ScienSage

Journal of Advanced Scientific Research

Available online through http://www.sciensage.info

ISSN
0976-9595
Research Article

ASSESSMENT OF THE STATE OF WATER POLLUTION DUE TO THE TEXTILE INDUSTRIES OF PALI, RAJASTHAN AFTER THE NGT BAN

Naresh Giri, Pallavi Mishra*

Department of Chemistry, J.N.V. University, Jodhpur, Rajasthan, India

**Corresponding author: pallavianuk@gmail.com*

ABSTRACT

Pali city is situated near Rohit area of Jodhpur city and is also known as textile industrial city of Rajasthan. There are thousands of dyeing and printing units of cotton and synthetic cloths. The industrial units of textile, dyeing and printing have been discharging a large quantity of effluents in the river Bandi thereby affecting the water quality. The soil in the area has also become sterile. Although the consciousness has been increased in the public by the media, which has resulted in the closure of many industries. NGT has also imposed ban on many textile units and many Common Effluent Treatment Plants have also been set up. But still a lot of illegal textile units are functional and their toxic effluents are still being thrown in to the Bandi River without genuine prior treatment, making it highly polluted river. In this paper, we report effluent water analysis of different textile industries and CETP centers in the months of June 2019-February 2020. We have compared their values with the standard values given by the WHO. We observed that in most of the samples, the quality of water was not up to the mark and metal toxicant levels were alarmingly high.

Keywords: *Water pollution, Textile effluents, NGT, CETP.*

1. INTRODUCTION

Water is very important for life to exist. The major environmental issue of the present era is the availability of clean and quality freshwater. The industrial and urban waste is the major cause of degradation of underground as well as surface water quality [1]. The rivers are the common recipients of industrial effluent. The degradation in the quality of water has an unfavorable effect on human being as well as aquatic ecosystem explicitly or implicitly [2]. The present practice of any industrial unit to pour effluents into open drains and river without any treatment results in the rise of the pollution.

2. DETAILS OF THE STUDY AREA

Pali is one of the most consistent industrial cities of Rajasthan where we can see numerous big and small-scale industries of various products and services, especially textile, dyeing and printing industries [3, 4] which are present in large number. The effluent water and chemicals used in these industries are directly poured into the Bandi river [5].

There are 2 major areas in Pali where most of industries are situated and they are linked directly with Bandi River via drains and channels.

(1) Mandia Road industrial area

(2) Punayta Road industrial area.

We have selected sampling stations outside industries as shown in the map (Fig.1).

3. METHODS AND MATERIAL OF ANALYSIS

3.1. Sample collection

The current study was done in the summers of 2019 and 2020. Overall, 30 effluent samples (three samples from each site) were procured from the main industrial drainage sites, and Bandi River, which were principal locations of industrial effluent discharge. The effluent samples were taken in plastic bottle containers of two litre capacity. Before collecting water samples, these bottles were thoroughly cleaned by washing with 10% HCl and were then rinsed using distilled water [6]. Precautions were taken during collection of water samples to avoid any kind of adulteration.

3.2. Sampling sites

The specimens were collected from major areas such as industrial area of Mandia road and Punayata road. The 10-sampling site of both areas are listed below-

(i) Vardhman Enterprises
(ii) Godavari Textiles Industries
(iii) Panna Textiles Industries
(iv) Vikash Fabrics

(v) Agrawal Cotton Mills
(vi) Pooja Textiles
(vii) Kamdhenu Textiles
(viii) Shree Dyeing Process
(ix) Padam Prabhu Fabrics
(x) CETP Foundation Punayata Road Pali.

