

AN EXPERIMENTAL ANALYSIS OF HEAVY METALS IN KAVERY RIVER WATER USING ATOMIC ABSORPTION SPECTROPHOTOMETER

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ABSTRACT

The present study perceives that textile dye effluents of Erode, Pallipalayam, and Bhavani region have substantial volume of electrical conductivity, pH, total dissolved solids, chemical oxygen demand, biological oxygen demand, sodium chloride, calcium, magnesium, potassium, and heavy metals. The results point out that irrespective of the source, effluent properties exceeded permissible limits by the WHO/Food and Agriculture Organization/Federal Environmental Protection Agency for irrigation. The textile industry consumes a mixture of chemicals and huge amount of water during the production process. About 200 L of water are used to produce 1 kg of textile. The textile effluent can cause several health infections such as hemorrhage, ulceration of skin, nausea, skin irritation, and dermatitis.

Keywords: Pallipalayam water sample, Atomic absorption spectrometry(AAS), Heavy metals (Lead, Cadmium, Magnesium, Chromium)

Introduction

Environmental pollution is one of the most important and vital nuisances of the modern world. Among them, industries are the utmost polluters of the water. Textile dyeing industry is one of the fast production in India (80%), it consumes substantial volume of water and chemicals (Ahluwalia and Goyal 2007). It categorized by their high load of heavy metals, chemical oxygen demand (COD), biological oxygen demand (BOD), total suspended solids, total dissolved solids (TDS), extreme Ph values, and colour adding to their odour. However, their excess or insufficiency caused severe damage to the soil, ground water, and food chain production; which ultimately leads to be toxic to human health. In addition, cluster of dyeing factories do not have sufficient store for treating the effluents, and hence, it is release into the river without proper treatment thus making the river water unusable. With references from journals and articles and from direct observation of the areas in Pallipalayam we came to know that there are many tanneries, dyeing industries and textiles in and around Pallipalayam which are discharging untreated waste water into the river. The sample has been collected from Pallipalayam, Erode District near Pallipalayam mosque which has been directly discharge into the Cauvery river. Another sample has been taken from Mettur Dam, Mettur, Salem District. The presence of heavy metals has been analysed in the using atomic absorption spectrophotometer.

1. Materials and methods

1.1 Sample collection:

Sample collection containers should be free of any contamination prior to use. Leave some space between ceiling of sample container and sample to permit expansion during transportation and storage.



Figure 1 Pallipayam water sample (Discharge of untreated waste water from industries)

1.2 Sample storage:

After sample collection its storage also plays a crucial role. Metal containers are not recommended for estimation of metals as they can result in sample contamination over storage period. Glass is also not an ideal choice as silicon, sodium or other metallic impurities from glass containers can leach and contaminate the sample. On the other hand some trace metals can get deposited on container walls and their concentrations can drop over the storage period. PTFE or plastic containers are ideal options for most analysis.

1.3 Sample transportation and preservation:

It is advised to conduct the analysis immediately after collection of samples. However, this may not be possible every time and transportation to testing laboratory becomes necessary. It is essential to ensure that the samples are properly sealed in their containers and are not exposed to direct sunlight or extremes of temperature during transportation and storage. Sample is kept in cold environment (refrigerator) until tested. The samples are collected, stored, transported and preserved accordingly as mentioned above and tested.

2. Analysis

2.1 Determination of pH value:

The pH test is carried out in both the samples using pH meter in laboratory and the pH of the samples were noted.

- Ph of Pallipayam water sample (Sample1) was found to be 7.37 .
- The Ph of Mettur dam water sample (Sample2) was found to be 7.64 .
- As per IS: 2296-1992 the pH of drinking water ranges from 6.5-8.5. Since pH values of both samples were within the limit, Pallipayam water sample and Mettur dam water sample were safe for drinking.



Figure 2 Determination of pH

2.2 Determination of dissolved oxygen:

The dissolved oxygen test is carried out in both the samples by titration with Sodium Thiosulphate and starch as indicator. The dissolved oxygen in both the samples were calculated from the results of titration.

