in normal healthy adults is quoted as 0.97 mg/day and as 3.0 mg/day. Copper is absorbed in the gut, and then transported to the liver bound to albumin after processing in the liver; copper is distributed to other tissues in a second phase. Copper transport here involves the proteicerculoplasmin, which carries the majority of copper in blood.
Cadmium (Cd): Cadmium (Cd) is a minor metallic element, one of the naturally occurring components in the earth’s crust and waters, and present everywhere in our environment. The most significant early use of cadmium was as a sacrificial corrosion protection coating on iron and steel. Exposure to certain forms and concentrations of cadmium is known to produce toxic effects on humans. Long-term occupational exposure to cadmium at excess concentrations can cause adverse health effects on the kidneys and lungs. Adverse human health effects have generally not been encountered under normal exposure conditions for the general population except in areas of historically high cadmium contamination. The potential risks from cadmium exposure have been extensively studied, and are now tightly controlled by occupational exposure standards, regulations for cadmium in ambient air, water and soil, and legislation covering cadmium emissions, labeling and disposal of cadmium-containing products, and impurity levels in other products such as fossil fuels, fertilizers and cement. Naturally a very large amount of cadmium is released into the environment, about 25,000 tons a year. About half of this cadmium is released into rivers through weathering of rocks and some cadmium is released into air through forest fires and volcanoes. The rest of the cadmium is released through human activities, such as manufacturing. Human uptake of cadmium takes place mainly through food. Foodstuffs that are rich in cadmium can greatly increase the cadmium concentration in human bodies. Examples are liver, mushrooms, shellfish, mussels, cocoa powder and dried seaweed. An exposure to significantly higher cadmium levels occurs when people smoke. Tobacco smoke transports cadmium into the lungs. Blood will transport it through the rest of the body where it can increase effects by potentiating cadmium that is already present from cadmium-rich food. Other high exposures can occur with people who live near hazardous waste sites or factories that release cadmium into the air and people that work in the metal refinery industry. When people breathe in cadmium it can severely damage the lungs. This may even cause death.

Cadmium is first transported to the liver through the blood. There, it is bound to proteins to form complexes that are transported to the kidneys. Cadmium accumulates in kidneys, where it damages filtering mechanisms. This causes the excretion of essential proteins and sugars from the body and further kidney damage. It takes a very long time before cadmium that has accumulated in kidneys is excreted from a human body.

Other health effects that can be caused by cadmium are:
- Diarrhea, stomach pains and severe vomiting
- Bone fracture
- Reproductive failure and possibly even infertility
- Damage to the central nervous system
- Damage to the immune system
- Psychological disorders
- Possibly DNA damage or cancer development

Studies and surveys on metal pollution in surface and groundwater were analyzed for concentrations of Copper (Cu), Zinc (Zn) and Cadmium (Cd).
Sedimentation of finely suspended particles from wash water using manganese

The various data collected from the study area and after proper analysis of data, it has been shown accumulation of the metal ions.

In the permissible limits of BIS.

The levels of Zn in the groundwater samples assessed were found to between 0.01 mg/l to 0.15 mg/l at S9 and S29. The Cd levels were as per the standards of BIS. The concentrations of Cd in the groundwater samples assessed were found to be between 0.01 mg/l to 0.15 mg/l at S9 and S29. The Cd levels were as per the standards of BIS. The various data collected from the study area and after proper analysis of data, it has been observed that the metal ions (Cu, Zn & Cd) were almost within the permissible limits of BIS. It has been observed that the sampling stations S2, S3, S8, S11, S12, S15, S23, S25, S26, S27 and S32 have shown accumulation of the metal ions. But the present level of accumulation of metal ions is not of very much concern regarding to human health. It is not deniable that accumulation of metal ions keeps on changing and increasing due to geographical phenomena, human activities etc so in near future accumulation of the metal ions may lead to some serious problems. Therefore, some remedial measures should be brought into practice to retain groundwater uncontaminated.

The levels of Cu were in the range of 0.01 mg/l to 0.13 mg/l. The sampling stations have showed the Cu levels well within the BIS limits except S2, S3, S8, S11, S12, S15, S23, S25, S26, S27 and S32. The levels of Zn in the groundwater samples assessed were found to be between 0.01 mg/l to 0.13 mg/l. All the samples assessed showed Zn levels well within the limits as per the BIS standards. The concentrations of Cd in the groundwater samples assessed were found to be between 0.01 mg/l to 0.15 mg/l at S9 and S29. The Cd levels were as per the standards of BIS. The various data collected from the study area and after proper analysis of data, it has been observed that the metal ions (Cu, Zn & Cd) were almost within the permissible limits of BIS. It has been observed that the sampling stations S2, S3, S8, S11, S12, S15, S23, S25, S26, S27 and S32 have shown accumulation of the metal ions. But the present level of accumulation of metal ions is not of very much concern regarding to human health. It is not deniable that accumulation of metal ions keeps on changing and increasing due to geographical phenomena, human activities etc so in near future accumulation of the metal ions may lead to some serious problems. Therefore, some remedial measures should be brought into practice to retain groundwater uncontaminated.

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