

Short Communication

Heavy Metal Analysis of Water of Kaliasote Dam of Bhopal, MP, India

Choudhary Ranjeeta

Department of Chemistry, Sant Hirdaram Girls College, Bhopal-462023, MP, INDIA

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Abstract

Present paper deals with the systematic sampling and quantitative analysis of seven heavy metals viz: Cu, Fe, Hg, Zn, As, Cd and Pb in the surface water of Kaliasote water reservoir of Bhopal (Madhya Pradesh). This study was carried out in the month of May 2011. The sampling station is situated near Shiv Mandir which is most polluted site of dam. The results obtained were compared with safe limits in ppm for heavy metals laid down by BIS, WHO, ICMR. It was found that the concentration of the heavy metals like Cu, Hg, Zn, As, Cd and Pb were below detectable limits.

Keywords: Heavy metals, quantitative analysis, contamination, Cu, Fe, Hg, Zn, As, Cd and Pb.

Introduction

Heavy metals are metallic elements which have a high atomic weight and have much high density at least 5 times that of water. They are stable elements i.e. they cannot be metabolized by the body and bio-accumulative i.e. passed up the food chain to humans. They are highly toxic and can cause damaging effects even at very low concentrations. Increasing urbanization and industrialization have increased the levels of trace metals, especially heavy metals, in water ways. There are over 50 elements that can be classified as heavy metals, but only 17 that are considered to be both very toxic and relatively accessible. Mercury, lead, arsenic, cadmium, selenium, copper, zinc, nickel, and chromium should be given particular attention in terms of water pollution. Heavy metal toxicity has severe effect on our mental health, nervous system, kidneys, lungs and other organ functions. Surface water bodies get polluted due to urban sewage discharge^{1,2,3}

Present study is focused on quantitative analysis of heavy metals of Kaliasote water reservoir (latitude 25° 11' 45' N and longitude 77° 24' E) which was constructed near Chuna Bhatti village across the river Kaliasote, a tributary of Betwa River (Yamuna Basin) in Bhopal (M.P.). The Kaliasote dam is 1080 m long with maximum height of 34.25 m having gross storage capacity of 35.387 m. The dam is used for irrigation as well as recreational purpose.

Material and Methods

Water sample was collected from most polluted site of Kaliasote dam which is situated near Shiv Mandir in plastic cans. The heavy metals were preserved by adding 5 ml of 1N HNO₃ in one liter of sample to maintain the pH below 4.0⁴.

The samples were then filtered through Whatmann filter paper No. 40 and the filtrate was directly used for analysis in the Atomic Absorption Spectrophotometer (Perkin Elmer Analyst 100). At the time of sampling the samples are acidified as per standard, international method reference given by APHA⁵.



Results and Discussion

The analysis of water quality of Kaliasote dam was carried out for heavy metals viz: Cu, Fe, Hg, Zn, As, Cd and Pb. These parameters are discussed below:

Iron (Fe): Iron may be present in varying amounts i.e from 0.5 ppm to 100ppm in surface water. Iron was found in the range of 0.14 ppm to 0.50 ppm which is well within the permissible limits as prescribed by ICMR⁶, WHO⁷ and BIS⁸ standards. Iron ingestion is not generally unhealthy and is

absolutely necessary in small amounts. Deficiency of iron in human body causes anemia.

Mercury (Hg): Mercury has been well known as an environmental pollutant. Mercury is a liquid metal that is used in cell batteries, fluorescent lights, switches, and other control equipment. Excess mercury in water can lead to loss of muscle control, kidney disease and brain damage. There are two kinds of mercury. The simple one atom Hg is called "Inorganic Mercury". The other type of mercury is called "Organic Mercury". The Organic mercury is 100 times more dangerous since it can easily penetrate cell walls and is easily absorbed in fatty tissues, nerve and brain cells. Elemental mercury is relatively inert in the gastrointestinal tract and also poorly absorbed through intact skin, but if inhaled or injected elemental mercury may have disastrous effects. Mercury was found below detectable limits in water of Kaliasote dam.

Arsenic (As): The usual arsenic level in drinking water is about 0.002 ppm^{9,10}. However, in the present study arsenic was found below detectable limits in water of Kaliasote dam. All types of arsenic exposure can cause kidney and liver damage, and in the most severe exposure there is erythrocyte hemolysis. During chronic intoxication "garlic breath", skin sensitivity, dermatitis, and keratitis occurs very frequently. The acute effect of arsenic poisoning by oral intake are intense abdominal pains, nausea, vomiting, diarrhea resulting from gastro-intestinal tract damage and all terminating in coma and death¹¹.

Cadmium (Cd): Cadmium is highly toxic because of the absence of homeostatic control of this metal in the human body. When excessive amount of cadmium is ingested, it replaces zinc at key sites and induces metabolic disorder. Cadmium was found below detectable limits in water of Kaliasote dam.

Lead (Pb): Lead was found below detectable limits in water of Kaliasote dam. In most individuals there is a "lead balance", that is one excretes as much as they take in. However an increase in the rate of intake will result in accumulation or a "positive lead balance". Since lead is chemically very similar to calcium, it is handled by the body as if it were calcium. Thus the first place to which it is transported is to the plasma and the membrane sites in soft tissues. It is then distributed to the other sites where calcium plays an important role, most notably in the teeth of developing children and in bone at all ages. Acute toxicity of Pb in invertebrates are reported at concentration of 0.1-10 mg/l¹².

Copper (Cu): Copper is one of the earliest known metals. ISI⁸ has prescribed the limit of copper is 0.05 ppm. In the present study the copper was found below detectable limit. Copper is essential components of key metalloenzyme that maintains the vascular and nervous system.

Conclusion

In the present study iron was found in the range of 0.14 ppm to 0.50 ppm which is well within the permissible limits as prescribed by WHO and BIS standards. Concentration of other metals like Cu, Hg, Zn, As, Cd and Pb was found below detectable limits. Hence the water of Kaliasote dam is suitable for drinking and irrigation purposes.

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