Eco-friendly Textiles -
A Survey
Chapter 3

ECO-FRIENDLY TEXTILES - A SURVEY

Indian textile industry is one of the oldest of all industries in India. It is the biggest export earner of the country. Nowadays there is an increasing consciousness about the environmental issues related to the consumption of textile goods in the international market and hence it has created a number of new issues in this sector.

3.1 PROBLEMS OF TEXTILE INDUSTRY AND ECO-FRIENDLY ASPECTS

Textile industry has been plagued with one problem or the other at different points of time. One of the problems has been that of growing sickness in that industry. The RBI has compiled a list of non-SSI sick mills in different industries including textiles. According to the latest available data as on 31.3.1994 there are 384 sick units of which 10 are in Kerala. The main reasons for sickness in textile industry can be attributed to the structural transformation in the mill sector and competition faced from power loom. The other reasons could be excess capacity, lower productivity, lack of modernization and technical upgradation, increase in cost of inputs particularly in the key raw materials.
One of the major issues of Indian textile industry in the background of the proposed removal of quantitative restrictions by 2005 is the concern about export sector. If we look at the textile trade we will find that the growth rate is not comparable as that of China, Bangladesh and other Asian countries. Countries like Indonesia and Thailand have achieved remarkable progress recently in textile manufacturing and exports. Against this background India's position in global textile business is lagging noticeably. Its share in the world textile trade is just about 3 percent. Global slowdown has adversely affected the Indian economy as a whole. The export growth has reduced in 2000 and GDP growth also declined from 5.8 percent in 2000-01 to two to three percent in 2001-2002.34

At this juncture to achieve global competitiveness, India should make products globally competitive with the best quality at minimum price. Our emphasis should be on high productivity, quality consciousness, skill and aptitude of the workforce, research and development facility. In order to compete more efficiently at the global level, the industry has to expand the garment and apparel range, reduce the cost, increase quality and adopt latest method and technology to ensure product quality at the user satisfaction level. Moreover, an increasing number of consumers are translating their concern for wider environmental problems into changes in their purchasing behaviour. The increasing green consumerism, especially in developed countries has promoted their governments to bring in environment related guidelines.

that will regulate trade. The result is the realization of dire necessity of environment related eco-friendly textiles for increasing global competitiveness of the industry.35

3.2 ENVIRONMENTAL ISSUES-BASIC CAUSE OF ECO-FRIENDLY TEXTILES

The eco-system or environment has a rhythm and a movement of its own which depend upon a whole set of delicately balanced cycle. All living organisms - microbes, plants, animals and man-have survived by adjusting themselves to the environment and attuning their lives to its rhythm. It is therefore, absolutely necessary that these cycles should be maintained unimpaired - the state of affair thus maintained can be called environment - friendly or eco-friendly.26

It was in this context that United Nations environmental agencies organised the International Conferences on Human Environment from time to time with the specific motto “only one Earth” (Stockholm Conference 1972), “The World Environment 1972-82” (a report adopted at Nairobi Conference 1982), “our common future” (the Rio Summit 1992 at Rio de Janeiro).Kyota Summit in 1997 at Japan to set a framework for international action to mitigate global warming for the next 10 years, and the latest at Johannesburg in 2002, which is called World Summit on Sustainable Development.

Coming to the International trade and environment there have been issues of the modern industrial world at debate. Issues like conservation of wild life and biodiversity and health and safety standards have become quite important today. A clear environment will ensure quality of life and hence will result in greater productivity that will lead to greater international trade relations. In the case of textiles the eco-friendly aspect plays a significant role. The two major techniques suggested for maintaining the quality of textiles through eco-friendly concept are eco-labeling and eco-auditing.37

3.2.1 Eco-labelling

Environmental labels operate as informative and voluntary market instruments. Eco-labelling can accomplish several goals:

◆ Improving sales or image of a labelled product.

◆ Stimulating consumer awareness about the environmental impact on products.

◆ Directing manufactures for the environmental impact of their product.

◆ Improving the quality of environment and encouraging the sustainable management of resources.

Environmental labelling is now becoming popular all over the world. At least 15 countries including India have launched the eco-labelling scheme by government or by voluntary organisation. Eco-labelling system in India is purely voluntary scheme open to all manufacturers both domestic and foreign. The names of countries, name of programme and the respective year in which the scheme has been launched are given in the following table.

