

Determination of heavy metal pollution in lake water during festival seasons using analytical technique

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Abstract

Monitoring and assessment of water has become an environmental issue and is of great concern due to its contamination by mankind. One of the most important crises of the 21st century is the availability of pure drinking water, a resource basic to our survival and growth. Most of the fresh water bodies all over the world are getting polluted thus decreasing the availability of fresh water. The area of the study, selected to estimate the levels of water pollution is the Varal Devi lake of Bhiwandi city, District Thane, (Mumbai-Agra Highway), Maharashtra, India. It receives domestic raw sewage from surrounding habitation and activities like washing of cattle, bathing, religious activities like idol immersion etc. which results in high concentration of harmful chemicals entering the lake.

Water samples were collected from Varal Devi Lake, Bhiwandi city and the amount of lead in the water samples were measured before, during and after idol immersion by colorimetric method. It was found that the concentration of the heavy metal in the lake water substantially increased after the religious activities like idol immersion. This heavy metal has a marked effect on the aquatic flora and fauna which through

bio magnification enter the food chain and ultimately affect the human beings as well.

Key Words: - *water, pollution, heavy metal, festival, colorimetry.*

1.Introduction

Our environment has witnessed a continuous and rapid deterioration due to pollution in all its abiotic and biotic components. Nowadays, water pollution is a burning issue all over the world. Like other developing countries water pollution in India has created an alarming situation. Just as the world we inherited today is what our past generation left for us, the future generations would inherit the legacy we leave for them. Water is essential for life on earth. Water is a unique liquid without which, life as we know is impossible. Water, due to its great solvent power, is constantly threatened and gets polluted easily. The requirement of water in all forms of lives, from micro-organisms to man, is a serious problem today because all water resources have reached a point of crisis due to urbanization and industrialization. **Water pollution** is the contamination of natural water bodies by chemical and physical substances. Adverse alteration of water quality presently produces large scale illness and

deaths, accounting for approximately 50 million deaths per year worldwide. (1, 2, 3).

The main threat to human health from heavy metals is associated with exposure to lead, cadmium, mercury and arsenic. These metals have been extensively studied and their effects on human health regularly reviewed by international bodies such as the WHO. Heavy metals have been used by humans for thousands of years. Although several adverse health effects of heavy metals have been known for a long time, exposure to heavy metals continues, and is even increasing in some parts of the world. These metals are harmful to human health even in very low concentrations, as well as being highly toxic and non-degradable. They accumulate in those organisms that occupy the highest levels in the food pyramid. Lead is toxic by ingestion or inhalation of dust or fumes. Long term effects are brain and kidney damage, birth defects, etc.

To study the extent of lead metal pollution in surface water, we have selected the Varal Devi Lake, Dhamankarnaka, Bhiwandi. The city of Bhiwandi, known for its textile industry, has the largest number of power looms in the country and is called the “Manchester of India”. The city is known for power loom, carpets and silk fabrics. Bhiwandi is in the district of Thane, in the western state of Maharashtra, India. Economy of Bhiwandi is mostly dependent on the power loom industry. Aim of the present research work is to analyze the lake water in one area of Bhiwandi to determine the Lead content. This lake receives domestic raw sewage from surrounding habitation. Activities like washing of cattle, clothes, bathing; idol immersion etc paves the way for high concentration of hazardous chemicals to enter the lake. Domestic waste water contributes the largest

source of heavy metal concentration in the lake. Immersion of idols is an anthropogenic activity which is responsible for adding pollution load in the lake. The idols are made up of clay, hay, cloth, paper, wood, bamboo, thermocol, adhesive material, paints, colored pigments etc. A large amount of lead enters the lake by corrosion of metal pipes. Lead from automobiles released into atmosphere find its way in the runoff waters. The discharge of heavy metals in the environment has much obvious impact on aquatic systems. Lead is one of the oldest metals known to man and Lead pollution can be defined as the excessive use of lead materials that results in toxic emissions of lead gases and particulate matters found in Storage Batteries, Gasoline additives, Cable coverings, Weapon Ammunition, Tank Lining, Solder and fusible alloys. Combustion of oil and gasoline account for greater than 50% of all anthropogenic emissions, and thus form a major component of the global cycle of lead. Atmospheric fallout is usually the most important source of lead in freshwaters. Hence this reservoir can serve as a model for studying heavy metal concentration.(4,5,6,7)

Clarity of water is important in producing product designed for human consumption. In many manufacturing operations for beverages and for water required for potable purposes, treatment plants draw water from a surface source and rely on fluid particle separation processes such as sedimentation and filtration to increase clarity and insure an acceptable product. The clarity of natural body of water is an important determinant of its condition and productivity.

