INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 3)
Available online at: www.ijariit.com

Processes involved in textile industry and waste streams identification during the manufacturing process

Shivani V. Bhargava
shivani241@gmail.com
Aadishwar College of Engineering and Technology, Venus Swarnim Startup and Innovation University, Gandhinagar, Gujarat

Dhwani Joshi
hodcl@venusict.org
Aadishwar College of Engineering and Technology, Venus Swarnim Startup and Innovation University, Gandhinagar, Gujarat

ABSTRACT

Textile processing is highly water intensive industry and generating enormous quantum of wastewater from various operations like mercerising, bleaching, dyeing, printing, washing, etc. Majority of these process houses are operated based on conventional practices resulting in generating higher quantum of wastewater having a relatively higher organic load. If hydraulic and organic loads of wastewater discharge could be reduced, associated environmental impacts on Common Effluent Treatment Plant (CETP) and the river would be reduced which in turn leads to sustainable development. In order to select the audit focus area a walk through survey was conducted to know about the process and to identify major waste streams. The aim of this study was to narrate various steps of manufacturing in the dyeing industry. We have also identified the waste streams of the dye manufacturing process.

Keywords— *Textile industry, Dyeing, Cleaner production, Waste streams*

1. INTRODUCTION

Deterioration of physical, chemical and biological quality of the environment can be referred to as Environmental pollution. Due to increasing population, anthropogenic activities are increasing that causes leapfrog development in the textile sector, which leads to deterioration of the environment. Consumers as well as industries both equally responsible for pollutants entry into the environment. Utilization of dyes and dyes intermediates by the industries causes' environmental pollution. Release of these pollutants in the environment may be deliberate and well regulated (industrial emissions) and/or accidental and largely unavoidable (chemical/spills). However, their recalcitrant nature affects the environment and human life.

Textile processing is highly water intensive industry and generating enormous quantum of wastewater from various operations like mercerising, bleaching, dyeing, printing, washing, etc. Majority of these process houses are operated based on conventional practices resulting in generating higher quantum of wastewater with having a relatively higher organic load. If hydraulic and organic loads of wastewater discharge could be reduced, associated environmental impacts on CETP and river would be reduced.

This has germinated an idea of conducting a study as to what extent hydraulic and an organic load of wastewater from the textile process could be reduced by adopting or switching over to good manufacturing (processing) practices or Best Available Technology (BAT) followed across the developed countries.

Dyeing section in the textile industry has more waste streams than other plants out of which wastewater streams are very important waste stream to handle. The study includes of different fabric processing steps currently in practice, desktop review of good manufacturing (processing) practices or Best Available Technology (BAT) in the textile sector and feasibility of its adoption, environmental auditing of in terms of water consumption and wastewater generation (hydraulic and organic load both) in existing and proposed scenarios, etc.

2. STEPS OF TEXTILE MANUFACTURING PROCESS

There are various steps involved in the textile process such as dyeing, rinsing, scouring, bleaching or whitening, weight reduction etc. In the following subsections, these steps have been narrated.

2.1 Dyeing

The grey fabric which is the basic polyester art silk cloth as the raw material for the textile process. The grey fabric is produced from the weaving units where POY (Partially Oriented Yarn) is the raw material. The grey cloth as per job work requirement is lifted from the market by transportation through vehicles and brought to grey stores of the industry. The grey cloth can be of different qualities. As per the programme and batch size, the lot of preparation takes place. With the necessary inspection of qualities and programme as per process requirements, the grey cloth is brought to the dyeing section. Dyeing can be carried out using Jet Dyeing Machine (U-type), Jet Dyeing Machine (Straight), and /or Centre Machine.

2.2 Rinsing

The raw water is taken in the batch in approximate quantity. The loading of fabric takes place through a high-pressure jet. The fabric which is totally loaded in the jet machine is internally circulated through the jet. By this process dirt, stain and other adhered impurities are removed. Depending upon the dirt, stain etc. washing with continuous water flow is carried out. This wastewater is discharged into the drain.

2.3 Scouring

The jet dyeing machine is again filled with raw water and by addition of scouring agent, soap, & other chemicals. After chemical addition in the tank, the process of scouring starts. The mass of water & chemicals added, is circulated by pump & through heat exchanger provided. The heating of water is generally done by direct steam or thermic oil. By this process, the temperature is attained at 60°C. The time taken for scouring is approximate 15 minutes. The wastewater of scouring bath is removed after the process to drain.

2.4 Bleaching or Whitening

The batch is filled with raw water and fabric is subjected to either milky whitening or Super Whitening.

2.4.1 Milky Whitening: In this process, the chemicals added are white-R + Sodium Hydroxide 0.8% + Hydrogen Peroxide 3% + Wetting Agent as required. The process of heating and circulation will remain the same, but the temperature of the bath is 120°C maintained for 20-45 mins. Depending upon quality. If only white is required for printing, then the temperature is reduced by the start-up of cooling. Cooling is done by taking up of raw water in batch and through the heat exchanger. Simultaneously washing process of heat fabric is also performed. This repeated three times. The pH is maintained 3-4 by adding chemicals as required.