Table 3.1

Environmental labelling programmes of various countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of Programme</th>
<th>Year Started</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Blue angel</td>
<td>1977</td>
</tr>
<tr>
<td>Canada</td>
<td>Environmental choice programme</td>
<td>1988</td>
</tr>
<tr>
<td>Japan</td>
<td>Ecomark</td>
<td>1989</td>
</tr>
<tr>
<td>Nordic Countries</td>
<td>White swan</td>
<td>1989</td>
</tr>
<tr>
<td>United States</td>
<td>Green seal</td>
<td>1990</td>
</tr>
<tr>
<td>Sweden</td>
<td>Good environmental choice</td>
<td>1990</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Environmental choice</td>
<td>1990</td>
</tr>
<tr>
<td>India</td>
<td>Ecomark</td>
<td>1991</td>
</tr>
<tr>
<td>Austria</td>
<td>Austrian eco-label</td>
<td>1991</td>
</tr>
<tr>
<td>South</td>
<td>Korea Ecomark</td>
<td>1902</td>
</tr>
<tr>
<td>Singapore</td>
<td>Green Table</td>
<td>1992</td>
</tr>
<tr>
<td>France</td>
<td>NF-environment</td>
<td>1992</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Stitching milieukeur</td>
<td>1992</td>
</tr>
<tr>
<td>European Union</td>
<td>European flower</td>
<td>1992</td>
</tr>
<tr>
<td>Coratia</td>
<td>Environmentally friendly</td>
<td>1993</td>
</tr>
</tbody>
</table>

Source: Textile Magazine, January 2000
3.2.2 Eco-auditing

Eco-auditing is a systematic, documented, periodic and objective review of the facility, operation and practices related to products to meet the environmental requirements. It is the assessment of the textile unit with regard to the conformance with norms and criteria stipulated in respect of certain eco-parameters. The criteria and parameter covered by Eco-tex Consortium, Germany, one of the eco-labelling issuing authorities is given in the ensuing section.

3.2.3 Eco-criteria and parameter

The eco-tex consortium assesses all textiles and garments according to segments. These criteria may vary as a result of different requirements in certain parameter ranges. All information must be supported by records, documented and guaranteed. The eco-tex parameter and auditing system covers:

1. Sizing
2. Desizing
3. No carcinogenic dyestuffs
4. No allergenic dyestuffs
5. No chlorogenic dyestuffs
6. No flameproof finish
7. No biocide finish
8. Perspiration fastness
9. Water fastness
10. Saliva fastness
11. Heavy Metals
12. Formaldehyde levels
13. pH value
14. Use of pesticide
15. Recyclability and disposal

The maximum value of some eco-tex parameter differs according to the requirements of the product group concerned. The assessment covers parameter for the following:

Clothing : baby clothing, children’s clothing, underwear, sleepwear, shirts, blouses, stockings, sportswear, outwear and work clothing.

Home textiles : Bed linen, bathroom textiles, household textiles, curtains and decorative fabrics.

Accessories : According to the basic materials employed.

The eco-auditing performed on textile units can be classified into two categories. They are:
1. Product audit

2. Production audit

The various aspects covered under these two audits are listed below:

1. Product Audit

   (a) Assessment of conformance of the textile goods to the eco-parameters.
   (b) Use of the textile goods.
   (c) Pollution caused by their use.
   (d) Disposal and recyclability.

   During the course of product audit the textile unit must provide information regarding the use of fabrics, dyestuffs and textile auxiliaries along with safety data sheets obtained from the suppliers of these items. Further the textile unit has also to give a liability declaration on the information furnished by them during the course of audit.

2. Production Audit

   (a) Raw materials, dyestuffs and other textile auxiliaries used.
   (b) Energy
   (c) Water
   (d) Working condition
   (e) Pollution of air, water and soil.
The purpose of eco-audit is to establish a continuous chain of information right from raw material to the finished garment or textile product. This chain of information obtained from the response of the companies to the questionnaires will enable the auditing organisation to have an initial assessment of the products including the fibers, dyestuff and other textile auxiliaries used by the audited company. Subsequently weak point analysis of the products as well as processes are conducted on the basis of the audit findings and the necessary assistance and advice is provided for the production of ecologically optimized textiles.

If the eco-auditing conducted in the unit is not satisfactory then the product will be sent for a list of analysis to ensure its conformance with the criteria stipulated regarding the various eco-parameters. Eco-auditing will enable the unit to get eco-labels. Eco-labels are passports for exports particularly to European countries.

3.3 INTERNATIONAL SCENARIO

In the absence of quantitative restrictions after 2005, the non-tariff barriers (NTBs) which consist of a wide range of issues such as quality norms, environmental specifications, subsidies and social issues are going to determine the market access and share of textile products. Out of these, environmental issues are the most significant. Such environmental issues are broadly classified into two:
1. Product related

2. Process related

Process related environmental issues primarily revolve around the way goods are manufactured. In India regulatory framework governing the environmental compliances of textile manufacturing activities has been in place for the last many years. The MOEF and State Governments are responsible for the formulation and monitoring of such regulations. Despite the existence of such regulations the compliance level is not very satisfactory.