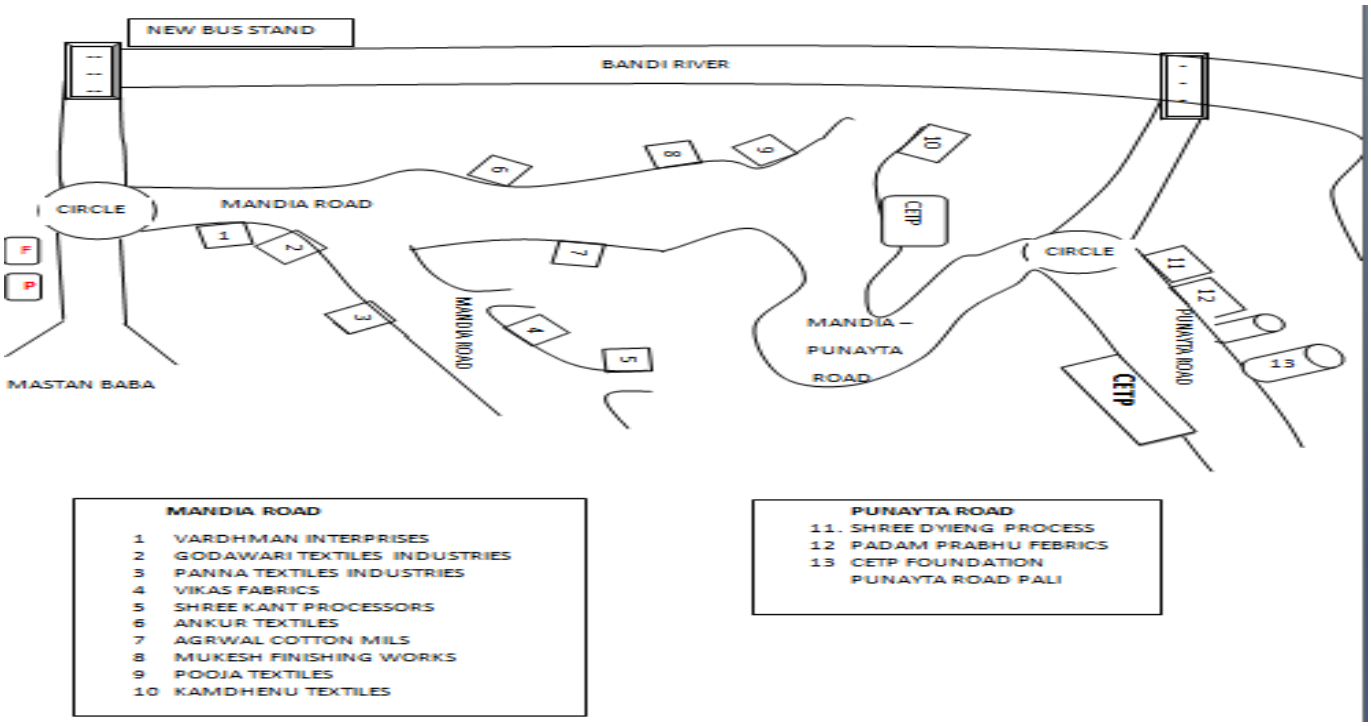

Fig. 1: Map of major industrial areas of Pali

Fig. 2: Sample collection sites

3.3. Analytical method of working

The Physicochemical parameters of samples like pH, Chloride, Electrical conductivity (EC), total hardness (TH), Total dissolved solids (TDS), alkalinity and calcium hardness were analyzed. Standard procedures were used to explore the water samples. The microelement such as Fe, Cu, Co, Cr, Cd, and Ni were determined by using AAS. The effluent samples were filtered through 0.45mm membrane filter and were acidified with concentrated HNO_3 (AR grade). The results obtained were compared with WHO standard values.

4. OBJECTIVE OF THE STUDY

The main purpose of the current study was to assess the state of water pollution of Bandi river and industries, after imposing of ban by the NGT. Determination of physico-chemical parameters of the textile effluents and assessing the metal toxicants present in it, helped us in assessing the impact of effluents and waste water on the soil, plant and human beings. For this purpose, monitoring of the quality of effluent water from various industries, CETP and Bandi River water was done.

5. RESULTS AND DISCUSSION

5.1. Physicochemical analysis of effluent water samples

5.1.1. pH

The permissible pH limit for industrial effluents are between 5.5 to 9.0. Observations presented in table 1 clearly reveals that 10 effluent water samples have pH between 8.5 to 10.7 which shows alkaline nature.

5.1.2. TDS & Electric conductivity

According to BIS standard the maximum acceptable value of TDS is 500 mg/L and according to WHO the Electric Conductivity should not exceed 400µS/cm. All the ten samples showed higher values for electrical conductivity and total dissolved solids higher than the standard limits. TDS values were between 6600 to 8820 mg/L and EC values were between 6210 to 17700 µS/cm as shown in the table 1.

