

ECO-FRIENDLY PROCESSING OF TEXTILES

Ms. ALPANA SHAH

ASSOCIATE PROFESSOR

TEXTILES AND CLOTHING

S.M.PATEL COLLEGE OF HOME SCIENCE

VALLABH VIDYANAGAR

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DEFINITION AND MEANING

Eco-friendly fabrics or textiles are generally defined as fabrics that have been made with a minimum use of chemicals and pesticides, best land management practices, sustainable farming and animal friendly practices; they follow fair trade practices, and have been eco-friendly certified.

The main aim of eco-friendly textile processing is to minimize global warming and waste disposal at the stages of growing the fiber, yarn fabrication, fabric manufacture, wet processing and manufacture of garment, its distribution and transportation to stores and customers, its use by consumers and finally the disposal of the product.

Eco friendly textiles are produced on four principles:

1. Reduction
2. Reuse
3. Recycle
4. Recover

- **ECO-FACTORS**

With respect to clothing textiles, the phrase 'ecology' can be classified into three groups:

1) Production ecology, which includes: .Cultivation and harvesting of natural synthetic fibers. . Production of regenerated and synthetic fibers.. Production of yarns, twisted threads and fabrics. Garment production by using fertilizers, growth regulators, crop protection agents like pesticides and a range of textile chemicals, auxiliaries and finishing agents.

2) User Ecology, which is related to the clothing textiles and the substances that give them beauty and performance characteristics during application.

3) Disposal Ecology, which refers to the disposal of textiles after application i.e., to-[recycling](#) composting, dumping or incinerating in a manner that ascertains the least probable environment effect.

The related factors for eco-standards are: Formaldehyde, pesticide, carcinogenic dyestuff, skin neutrality, heavy metal content, -pH, fastness to perspiration.

PROCESS SEQUENCE FOR PRODUCTION OF ECO-FRIENDLY FABRICS:

Following are the stages to produce eco friendly textiles:

I. Fiber stage

II. Yarn fabrication and fabric manufacture

III. Textile processing

IV. Garment manufacturing

V. Transportation and disposal

VI. Use and disposal

I. RAW MATERIALS

ECO-FRIENDLY FIBERS

- *Substitute cotton for other natural materials like Hemp, Soy Silk, Bamboo Fabrics, Jute, Corn fiber(they are available in a cheaper rate) etc. are considered as eco-friendly fabrics due to their availability from nature without any harmful effects of chemical or toxics. Moreover, as compared to other synthetic fibers.*
- *Organic Cotton, is produced without use of synthetic chemical pesticides, fertilisers and genetically modified organisms. Organic manure and plant based pest management products such as neem or garlic extracts are used.*
- *Cellulose based fibers like viscose can be used. Tencel is a natural, man-made fiber. It has many of the qualities of synthetics, but is made of natural cellulose found in wood pulp making it fully biodegradable. The pulp used to produce Tencel is grown in tree farms, and the closed-loop production process recovers a solvent used in the spinning process and is able to re-use 99% of it. The process also uses no chlorine for bleaching, making the entire process relatively environmentally friendly.*
- *Synthetic fabrics, such as polyesters are easy care and more durable alternative to natural fabrics.*

II. YARN FABRICATION AND FABRIC MANUFACTURE

Spinning

In the spinning process, individual fibres float in the air and thus pollute the atmosphere in the spinning department. Such floating fibres are dangerous to human beings who inhale it. To minimize the effect of these floating fibres or impurities, the humidified air which is scattered in the spinning department is filtered so as to remove these floating impurities from the air.

Sizing

In the sizing function, starch is used in sticky paste form to the yarn to enhance its strength and abrasion resistance. The starch paste consists of preservatives in order to protect it from the attack of microorganisms. Some preservatives like pentachlorophenol, which are obtained from phenolic and/or chlorinated compound, possess a toxic effect on human skin. Hence, such preservatives should be avoided. Utilizing a synthetic starch decreases the use of such preservatives, thereby decreasing the health hazards likely to occur because of phenolic and/or chlorinated preservative.

