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ORIGINAL ARTICLE

ECO-FRIENDLY TECHNOLOGY IN SMALL AND MEDIUM TEXTILE WET PROCESSING INDUSTRIES

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Abstract:

The Small and Medium wet processing industries in India contribute more to industrial development and trade and at the same time, they create environmental issues related to water pollution. This article attempts to analyse the main challenges of wet processing industries in adoption of cleaner technology options in reducing water pollution. Irreversible nature of water resource alarms the overall sustainability of environment. Traditional technology management concepts followed in SMIs will not help the industries to maintain the water quality parameters in the emission. So, effective approach towards innovative technology is to be identified and implemented. The present study examines the possibilities of implementing cleaner production technology in textile wet processing industries inTirupur, Tamilnadu. The main focus of the study is on technological choice and strength and weakness of SMIs to implement the Better Available technology (BAT). SWOT model is discussed to apprehend the adoption of technologies available.

KEYWORDS:

BAT, Water pollution, Textile Wet processing, SWOT.

INTRODUCTION

Open market Avenue in a globalised scenario has encouraged entrepreneurs to produce more and has made the industries to share a major contribution to the domestic as well as global market. In India, the small-scale industrial sector has acquired a prominent place in the economic development of the country for the past 65 years by providing employment to 19.3 million people and contributing 35 per cent of the total exports. As is stated in the Rio Summit, environment and development are inseparable and that industry is an important contributor to development. Production in wet processing industries is closely associated with the problem of water pollution. Over production in these industries brings complexities in natural resource management. Industries produce `good product` when the product they intended is produced and also 'bad product` (environmental pollution) as a by product. The problem becomes acute when it is not addressed by the industries. The Small and Medium wet processing industries in India contribute more to industrial development and trade and at the same time, they create environmental issues related to water pollution. Conventional methods of production do not support the industries to bring a better trade off between development and environmental problem. The need for preventive approaches to industrial pollution has been emphasised and cleaner production is seem to be one of the central tools for industry to achieve

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environmental improvements while remaining competitive and profitable. However the need for adoption of cleaner technology is greater in small and medium-sized industries whose cumulative impact on the environment is greater than that of large-sized industries owing to the increasing number of SMIs.

LITERATURE REVIEW

Sushil Kumar Hada in his article on "Benefits of Glauber's salt in Textile Wet processing" highlighted that the Textile Research and Application Development Centre (TRADC) carried out a study by using Birla's Glauber salt, which is a by-product of Birla Cellulose's viscose manufacturing process. In this study, emphasis is given on fabric dyeing by using glauber salt and its comparison with common salt and vacuum salt. Moreover, pollution load caused by addition of all salts are comparatively analyzed. After extensive experimental trials, TRADC got positive results not only in terms of environmental issues but also from fabric processing point of view.

Aravin Prince (2009) in his article on" Ultrasonic-assisted wet processing" pointed out the use of ultrasound in textile wet processing as it offers many potential advantages including energy savings, process enhancement and reduced processing times. Enzymatic treatments supplemented with ultrasonic energy resulted in shorter processing times, less consumption of expensive enzymes, less fibre damage, and better uniformity treatment to the fabric.

Parmar et.al in his article on "Wet processing of Garments: Some facts" revealed that in India most of the Garment industries is in unorganized sector. This sector is far behind the international standards in productivity and quality. The important reasons of legging behind of this sector are listed as non-availability of qualified and trained operators, absence of quality control activities, application of sub standard dyes and chemical auxiliaries and lack of sophistication in the technology used in wet processing

Statement of the problem:

Increasing environment consciousness, newer legislations to preserve environment and human rights, scarcity of water and energy has driven R&D efforts in search of safe substitutes of the dyes and auxiliaries. In this customer driven market

the specific needs of customers have further created challenges. This article addresses the two important aspects of cleaner technology management in SMIs.

Objectives of the study:

· To find out the cleaner technological choice adopted in small and medium scale textile wet processing industries to reduce water pollution.