The product related environmental issues are basically the customer or user who purchases the textiles or clothing. The textile products purchased by him should not have any substance harmful to human health. With this concern as the primary focus, many standard stipulations, banning and limiting the presence of various harmful substances in textiles and clothing have emerged in the world.

3.3.1 International events

The environmental problems posed by textile products processed with azo dyes have alerted the western countries, which are now left with no alternative but to impose ban import or eco-regulation against such products. Germany was

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the first to react on the basis of some media reports of cases of skin allergy, cancer and other problems caused by the use of some textile items, which contain toxic and harmful dyes and chemicals.\textsuperscript{39}

The German ban came on 15.7.94 when an ordinance for second amendment to the German Commodity Goods Ordinance dated the 10th April 1992 was issued. According to that ordinance, from 1st Jan 1995 the azo dyes that could form any of the 20 listed prohibited amines through cleavage of one or more azo groups, were not to be used in the manufacture of the products, whose contact with the human body was intended to be not merely of a temporary nature. By a third ordinance dated 16.12.94 the German government postponed the deadline by six months and from 1st July 1995, no textile product containing banned azo dyes would be allowed for import in Germany. From 1st Jan 1996 designated products (including textile items) that have been dyed or printed with the banned dyes, would be prohibited for sale, marketing or distribution in Germany, even if those had been imported into Germany, before 01.07.1995. The violation of the regulation would be treated as a criminal offence and those who violate are liable to be prosecuted and punished for imprisonment. Any consignment containing the banned dyes may not only be rejected but may also pose a threat on India, being black listed for such supplies. They have listed eleven articles as are being affected by the ban. Among those articles three are from the field of

textiles. They are 1) Garments 2) Home textiles (especially bed clothes and towels) 3) Other clothings.\textsuperscript{40}

Although Germany alone has imposed this ban, it is expected that other European countries and developed countries might also follow it. Germany has imposed the eco-regulations due to the increasing awareness about present and future environmental problems and noticeable increase in the number of textile related allergies being reported etc.\textsuperscript{41}

**DYEING OF TEXTILES**

Marketing of fabrics depends on the design of the fabrics. Design may be done either by adopting weaving methods or by dyeing and printing the textiles. Until 1850 AD, all dye stuffs were natural in origin. They were either extracted from the roots, stems, stalks, folicies, barks, berries and seeds of various plants, or they were made from mineral substances. Some dyes were extracted from insects and sea shells. The vegetable dyes were mainly indigo - indigotin is its official name. It is the oldest known dye. Mummy clothes, 5000 years old have been found that were dyed with indigotin. Indigo was produced from the stem and foliage of an indigofera family of plants once grown abundantly in Assam, Bengal and North Bihar. Incidentally in the 19th century, when the momentum of Indian

\textsuperscript{40} Textiles Committee: Guidance for manufacture of Eco-friendly Textiles, P. 1.

independence movement intensified, the indigo cultivators actively participated in the agitation. Hence there was neglect and a subsequent decline in the indigo cultivation. By this time Germany had developed the synthetic blue colour and with this, indigo cultivation collapsed in India, thus putting an end to an age-old produce of India. Indigo is now prepared synthetically.

Some dyes cannot be applied in the bleached thread directly. In such cases mordants are being used. Mordants will act as an agent between the dye and the substrate.

The chief mordants are alum (potassium aluminium sulphate) and chrome (potassium dichromate) which effect a chemical union with the fabric and colouring matter.

Vat dyes produce a very fast colour. Vat dyes are basically water insoluble. By reaction with reducing agent (Sodium bisulphite) in an alkaline medium they are converted to water soluble colourless compounds, so called leuco-derivatives, which have an affinity for fabrics. The alkaline solution of the leuco-derivative is called vat solution. At one time reduction to the leuco-derivative was done in vats - hence the name vat dyes. They have a wide range of application. They are used for dyeing and printing on various types of fabrics, plastics etc. The material to be dyed is soaked in the vat solution and then exposed to the air, whereupon the original blue dye is regenerated in the fabric.
William Henry Perkin, an young English Chemical Scientist discovered synthetic dyes in 1856. While trying to produce synthetic quinine, he oxidised a specimen of commercial aniline and produced the first artificial dye - "aniline purple" or "mauve" or mauveine from coal tar, which dyed natural silk purple. The term aniline is derived from the Indian term "NEEL" meaning blue.