Acidity of water is its quantitative capacity to react with a strong base to a designated pH. The measured

value may vary significantly with the end point pH used in the determination. Acidity is a measure of aggregate property of water and can be interpreted in terms of specific substances only when the chemical composition of the sample is known. Strong mineral acid, weak acids such as carbonic and acetic acid, hydrolyzing salts such as iron or aluminum sulfates may contribute to the measured acidity according to the method of determination. Acids contribute to the corrosiveness and influence chemical reaction rates, chemical speciation, and biological processes. The measurement also reflects a change in the quality of source water (8)

2. Materials and Methods

Varal Devi Lake is subjected to enormous anthropogenic stress; receive heavy inputs of domestic waste and sewage. The lake water is used for drinking purposes and the local inhabitants use it for fishing and other recreational activities. Sampling sites were selected by keeping in mind the feeding sources of the lake. The study period of festival was divided into three parts based on Idol Immersion before, during and after Immersion i.e., from August to September (4,9,10). The water samples after collection were subjected to analysis following the procedures prescribed by APHA (American Public Health Association) (10). Certain physical and chemical parameters were determined. pH is determined using pH meter (Model EQ-614), Conductance is determined using Conductivity meter (Digital EQ-660). For heavy metal analysis, the samples were preserved by adding 1.5 mL concentrated nitric acid in one liter of sample to maintain the pH below 2.0. The sample was directly used for analysis on a Colorimeter (Equiptronics Digital colorimeter EQ 650-A) (8)

3. Observations

The water was found to be yellow to light green in color because of algae and accumulation of nutrients, untreated sewage and eutrophication, having a foul odor. The yellow colour is due to soil, dust particles, Iron and indicates low growth of algae. Low productivity rates are associated with yellow colored lakes that experience less algal blooms. The foul odor is due to the decomposition of organic matter in the water.

3.1. Determination of Acidity

50ml of water sample is titrated against 0.01N NaOH using Phenolphthalein as indicator.

End Point is Colourless to Pink

1000ml of 1N NaOH = 50g of CaCO_3

3.2. Determination of Lead

The concentration of Pb is found out to be comparatively higher in the month of September as Pb is contributed by paints and enamel used to color the idols. Pb also finds its way in the runoff waters of the lake through the vehicle washing and gasoline combustion.

Acute toxicity generally appear in aquatic plants at concentration of 0.1-5.0 mg/L. Acute toxicity of Pb in invertebrates are reported at concentration of 0.1-10 mg/L. Higher levels pose eventual threat to fisheries resources. (3, 11, 12)

According to the USPH (United States Public Health Drinking Water Standards), the permissible limit for Lead in drinking water is 0.05 mg/L. According to WHO (World Health Organization), the permissible limit for Lead in drinking water is 0.01mg/lit and in fish is 0.001 to 0.007mg/lit. The MCLG (maximum contaminant level Goal) for lead is zero. EPA has set

this level based on the best available science which shows there is no safe level of exposure to lead. Action Level for Treatment Technique is 0.015 ppm (set by EPA).

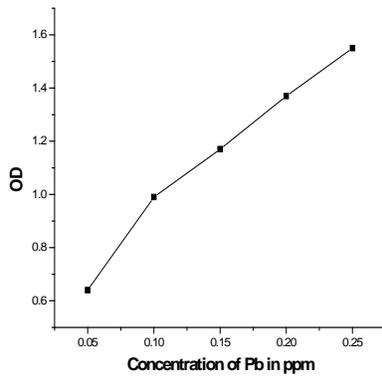


Fig.3.1.Graph of OD against Concentration of Pb in ppm

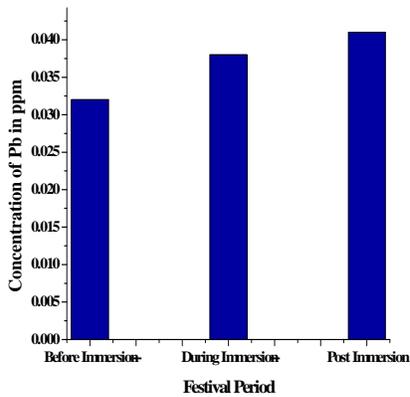


Fig.3.2.Graph of Concentration of Pb in ppm against Festival Period

Sr No	Physical and chemical parameter of water	Before idol immersion	During Idol Immersions	After Idol Immersion
1	Appearance	Unclear Liquid	Unclear Liquid	Unclear Liquid
2	Odour	Very slight decaying smell (irritant to nasal way on smelling)	Very slight decaying smell (irritant to nasal way on smelling)	Slightly ammonia like smell
3	Taste	Sour	Sour	Sour
4	Temperature	280 °C 301K	280 °C 301K	280 °C 301K
5	Reaction	Neutral	Neutral	Very Slight Alkaline Reaction

4.Results and Discussion

Table4.1. Parameters of water samples collected

6	Organic Matter	Present	Present	Present
7	pH	8.18	7.67	7.09
8	Conductance	340.0 μm	400.0 μm	360.0 μm
9	Density/Specific Gravity	0.9963	0.9972	0.9986
10	Total Dissolved Solid(TDS)	20.0ppm	100.0ppm	100.0ppm
11	Acidity in terms of CaCO_3	0.270ppm	0.4845ppm	0.2907ppm
12	Pb	0.0320ppm	0.0380ppm	0.0410ppm

5. Conclusion

The heavy metal load in the reservoir indicates the heavy metal toxicity which varies at different festival conditions. Most of the heavy metals, if present beyond permissible limits in water are toxic to human beings, aquatic flora and fauna. In the present study, the appearance, colour, odour and taste are not according to the standards set by IS. pH, dissolved solids and acidity are within the normal values.

We find that Pb is present in relatively higher concentrations as compared to their permissible limits (set by WHO and EPA), but less than the permissible limit set by USPH. As the Varal Devi

lake is also used for fishing purposes, it is quite evident that these heavy metals may enter the food chain, and thus through bio magnifications enter the human body as well. Periodical monitoring of the water quality is thus required to assess the condition of water body and immediate steps should be taken to check the anthropogenic activity around the lake. This will be helpful in saving the lake from heavy metal pollution.(8,13,14)

6. References

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