INNOVATIVE TECHNIQUES IN TREATMENT OF TEXTILE DYE WASTEWATER

Ankita Araballi[1], Dr MC Sampath Kumar[2]

[1]*Student, Environmental Engineering, BMS College of Engineering, Karnataka, India*

[2]*Professor, Civil Engineering, BMS College of Engineering, Karnataka, India*

ABSTRACT

Water pollution has been one among the key topics within the environmental issue in present days. The predominant culprit of this issue is – human kind and activities. Human aspires to meet out his needs at cost of anything. This study was made to take look at such an issue in Textile Dye Industries. Due to usage of huge amounts of many range dyes, the water gets polluted. This polluted water creates secondary problems like seepage into groundwater, leaching, harming aquatic life, imbalance in ecosystem etc. This paper observes approximately strategies for use to lessen pollutants due to fabric industries and techniques to get better the wastewater from those industries. The study has conducted tests on effluent parameters such as pH, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), BOD, COD, Nitrate, Copper and Iron of six industries in Bangalore. Recorded values for parameters with standard permissible limits are compared with standard CPCB limits; impact on environment and near proper measures to be followed is highlighted by some suggestions.

Keywords – Textile dye treatment, Environmental issue

I. INTRODUCTION

India is first in worldwide jute manufacturing and stocks 63% of the worldwide fabric and garment market. India is second in international fabric production and additionally second in silk and cotton manufacturing. The main supply of dye, historically, has been nature, with the dyes being extracted from animals or plants. Since the mid-nineteenth century, however, human beings have produced synthetic dyes to gain a broader variety of colours and to render the dyes more strong to washing and widespread use. Different classes of dyes are used for exclusive styles of fibre and at exclusive levels of the fabric manufacturing process, from free fibres thru yarn and material to finish garments.

Fig1: Textile Dye Industries in Bangalore

In this study we have considered few industries from Peenya Industrial Estate, Avenue Road, Shivaji Nagar, Cubbonpet areas. We have collected wastewater samples and have done parameter check. These industries are all small to large type of industries. They follow their own set of process sequence to dye but below shown is the major process part from where wastewater is more likely to generate.

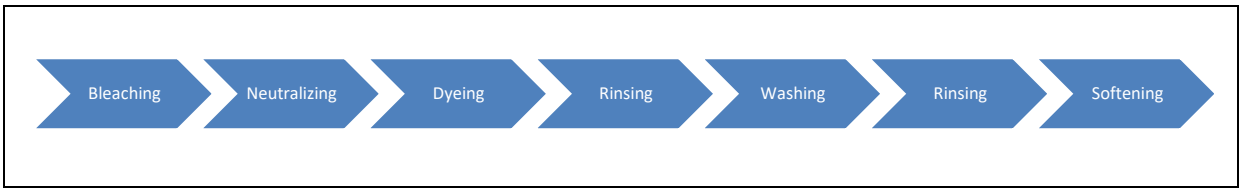


Fig2: Flowchart of Dyeing process

II. LITERATURE REVIEW

Bangalore has one of the high numbers of textile dye industries. Dyes give a very great outlook to fabric. Dyes can be prepared naturally or artificially. In olden days, dyes were mainly synthesised using natural components like leaves, fruits, flowers, soils so on. But present days demands variety of colors and therefore many dyes are artificially synthesised using various chemicals and chemicals compounds. These dyes take longer time to degenerate in environment and lead to production of secondary toxic components. The properties of artificial made dyes have poor effects on its long lasting life as well. There are many methods classified based on dyeing applied at various stages, such as Dope dyeing, Fibre dyeing, Yarn dyeing, Piece dyeing and Garment dyeing. Some important techniques that are widely used for dye removal include physic-chemical methods such as, adsorption, oxidation, chemical precipitation, electrochemical treatment, membrane filtration, coagulation – flocculation, ion exchange, membrane and biological methods such as, treatment by bacteria, algae, fungi and yeast. New methods to harness natural dyes and usage in commercial industries are to be discovered so as to avoid negative impacts causing on environment.