5.1.3. Chloride

On analyzing chloride content in all the ten surface water samples, values were between 827 to 1254 mg. According to the EPA standards, 250mg/L chloride in water is an acceptable value. It was observed that, none of the sample had the chloride content in the permissible limits.

5.1.4. TH

Total hardness estimated from the samples ranged from 702 to 1167 mg/L, which is higher than standard values. According to WHO, the maximum acceptable limit of Hardness is 500 mg/L.

5.1.5. CaH

Calcium hardness is the total amount of calcium ion present in the water. The WHO range of calcium ion in the effluent water ranges between 100 to300 mg/L. The calcium hardness was estimated 120 to 1200 mg/L, which is very high.

5.1.6. Nitrates

Almost all inorganic nitrates are soluble in water, according to the USEPA, the maximum limit of nitrates in effluent is 10mg/L and according to WHO, the acceptable limit is 3 to 10 mg/L. All 10 samples contained nitrates between 119 to 210 mg/L, which is higher the standard value.

5.1.7. Sulphate

Sulphate is classified under the SMCL standards and according to that the acceptable limit of sulphate is 250mg/L. All the ten effluent samples contained higher value of the sulphate. The sulphate values are between 417 to 1395 mg/L.

5.1.8. Sulphide

Many metal sulphides are insoluble in water but some are soluble in water and according to WHO, the permissible limit for sulphide is 2.0 mg/L. All the ten samples crossed the permissible limit, having sulphide between 3.8 to 48.7 mg/L, which is higher than the standard value.

5.1.9. Sodium

Sodium is the major cation which is present in textile wastewater due to high consumption of sodium salt in the processing units. According to the WHO, the acceptable limit of sodium ion in effluent water is 200 mg/L. All the 10 effluent samples contained sodium ion between 730 to 2750 mg/L, which is higher than the permissible limit.

