International Journal of Advanced Research in Biological Sciences
ISSN : 2348-8069
www.ijarbs.com

Research Article

Impact of Textile Effluents on Water bodies of Western Rajasthan

Shellina Khan[1] and Nishi Mathur[2*]

[1]Ph.D Research Scholar, Department of Biotechnology, Faculty of Applied Science, JNU, Jodhpur, Rajasthan, India.
[2]Head of Department, Department of Biotechnology, Mahila PG Mahavidhyalaya, Jodhpur, Rajasthan, India.
*Corresponding author: *drnishimathur@scientist.com*

Abstract

Jodhpur the Blue city of Rajasthan is mainly known for its traditional Art and Craft and Historical impact throughout the world. The magic of colors come out from Rajasthan in the form of Bandhej won the heart of millions but with this magic a negative result also display i.e., the disposal of waste water effluent from the industries become a big problem. The determinations of physio-chemical parameters were observed in present study and also examined the harmful impact if it enters in nearby water body. Three sites were selected in each area for collection of samples from different locations. This waste water analyzed for selected parameters i.e. pH, electric conductance, bicarbonate, chloride, Ca, Mg, Na and K ions, SSP, SAR and RSC. Results indicate that parameters of sample have great variability. These can cause damage if not properly treated before discharge to the environment.

Keywords: Waste water effluents, Physio-chemical parameters, Disposal, Electric conductance, Environment.

Introduction

Rajasthan is well known all over the world for its hand-printed textiles. Rajasthani textiles come in a fascinating range of dyed and block-printed fabric which is further embroidered (**Error! Hyperlink reference not valid.**). Each region has its own special color scheme, design and technique. Tie-and-dye textiles, called **"**bandhej" or "bandhani" are an important Rajasthan craft. Different methods are used to tie the fabric into small points and produce various patterns like lehariya, mothda, ekdali and shikari (**Error! Hyperlink reference not valid.**). There is a magical quality about Bandhini: vibrant colours, arresting combinations, dramatic swirls and twirls. Bandhani is an ancient art practiced mainly in Western India. Heart - warming textiles, dyed in the bandhani or tie & dye style reign supreme in Rajasthan. The best bandhej comes from Jodhpur, "The Jodhpur, mainly known as Blue City around the world for its Traditional Art & Craft, Handicraft, History, Tradition and Historical themes."

The town Balotra is famous for hand block printing and textile industry. Balotra is also famous for dyeing and printing of cotton and polyester fabrics. "Ummed Mill" of Pali is world famous in textile area.

Most of the industries in India are situated along the river banks for easy availability of water and also disposal of the wastes. These wastes often contain a wide range of contaminants such as petroleum hydrocarbons, chlorinated hydrocarbons and heavy metals, various acids, alkalis, dyes and other

chemicals which greatly change the physiochemical properties of water (Lokhande.S.et.al.,2011) (Agor.A.2007) (Kumar.A.1996).

Luni River is flows in western part of India in the state of Rajasthan. It is only Major River of the area and the source of irrigation. (Fig. 1) The Jowai, Sukri and Jojari River are its main tributaries (http://www.britannica.com/EBchecked/topic/351624/ Luni-River).Jojari River is the sole outlet for all of Jodhpur city's waste. Jodhpur is known for its numerous textile dyeing, steel polishing industries. According to State Pollution Board, some amounts of untreated effluent find its way into the river as Common Effluent Treatment Plant set up in Sangariya District(www.cseindia.org/bootcamp/jojari_river.html) .

Fig: 1. Present condition of Luni River near Balotra.

In order to minimize the problem of water pollution caused primarily by textile units in Pali, a 12 MLD, Common Effluent Treatment Plant (CETP) has been set up by Pali Water Pollution Control Treatment and Research Foundation (PWPCTRF) Mandia Road which operates on Biological treatment (Activated sludge) (Sharma.N.et.al.,2013).

Although all the Indian industries function under the strict guidelines of the Central Pollution Control Board (CPCB) but still the situation of environmental pollution is far from satisfactory. Different norms and guidelines are given for all the industries depending upon their pollution potentials. Most of the major industries have treatment facilities for industrial effluents. (Rajaram.T.et.al. 2008 and Singare.P.et.al., 2010).

Industrial wastewater disposal needs proper considerations from the points of view of manufacturer, public and the sanitary engineer alike.

From the public point of view, industrial wastes cause pollution to stream making it unfit for domestic, recreational and commercial purposes, deteriorate sewers and treatment, and increase cost of treatment. Water quality in urban locale and villages adjoining textile industrial areas has deteriorated owing to effluent inflow into land and water bodies.

