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Study of Heavy metals in Indrayani River at Alandi, District Pune (Maharashtra) A Case Study

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Abstract- This study is focused on the determination of heavy metals in the Indrayani river. Due to rapid urbanization and industrial development in the recent years resulted in the discharge of enormous pollutants and toxic metals in the aquatic ecosystems. Heavy metals are one of the major groups of toxic environmental contaminants due to their toxicity. For this study seven sampling stations are selected for the analysis, on the course of the river. The purpose was to assess the water quality for drinking and other purposes. The water analysis was done in the month of December 2016 for the heavy metals like Fe, Cu, Zn, Mn, Pb and Hg respectively. After the analysis it is observed that only lead is beyond the permissible limit given by WHO and rest of the parameters are within the limit.

Index Terms: Indrayani River, Heavy metals, industrialization, fertilizers and pesticides, etc.

1. INTRODUCTION

Out of many essential elements for the existence of human beings, animals and plants, water is one of the more important parameter. Without food one can survive for a number of days but without water one cannot. Water is one of the most important compounds to the ecosystem. Physical chemical and biological characteristics of water determine the quality of water. The water gets polluted due to the increased human population, industrialization, excessive use of fertilizers and pesticides in agriculture and human activities. Due to inadequate supply of surface waters, most of the people in India are depending mainly on groundwater resources for drinking, domestic and irrigation uses in rural areas[20]. The dependence of groundwater as well as surface water has increased tremendously in recent years in many parts of India. Because of this situation physico-chemical analysis of water in rural as well as urban area for the suitability of water for drinking, domestic, irrigation and other needs is essential[17]. Water is essential for any development activity and the availability of good quality water for domestic and industrial use will help in fast development of the region[4]. In the marine environment rivers are having a major contribution in the transportation of metals[12].

If the untreated industrial waste water is discharged to the nearby water bodies like rivers and lakes, then it may cause severe ground water pollution[10] High concentrations of all the heavy metals have various effects on the environment[8]. If the organic and inorganic contaminants are more than the limit then it affects the water quality of the river as well as the biodiversity of the river[2]. Total concentration of heavy metals might serve as useful indicators for appropriate assessment of sediment contamination[3].

1.1 *Study area*

Indrayani river is a very old river in Maharashtra. River originates near Lonavla, a hill station on the Mumbai-Pune highway. It flows east from there to meet the river Bhima through the religious villages of Dehu and Alandi, and north of Pune. It is termed as a holy river and is associated with such great religious saint such as Saint Tukaram. and Sant Dyaneshwar. Dehu is a sacred place and home town of Sant Tukaram and Alandi which has the Samadhi of Saint Dyaneshwar is also equally important. Rich marine life is also a notable activity here and a coliseum has come up at the Ghats section

to take care of different requirements. It is pertinent to add that the inmates living along the sides of the Indrayani River have faced many difficulties due to increase in the industrialization and various other extracurricular activities taking place in and around this holy river. More so, there is delay in completion of sewage treatment and actions have been initiated for speedy completion of the same. There is also the risk of loss of life since this place attracts lots of pilgrims regularly

2. MATERIALS AND METHODS

The sampling was carried out during summer season. The study was conducted in the year 2016. Water was collected in clean, autoclaved one litre plastic containers. The samples were brought to the laboratory immediately and kept at 40^0 C to maintain its condition very close to the time it was sampled. The analysis was carried out within 4 hours of water collection. The digestion was carried out by standard methods[5, 18]

3. RESULT AND DISCUSSION

Iron is the fourth most abundant element by mass in the earth's crust. Iron is an essential nutrient for erythroporesis. The shortage of iron causes disease called "anemia'' and prolonged consumption of drinking water with high concentration of iron may lead to liver disease called as haermosiderosis[15,6]. In water, it occurs mainly in ferrous or ferric state[11]. It is an essential and non-conservative trace element found in significant concentration in drinking water because of its abundance in the earth's crust. Usually, iron occurring in ground water is in the form of ferric hydroxide, observed concentration is less than 500 μg/L[13]. Iron is an important dietary requirement in humans needed by hemoglobin and good for several other functions, in the present study, iron content varied from 0.895mg/l to 3.711mg/l.

The amount of copper observed at all the sampling stations in this study is within the permissible limits of the WHO[19]. The range was from 0.087mg/l to 0.532mg/l. Copper is an essential component of several enzymes. It is essential for utilization of iron[9]. Contamination of drinking water with high level of copper may lead to chronic anemia[14& 1]. Copper in excess could impart a bitter taste to water and could promote the corrosion of galvanized iron and steel fittings[7].