2.4.2 Super Whitening: The basic process will remain the same as milky whitening, but chemicals added are Gully + White-R + Sodium Hydroxide 0.8% + Hydrogen Peroxide 3% +Wetting Agent as required. The composition of Gully is Violet 3R 60 gm + 10 gm Blue 2RA + 10L water. The temperature after completion of the bath is drained. The batch is then subjected to cooling and washing with water and other activity remains the same as milk whitening.

2.5 Weight Reduction

The aim of weight reduction is to decrease the weight of the fabric and to give the light feeling. This process is also done using a jet machine. For this purpose, caustic soda is used. The process temperature is maintained 80°C -90 °C with process time 10 mins.

2.6 Dyeing

The process of dyeing takes place with the addition of water and chemicals like Acetic acid, levelling agent, wetting agent, dispersing agent and disperse dyes. Generally, caroline dye and Water as required. pH is maintained between 3-4 with Acetic Acid. Temperature is maintained at 120°C - 130°C. The time required to complete the dyeing is up to 20 minutes according to the quality. The dye batch is drained to the discharge. Freshwater is taken into the tube; the fabric is washed at 60°C and the wastewater is discharged. Two water washes are given to the dyed fabric. If the fabric is to be pad dyed, then after scouring, the fabric is taken to pad dyeing machine. If only white is to be done as per the requirement of the program to be printed, the dyeing operation with disperse dye is not done.

3. WASTE STREAMS IN THE DYE MANUFACTURING PROCESS

As explained in the above section the textile manufacturing process involves various steps. Hence in every step/section, there is a chance for wastewater generation. Owing to the value of water we have identified different waste streams in the process involved, as shown in table 1.

Table 1: Waste Streams involved in the dye manufacturing process

Waste Stream No.	Description of Waste Stream
Dyeing Section	
1	Grey cloth wash water stream
2	Washing of cloths by soap
3	Treat clothes with different chemicals
4	Washing with Fresh Water
5	Washing of cloths with Oxalic acid and Acetic Acid
6	Whitening Process
7	pH adjustment of cloths using Acetic Acid
8	Steam loss
Printing Section	
9	Washing of belt using water

10	Spillage during the transfer of paste from drum to screens
Colour Kitchen Section	
11	Spillage during the transfer of paste from the colour kitchen to the printing machine
12	Wastewater during screen wash
General	
13	Boiler Blow Down
14	Pump leakage
15	ETP Waste Water discharge

4. CONCLUSION

Different steps of manufacturing in the dyeing industry and waste streams have been discussed. From this paper, it can be concluded that water consumption in the dyeing section is very high hence there is a maximum chance to save water. Steam condensate is going to ETP. Spent liquor contains the maximum chemical load. There is a chance to reuse spent liquor in another batch.

Thus it can be concluded that as more industries adopt the methodology for mitigation of load in the house they shall obtain gain by a reduction in effluent load generation as well as in cost benefits that have a short term return period. Below is a depiction of cost-benefit possible in the individual industry.

Table 2: Cost-benefit possible in individual industry

S. no	Name of industry	Cost in %	Cost in % after CP option	Remarks
1	Electricity (DGVCL)	11	11	
2	Fuel (Coal/Lignite)	20	20	
3	Salary	6	6	
4	Wages	18	18	
5	Misc	1	1	
6	Diesel	0.5	0.5	
7	Maintenance	5	5	
8	Dyes	16	14.5	
9	Chemical	14	12.5	
10	General	3	3	
11	Discount / claim/rate difference	4	4	
12	ETP/ CETP	1.5	1.25	
Total		100	96.75	3. 25% SAVINGS