The three main kinds of ecological risks are associated to this fact:
• The loss of productivity in the soil compartment,
• The pollution of ground-water due to metal leaching,
• The accumulation of pollutants in the food-chain, with effects on vegetation and animals, including humans. (Sulieman.M.et.al.2010).

The day by day increasing tremendous industrial pollution in Rajasthan has prompted us to carry the systematic and detail study of physico-chemical properties of industrial waste water effluent (Lokhande.S.et.al., 2011).

The presence of very small amount of dyes in water is highly visible and affects the aesthetic merits, water transparency and gas solubility in lakes, rivers and other water bodies(Mc Kay,1979) and degradation products of these dyes are often carcinogenic(Kim et al., 2003).

Pollution due to dyes

A dye is a synthetic chemical used to impart color to materials of which it becomes an integral part. The large variety of chemicals used in bleaching and dyeing process render them very complex (Rajagopalan, 1990). Correlation of chemical structure with color has been accomplished in synthesis of dye using a chromogen-chromopre with auxochrome. The nature of pollution that accompanies the dyeing industry is primarily due to the non-biodegradable nature of dyes along with the strong presence of appreciable amounts of toxic trace like acids, alkalis, carcinogenic aromatic amines in the effluents (Manivasakam, 2003).

Materials and Methods

Study Area

Balotra

Balotra is a city located at 25°50′N 72°14′E / 25.83°N 72.23°E. It has an average elevation of 106 metres (347 feet) in Barmer District of Rajasthan state in India. It is about 100 km from Jodhpur. For 60 years, Balotra has been known as a leading centre in India for processing and trading of various types of fabrics. More than 5000 textiles units are located here. It is the leading textiles hub of India. (Fig. 2)

Pali

Pali is also one of the major textile clusters of Rajasthan. Pali is located between 24.75 degree to 26.483 degree North latitude and 72.783 degree to 74.30 degree East longitude. The major part of district has elevations ranging from 200-300 metres above MSL, but in the east toward the Aravalli Range the elevation increases and the average is nearer 600m at some places. (Fig. 2)

Jodhpur

The city is also known as “Sun city” and also known as “Blue City”. “Jodhpur topped Lonely Planet’s list of most extraordinary place to stay in 2014”. It covers total area of 22850sq. km. It covers 11.60% of the total area arid zone. The district stretches between 2600’ and 27037’at the North latitude and between 7255’ and 7352’ East Longitude. This district situated 250-300 meters above the sea level. (Fig. 2)

Fig: 2. Areas of textile Effluent in Western Rajasthan

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Sample Collection

Total 14 samples were collected from textile industrial areas of Rajasthan.

Five samples from Jodhpur, Six from Balotra and Three from Pali. The locations of the samples were listed in Table-1. Effluent samples from sites were collected in pre cleaned plastic bottles.

Sample No.	Textile Mill	Localities
1.	Adarsh Textiles Mill	Jodhpur
2.	Navkar Textiles Mill	Jodhpur
3.	Jodhpur Dyeing Centre	Jodhpur
4.	Chhippa Colony	Jodhpur
5.	Marudhar Textile Mills	Jodhpur
6.	Ramanug Textiles	Balotra
7.	Mohammad Abas Textiles	Balotra
8.	Ambika Textiles Mills	Balotra
9.	Navrang Textiles mills	Balotra
10.	Waste Water Treatment Plant	Balotra
11.	Vardhman Textiles	Balotra
12.	G.R. Textiles	Pali
13.	Maharaja Shree Umaid Mills Limited	Pali
14.	Mahadev Textile Mills	Pali

The collected effluent samples have been analyzed to determine its physicochemical parameters. The water samples were collected during the month of January. Temperature and pH were recorded on the site. The effluent samples were analyzed for Color; pH; electrical conductivity (EC); Calcium (Ca); Magnesium (Mg); Sodium (Na); Pottasium (K); Carbonate (CO_3^-); Bicarbonate (HCO_3); Chloride (Cl^-); SO_4 ; SAR, SSP, RSC. Physicochemical parameters of samples were analyzed by standard protocol.

Results and Discussion

The experimental data on physio-chemical properties of water samples collected from different industries of Rajasthan is presented in Table: 1.

Table: 1. Physio-chemical analysis of Textile Effluents.