The impure aniline, extracted from coal tar has some toluidine mixed with it, which is essential for making dye. The substance called "Perkin's Mauveine" paved the way for a chain of new discoveries such as dye fuchsine or magenta in 1859, alzarin in 1869 followed by azo dyes.  

Textiles are dyed using a wide range of dye stuffs, techniques and equipment. Dyes used by the textile industry are largely synthetic and are derived from coal tar and petroleum based intermediaries. A variety of auxiliary chemicals are used during dyeing to assist in dye absorption and fixation into the fibers. Important factors in dye selection include type of fibre and machine, product end use application and customer demands and preferences. Historically, the environmental impact of dye selection, application and use has not been a major consideration. Until recently dyers had little access to information concerning the environmental impact of dyes, and even now the chemical composition of several dyes are unknown. However, more information on the environmental

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consequences of dyes has become available and dye manufacturers have substantially eliminated hazardous dyes from their product lines while actively searching for safer substitutes. Thus environmental friendly and customer need oriented dyes became more popular.43

Textile dyes may be classified in several ways; according to chemical constitution, application class and end use. The primary classification, of dyes is based on the fibers to which they can be applied and the chemical nature of each dye determines the fibers for which the dye has affinity. Table A.1 lists the major dye classes and types of fibers for which they have an affinity.

Table 3.2

Dye classes and fibers for which they have affinity

<table>
<thead>
<tr>
<th>Dye classes</th>
<th>Fibers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid</td>
<td>wool and nylon</td>
</tr>
<tr>
<td>Azoic (Naphthol)</td>
<td>cotton, rayon and cellulose</td>
</tr>
<tr>
<td>Basic</td>
<td>Acrylic, some polyesters</td>
</tr>
<tr>
<td>Direct</td>
<td>Cotton, wool and other cellulosic</td>
</tr>
<tr>
<td>Food dyes</td>
<td>Not used in textiles</td>
</tr>
<tr>
<td>Optical brightners</td>
<td>Various fibers</td>
</tr>
<tr>
<td>(Fluorescent)</td>
<td>All requires binders just like painting</td>
</tr>
<tr>
<td>Pigment</td>
<td>Synthetic, rarely used in industries</td>
</tr>
<tr>
<td>Solvent</td>
<td>Cotton and other cellulose</td>
</tr>
<tr>
<td>Sulphur</td>
<td>Cotton and other cellulose</td>
</tr>
<tr>
<td>Vat</td>
<td>Cotton and other cellulose</td>
</tr>
</tbody>
</table>


Azo dyes

The molecule of an azo dye contains one or more azo (-N = N) groups. Azo dyes containing one azo group are called mono azo dyes, those containing two azo groups - diazo dye, three groups - triazo dyes, more than three - polyazo dyes. Chemical formulae of some simple azo dyes are shown below.
Azoic dyes are water insoluble which are formed on the fiber and applied to the fabric in a two stage process. The reaction of the two chemically reactive compounds in the fiber produce the coloured azo chromophore. During dyeing, the azoic dye forms inside the fibers.

The colour index (CI) refers to the components used in azoic dyeing as C1 Azoic coupling components and C1 Azoic diazo components. The coupling components are mostly derived from β - naphthol and are available in powder or liquid form, while the azoic components are available as free base (fast colour bases) and diazonium salts (fast colour salts). The depth of shade is determined by the extent to which the coupling component is absorbed when the diazo component is applied to the fiber. Azoic dyes produce bright and dark shades of yellow, orange, red, maroon, navy blue, brown and black. The use of azoic dyes declined over the years and it is almost stopped because of the possible presence of carcinogenic naphthylamines in the effluent. Further some skin allergy cases have been reported from some Germans who have used the fabrics processed with azo dyes.
It is in this context that Germany has imposed ban on azo dyes in textile processing.

The topic of eco-friendly textiles has assumed a great urgency with the ban of the use of azo dyes in textile. The azo dyes are capable of releasing certain amines which are dangerous to human health. Those amines are categorically listed below.\(^\text{44}\)

**Definitely carcinogenic in nature:**

1. Benzidine
2. 4-Chloro-o-toluidine
3. 2-Napthylamine
4. 4-Aminodiphenyl

**Reasonably suspected to be carcinogenic**

1. 3, 3' - *Dimethly benzidine*
2. 3, 3' - Dimethoxy Benzidine
3. p - Chloroaniline
4. o - Toluidine
5. 3, 3' - Dichlorobenzidine

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\(^{44}\) Colourage, October 1995, P. 17.
6. o - Aminoazotoluene
7. 2 - Amino-4 nitrotoluene
8. 4 - Methyl-1, 3-Phenylenediamine

Other prohibited amines

1. 4 - Methoxy-m-phenylenediamine
2. 4, 4' - Diaminodiphenylmethane
3. 3, 3' - Dimethyl 4, 4' diaminodiphenylmethane
4. 2 - Methoxy-5-methylaniline
5. 4, 4' - Methylene-bis-(2-chloroaniline)
6. 4, 4' - Oxydianiline
7. 2,4,5 - Trimethylaniline
8. 4,4' - Thiodianiline

Source: Eco-Tex Consortium, Germany

It is in this context that Germany has imposed ban on textiles manufactured by using these 20 dyes.