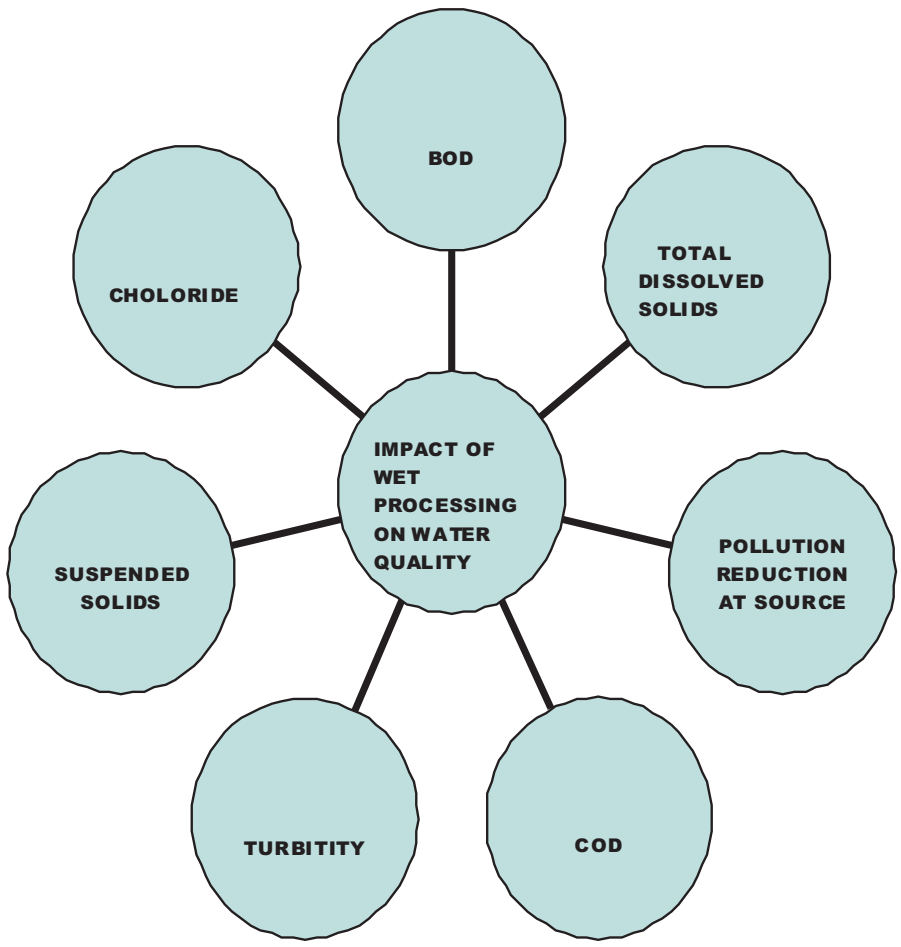
· To examine the SWOT (Strength,Weakness,Opportunities,Threats) of small and medium scale industries in implementing cleaner production technology in reducing water pollution.

METHODOLOGY:

SWOT technique is used to study the factors affecting the adoption of technologies available to Small and medium scale textile wet processing industries. Out of 700 industries doing wet processing in Tirupur, 105 industries (15%) are selected by systematic random sampling technique. A structured questionnaire containing statements with seven scales regarding their strength, weakness, opportunities and threats were given.

WET PROCESSING IN TEXTILE INDUSTRY:

Textile processing industries are classified as wet and dry processing industries. Bleaching, scouring, dyeing, softening, printing, finishing are the different value chains of textile industries. The chemicals used in different value added processes and the consumption of large quantity of water release toxic effluent. The industrial effluent when it is directly released into the water bodies, water becomes unsuitable for drinking and irrigation purposes. The industries find it difficult to adhere to the prescribed limits of the effluent. The following diagram shows the pollutants that are present above the prescribed limit in waste water.



The problem of water pollution in the case of textile wet processing industries is two sided. That is, it consumes large quantity of water on one side and discharge of effluent in large quantity on the other. The two sided problem has to be met with optimum technical solution.

CLEANER TECHNOLOGY:

Cleaner Technology is a holistic approach focussing on economic and ecological efficiency. While applied in production processes, however results in less or no harm to environment. According to UNEP (1994) it is "the continuous application of an integrated preventive environmental strategy to processes, products and services to increase eco-efficiency and reduce risks to humans and the environment'. In other words, Cleaner technology is more inclined towards prevention rather than administering the problem with treatment technology. Minimising waste at source enables progressive reduction of the environmental impacts of processes, products and services. It underlines preventive approaches rather than control and management of pollutants and wastes. But adoption of cleaner technology requires changing attitudes, responsible environmental management and evaluating technology options.

Cleaner Technology Choice:

Cleaner Technology Choice is oriented towards
Productivity improvement
Environmental protection and
Sustainability

With these objectives the industry can adopt any or all of the following cleaner technology tools for environmentally healthy production process.

1.Input substitution
2.Equipment modification
3.Energy saving technology
4.Automation
5.Reuse and Recycling

Input Substitution:

Non-hazardous chemicals and dyes can be substituted for hazardous chemicals and dyes which make irreparable harm to water resources. For example Sodium Sulphate can be substituted for Sodium Chloride. This substitution avoids salt concentration in the water resources. Acids and fixing agents can be replaced by enzymes. Azo dyes can be substituted for Azo- free dyes.