Zinc plays an important role in protein synthesis and is a metal which shows fairly low concentration in surface water due to its restricted mobility from the place of rock weathering or from its natural sources[15]. In this study, a minimum of 0.087mg/l and maximum of 2.63mg/l is recorded from seven samples. Zinc is a nutritionally essential metal, and its deficiency results in severe health consequences[9]. Nevertheless, higher concentrations of zinc can be toxic to the organism[16&19].

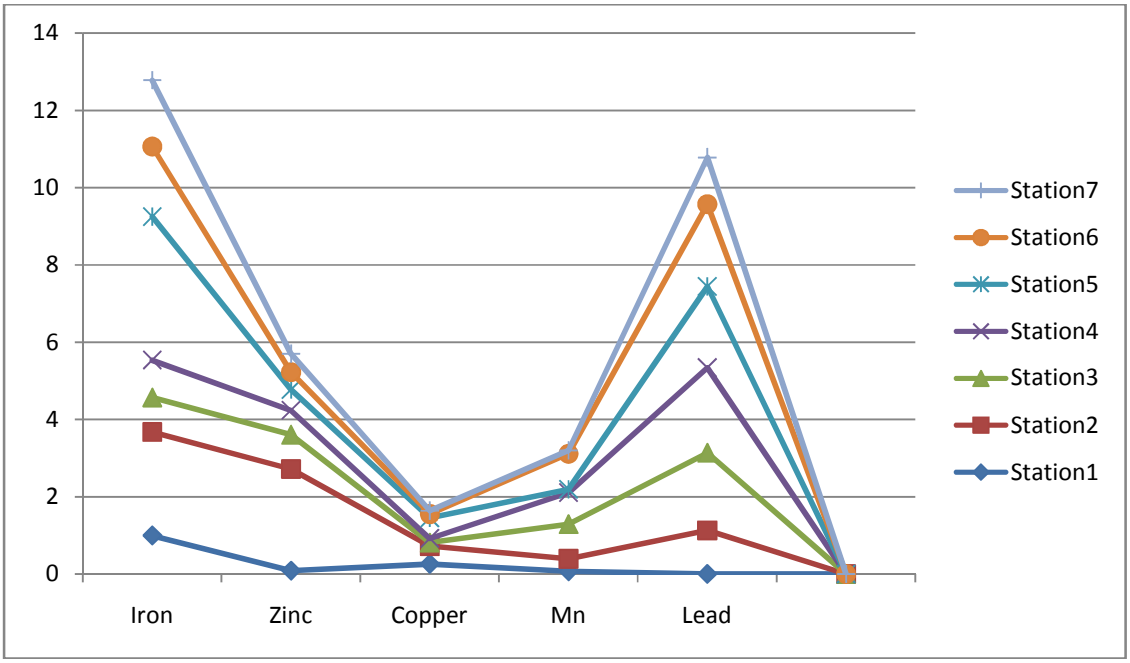
Because of physical and chemical properties of lead, it is used in the manufacturing, construction and chemical industries. It is also used in batteries, petrol additives, alloys, pigments and compounds. These are few listed uses of lead. Its exposure has negative effects on neuropsychological developments in children. The permissible limit for lead suggested by CPCB is 0.1.mg/l. Here observed values are in the range of 0.00mg/l to 2.20mg/l. Manganese levels are observed in the range of 0.072 to 0.916 mg/l for these Sampling stations.

OBSERVATION TABLE

Metals	1	2	3	4	5	6	7	WHO limit
Iron	0.997	2.68	0.895	0.964	3.711	1.814	1.713	---
Copper	0.261	0.463	0.089	0.109	0.532	0.098	0.087	2mg
Zinc	0.087	2.63	0.891	0.632	0.534	0.451	0.476	3mg
Mn	0.072	0.321	0.901	0.813	0.086	0.916	0.091	0.5mg

Lead	0.00	1.13	2.01	2.20	2.10	2.13	1.21	0.1mg
Mercury	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001mg

Graphical Presentation of observed parameters:



4. CONCLUSION

The present study shows the selected heavy metal contents in river water. The distribution of selected metals in water body exhibited Moreover; we also found that quality and quantity of applied fertilizers and industries near by the river were the important sources leading to different accumulations of heavy metals in water under the studied area. Hence, this situation may aggravate the risk to environment in general and specifically to human health in particular. It is, therefore, suggested that the application of agro-based chemical fertilizers and pesticides with high heavy metals content should be avoided to keep high quality water for sustainable use in the reservoir watershed. Further studies are required to obtain adequate knowledge of the pollution levels and their environmental consequences in the region for better watershed management.

This study, therefore, recommends the government and other responsible authorities to: (a) introduce relevant drinking water treatment techniques which can reduce the current levels of heavy metals, (b) Prevent any kind of waste disposal into rivers, canals or any reservoirs that supply domestic drinking water (c) support further study to be conducted on other physical, chemical and biological parameters of significant health concern and on identification of potential sources of the contaminants including heavy metal contaminants.

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