3.4 NATIONAL SCENARIO

In the light of the changing global business environment, it is important to understand the nature of market, restrictions and regulations, global competition, customer tastes and fashion trends. Survival and progress largely depends on the capacity to adopt modern methods to match the demands and adjust
to the changing times. Our exporters have also felt that new issues like eco-friendliness can easily negate the gains secured through the lower trade barriers. A study conducted by Apparel Export Promotion Council (AEPC) of India in 1997 found out that the environmental standards in USA and other European Countries will ultimately affect all stages of textile production in our country. The World Bank has conducted a study in 1995 on India and has estimated that the cost of environmental changes can be conservatively estimated at Rs. 340 million annually. The study pointed out that the damage will surely reflect on the cost of industrial products in the future. Among the industries that are identified as pollutants textiles and garments is also included. 45

Unless, India gears up to changing trends with customer-oriented market services to deliver better quality products, it cannot survive in the global market. 46 If the textile industry of India does not take up the challenges posed by the position of these eco-regulations, our textile exports to developed countries will gradually taper off and consequently the government will be deprived of the much-needed foreign exchange. According to the sources of Indian Institute of Foreign Trade (IIFT) cases involving India are mainly concerned with pollution caused by export based like agro based and marine products, leather, dyes, intermediaries, pharmaceuticals and textiles. 47

47 The observer of Business and Politics, 30 March 1999.
3.4.1 Measures taken at national level

The eco-labeling criteria for textiles GSR (General Standard Rules) 457 (e) dated 4th October 1996 stipulate one of its criteria in its clause (VII) as under: The 20 dyes prohibited for handling in India as given in Annex C of GSR shall not be used. Moreover, in line with the eco-labelling, the scheme “ECOMARK” is launched by the Ministry of Environment and Forest for the Government and being administered by the Bureau of Indian Standards (BIS) for products covered by its scope of work under the BIS Act 1986. The standard mark of BIS under “ECOMARK” scheme would be a combination of ISI mark and ‘ECO’ logo. An earthen pot has been chosen as the logo for Ecomark. The ecomark steering committee has identified a number of consumer goods product to label the ECOMARK including textiles.

As regards eco-auditing if it is found to be unsatisfactory then it is necessary to test the textile goods manufactured whether they are contaminated with any toxic substances and if so to find out the type and extent of contamination. The details of equipment used and the process of analysis are shown in the table VIII of the handbook issued by Textile Committee.48

The Ministry of Textiles, Government of India, has released National Textile Policy 2000 (NTnP - 2000) with the vision of developing a strong and

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vibrant industry that will produce good quality cloth, at competitive price, contribute to sustainable employment and economic growth of the nation and also compete in global market. The new Textile Policy is to be seen in the background of fast changing international scenario in the post GATT and post MFA. The policy documents specially mentions the need for review and revitalisation of Textiles Research Associations (TRAs) and Textile Committee.49

3.4.2 Textiles Research Associations (TRAs)

TRAs are co-operative research association of firms engaged in textile industry. India has adopted this model of association from Germany. Totally seven TRAs were set up in different years after independence under the joint patronage of industry association and the State and Central Governments. In 1980 the TRAs were brought under the Ministry of Commerce and Civil Supplies. In 1986-87 when the Ministry of Textiles was created as a separate Ministry all the TRAs started functioning under the Ministry of Textiles (MOT). The following are the seven TRAs now functioning throughout the country.

1. Bombay Textiles Research Association (BTRA)

2. Wool Research Association (WRA)

3. Ahmedabad Textile Industry Research Association (ATIRA)
4. North India Textile Industry Research Association (NITRA)
5. Silk and Artsilk Manufacturing Industry Research - Association (SASMIRA)
6. Manmade Textile Research Association (MANTRA)
7. South India Textiles Research Association (SITRA)\textsuperscript{50}

The TRAs were formed mainly to perform functions like R & D at the higher end of the technology and also for certain services like testing, calibration and certification including eco-testing.