Loom shed

There are two types of pollutants created by the loom shed, namely floating particles like fibrous substances and size particles and noise pollutions. If proper measures are not taken during the weaving operations, oil stains are formed. Before textile chemical processing, these oil stains are removed in subsequent gray folding department by applying stain remover. Hence, measures are taken to lessen oil stains in the cloth and probably the application of carbon tetra chloride based products should be avoided in stain remover and other textile products.

III. TEXTILE PROCESSING

-Use of chemicals like potassium dichromate, sodium hypochlorite or peroxide and sodium hypochlorite in the preparation process of desizing, scouring and bleaching with their related wash-off stages, produces heavy Biological Oxygen Demands (BOD) in the effluents. Chlorine is not used in bleaching because it creates halogenated organic substances, of which some are suspected to be carcinogenic, e.g., chloroform.

- For decreasing BOD, it is recommended to choose the size recipes offering a low COD (Chemical Oxygen Demand) and BOD value. A change from pure starch to synthetic starch decreases BOD because of starches by approximately 90 per cent.

-Wool industry uses chlorine based compounds for anti-shrinking dealing, and such practice also generates toxic effluent. For removing rust stains in bleaching, before bleaching the cloth is treated with oxalic acid. The oxalic acid is lethal to aquatic organisms and it increases COD and BOD to a significant level.

-Peroxide bleaching requires a stabilizer to ensure identical and monitored bleaching during the bleaching operation. Optional stabilizers such as Aminio Tri Methylene Phosphoric Acid (ATMP), Hydroxy Ethylidene Disphosphonic Acid (HEDA), Diethylene Triaminc Penta Methylene Phosphoric Acid (DTPMP) and Ethylene Diamine Tetra Methylene Phosphoric Acid (EDTMP) are also being suggested as peroxide stabilizers.

- **Dyeing**

German legislation consumer goods ordinance states that, "No articles of dresses (textiles, shoes, leather) and bed linen can be put in trade, if they have been colored with azo dyes that can release one of the twenty named amines". Currently the list has been extended to 24 amines. The prohibition includes a variety of other commodity goods like leather components for furniture, seat covers, etc. The prohibited amines have been categorized as amines of the MAK Group-III A 1 and III A 2.

- **MAK Group III A1:** (workplace exposure):

Carcinogenic amines: Benzidine, 4-chloro-o-toluidine, 2-naphtylamine and 4-aminodiphenyl.

- **MAK Group III A 2:**

These materials are tested only on animals and they have been proved carcinogenic. A variety of amines in these types are: a-toluidine, o-dianisidine, o-tolidine, o-aminoazotoluene, p-chroanneline, 3, 3' dichlorobenzidine, 2-amino-4-nitrotoluene and 2, 4-toluylene-diamine. This group also includes materials that may perhaps produce health hazards.

- Some dyes form carcinogenic amines on reduction in dyeing and hence they require to be strictly evaded as per stipulation in a number of countries, considerably for increase of BOD/COD and hence, these dyes also need to be avoided for use in dyeing. Most of the known producers have stopped making and marketing dyes creating carcinogenic amines.

- High fastness direct dyes should be chosen in such a way that applying copper or chromium salts in their dyeing is avoided. Cationic dye fixing agents utilized for direct dyes and reactive dyes should have low formaldehyde content and low BOD. During reactive dyes the use of urea needs to be lessened. Instead of extremely contaminated sodium sulphide other agents such as hydrol or hydroxyl acetone should be used while dyeing with sulphur dyes.
- In polyester dyeing, the carriers and leveling agents utilized should not be supported with chlorinated or phenolic composites. Carriers supported with chlorobenzene are highly toxic and more or less carcinogenic. The leveling agents that contain chlorobenzene as well as per chloroethylene or trichloroethylene are carcinogenic compounds, and therefore they should be avoided.
- With regards to the direct, vat, sulphur and reactive dyes, dyeing processes need huge amount of salt to achieve good exhaustion of dye-bath. This leads to an increase in the dissolved salts in effluent water. Therefore, new dyes are being made, which would need less salt dilution for achieving dye fixation.

Printing

As in the case of dyeing, in printing too, colors chosen should be non-toxic and not based on forbidden amines. Dyes with high fixation properties and modified printing process requiring fewer washouts are recommended to be applied in printing. Use of kerosene in pigment printing has been significantly decreased, but it should be totally removed.