5.2. Graphical representations

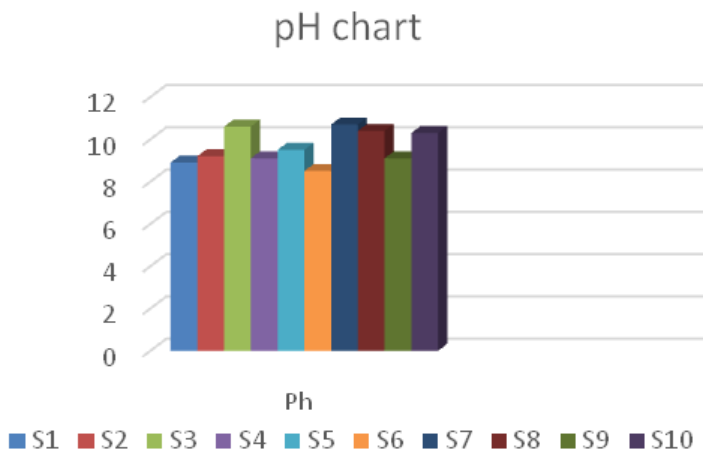

Fig. 3: pH analysis of effluent water samples

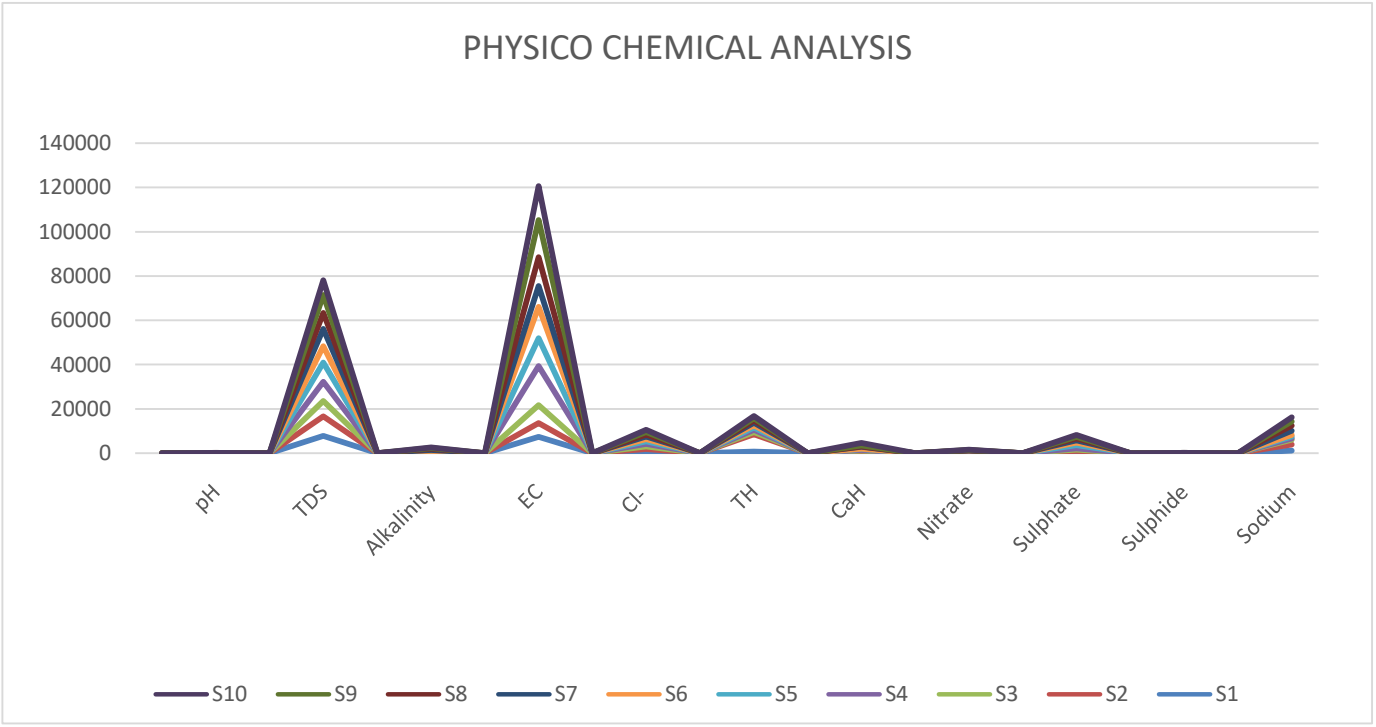

Fig. 4: Physico chemical analysis of effluent water samples

5.3. Heavy metal investigation of effluent water samples

All the ten effluent water samples were also evaluated for heavy metals using AAS [7]. The results showed that, heavy metals (Ni & Cr, Cu, Cd, Co, Fe) were detected in all the samples. Lead was detected only in four samples. The release of acids and alkaline materials from the textile, coal-fueled and chemical industries disturb the pH buffer system of the natural water, reducing its potential to reduce injurious micro-organisms. Atomic Absorption Spectrophotometry (AAS) is a technique which is reliable for detecting metals, metalloids in various samples [8]. In order to estimate the number of heavy metals in effluents, blank and reference solution for device calibration were used [9], a typical set of reference calibration curves with good linear regression and better relative standard deviations were achieved [10]. Highly pure (AR grade)

chemicals and doubly purified water were used for making solutions for the analysis [11]. Preservation and investigation of effluent samples were based on reference guideline proposed by APHA. The results are shown in the table (1) and fig (4) and (5).

Table 1: Physicochemical and heavy metals investigation of Industrial Effluents Water Samples

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Color	Green	Dark Blue	Dark Green	Light Brown	Brown	Light Yellow	Light Brown	Dark Blue	Pink	Light Brown
pH	8.9	9.2	10.6	9.1	9.5	8.5	10.7	10.4	9.1	10.3
TDS (mg/L)	7850	8820	6950	8740	8600	7340	7910	7210	8100	6600
Alkalinity (ppm)	245	196	120	80	243	194	373.1	590.4	260	240
EC (µS/cm)	7400	6210	8100	17700	12500	14200	9500	13010	16750	15310
Cl^- (mg/L)	895	1027	1089	1120	1255	985	1180	827	1230	925
TH (mg/L)	702	7898	1009	915	1030	1062	1167	1007	990	1007
CaH (mg/L)	290	560	290	300	500	120	800	160	400	1200
Nitrate (mg/L)	119	121	177	186	210	190	135	142	157	195
Sulphate (mg/L)	417	650	480	627	1395	1185	1025	928	735	825
Sulphide (mg/L)	30.2	16.1	9.1	24.1	3.8	48.7	46.7	15.2	7.3	9.2
Sodium (mg/L)	1175	2750	2163	560	920	730	1786	2350	1920	1870
Cd (ppm)	0.168	0.124	0.088	0.157	0.189	0.088	0.094	0.086	0.072	0.081
Cr (ppm)	3.24	3.10	6.6	3.6	3.6	3.4	4.87	1.2	2.2	1.5
Ni (ppm)	1.30	0.09	2.50	1.36	1.36	1.70	0.20	0.03	0.07	0.02
Co (ppm)	0.15	0.24	0.65	0.37	0.37	0.56	0.15	0.73	0.16	0.18
Fe (ppm)	0.39	0.55	0.64	0.43	0.43	0.40	0.34	0.35	0.31	0.32
Cu (ppm)	0.343	0.315	0.145	3.089	ND	ND	ND	0.249	0.218	0.192