- The concentration of DO in Pallipalayam water sample (Sample1) is 0.3ppm.
- The concentration of DO in Mettur dam water sample (Sample2) is 4.5ppm.
- As per IS: 2296-1992 the minimum amount of DO concentration is 6ppm. Since the concentration of DO is not within the limit, Pallipalayam water sample and Mettur dam water sample were unsafe for drinking.

2.3 Determination of biological oxygen demand:

The BOD test is carried out in both the samples by titration with Sodium Thiosulphate and starch as indicator. The samples were kept in BOD Incubator for 5 days and the same test is carried out and the BOD is calculated from the results of titration.

- The concentration of BOD in Pallipalayam water sample (Sample1) is 1.6 ppm.
- The concentration of BOD in Mettur dam water sample (Sample2) is 2.4ppm.
- As per IS: 2296-1992 the minimum amount of BOD concentration is 2ppm. Since the concentration of BOD of Pallipalayam water sample is not within the limit, it is unsafe for drinking. Since the concentration of BOD of Mettur dam water sample is within the limit, it is safe for drinking.



Figure 3 Samples in BOD incubator



Figure 4 Determination of BOD by titration

2.4 Result of Magnesium ion analysis:

- The concentration of MAGNESIUM in Pallipalayam water sample (Sample1) is 23.7010 ppm. The concentration of MAGNESIUM in Mettur dam water sample (Sample2) is 21.2437 ppm.
- per IS: 2296-1992 the minimum amount of MAGNESIUM concentration is 24.28 ppm. Since the concentration of MAGNESIUM is within the limit, Pallipalayam and Mettur dam water sample were safe for drinking.

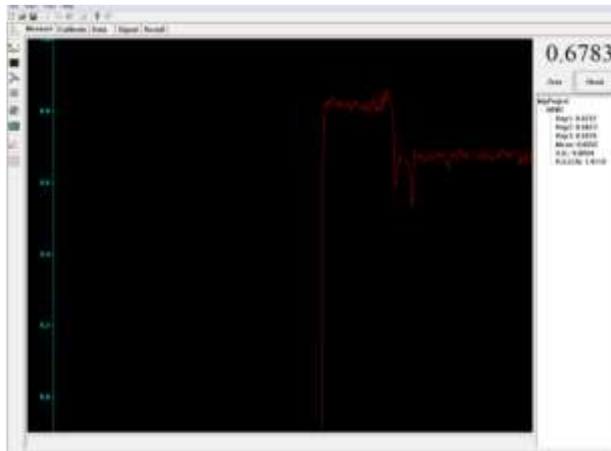


Figure 5 Graph of magnesium

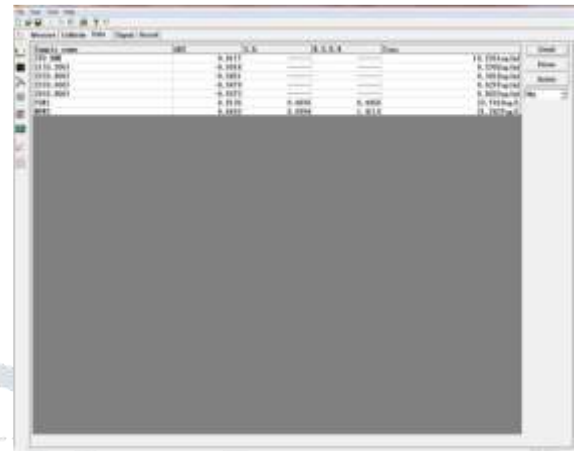


Figure 6 Result of magnesium

2.5 .Result of Lead ion analysis:

- The concentration of LEAD in Pallipalayam water sample (Sample1) is 1.0346 ppm.
- The concentration of LEAD in Mettur dam water sample (Sample2) is 0.5725 ppm.
- As per IS: 2296-1992 the minimum amount of LEAD concentration is 0.1 ppm.
- Since the concentration of LEAD is not within the limit, Pallipalayam water sample and Mettur dam water sample were unsafe for drinking. water should be treated as per standards before human usage.

