

Status of Heavy Metal Concentration in Adan River of Washim District, Maharashtra, India

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Abstract

The present work managed to study the water quality of Adan River. It lies between longitude 77^o4468 E and latitude 20^o3865 in Washim district of Maharashtra. Karanja (Lad) is nearest town to Adan river. The present study deals with assessment of the water quality of Adan river, Dist. - Washim, (M.S.), India. The heavy metals like Iron (Fe), Cobalt (Co), Nickel (Ni) and Copper (Cu) were studied during the period of one year i.e. June 2014 to May 2015. Seasonal fluctuation in the heavy metals were observed. Iron (Fe), Cobalt (Co), Nickel (Ni) and Copper (Cu) were found out of the permissible limit of prescribed by BIS and WHO while.

KEYWORDS : Heavy metals, Adan river, Washim.

INTRODUCTION :

In any ecosystem, the quality of water provides significant information about the available resources for supporting life in that ecosystem. Water resources are of critical importance to both natural ecosystem and human development. It is essential for agriculture, industry and human existence (Venkatesharaju *et al.*, 2010).

In the recent age of science and technology, the increasing thrust for industrialization and unplanned urbanization gave birth to the problem of river water pollution; particularly, heavy metals and microbial pollution. Aquatic habitat is the ultimate recipient of almost everything including heavy metals. Contamination of aquatic environment by heavy metals is a growing problem worldwide and currently it has reached an alarming rate. 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. Heavy metals are pollutants that have been a source of concern for aquatic ecologists. This is because most heavy metals are non-biodegradable (Pekey, 2006).

Copper and chromium are essentials micronutrient for plants and animals. In humans, copper helps in the production of blood haemoglobin while in plants it is important in seed production, disease resistance and regulation of water. Copper is used as an effective algacide and molluscicide (Ndimele and Kumolu-Johnson, 2012).

Contamination of streams and rivers flowing through agricultural areas where pesticides, fungicides and herbicides might have been applied and industrial districts

where there may have been organic and inorganic waste deposits, all these present varied and difficult problems due to drainage into different water bodies. Effluents discharged into a river, which may affect aquatic life, may either directly or indirectly. However, it must be mentioned that some heavy metals are naturally present in some natural water sources. Some of them are essential for health of living organisms, but when their concentrations are very high, beyond tolerable limits, they become toxic (Bhat *et al.*, 2012).

The effect of heavy metal on fresh water ecosystem has become worldwide problem. These metals are persistent and once released they remain in the environment for a prolonged period. There is no doubt that presence of pollutants deteriorates the quality of water and reduces its utility for drinking purpose and other aquatic animals, which serves as food for human being (Matkar, 2008; Ghorade, 2013).

The present investigation has been undertaken to assess the water quality of Adan River.

MATERIALS AND METHODS :

Heavy metal analysis of Adan River of Washim District of Vidarbha were taken for present investigation. The samples were collected for the years 2014-2015. The water samples were evaporated to one tenth, 10 ml of 2% ammonium pyrrolidine dithiocarbamate, 4 ml of 0.5 M HCl was added and extracted with 10 ml of methyl isobutyl ketone (MIBK). The MIBK extract containing the desired metals was then diluted to give final volumes (Chen and Ma, 2001). The analysis of Iron (Fe), Cobalt (Co), Nickel (Ni) and Copper (Cu) was done by Perkin-Elmer method ASS-300 Flame Atomic Absorption Spectrophotometer.

RESULT AND DISCUSSION :

Heavy Metals like Fe, Co, Ni and Cu were studied seasonally during the period of one year i.e. June 2014 to May 2015. The observations are given in following Table 1.

Sr. No.	Heavy Metals	Monsoon	Winter	Summer
1	Iron (Fe)	5.48	6.08	8.26
2	Cobalt (Co)	0.828	1.123	1.396
3	Nickel (Ni)	0.447	0.599	0.844
4	Copper (Cu)	1.65	2.02	6.55

Table 1: Average Seasonal variation in heavy metals of Adan river of Washim District, Maharashtra (India) during 2014-2015

Permissible Limits of Heavy Metals according to BIS and WHO			
Sr. No.	Heavy metals	BIS	WHO
1	Iron (Fe)	0.3 mg/L	0.3 mg/L
2	Cobalt (Co)	0.05 mg/L	1 mg/L
3	Nickel (Ni)	0.02 mg/L	0.02 mg/L
4	Copper (Cu)	1.5 mg/L	0.05 mg/L

Table 2 : Permissible Limits of Heavy Metals according to BIS and WHO

Concentration of heavy metals like Fe, Co, Ni and Cu increases from monsoon to summer. Concentration of heavy metals in monsoon, winter and summer season found as Fe 5.48 ppm, 6.08 ppm, 8.26 ppm; Co 0.828 ppm, 1.123 ppm, 1.396 ppm; Ni 0.447 ppm, 0.599 ppm, 0.844 ppm and Cu 1.65 ppm, 2.02 ppm and 6.55 ppm.

Iron (Fe) :

Iron is a naturally derived metallic pollutant which owes its origin in H₂O mostly from sources derived from soil and rocks. Iron in natural H₂O remains present in ferric or ferrous form. Large quantities of iron can leak out from soil runoff, especially in acidic conditions such as associated with acid mine drainage and degradation of excessive organic matter accumulated in the soil (Nagarsekar and Kakde, 2014).

Cobalt (Co) :

It is a naturally occurring element with one stable isotope (⁵⁹Co) and 26 known radioactive isotopes. Inhalation of cobalt particles results in deposition in the upper and lower respiratory tract. In humans inhalation and dermal exposure to cobalt can result in sensitization. Bronchial asthma has been described in workers exposed to various forms of cobalt. Interstitial lung disease caused by metallic cobalt containing particles is an occupational lung disease generally referred to as hard metal lung disease. (Chennaiah *et al.*, 2014).

Nickel (Ni) :

Nickel is also non-toxic element, but it affects physiological process at very high concentration (Hussain and Sheriff, 2013). The primary critical effect of nickel exposure is dermatitis, including contact dermatitis, atopic dermatitis, allergic sensitization and also Nickel is neurotoxic, genotoxic, and carcinogenic agent.

Copper (Cu) :

Copper occurs naturally in environment, plants and animals. For maintaining good health low level of copper is essential. Irritation of nose, mouth and eyes, nausea, vomiting, diarrhea, lesions in the gastrointestinal tract, hemolytic anemia, neurotically abnormalities, corneal opacity, loss of hair pigment, reduced growth, loss of arterial elasticity and stomach cramps are the harmful effects of high copper level. It is a naturally derived metallic pollutant.

During the study period seasonal value of heavy metals were recorded higher in summer and lower in monsoon. Maximum values of heavy metals in summer season may be due to evaporation of water, contamination of domestic wastewater, garbage and fertilizers etc.

CONCLUSION :

The summer, monsoon and winter seasons shows seasonal fluctuations in various heavy metals. Heavy metals like Fe, Co, Ni and Cu were found out of the limit prescribed by BIS and WHO. The water of Adan river is useful for irrigation, agriculture and industrial purposes. Time to time proper monitoring of water of Sonala Dam is necessary by government agencies for the sake of human population.

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