		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Color		Leaf green	purple	Red	dark green	Orange	Light yellow	Brown	Light Green	Grey	Transparent	Orange	Dark Red	Orange	colorless
Smell		Pungent	Earthy	Earthy	No smell	Earthy	Earthy	No smell	Rotten Egg	Rotten Egg	No Smell	Pungent	cloth y Smell	Clothy Smell	No smell
pH		6.3	6.8	6.7	4.8	6.4	11.8	12.7	13.3	12.6	11.7	7.4	3.6	9.6	7.7
EC		5.8	5.2	15.1	20.0	15.1	15.8	17.7	29.0	26.3	24.1	17.2	11.6	19.9	12.2
	$C^{++} + Mg^{++}$	5.4	13.6	28.8	15.4	18.8	0.8	1.2	1.8	2.4	3.2	26.0	9.8	6.2	18.4
	Na^+	47.5	33.1	109.8	172.6	119.7	141.5	168.3	251.3	212.8	218.7	128.3	95.4	164.4	95.1
	K^+	5.1	5.3	12.4	12.0	12.5	15.7	7.5	38.7	47.8	19.1	17.7	13.8	28.4	8.5
	$CO_3 + HCO_3$	13.8	11.4	3.8	7.4	17.4	22.8	47.4	NA	NA	NA	40.8	3.8	NA	16.0
	Cl^-	40.1	40.0	142.2	183.4	120.3	126.8	118.2	249.2	206.4	211.6	112.0	96.8	137.8	93.0
	SO_4^-	4.1	0.6	5.0	9.2	13.3	8.4	11.4	40.8	56.6	29.4	19.6	18.4	61.2	13.0
SAR		28.9	12.6	28.93	62.20	39.04	233.7	217.2	264.8	194.2	172.8	35.58	43.0	110.4	31.35
SSP		81.8	63.6	72.7	86.3	79.27	89.5	95.08	86.65	80.91	90.74	74.59	80.1	82.61	77.95
RSC		8.4	NA	NA	NA	NA	22.0	46.2	NA	NA	NA	14.8	NA	NA	NA

Color

Color is the major pollutant of textile sector and owes its origin by extensive use of different types of dyes. The samples from site were different in color. Brownish black raw effluent from textile industries has been reported (Desai and Kore, 2011). The color of few samples was slightly light. This slight lightning

may be attributed to the use of coagulants and flocculants (Wong *et al.,* 2007). Sample from site was grayish green in color utilizes the phenomenon of activated sludge. Effluent generated form site Jodhpur though contain different colors but was free of turbidity and particulate matter.

pH

pH is a measure of the acidity or alkalinity of water and is one of the stable measurements. pH is a simple parameter but is extremely important, since most of the chemical reactions in aquatic environment are controlled by any change in its value. Anything either highly acidic or alkaline would kill marine life. Aquatic organisms are sensitive to pH changes and biological treatment requires pH control or monitoring. The pH of effluents collected from Balotra was very high (11.3±1.6-13.3±0) as the incoming wastewater is highly alkaline in nature. The bleaching agents and chemicals NaOCl, NaOH, surfactants and sodium phosphate used in the processes are reasons for high alkaline wastewater (Paul *et al.,* 2012). A similar trend in pH of raw textile waste water has also been reported (Ramamurthy *et al.,* 2011). pH higher than the observed range has also been reported(Desai and Kore, 2011). Waters with pH value of about 10 are exceptional and may reflect contamination by strong base such as NaOH and Ca $(OH)_2$ which are extensively used in textile sector. Effluents collected from Pali were showed vast variation (3.6-9.6). The pH of effluents collected from Jodhpur was in the neutral to slightly acidic range (4.8±0.2-6.8±0.2). Effluents from Jodhpur witnessed pH in standard range (6.5-8.0).

Electrical Conductivity (EC)

The standard value of Electrical Conductivity of water is **0-2.0 ds/m.** The effluents collected were having very high range **(5.2 – 29.0).**

SAR (Sodium Adsorption Ratio)

The standard value of SAR of water is **10.** The effluents collected were having very high range **(12.69-264.89).**

SSP

The standard value of SSP of water is **50.** The effluents collected were at high range **(63.65-95.08).**

RSC (Residual Sodium Carbonate)

The standard value of RSC of water is **2.5meq/L.** The effluents collected were having very high range **(8.4-46.2meq/L).** Few effluents were ranging very high and not detected.

Conclusion

The results can be used as starting points in order to design the project for prevention of natural resources and to ensure its protection in case of the joint effect of some toxic and corrosive pollutant agents. Certain pollutants in textile wastewater are more important to target for pollution prevention. The large volumes of wastewater generated also contain a wide variety of chemicals used throughout processing. The aquatic toxicity of textile industry wastewater varies considerably among production facilities. Most textile dyes have low aquatic toxicity. Wastewater in bleaching, dying, printing and finishing sectors required separate treatment which can decrease the concentration of polluting agents.

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