3.4.3 Textiles committee

The Textiles Committee set up under the Textiles Act 1963 is an autonomous statutory body under the administrative control of the Ministry of Textiles, for promotion of quality in Indian textiles industry and trade. The Committee is India’s largest public sector testing, research and evaluation centre with 18 laboratories and 12 collection centres covering all the major textile clusters of the country. The Committee is equipped with state of art precision and calibrated equipments traceable to international and national standards for testing physical, chemical and ecological parameters of textiles dyes and chemicals. The committee provides bench marking and continuous improvement

through accreditation of laboratories as per ISO 17025 marking at par with any international testing service provider. Labs at Bangalore, Kannur, Chennai, Coimbatore, Delhi, Karur, Mumbai, Tirupur are National Accreditation Board for Testing and Calibration Laboratories (NABL). Labs are set up at Delhi and Ludhiana for awarding WOOLMARK under International Wool Secretariate (IWS). According to Mutual Recognition Agreement (MRA) testing carried out by these accredited labs as per ISO 17025 are acceptable in 28 countries all over the world.

The committee has also brought out publications on guidance for manufacturing eco-friendly textiles and related topics and taken the responsibility and initiative of creating awareness among the trade and industry and has conducted a series of seminars and workshops all over the country. The committee provides infrastructure for eco-parameters from raw materials to finished product to ensure the production of eco-friendly textiles. 51

3.4.4 Eco-prescription for Indian Textile industry

Scientists have recently found out that a number of dyestuffs and chemicals used in the industry contain hazardous and toxic substances, which cause irreparable damage to ecology and mankind. So Germany and other European countries are now imposing eco-regulation to ensure that the textile items imported by them are safe and eco-friendly.

51 Brochure issued by Textile Committee: Mumbai dated May 2002.
Chemicals are very essential without which dye is not possible. At present around 8000 chemicals are used in the manufacture of various textile goods. Chemicals are used for imparting some special characteristics like flame retardancy, water repellency, and wash and wear. Consumer requirement cannot be fulfilled without the use of some chemicals. Hence a policy of “Less is More” should be adopted by textile units with regard to the use of chemicals. Indiscriminate use of chemicals should be stopped. It is for this reason that chemically treated textile items are referred to as “ecologically optimised textiles” instead of “eco-friendly textiles.”

As part of eco-prescription for Indian textile industry, the committee has published a list of toxic and harmful substances used at present by the industry. The details of which are given in table 3.3.

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Table 3.3

List of toxic and harmful substances used in textile industry

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Textile Process</th>
<th>Toxic Substance Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cotton growing</td>
<td>Banned pesticides such as DDT, Dieldrin and Aldrin</td>
</tr>
<tr>
<td>2.</td>
<td>Sizing</td>
<td>Pentachlorophenol as a preservative</td>
</tr>
<tr>
<td>3.</td>
<td>Scouring</td>
<td>Chlorinated products</td>
</tr>
<tr>
<td>4.</td>
<td>Bleaching</td>
<td>Hypochlorite (chlorine bleaching)</td>
</tr>
<tr>
<td>5.</td>
<td>Dyeing &amp; Printing</td>
<td>i) Azo-dyes containing aromatic amines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Dyes containing traces of heavy metals such as Arsenic, Lead, Cadmium, mercury, Nickel, Copper, Chromium, Cobalt and Zinc.</td>
</tr>
<tr>
<td>6.</td>
<td>Finishing</td>
<td>iii) Formaldehyde as a mordant. Formaldehyde as a cross linking finish, urea formaldehyde as F.R. finish</td>
</tr>
<tr>
<td>7.</td>
<td>Garment manufacture</td>
<td>Stain removers containing chlorinated products.</td>
</tr>
<tr>
<td>8.</td>
<td>Packaging</td>
<td>Wooden boxes treated with insecticides.</td>
</tr>
</tbody>
</table>

Source: Textile Committee, Seminar on Eco-friendly Textiles: Challenges to the Textile Industry

In addition to this, a negative list is brought out by Indo German Export Promotion Project (IGEP) and AEPC in collaboration with Technological Institute of Textiles and Science in Bhiwani, which lists the dyestuff to be immediately avoided by the industry. In this regard “Red Listed” chemicals used by the industry have been identified and given in Table 3.4.
Table 3.4

Red listed chemicals

<table>
<thead>
<tr>
<th>Mercury and its compounds</th>
<th>Dichlovovos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium and its compounds</td>
<td>1, 2 - Dichloroethane</td>
</tr>
<tr>
<td>Hexachlorocyclohexane (all isomers)</td>
<td>Trichlorobenzene</td>
</tr>
<tr>
<td>DDT (All isomers)</td>
<td>Altrazine</td>
</tr>
<tr>
<td>Pentachlorophenol (PCP) and its derivatives</td>
<td>Simazine</td>
</tr>
<tr>
<td>Hexachlorobenzene</td>
<td>Tributyltin Compounds</td>
</tr>
<tr>
<td>Hexachlorobutadiene</td>
<td>Fenithrothion</td>
</tr>
<tr>
<td>Aldrin, Dieldrin</td>
<td>Aziphosmethyl</td>
</tr>
<tr>
<td>Endrin, Polychlorinated Biphenyls</td>
<td>Malathion, Endosulfan</td>
</tr>
</tbody>
</table>