Equipment Modification:

Since the processes are water intensive, machinery with low water requirement can be substituted for machinery with high water requirement. For example, Dyeing using Winch requires 120 litres of water to dye 1 kg. of fabric. But Soft flow machines require 50 to 80 litres to dye 1 Kg. of fabric. In the case of air flow machines, the water requirement is still less, that is 30 to 35 litres only. Carbon flow dyeing is yet another machine available in the market that requires no water to dye the material as the dyeing process is done using carbon dioxide. It is a naturally occurring, chemically inert, physiologically compatible, relatively inexpensive and readily available for industrial consumption. A further advantage of this dyeing technique is that the dye can be easily separated from CO2 and each can therefore be recycled and leaves no waste after processing.

Energy Saving:

Time is an important element in textile processing. The equipment which requires less time to process will also result in energy saving. All innovative technologies are, no doubt, power intensive. But to save energy they can opt for machines that require less time. For example Carbon blow dyeing equipment requires only two hours to complete the process where as other machineries require 3 to 6 hours to complete a batch. Processing technique such as continuous or semi- continuous will also reduce the quantity of waste water since it carries over water for the next stage.

Automation:

Full automation of processing technique will prevent spill over of chemicals and dyes. Process system is controlled by computers will regulate the ratio of inputs. Closed pipes used to carry over water avoid health risks of workers working in the process corridor.

Reuse and Recycling:

Reuse and Recycling techniques play a vital role in conserving the resources. Suitable technology to separate water and salt from waste water, removal of colours helps to prevent water pollution. Further, the resource available for reuse reduces virgin resource consumption and thus reduces the cost of processing.

Technological choice in wet processing units of textile industry depends not only on environmental objectives but also on economic objectives of the industry. Industry goes for technological choice after considering the determinant factors of technical competitiveness. SWOT analysis helps to evaluate competency of SMIs in adopting eco-friendly technology in their industries.

SWOT Analysis (Strength, Weakness, Opportunity, and Threat):

This tool is applied to analyse the internal and external environments however encouraging the small and medium industries to have strategic plan for their production with environmental performance. A questionnaire consisting of 47 statements under strength, weakness, opportunities and threats were given with seven point scale to identify the factors that contribute to the SWOT of SMIs.

Strength of introducing eco-friendly technologies:

The analysis explains that there are five factors that are considered as strength of introducing eco-friendly technologies. It is presented in Table no.1

Table No.1 Strength of introducing eco-friendly technologies
(Factor loading)

Factors	Variables/ Loading	% of Variance	Name of the Factor
1	S1=0.723, S9=0.740	17.687	Reduction in pollution load
2	S4=0.780, S5=0.665,	13.177	Quality improvement
3	S2=0.571,S8=0.623 S11=.716	11.268	Environmental consciousness
4	S3=0.627,S6=0.550,S7=.645	9.809	Technological upgradation
5	S10=0.864	9.296	Time saving
Total Variance extracted by five factors		61.238	

Source: Survey data

Factor I - Reduction In Pollution Load:

It states that application of eco-friendly technology in the production processes results in a notable decrease in the pollution load. The load is reduced by reducing water consumption and also reducing the range of pollutants present in the effluent.

Factor II - Quality Improvement:

Eco-friendly technologies make quality improvement such as softening in the processed material. The shade and colouring technique through technological advancement attract customers.

Factor III - Environmental Consciousness:

Eco- friendly technology motivates the entrepreneurs to introduce modern and innovative technology to save the scarce resources

Factor IV - Technological Up gradation:

Modernisation of industries creates competitive strength of small and medium scale industries.

Factor V – Time Saving:

Eco- friendly technologies not only favour environmental quality but also enable industries to have quick processing. This will reduce man hour work and enhance product delivery at the earliest.

Weaknesses in the Introduction of Eco- Friendly Technologies:

SMIs find some weaknesses in the introduction of eco- friendly technologies which is presented in Table No.2

Table No.2. Weakness in the Introduction of Eco- Friendly Technologies (Factor Loading)

Factors	Variables/ Loading	% of Variance	Name of the Factor
1	S2=0.581, S4=0.599, S9=.683,S11= .638	14.824	Continuous investment
2	S1=0.524, S10=0.795,	12.286	Power intensive
3	S5=0.606,S8=0.830	10.169	Low return on investment
4	S13=0.871	10.062	Low resource availability
5	S3=0.776,S7=.509	9.448	Competition
6	S6=0.512,S12=.804	7.931	Technical man power
Total Variance extracted by five factors		64.721	

Source: Survey data

Factor I - Continuous Investment:

Investment on eco-friendly technologies are continuous and cannot be easily adjusted by the SMIs. For that they depend on financial institutions which in turn create additional debt burden.

Factor II - Power Intensive:

All modern machineries, no doubt, are power intensive. However the time of production can somehow manage the situation. But problem of power failure makes the industries to find an alternative option (wind mill, solar panel etc.) which requires high capital investment even with Government subsidy.