III. LABORATORY WORK AND ANALYSIS

3.1. Preliminary Analysis of Wastewater Sample

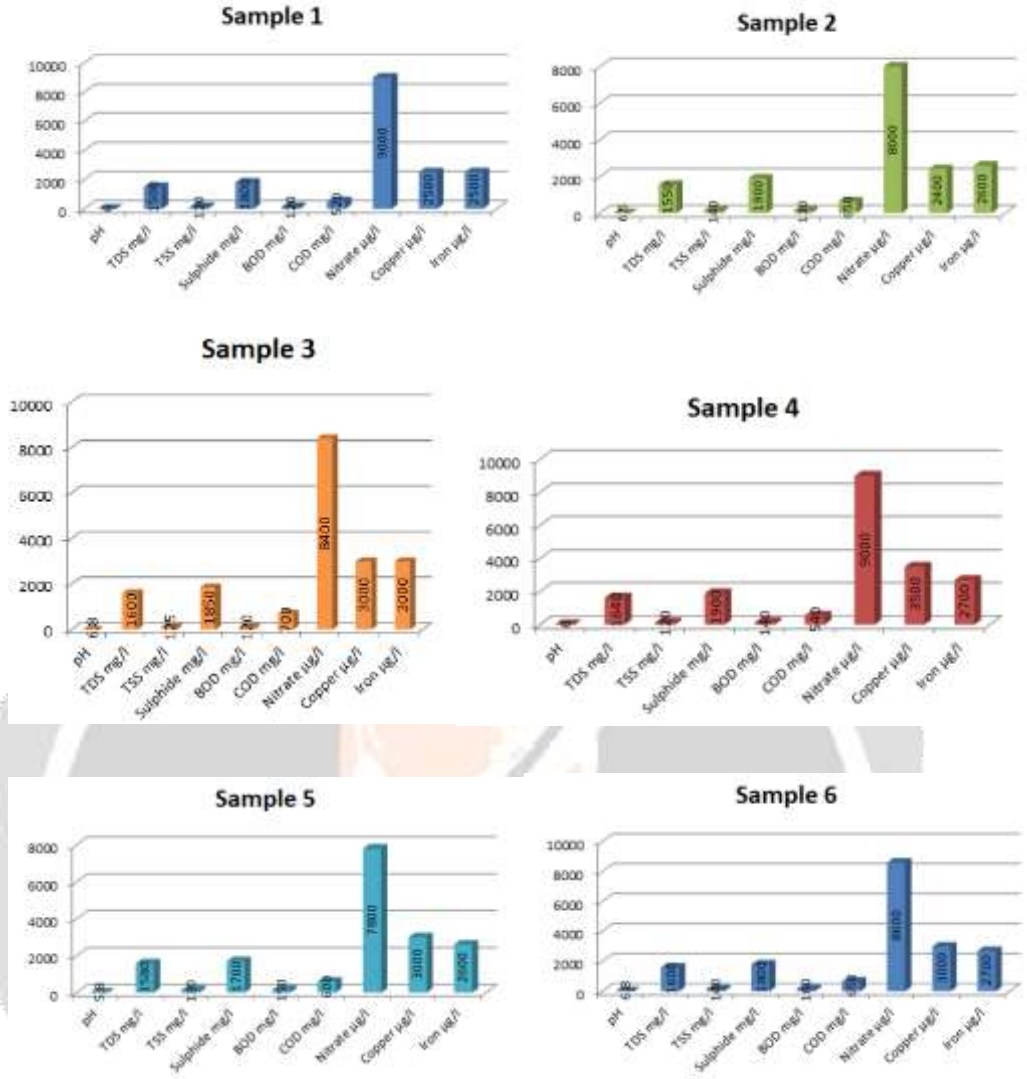
The collected water samples were tested for following parameters. It was noticed that pH, Nitrate, Copper and Iron were within BIS standard limits, while other parameters were out of limit range. Preliminary analysis gave us a quick look at what extend wastewater is polluted and to what extent treatment is to be given.