Source: Textile Committee, Seminar on Eco-friendly Textiles: Challenges to the Textile Industry

Further, a list of chemicals, which are being phased out from textile processing and some, suggested alternatives in the textile processing are given in Table 3.5 and 3.6 respectively.53

### Table 3.5

**Chemicals being phased out from textile processing**

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Chemicals</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Benzidine</td>
<td>Dye Intermediate</td>
</tr>
<tr>
<td>2.</td>
<td>Bensoprine</td>
<td>-do-</td>
</tr>
<tr>
<td>3.</td>
<td>Hexachloropentadiene</td>
<td>-do-</td>
</tr>
<tr>
<td>4.</td>
<td>Chloro aniline</td>
<td>-do-</td>
</tr>
<tr>
<td>5.</td>
<td>Dichloro aniline</td>
<td>-do-</td>
</tr>
<tr>
<td>6.</td>
<td>Thiram</td>
<td>Bacteriostatic/Insecticide</td>
</tr>
<tr>
<td>7.</td>
<td>Trichloro phenoxy acetic acid</td>
<td>-do-</td>
</tr>
<tr>
<td>8.</td>
<td>Toxaphane</td>
<td>-do-</td>
</tr>
<tr>
<td>9.</td>
<td>Dibutyl phthalate</td>
<td>Plasticiser</td>
</tr>
<tr>
<td>10.</td>
<td>Tributyl phosphate</td>
<td>-do-</td>
</tr>
<tr>
<td>11.</td>
<td>Chlorinated paraffins</td>
<td>-do-</td>
</tr>
<tr>
<td>12.</td>
<td>Octachlorostyrene</td>
<td>Flame Retardant</td>
</tr>
<tr>
<td>13.</td>
<td>Polychlorinated Terphenyls</td>
<td>-do-</td>
</tr>
<tr>
<td>14.</td>
<td>Tetrachloro dibenzo-p-dioxin</td>
<td>Flame Retardant</td>
</tr>
<tr>
<td>15.</td>
<td>Nonylphenol ethoxylates</td>
<td>Surfactant in processing</td>
</tr>
<tr>
<td>16.</td>
<td>Arsenic Compounds</td>
<td>Miscellaneous uses</td>
</tr>
<tr>
<td>17.</td>
<td>Fluorides</td>
<td>-do-</td>
</tr>
<tr>
<td>18.</td>
<td>Decabromo diphenyl ether</td>
<td>Flame retardant</td>
</tr>
<tr>
<td>19.</td>
<td>Dichloro toluene</td>
<td>Carrier</td>
</tr>
<tr>
<td>20.</td>
<td>Trichloro benzene</td>
<td>Carrier</td>
</tr>
</tbody>
</table>

Source: Textile Committee, Seminar on Eco-friendly Textiles: Challenges to the Textile Industry
Table 3.6

Some of the suggested alternatives in the textile processing

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Chemical used at Present</th>
<th>Suggested alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Chlorine bleaching</td>
<td>Peroxide bleaching</td>
</tr>
<tr>
<td>2.</td>
<td>Benzidine based dyestuffs</td>
<td>Mineral/pigment dyes</td>
</tr>
<tr>
<td>3.</td>
<td>Acetic acid</td>
<td>Formic acid</td>
</tr>
<tr>
<td>4.</td>
<td>Starch based warp sizes</td>
<td>synthetic ones like PVA and acrylates</td>
</tr>
<tr>
<td>5.</td>
<td>Kerosene in pigment printing</td>
<td>synthetic thickness based on poly-carboxylic acids</td>
</tr>
<tr>
<td>6.</td>
<td>P/C two stage dyeing</td>
<td>single class dyes like Indigosol, pigments</td>
</tr>
<tr>
<td>7.</td>
<td>Carding oils and anti static lubricants</td>
<td>Non-ionic emulsifiers</td>
</tr>
<tr>
<td>8.</td>
<td>Formaldehyde</td>
<td>Poly carboxylic acid method</td>
</tr>
<tr>
<td>9.</td>
<td>Pentachlorophenol</td>
<td>Benzothiazol</td>
</tr>
<tr>
<td>10.</td>
<td>Alkylphenol ethoxylate</td>
<td>Fatty alcohol ethoxylates</td>
</tr>
<tr>
<td>11.</td>
<td>Sodium sulphide</td>
<td>Glucose based reducing agent</td>
</tr>
</tbody>
</table>