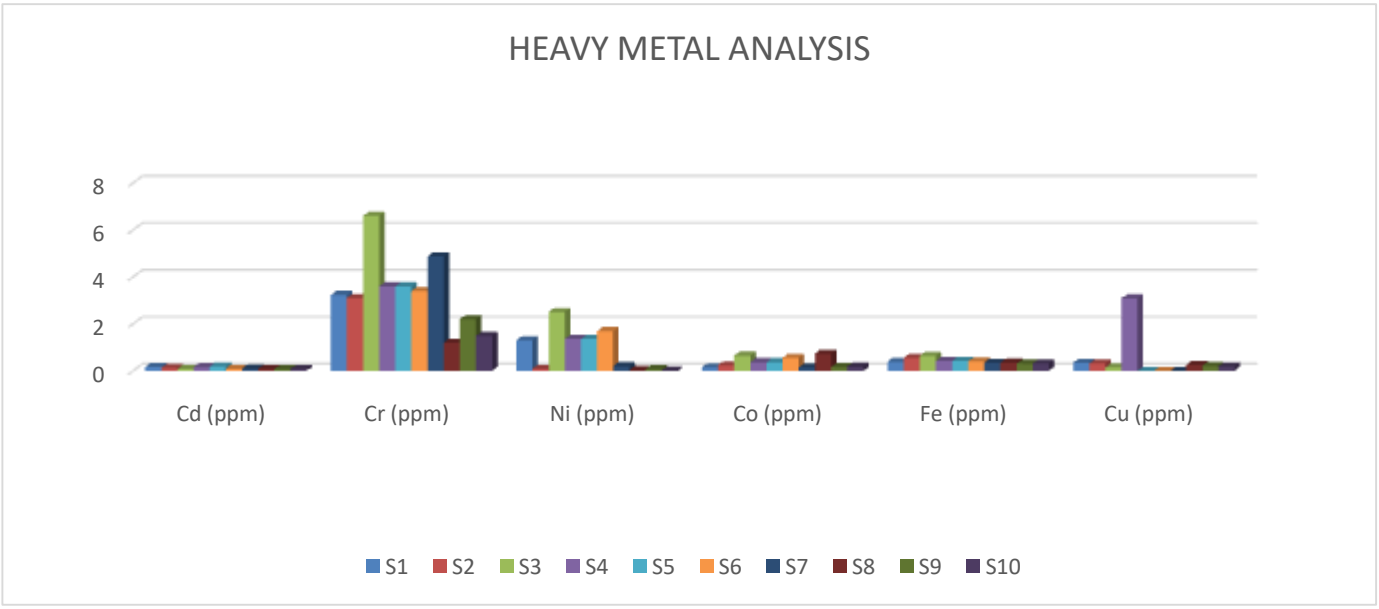

Fig. 5: Heavy metal analysis of effluent water samples

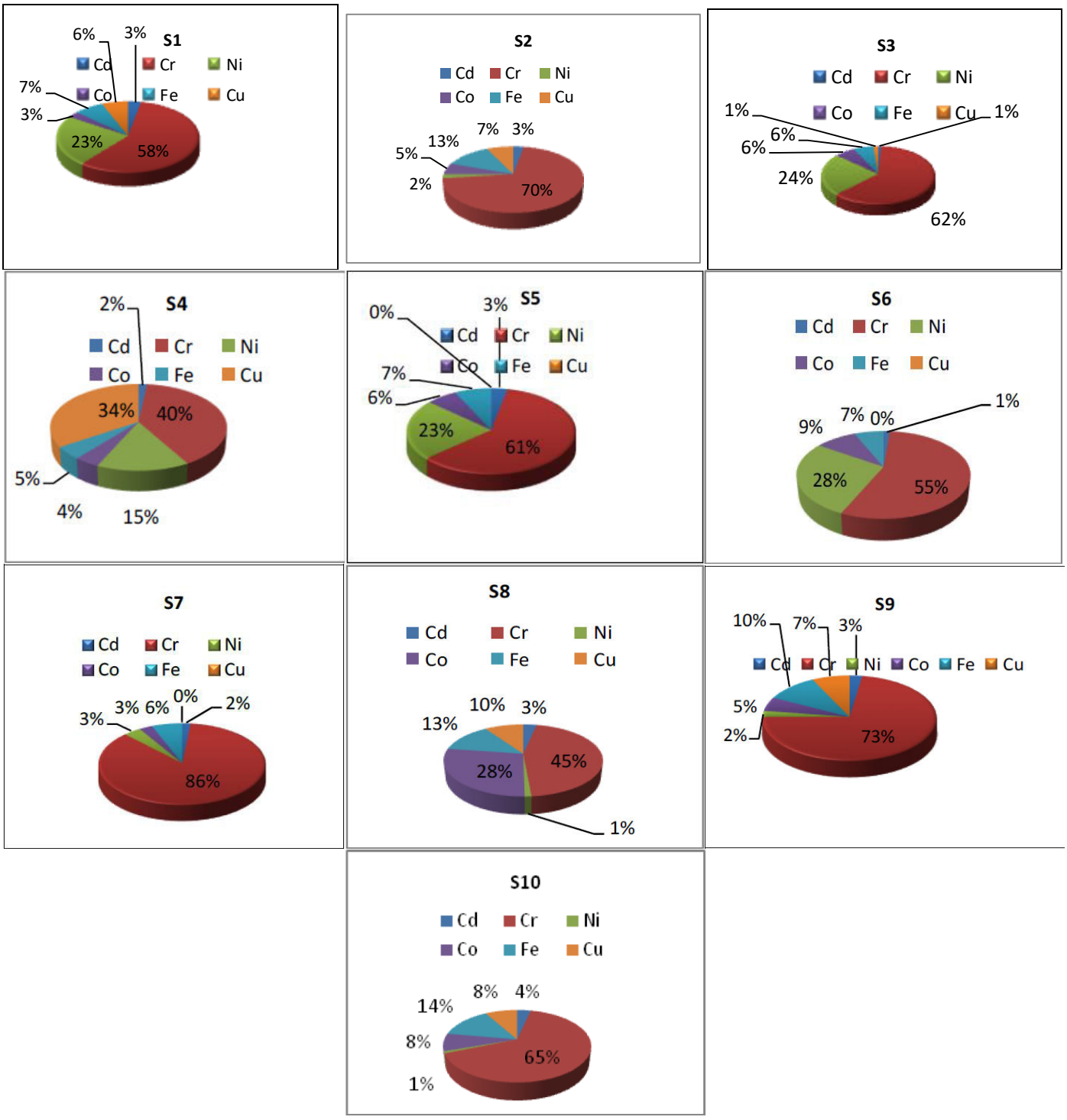

Fig. 6: Graphical representation of heavy metal analysis in different effluent water samples

The values of the parameters analyzed for the samples were compared to the permissible limits, standardized according to WHO guidelines [12] and it was perceived that the concentration of heavy metals in the collected effluents was found to be more than the limits issued by WHO as shown in the table (2).

By comparing the values of analysed samples with the standard values following results were obtained:

1. ***Cadmium***: The concentration of cadmium present in the samples was found between 0.081 to 0.189 ppm which is very much higher than the standard value.

2. ***Chromium***: The concentration of chromium was found between 1.2 to 6.6 ppm which is above permissible value of WHO that is 0.05ppm.
3. ***Nickel:*** Its concentration was found between 0.02 to 1.70 ppm which is slightly higher than standard value.
4. ***Cobalt***: Its concentration in samples was found between 0.15 to 0.73 ppm which is more than the standard value of 0.05 ppm.
5. ***Iron***: The value of iron in samples is 0.31 to 0.64 ppm which is very high.
6. ***Copper***: The concentration of copper was found in the range of 0.145 to 3.089 ppm which is a bit higher than the standard values.