The use of urea has also been lessened by substituting it with other ingredients and modifying the printing methods. Citric acid in disperse prints should be substituted by optional chemicals. For nylon fabric printing phenol is utilized to a considerable extent, therefore it is suitable to replace it by diethylene glycol. Application of formaldehyde based on fixers for enhancing fastness of pigment prints should be limited so as to decrease free formaldehyde in final fabric.

- **Finishing**

Chemical formaldehyde based cross-linking agents applied to cellulosic textiles for crease resistance and dimensional stability are the most toxic chemicals. Free formaldehyde may be discharged from resin-finished fabrics either because of un-responded formaldehyde in the product in cross-linking or while storage of the finished fabrics. Many countries set various tolerance limits for free formaldehyde according to the end use of the treated fabrics or garments. Presence of formaldehyde in the atmosphere and in waste-water is regarded as highly toxic and to overcome this trouble, formaldehyde scavengers (chemicals which neutralise toxic effects of formaldehyde) are to be used.

Among the various procedures, finishing presumes significant importance because the value addition is understood by functional finishing of cotton in fabric or garment form to reveal advantageous properties. Some of the most important finishes are easy care, durable press, wrinkle-free finishes, softening and enzyme/ bio-finishing.

IV. GARMENT MANUFACTURING

- Maintaining the ready data bank based on design forecast containing components of design.
- Appointing supervisors in various countries to check the problems.
- Instead of synthetic trims, prefer biodegradable trims like pearl, wood, shell, leather etc. Avoid using plastic and metal buttons, rivets and snaps of brass, stainless steel.
- Avoid use of fusible interfacings which contain solvent based adhesives as formaldehydes.
- Avoid use of metal buttons and zippers made up of chrome, cadmium, lead, nickel or such heavy metals.
- Do not use solvent based dye formulations for transfer printing technique.
- Instead of individual polyethylene bags for storage, use large baler bags.
- CAD and CAM system can be used to gain optimum fabric utilization.
- Follow efficient sewing methods like correct needle size, stitch length, machine type and threads will reduce waste generation.
- Installation of LED lights at the needle points.
- Use of motorized sewing machine with 'Energy star marks' will lower consumption of electricity.
- Regulation maintenance, lubrication and upkeep of machines and other equipments.

Eco-labelling

- **OEKO- TEX Standard 100:**

The OEKO-TEX standards have described a variety of norms and limit values for different classes. They can be described as follows:

1. **Product class I:** Defined for babies and infants up to two years of age.
2. **Product class II:** This class is defined for textiles that come into direct contact with the skin and cover a large part of its surface, during usage.
3. **Product class III:** The class includes textiles which do not come into direct contact with the skin or cover only a small part of its surface during application.
4. **Product class IV:** This class covers furnishing materials which are used for decorative purposes.

- **Trademarks for textile tested harmful substances:**

1. **MUT:** This is a trademark for textiles that are made by environmentally sound protection methods (VVUT). It needs acquiescence of certain rules in their manufacture.
2. **GUT:** This eco-label was established by well-known companies in European carpet industry. It is an association for environmentally friendly carpets with an objective of maximizing textile floor-coverings and their protection cycle.
3. **GuW:** It is a seal of Eco-friendly Furnishing Fabric Association.
4. **CLEAN FASHION:** It is an Eco-label introduced by private companies related to textiles.
5. **STEILMANN:** This is an Eco-label of the most prominent German Textile Company.
6. **GREEN COTTON:** A label based on an internal evaluation system that considers social, ecological and toxicological values.
7. **ECO MARK:** This is an Indian eco-label.

V. TRANSPORTATION AND DISTRIBUTION

- Use the bus or train rather than car for transportation and travel purpose.
- Consider cleaner fuel like ethanol
- Cut back number of visits, wherever possible use technology like audio conferencing, web conferencing or video conferencing instead of meeting in person.

VI. USE AND DISPOSAL

- Recycle as much as possible. Make use of old fabrics for wipes, quilt making, applique work etc.
- Cellulosic waste can be recycled to make hand made papers.

THANK YOU