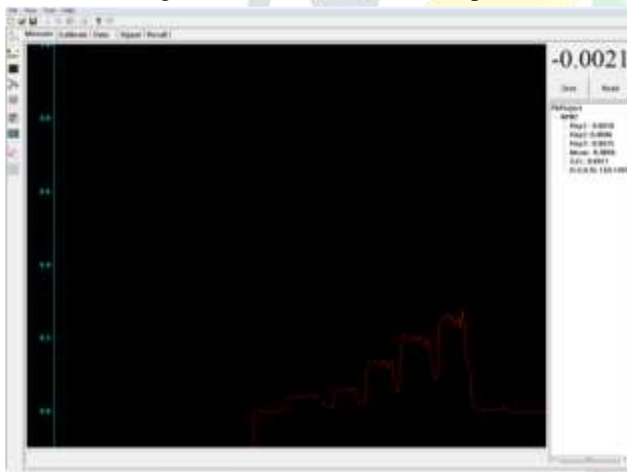


Figure 7 Graph of lead

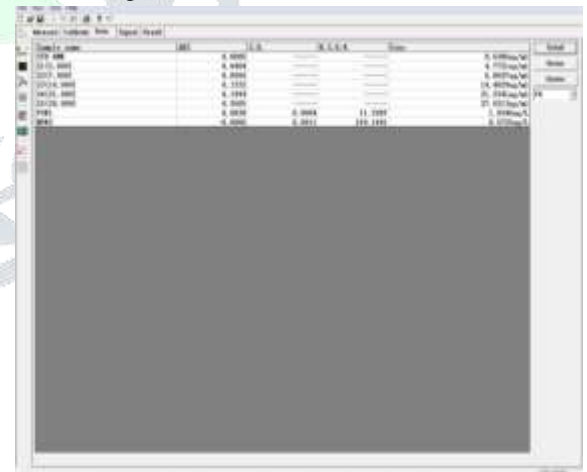


Figure 8 Result of lead

2.6 Result of Chromium ion analysis:

- The concentration of CHROMIUM in Pallipalayam water sample (Sample1) is 0 ppm.
- The concentration of CHROMIUM in Mettur dam water sample (Sample2) is 0 ppm.
- As per IS: 2296-1992 the minimum amount of CHROMIUM concentration is 0.05 ppm.
- Since the concentration of CHROMIUM is within the limit, Pallipalayam water sample and Mettur dam water sample were safe for drinking.

