IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 9, Issue 10 Ver. II (Oct. 2015), PP 20-23
www.iosrjournals.org

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 complexcytochrome oxidase. In molluscs and crustacea copper is a constituent of the blood pigment hemocyanin, which is replaced by the iron-complexedhemoglobin 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 proteinceruloplasmin, which carries the majority of copper in blood.

Zinc (Zn):- Zinc (Zn) is an essential mineral perceived by the public today as being "exceptional biologic and public health importance", especially regarding prenatal and postnatal development. Zinc deficiency affects about two billion people in the developing world and is associated with many diseases. In children it causes growth retardation, delayed sexual maturation, infection susceptibility, and diarrhea. Enzymes with a zinc atom in the reactive center are widespread in biochemistry, such as alcohol dehydrogenase in humans. Consumption of excess zinc can cause ataxia, lethargy and copper. Zinc is included in most single tablet over-the-counter daily vitamin and mineral supplements. Preparations include zinc oxide, zinc acetate, and zinc glaciate. It is believed to possess antioxidant properties, which may protect against accelerated aging of the skin and muscles of the body; studies differ as to its effectiveness. Zinc also helps speed up the healing process after an injury. It is also suspected of being beneficial to the body's immune system. Indeed, zinc deficiency may have effects on virtually all parts of the human immune system. Zinc deficiency is usually due to insufficient dietary intake, but can be associated with malabsorption, acrodermatitis enteropathica, chronic liver disease, chronic renal disease, sickle cell disease, diabetes, malignancy, and other chronic illnesses Groups at risk for zinc deficiency include the elderly, children in developing countries, and those with renal insufficiency. Symptoms of mild zinc deficiency are diverse. Clinical outcomes include depressed growth, diarrhea, impotence and delayed sexual maturation, alopecia, eye and skin lesions, impaired appetite, altered cognition, impaired host defense properties, defects in carbohydrate utilization, and reproductive spermatogenesis

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 bond 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 survey on metal pollution in surface and ground water had been carried out in recent years at different places viz.nirjuli, naharlagun, Ganga and itanagar. In the present investigation groundwater samples were analyzed for concentrations of Copper (Cu), Zinc (Zn and Cadmium (Cd).

IV. Result:-Cucr C

Drinking water standards (IS: 10500, 1991)0.05 5.0 0.01

SAMPLE NO	Cu	Zn	Cd
S1	0.05	0.05	0.005
S2	0.07	0.07	0.007
S3	0.11	0.11	0.011
S4	0.03	0.03	0.003
S5	0.04	0.04	0.004
S7	0.02	0.02	0.003
S8	0.07	0.07	0.008
S9	0.01	0.01	0.001
S10	0.01	0.01	0.001
S11	0.13	0.13	0.013
S12	0.11	0.11	0.009
S13	0.02	0.02	0.003
S14	0.10	0.10	0.009
S15	0.07	0.07	0.007
S16	0.02	0.02	0.002
S17	0.02	0.02	0.002
S18	0.12	0.12	0.012
S23	0.07	0.07	0.007
S24	0.02	0.02	0.02
S25	0.12	0.12	0.12
S26	0.08	0.28	0.28
S27	0.07	0.07	0.07
S28	0.05	0.04	0.04
S29	0.02	0.15	0.15
S30	0.05	0.029	0.06
S31	0.02	0.02	0.02
S32	0.12	0.12	0.12

The findings of the present study are tabulated in table 1.

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 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 noticed 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 S32have shown accumulation of the cu 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.

References

[1]. Gupta, S., and M. Gupta. (1997). Water and Its Management, Water And Basic Environmental Technology, 1st Edition, Anmol Publications Pvt. Ltd., Delhi, pp 1-17.

[2]. Rai, N.J.P. and H.C. Sharma. 1995. Bacterial contamination of ground water in rural areas of North-West (U.P.). Indian J. Env. Hlth., 37(1):37-47.

[3]. Sawhney, I. 2006. On World Water Day, drinking water still eludes many. Delhi Dairy – Free Press Journal dated 23rd March, 2006:5.

[4]. Bhu-Jal News. 1997. Ground water pollution and quality hazards scenario in India, 12(2-4):55-58. Central Ground Water Board, Ministry of Water Resources, New Delhi.

[5]. Srinivas Ch., Ravi Shankar Piska, Venkateshwar, C., Satyanarayana Rao, M.S. and R.R. Reddy. 2000. Studies on

[6]. Groundwater quality of Hyderabad. Poll. Res., 19(2):285-289.

[7]. Chandra, S.V. 1980. Toxic Metals in Environment, A status report of R & D work done in India, Industrial Toxicology Research centre, Luck now.

[8]. Gupta, S.G. and A.D.Agate, 1988. Sedimentation of finely suspended particles from wash water using manganese oxidizing bacteria. J. of Industrial Poll. Contl. (2):1-4.

[9]. Murti, K.C.R. 1987. The cycling of Arsenic, Cadmium, Lead and Mercury in India, SCOPE-31, John Wiley and Sons, pp315-333.Fazil et al www.bepls.com ~ 21 ~ E ISSN 2277 - 1808

[10]. Murti, K.C.R. 1989. Chemicals in tropical and arid regions – In : Phillippe Bureau, John, A. Hains, Werner, Werner

[11]. Klein and C.R. Krishnamurti, (eds.), Ecotoxicology and Climate, SCOPE-38, John Wiley and Sons, pp 97-136.

[12]. Hasan, M.Z.and S.P. Pande. (1979). Comparative study on methods of determination of lead in drinking water. Indian J. Environ. Hlth, 20(3):232-248.
[13]. Kumar, S.S., Lokesh, S.V., Puttaiah, E.T., Sherigara, B.S. and H.K. Babu. 2006. Analysis of trace metals in river Tunga of Karnataka by Differential Pulse Anodic Stripping Voltametry (DPSV). Nature Environ. Poll. Technol., 5(3):425-428.
[14]. Seth, T.D., Hasan, M.Z. and S. Sircar. (1975). Lead level in urban water supply. J. Ind. Med., 21:97.
[15]. Agrawal, V.K., Raj, K.P.S., Panchal, D.I. and R. Balaram. 1978. Heavy metal content in the water and sediment of Surasagar Lake of Baroda (Gujarat), Inter. J. Env. Study.
[16]. Singh, H.P. and L.R. Mahavir. (1997). Preliminary observation on heavy metals in water and sediments in a stretch of river Ganga and some of its tributaries. J. Env. Biol., 18(1):49-53.Ayyadurai, K.N., Kamalam and C.K. Rajagopal.1988. Mercury pollution in water in Madras city. Indian J. Environ. Health, 25(1):15-20.
[17]. Ayyadurai, K.N., Kamalam and C.K. Rajagopal. (1988). Mercury pollution in water in Madras city. Indian J. Environ.Health., 25(1):15-20.