Factor III - Low Return of Return on Investment:

High investment with long pay back period creates reinvestment problem. Low return on investment prevents the entrepreneurs to invest more on eco-friendly technologies.

Factor IV - Low Resource Accessibility:

Both technical and capital resource accessibility is low in the case of small and medium scale industries due to their poor economic back up.

Factor V - Technical Competition:

Changing technology, now a day has become a day to day process. Large scale industries are able to face the technological competition created but SMIs have no resource to keep pace with the ever changing technology.

Factor VI - Technical Man Power:

Mostly eco-friendly technologies and machineries are imported from foreign countries. For that the industries have to depend on foreign expertise or they have to employ skilled technicians. In the case of non- availability of skilled technicians, the industry keeps away from modern technology.

Opportunities available to the SMIs to adopt eco-friendly technologies:

Regarding the opportunities available to the SMIs to adopt innovative and eco-friendly technologies, the following factors support the existing opportunities. It is given in Table No. 3

Table No. 3 Opportunities available to the SMIs to adopt Eco-friendly Technologies :(Factor Loading)

Factors	Variables/ Loading	% of Variance	Name of the Factor
1	S3=0.689, S9=0.732, S12=0.766	18.322	Reduction of waste at source
2	S1=0.647, S2=0.752,S10=0.458,S11=0.699	15.081	Training and 'expo'
3	S5=0.619,S7=0.842	11,748	Tool for market expansion
4	S4=0.879	10.292	Green technology
5	S6=0.851,S8=0.580	9.055	Government support
Total Variance extracted by five factors			64.492

Source: Survey data

Factor I - Reduction in Water Consumption:

Water has become a highly demanded commodity everywhere. Water consumption is less in the case of eco-friendly technologies which in turn assures environmental sustainability.

Factor Ii – Training and 'Expo':

Technological exhibition and training conducted enrich the technical knowledge of the industries in implementing eco-friendly technologies. More the training more will be the knowledge.

Factor III – Market Expansion:

Global market demands commodities which are produced with environmental friendly technologies. Hence the technology acts as a categorised brand for SMIs to expand market for their product.

Factor IV – Green Technology:

Adoption of environmental friendly technology ensures the industries to get acquainted with green technologies like green certification for their product. This may help SMIs to compete with industries in the global market.

Factor V – Government Support:

Tax relaxation, subsidy are some of the Government support factors to adopt eco-friendly technologies.

Threats in the introduction of eco- friendly technologies:

SMIs find the following threats in the introduction of eco- friendly technologies. It is given in Table No. 4

Table No.4 Threats in the Introduction of Eco- Friendly Technologies (Factor loading)

Factors	Variables/ Loading	% of Variance	Name of the Factor
1	S2=0.770, S5=0.655, S10=0.547	19.798	Recurring expenditure
2	S3=0.806, S6=0.384, S8=0.728	15.087	Long pay back period
3	S1=0.498,S4=0.667,S7-0.634	10.159	Long run survival
4	S9=0.750,S11=0.674	9.629	Finance
Total Variance extracted by five factors		54.673	

Source: Survey data

Factor I –Recurring Expenditure:

Technical up dates are frequent but requires heavy capital investment. Technology though helps to adjust with the environmental standards; it is difficult for small and medium scale industries to invest more on technology.

Factor II -Long Pay Back Period:

Technology if it adopted at present will give production result but it takes a long period to give financial benefit to the industries. That is industries have to wait for a long period to enjoy profit out of the technology adopted.

Factor III - Long Run Survival:

Irreversibility nature of natural resources requires high technology to adhere Environmental standards. New technology makes the present technology obsolete. SMIs long run survival is questioned by the changing nature of available technology.

Factor IV – Finance:

Continuous investment is beyond the affordability of the small and medium industries

SUMMARY OF FINDINGS AND CONCLUSION:

SWOT analysis of SMIs elucidates that reduction in pollution load, quality improvement, time saving; technological up gradation and environmental consciousness are the strengths of adopting wet processing. But there are threats to the application of Eco-friendly technologies for a long period as it involves heavy capital investment and yields low return on the invested capital. Government has to promote industrial ecology with policy instruments. Water pollution will be a stigma to sustainable development if it is uncontrolled. Hence industries have to adopt such technology which promotes their production processes and accomplishes with the environmental norms. The latest United Nations Report on environmental trends states that the expansion of cities, destruction of forests, erosion of fields and rising demand for water are likely to threaten human and ecological health in many countries for at least a generation. The report also observes that "Without the protection of environment, there can never be the kind of development needed to secure a fair deal for this or future generations". As it is stated, a responsible environmental option is to minimise environmental degradation without cutting off industrial production is adoption of cleaner technologies or eco-friendly technologies.

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