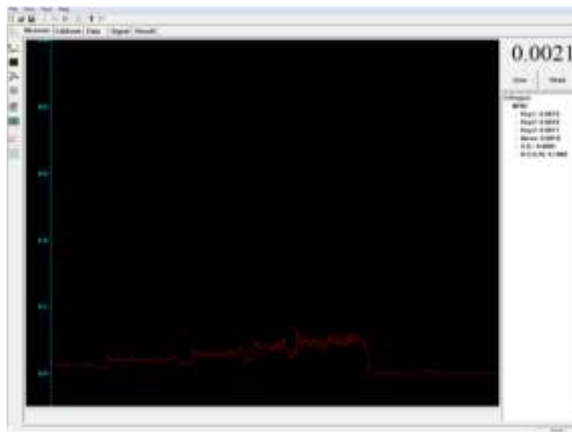


Figure 9 Graph of chromium

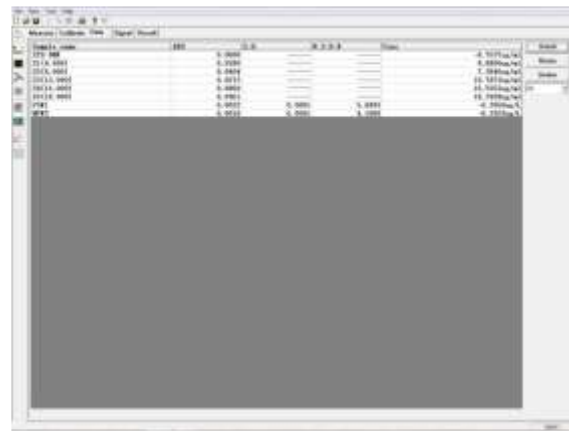


Figure 10 Result of chromium

2.7. Result of Cadmium ion analysis:

- The concentration of CADMIUM in Pallipalayam water sample (Sample1) is 0 ppm.
- The concentration of CADMIUM in Mettur dam water sample (Sample2) is 0 ppm.
- As per IS: 2296-1992 the minimum amount of CADMIUM concentration is 0.01 ppm.
- Since the concentration of CADMIUM is within the limit, Pallipalayam water sample and Mettur dam water sample were safe for drinking.

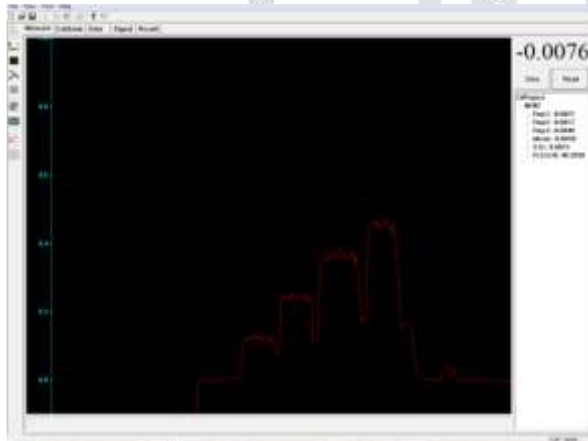


Figure 11 Graph of cadmium

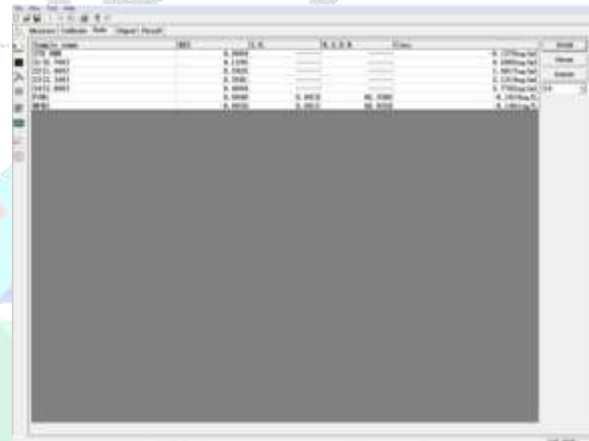


Figure 12 Result of cadmium

3. Result and discussion:

TESTS / OBSERVATION	PALLIPALAYAM WATER SAMPLE (SAMPLE 1)	METTUR DAM WATER SAMPLE (SAMPLE 2)	SURFACE WATER QUALITY STANDARDS (AS PER IS: 2296-1992)
COLOUR	VIOLET	—	—
ODOUR	EARTHY OR ORGANIC	—	UNOBJECTIONABLE
pH VALUE	7.37	7.64	6.5 – 8.5
DISOLVED OXYGEN (ppm)	0.3	4.5	6

BIOLOGICAL OXYGEN DEMAND (ppm)	1.6	2.4	2
MAGNESIUM (ppm)	23.7010	21.2437	24.28
LEAD (ppm)	1.0346	0.5725	0.1
CHROMIUM (ppm)	0	0	0.05
CADMIUM (ppm)	0	0	0.01