Table 2: Permissible value of heavy metals in water

Heavy Metals	Permissible Values (ppm)
Cd	0.003
Cr	0.05
Ni	0.02
Co	0.05
Fe	0.30
Cu	2

6. CONCLUSION

In our experiments it was found that industries of Pali region were throwing industrial effluents containing various heavy metal ions such as cadmium, zinc, copper, chromium, nickel, iron etc. without proper treatment to the open drains. The river has become severely polluted due to high load of heavy metal ions concentration [13]. Though NGT has imposed ban on hundreds of industries, still many of them are working without following proper guidelines given by the NGT. The appearance of high toxic concentration of lead, chromium, cadmium, Ni and Fe in the industrial effluent of various factories is clear indication that the dyeing printing industries are not treating effluent water before throwing them in drain and then to Bandi river [14]. Lead, chromium, cadmium, copper, iron, zinc contents have been found to be far above the prescribed limit in all the effluent samples, except at one or two sites. In the current study Cd, Cr, Pb, Ni, Cu, Fe and chromium were found to be exceeding their permissible limits. Effluents from textile industries in particular are also making soil infertile around Bandi. This water is reaching to the underground levels through seepage and making tube wells /boring water highly toxic. This water when consumed, causes very harmful effects to human beings, plants, animals and environment [15, 16]. It is clear that these heavy metals may enter the food chain, and through bioaccumulation can easily reach humans through plants and can cause various deadly diseases [17]. The main purpose of our work is to make people aware of dangerous effects of effluent water on human life. Therefore, we suggest regular monitoring of various textile effluents and imposing heavy penalty and even permanent closure to save human beings and environment.

7. ACKNOWLEDGEMENT

We are thankful to our HOD, Professor Kailash Daga, department of Chemistry, Jai Narain Vyas University, Jodhpur and authorities at the Pollution Control Board, Jodhpur, for providing laboratory facilities and chemicals needed for the conduct of this work.

Conflict of interest

There is no conflict of interest involved.

8. REFERENCES

1. Bhadra BK, Pathak S, Sharma JR. *Geological Society of India*, 2013; **82**:675-691.
2. CPCB, "Performance Status of Common Effluent Treatment Plants in India". *Central Pollution Control Board*, 2005; 68.
3. Rathore J. *International Journal of Environmental Sciences*, 2011; **2(2)**:560-568.
4. DuttaS, Singh S. *Journal of Environmental Research and Development*, 2014; **8(3A)**:574-581.
5. Rathore J. *International Journal of Environmental Sciences*, 2012; **3(1)**:735-742.
6. CSE. CSE Study on Pollution of Bandi River by Textile Industries in Pali Town. *Centre for Science and Environment*, New Delhi, 2006; 13.
7. A Report of Pali Water Pollution Control, Treatment and Research Foundation, 2007; 1-4.
8. Haswell SJ. Atomic Absorption Spectroscopy, Theory, Design and Application. Amsterdam: Elsevier, 1991.
9. Lajunem LHJ. Spectrochemical Analysis by Atomic Absorption and Emission. *Royal Society of Chemistry*, 1992; (**23**)**:**154-194.
10. Radulescu C, Dulama ID, Stihi C, Ionita I, Chilian A, Necula C, Chelarescu ED. *Romanian Journal of Physics*, 2014; **59(9-10)**:1057-1066.
11. Adnano DC. Trace Metals in the Terrestrial Environment. New York: Springer Verlog, 1986.

12. Khan SA, Din ZU, Ihsanullah, Zubair A. *International Journal of Science and Nature*, 2011; **2**:648-652.
13. Wood KN, Bishop AL. *Water Science and Technology*, 1992; **25(1-2)**:301-307.
14. Guidelines for drinking-water quality [electronic resource] incorporating first addendum. *APHA*, 3rd ed1998;1.
15. Buffle J. Complexation Reaction in Aquatic System, Englewood Cliffs. Prentice Hall, 1990.
16. Needleman H. *Lead Poisoning. Annual Review of Medicine*, 2004; (**55)**:209-222.
17. Duruibe JO, Ogwuegbu MOC, Egwurugwu JN. *International Journal of Physical Science*, 2007; **2(5)**:112-118.