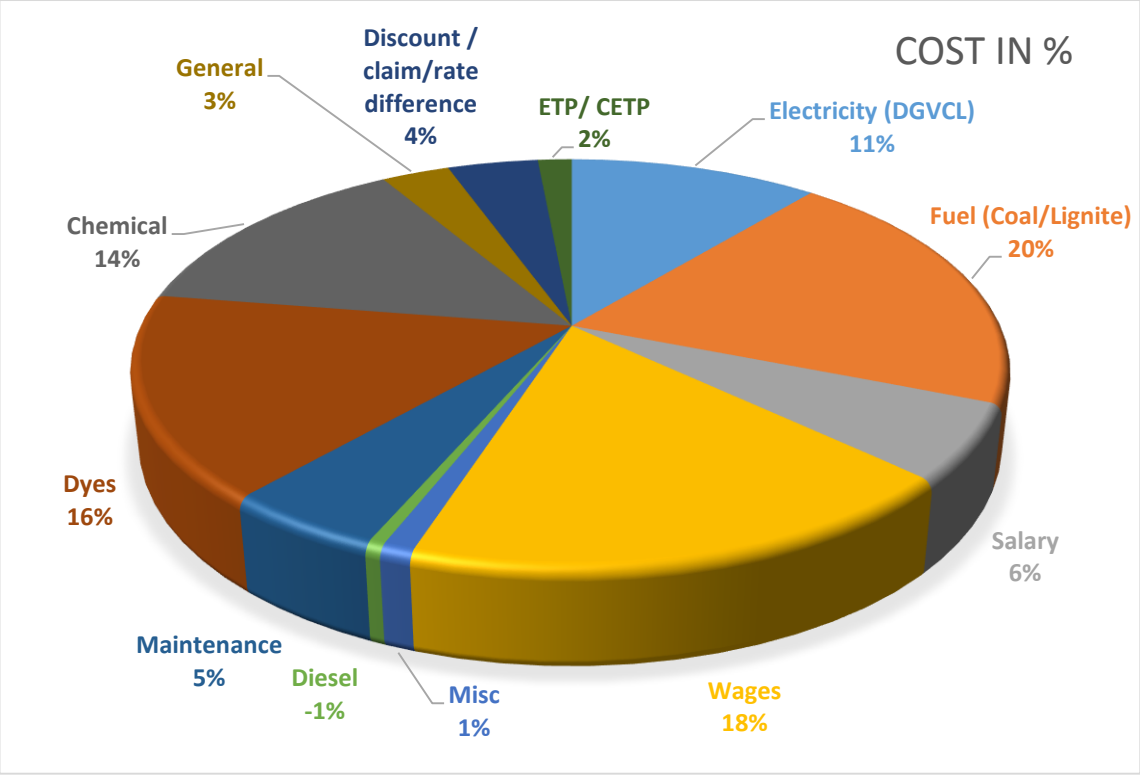

Fig. 1: Cost in percentage

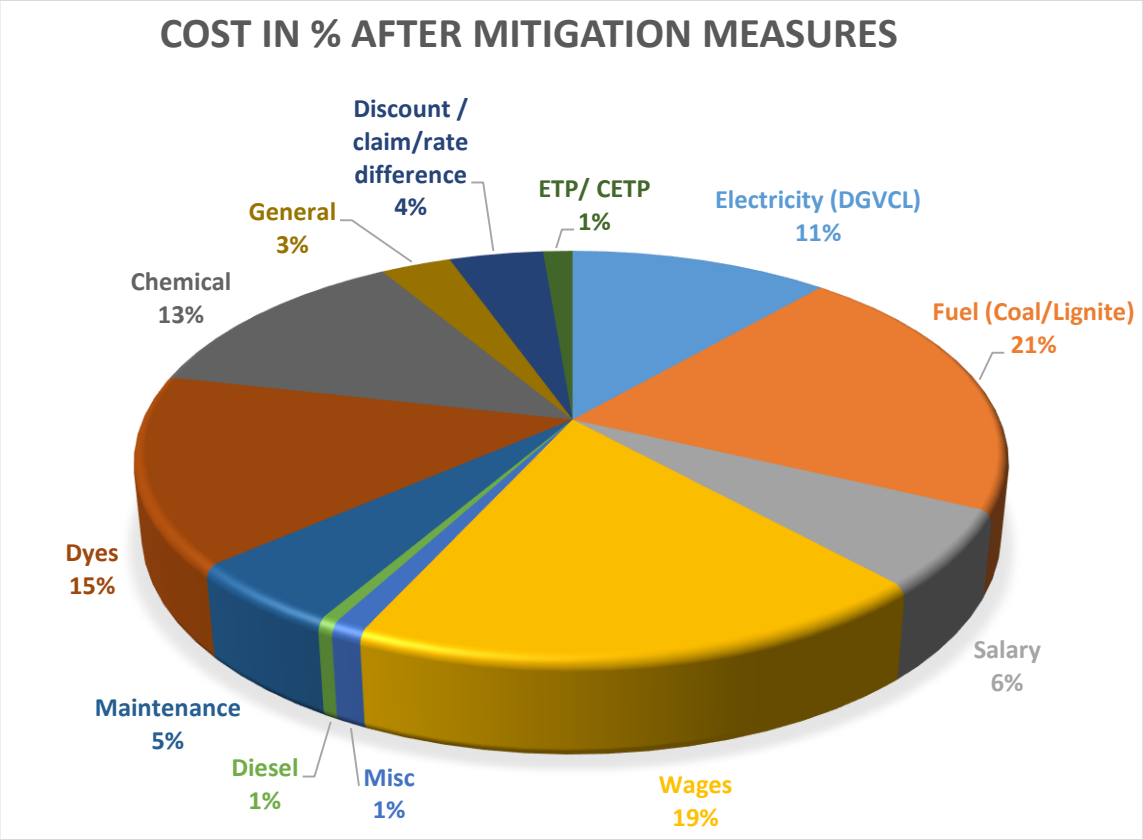

Fig. 2: Cost in percentage after mitigation measure

5. REFERENCES

[1] Cleaner Production case studies in Gujarat, Forest and Environment Department, Government of Gujarat
[2] Comprehensive Industry documents Series : COINDS/59/1999-2000,
[3] Textile Industry, Central Pollution Control Board.

