

PLC CONTROLLED JET DYEING MACHINE

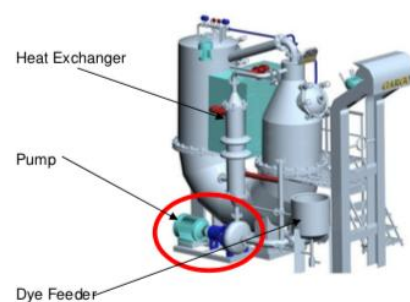
(For Surat Textile Cluster)

Cluster Brief:

Surat, known as the synthetic capital of India, is home to about 400 textile processing units, involved in processing of synthetic sarees and dress materials. The textile processing units can be broadly classified into 'Dyeing' units and 'Printing' units. Most of the units have the facilities of both dyeing and printing. The sarees and dress materials produced in Surat cluster are not only marketed in India but also exported to various countries. The textile processing units in Surat, are mainly micro, small and medium enterprises (MSMEs) and are spread over various locations like Palsana, Sachin, Pandesara and Surat city industrial areas. The main raw material for the cluster is polyester grey cloth which is sourced from local polyester producers in and around Surat. Majority of the industries located in Surat are wet processing units which require high amounts of thermal energy in the form of steam and thermic-fluid, leading to a high share of energy cost. The sector is unorganized in nature, mostly using old and inefficient technologies. There is a significant potential to make these units energy efficient and cost competitive, through accelerated adoption of energy efficient technologies in the cluster.

Existing practice:

Textile processing units at Surat are equipped with multiple jet dyeing machines and most of them are operated manually. It is used for dyeing the cloth by forcibly contacting the jet flow of dyestuff chemical. It is done in such a way that the cloth gets dyed evenly with a relatively less quantity of chemical without applying much tension on the cloth in order to keep the quality of the cloth intact. Other than that, the steam is used to raise the temperature of the dyeing solution through the heat exchanger; this process undergoes both heating and cooling cycles. In the present system, this operation is done manually where the batch time depends on the skill of the person. Moreover, the amount of water and chemical required for completing the process also depends on the individual operator's skill set.

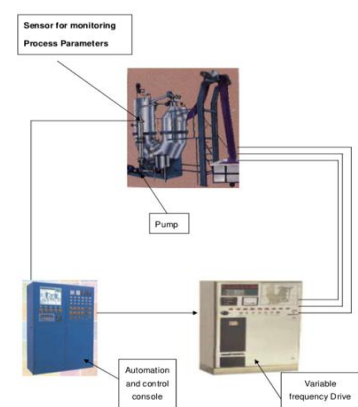


Existing jet dyeing machine

Proposed technology:

Based on the detailed analysis of the jet dyeing process, it is proposed to install "Automation and control system in the machine". This system will be providing the following added advantages in the system.

- ✓ The automation system will optimize and reduce the batch time of the existing process.
- ✓ It enhances the overall production capacity.
- ✓ It automatically selects the heating and cooling cycle as per the process requirement and it also optimizes the temperature as per the system requirement.



Proposed system

Justification of technology selection:

This PLC based automation system optimizes the chemical, energy and time requirement of the batch:

- ✓ Less man power needed.
- ✓ Less time required for completing the batch.
- ✓ Less energy requirement for batch completion.
- ✓ Amount of water and chemical required is less.
- ✓ Reduction in steam consumption.

Energy & monitoring saving:

For calculating the energy and monetary benefits, a typical case of boiler of 8 tph capacity has been considered. The benefits envisaged through installation of boiler automation and control system has been summarized in the table below:

Parameters	Units	Values
Number of batches per day	Nos.	80
Mass of fabric per batch	kg/batch	250
Steam requirement	t/h	1.18
Initial water requirement	kg/d	200000
Steam Saving due to installation of PLC in Jet Dyeing	t/h	0.094
Water saving due to PLC system	kl/y	2745
Total monetary saving	Rs Lakh/y	7.3
Estimated investment	Rs. Lakh	26.4
Simple payback period	years	3.6

* extracts of calculation provided

The benefits can be summarized as:

- ✓ 3-8 % reduction in specific steam consumption
- ✓ 1-3 % reduction in specific water consumption
- ✓ Uniformity in colour
- ✓ Optimum process cycle including pressurization de-pressurization and cooling cycles.

Parameters	Units	Values
Annual fuel saving (one unit)	t/y	125
Annual thermal energy saving (one unit)	MJ/y	2508998
Annual fuel saving (considering 20% replication)	t/y	7992
Annual CO ₂ emission saving (one unit)	tCO ₂ /yr	250
Annual CO ₂ emission saving (considering 20% replication)	tCO ₂ /yr	15993
Estimated investment in technology (one unit)	Rs in Lakh	10
Estimated investment in technology considering 20% replication (assuming price down due to demand	Rs in Lakh	704

Parameters	Units	Values
aggregation)		
Total Investment	in million USD	1.01
Life time energy saving	TJ	25.09
Life time CO₂ saving	tCO ₂ /yr	159934

Replication Potential:

Based on the discussion with associations, units, sample survey and energy audits, it is estimated that the technology has a replication potential of 20% in the cluster. Based on 20% replication, the overall project benefits will be as follows:

Availability of the technology

There are good many technology providers available in India and many of them have their base in Surat. The following are the technology providers available in the cluster.

1. Semitronics Pvt. Ltd.
2. R. B Electronic and engineering Pvt. Ltd.
3. Sun Instrumentation and control.
4. S K controls Pvt. Ltd.
5. Electrocom technology India LTd.
6. Rekon Industries.

Effect on the process

This technology increases the existing production process without increasing the capacity of the jet dyeing machine. It may also enhance the quality of the product.

Reasons for unpopularity:

This technology has yet not penetrated the cluster because of the following reason:

- ✓ Less knowledge of the automation system.
- ✓ Higher capital cost of the technology.
- ✓ Less availability of skilled person for operating such system.
- ✓ No one has yet demonstrated the results of the technology to all unit owners in the cluster.