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ANALYSIS OF HEAVY METALS IN JAIKWADI DAM WATER, MAHARASHTRA (INDIA)

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ABSTRACT

The fresh water ecosystem occupies a very small area in comparison to marine ecosystem. Now a day's degradation of these fresh water resources due to water pollution has become a serious problem for entire world. The effect of heavy metal on fresh water ecosystem has become global concern. These metals are persistent and once released the environment for a prolonged period. These heavy metals are well known pollutants, which are often encountered in many ponds, Lakes, rivers and dams of India and the most important aquatic fauna being subjected to stress caused by these heavy metals. Hence the present study is aimed to investigate some of the important heavy metals contents such as Iron (Fe), Copper (Cu), Manganese (Mn), Lead (Pb), Cadmium (Cd), Zinc (Zn) and Fluoride (F) of the Jaikwadi dam during the year 2012-2013.

KEYWORDS: Heavy Metals, Jaikwadi Dam, Ecosystem, Pollutants and Environment

INTRODUCTION

Out of 105 elements discovered and confirmed so far, over 65 are metals. Owing to their high thermal and electrical conductivity, high density, high melting and boiling points, malleability, ductility and other distinctly useful properties, metals find extensive use in human civilization. According to a rough estimate, 0.5 million tones of Zn and 310 million tones of Cu have been mined so far, used for domestic and industrial purposes and thus dispersed in to biosphere (Dar, 2002).

The fresh water ecosystem occupies a very small area in comparison to marine ecosystem. Now a day's degradation of these fresh water resources due to water pollution has become a serious problem for entire world. The effect of heavy metal on fresh water ecosystem has become global concern. These metals are persistent and once released the environment for a prolonged period (Matkar, Ghorade).

These heavy metals are well known pollutants, which are often encountered in many ponds, Lakes, rivers and dams of India and the most important aquatic fauna being subjected to stress caused by these heavy metals (Lohar, 2000).

Heavy metal pollutants are a major problem in aquatic environment because of their toxicity, their persistency and tendency to accumulate in organisms and undergo food chain amplification.

The problem of water pollution by trace metal is now well known to be crucial all over the world and especially in a developing country like India, everybody is facing the problem of ever widening threat of water pollution due to modern technology, industrialization and civilization (Ghorade, 20013).

Hence the present study is aimed to investigate some of the important heavy metals contents such as Iron (Fe), Copper (Cu), Manganese (Mn), Lead (Pb), Cadmium (Cd), Zinc (Zn) and Fluoride (F) of the Jaikwadi dam during the year 2012-2013.

MATERIAL AND METHODS

For analysis of heavy metals in water, samples were collected from the study area in three different seasons during the year 2012-2013. Water, samples were collected in plastic containers, which were thoroughly cleaned with nitric acid and rinsed several time with distilled water. Analysis was carried out to determine the concentration of various metals like Iron, Copper, Manganese, Lead, Cadmium, Zinc and Fluoride by using atomic absorption spectrophotometer (AAS) (Alan Walsh, 1950's). As it is the most versatile instrumental technique for the quantitative determination of trace metal in liquids. (Willard, Merrytt, Dean and Sattle, 1986). This method provides a fetal metal content of the sample and is independent of the molecular from of the metal in the liquid. Versatility of AAS can be realized from the fact that 70 elements, including most of the common rare earth metals, have been determined by it in concentration that range from trace to macro quantities, in the presence of other elements. Analyses of heavy metals such as Iron (Fe), Copper (Cu), Manganese (Mn), Lead (Pb), Cadmium (Cd), Zinc (Zn) and Fluoride (F) were carried out in the present work.

RESULTS AND DISCUSSIONS

Iron (Fe)

Iron is found in ground water all over the world and its high concentration causes bad taste, discolouration, staining, turbidity, esthetic and operational problems in water supply system (Vigneswaran and Vishvathan 1995). The concentration of iron in ground water of study area varies from 0.19 (S4) to 0.513 mg/l (S9) (Table 1 and Figure 1). The Bureau of Indian standards has recommended 0.3 mg/l as the desirable limits and 1.0 mg/l as the maximum permissible limit for drinking water (BIS, 1991). High concentrations of iron generally cause inky flavour, bitter and astringent taste.

Copper (Cu)

In the present study the Copper concentration varies from 0.193 (S8) to 0.516 mg/l (S1) (Table 1 and Figure 1). The toxicity of copper to aquatic life is dependent on the alkalinity of water, as copper is generally more toxic to aquatic fauna at lower alkalinities (Train, 1979). Over doses of copper may also lead to neurological complications, hypertension, liver and kidney dysfunctions (Rao., *et. al*., 2001, Krishna and Govil 2004).

Manganese (Mn)

In the present study the Manganese concentration varies from 0.076 (S3) to 0.276 mg/l (S1) (Table 1 and Figure 1). Manganese is an essential element, which does not occur naturally as a metal but is found in various salts and minerals frequently in association with iron compounds. In general, concentration of manganese in ground water is low due to geochemical control. A concentration of 0.1 mg/1 has been recommended as a desirable limit and 0.3 mg/l as the permissible limit for drinking water (BIS 1991). Inhalation of high concentration of manganese dust can cause permanent crippling and deterioration of the central nervous system (SDWC, 1977).