Source: Textile Committee, Seminar on Eco-friendly Textiles: Challenges to the Textile Industry

3.4.5 Action by Government of India against azo dyes

The Union Government has slapped a ban on the use of certain azo dyes. Over 70 banned azo dyes are specified in the schedule appended to the recent
notification. These dyes are considered to be detrimental to human health and are carcinogenic nature. The ban, which came into force on May 23rd 1997, includes all substances and articles containing these dyes. The Government had earlier considered the views of the public and trade associations before slapping the ban. The ban is imposed under clause (D) of sub section 2 section 6 of the Environment Protection Act 1986.54

Action has also been taken by other organisations like Textiles Committee, TRAs, and Indo German Export Promotion Council (AEPC) etc. A brief description of such actions are listed below:

1) To organise workshops at every nook and corner of India for disseminating the information on the use of toxic substances by the industry.

2) To bring out brochures in English as well as in vernacular languages for educating the industry including the small-scale sector.

3) To examine the list of chemicals used by the industry and to isolate the toxic and harmful ones.

4) To find suitable alternatives for these toxic and harmful substances being used by the industry.

5) To prevent the textile industry in India from using these toxic materials. Accordingly, to amend the textile control order and notify in the Gazette.

6) To conduct eco-auditing of textile units in order to assess their eco-status.

7) To provide the much needed testing facilities at all the Regional offices of Textiles Committee all over India for testing eco-parameters of various textile items.\textsuperscript{55}

The Textiles Committee has its own publication division and has issued books and brochures on eco-friendly textiles for helping the manufacturers for complying with the ban announced by Germany and for producing eco-friendly textiles. The brochure on Do’s and Don’t’s for the manufacture of eco-friendly textiles (see Appendix II) throws light on all aspects to follow a “cradle to grave” approach for the manufacturers of textile.\textsuperscript{56}

Considering all these, serious thinking has taken place for the overall promotion of this sector. This is reflected in the thrust given in the 10\textsuperscript{th} five year plan also. On the basis of the recommendations made by the Sathyam Committee (1998), the National textile Policy 2000 was announced by the Government in November 2000, which provides the broad policy framework for direction of growth and development of the Indian textile industry and trade. NTP 2000 and X\textsuperscript{th} plan give due importance to the need for eco-friendly aspects in textiles.\textsuperscript{57}

\textsuperscript{55} Textile Committee: Seminar on Eco-friendly Textiles: Challenges to the Textiles Industry, Bombay, P. 3.

3.4 CONCLUSION

Indian textile processors have realised that environmental issues are going to dominate and it is no longer possible to neglect them. Rising environmental consciousness in Germany has forced Indian textile producers to focus their attention on ecological standards if they want to maintain and diversify their export markets. At present only product related standards and the prohibition of certain substances such as formaldehyde or azoics have been taken into account. But in future "clean processing" could become an additional requirement for exporters.

Consumer awareness in the matters of environmental and health problems has a direct bearing on textiles and clothing. Buyers are more informed about the pollutants in close-to-skin textiles like bed sheets and under garments. New information concerning allergy and cancer causing chemicals in materials force the consumers and manufacturers to react.

To maintain its position in the international textile market Indian Government and industry together have taken a serious note of the situation and developed eco-strategy with stress on:

1) Awareness and eco-information programmes.
2) Eco-mark scheme through BIS
3) Development of necessary eco-related testing facilities.

Life cycle analysis of the product involving “Cradle to Grave” approach, made by some developed countries, is being closely observed for necessary adoption of important findings. It has been realised that traditional industries such as textiles have had to change their working culture from the days when natural resources were readily available and when effluents and disposal of waste were no issue. Consumer awareness regarding environmental issues is increasingly focusing the attention of management to take necessary steps.

There is a definite market for textiles, which can be exploited through marketing eco-friendly, clean processing product. For such fabrics and garments enlightened consumer is ready to pay a reasonably higher price. Chemical treatment giving due consideration to ecological problems will also ensure lower air and water pollution. The need is for commitment by management, technologists, marketing personnel, research scientists and manufacturers of textile dyes and chemicals to co-operate and take effective steps towards the goal. A concerted and sustained sincere effort by all concerned will be necessary to create an image in the world that Indian textiles are not only economical but also have quality assurance with due environmental precautions. In this context the study attempts to evaluate the textile mills in Kerala in the light of the implementation of eco-friendly aspects. The following chapters focus on the issues.

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Analysis

PART - I