All the experiments were conducted by following standard procedures. pH of all samples were tested as soon as bought to laboratory, as dyes used in industries may be acidic or alkaline may intend to change property if kept for long time. Iron and copper were found in trace amounts as they were just used as adding agent to dye.

Table1: Result Analysis Chart of conducted experiment

Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
pH	6	6.5	6.8	6	5.8	6.8
TDS mg/l	1500	1550	1600	1640	1580	1600
TSS mg/l	120	140	125	120	130	140
Sulphide mg/l	1800	1900	1850	1900	1700	1800
BOD mg/l	120	130	120	140	150	160
COD mg/l	520	650	700	540	600	650
Nitrate µg/l	9000	8000	8400	9000	7800	8600
Copper µg/l	2500	2400	3000	3500	3000	3000
Iron µg/l	2500	2600	3000	2700	2600	2700

3.2. Graph representing the laboratory obtained values of parameters



IV. DISCUSSION

The wastewater sample was collected at temperature 28 - 38°C by considering sampling temperature every time as it also plays a major role in properties of parameters.

Table 2 summarizes the range of values determined in laboratory and standard value limits by CPCB for effluent disposal into inland surface waters.

From Table 2, pH observed is 6.4 which is mild acidic in nature due to presence of more acidic or basics dyes. High or low pH in effluent affects quality of cleanness of water and rate of biological reaction. Textile industries usually show high TDS values due to processing methods of dyeing. This can be reduced only by adopting alternative methods to conventional method of dyeing process. But obtained values from samples are within limit and so process methods are efficient. Sulphides obtained values are less than permissible limits. Copper and Iron are within permissible limits.

TSS value depicts the presence of suspended particles in wastewater; higher value of this may hamper the food chain and depletes oxygen level. In obtained values it is very mild higher than permissible value; so can be acceptable. The obtained values of BOD and COD are higher than permissible limits; leading to high presence of organic matter and organic strength respectively in effluent. This suggests that water is highly contaminated. Nitrate is also higher than limit which leads to organic content increase in effluent.

Table 2: Effluent parameters of Textile dye Industry

PARAMETER	LAB TESTING PARAMETERS	PERMISSIBLE LIMIT	SOURCE
pH	6 – 6.8	5.5 - 9.0	CPCB
TDS mg/l	1500 – 1640	2100	CPCB
TSS mg/l	120 – 140	100	CPCB
Sulphide mg/l	1800 – 1900	2800	CPCB
BOD mg/l	120 – 160	30	CPCB
COD mg/l	520 – 700	250	CPCB
Nitrate µg/l	7800 – 9000	3000	CPCB
Copper µg/l	2400 - 3500	3000	CPCB
Iron µg/l	2500 - 3000	3000	CPCB

V. CONCLUSION

The color obtained from wastewater of these textile dye industry is very strong with respect to most parameters and so needs innovative techniques to treat this wastewater. One of those could be with use of Activated Carbon (AC), Nanoparticle, Organic adsorbents.

We can try to aware the industry people to use organic/natural colors as wherever as possible, so that extreme of pollution can be reduced.

Following the proverb; “Prevention is better than cure” - We can synthesis dyes with natural components like leaf extracts, flower extracts, bark extracts, seed extracts so on to avoid secondary pollutants to generate.

Remedies: Go for natural color dyes and natural fabrics.

REFERENCES

1. CPCB (Central Pollution Control Board): Minimal national standards: Dye and dye Intermediate industry. Comprehensive Industry Document Series: COINDS / 34/1990 (1990).
2. Husain J. and Husain I., Groundwater pollution by discharge of dyeing and printing industrial waste water in Bandi river, Rajasthan, India, Int J. Environment and Bioenergy, 2(2), 100-119 (2012)
3. Mohammadi T. and Esmaelifar A., Journal of Membrane Science, 254, 129-137 (2005)
4. Raja Ram T. and Das A., Water pollution by industrial effluents in India: discharge scenarios and case for participatory ecosystem specific local regulation, Futures, 40(1), 56-69 (2008)
5. https://en.wikipedia.org/wiki/Dyeing