Lead (Pb)

In the present study the Lead concentration varies from 0.226 (S9) to 0.56 mg/l (S7) (Table 1 and Figure 1). The Bureau of Indian Standards has prescribed 0.05 mg/l lead as the desirable limit for drinking water (BIS, 1991) Beyond this limit, the water becomes toxic. Lead can cause neurological and behavioral disorders, especially in children, anemia, impaired kidney and testicular function (Barzilay *et. al*., 1999), miscarriage, birth defects, and infant death (Gordon, 1984).

Cadmium (Cd)

In the present study the Cadmium concentration varies from 0.006 (S2) to 0.046 mg/l (S10) (Table 1 and Figure 1). Cadmium is a nonessential non-beneficial element known to have a high toxic potential. The Bureau of Indian Standards has prescribed 0.01 mg/l as the desirable limit for drinking water (BIS 1991). Beyond this limit, the water becomes toxic. High level of cadmium concentration may be due to discharge from industrial waste or by leaching from sewage laden landfills (Singh, 2003; wagh, 2012).

Zinc (Zn)

In the present study the Zinc concentration varies from 0.053 (S8) to 0.31 mg/l (S9) (Table 1 and Figure 1). The Bureau of Indian Standards has prescribed 5 mg/l zinc as the desirable limit and 15 mg/l as the permissible limit for drinking, water (BIS, 1991). Zinc is a very common substance that occurs naturally. Many foodstuffs contain certain concentrations of zinc. High level of these metals in groundwater can harm ecosystems, plants, and animals and cause health problems in humans (Hassan, 2012; Ghorade, 2013).

Fluoride (F)

The fluoride concentration varies from 0.366 (S10) to 3.866 mg/l (S5) (Table 1 and Figure 1). As fluoride is naturally present in water it becomes toxic to animal and human being when present at more than 1.0 mg/l concentration in drinking water. At the level of 1.5 mg/l, molting of teeth and bones has been reported very occasionally and above 3.0 mg/l Skelton flourisis may be observed when a concentration of 10 mg/ l is exceeded it may cause crippling problem (Goyal *et. al*., 2006).

CONCLUSIONS

In the present study the fluoride content in water body is high in all sampling stations except station number S9 and S10. The Fluoride content in water body is cross a desirable and permissible limit as per Bureau of Indian Standards. The present study indicates that the Jaikwadi Dam water is not suitable for drinking purpose.

Table 1: Variation in Heavy Metals (mg/l) of the Jaikwadi Dam Water 2012-13

Station No.	Iron (Fe)	Copper (Cu)	Manganese (Mn)	Lead (Pb)	Cadmium (Cd)	Zinc (Zn)	Fluoride (F)
S1	0.403	0.516	0.276	0.27	0.016	0.18	1.7
S2	0.253	0.203	0.226	0.31	0.006	0.123	1.183
S3	0.4	0.506	0.076	0.413	0.01	0.113	1.596
S4	0.19	0.29	0.123	0.526	0.013	0.08	1.98
S5	0.23	0.393	0.08	0.41	0.016	0.09	3.866
S6	0.313	0.296	0.083	0.483	0.013	0.073	1.263
S7	0.223	0.283	0.09	0.56	0.006	0.07	1.276

Table 1: Contd.,

S8	0.413	0.193	0.273	0.53	0.016	0.053	1.45
S9	0.513	0.326	0.253	0.226	0.026	0.31	0.766
S10	0.473	0.323	0.363	0.306	0.046	0.22	0.366

* All values are in mg/liter, S1 to S10 = Station 1 to Station 10

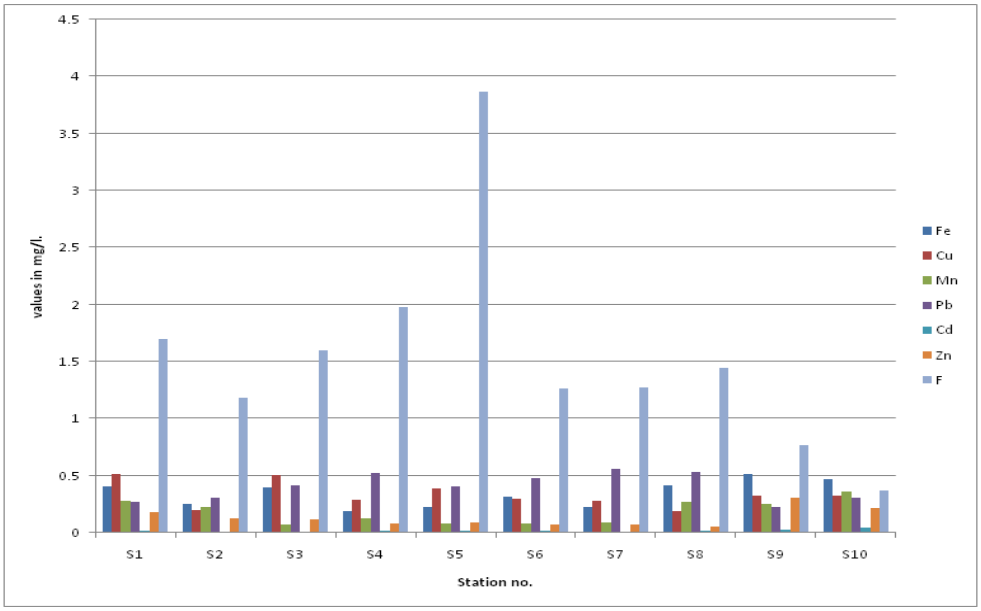

Figure 1: Variation in Heavy Metals (Mg/L) of the Jaikwadi Dam Water 2012-13

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