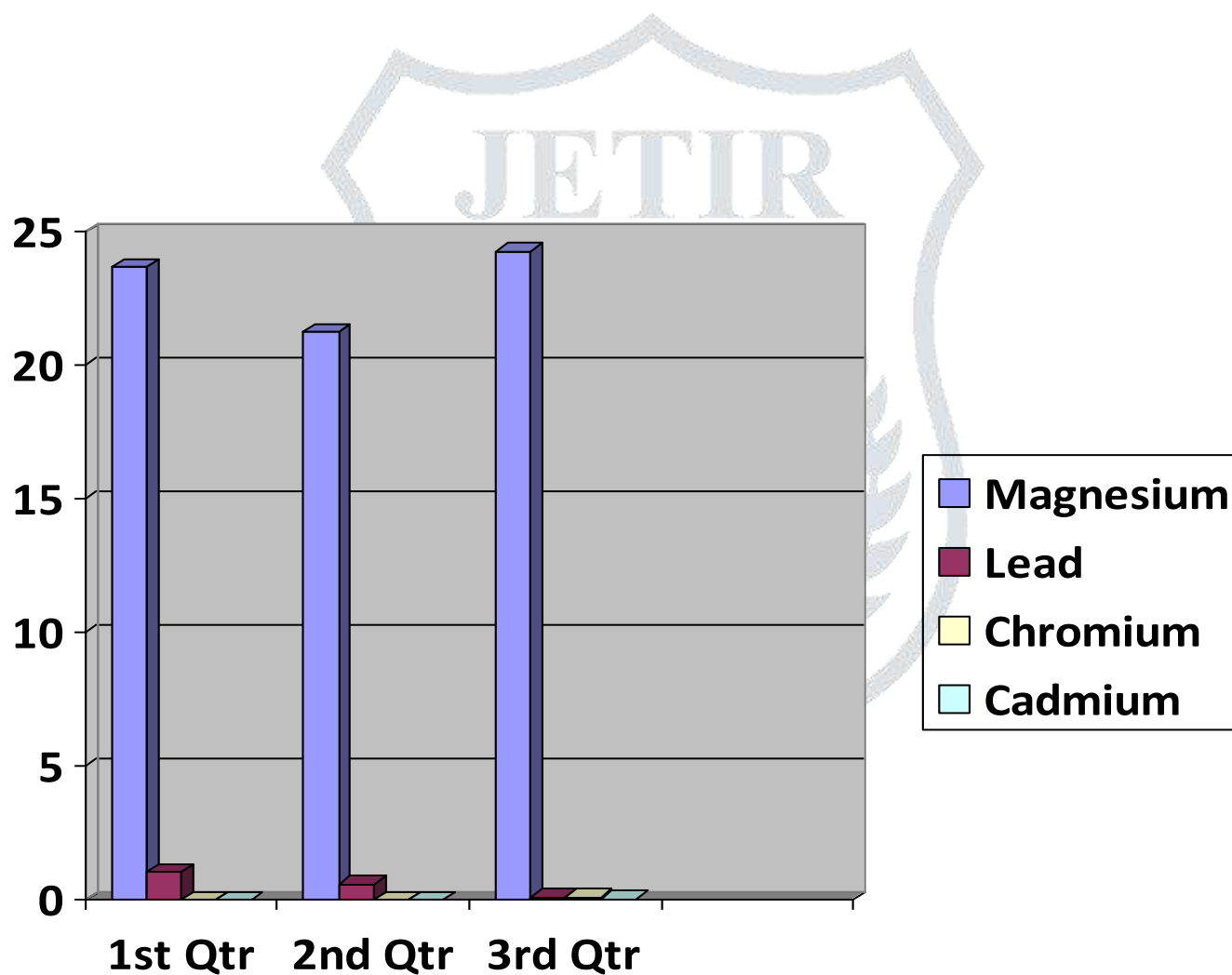


Figure 13 Pie chart representing the analysis result

4. Conclusion

- The concentrations of Magnesium, Chromium, Cadmium and Ph value of Pallipalayam and Mettur dam water samples and BOD of Mettur dam water samples are within the limits (As per IS: 2296-1992).
- The concentrations of Lead and DO of Pallipalayam and Mettur dam water and BOD of Pallipalayam water sample are above the limits (As per IS: 2296-1992).
- The water should be treated properly as per INDIAN STANDARDS before Human usage.

- The industries should be properly inspected periodically and the effluents released from industries should be treated properly before discharging into the environment.

5. Reference

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