BioGecko Vol 12 Issue 01 2023

ISSN NO: 2230-5807

"ARTICLE ON ORGANIC YARN PREPARATION , WEAVING ORGANIC FABRIC AND ENZYMATIC DESIZING PROCESS"

[1].V.S.Karpagavalli M.Sc.,M.Phil.,(Ph.D) Research Scholar, Dept of Textiles and Apparel Design, Bharathiar University, Coimbatore
[2].Dr.M.Sumithra, Asst.professor, Dept of Textiles and Apparel Design, Bharathiar University, Coimbatore.

1.ABSTRACT:

Organic commodities can be seen as eco products that prioritize bettering one's health and one's quality of life. The term "organic apparel" refers to environmentally friendly products that can reduce pollution, safeguard the environment, and preserve ecological harmony throughout the entire manufacturing, utilizing, and recycling raw materials. The interest in organic textiles is rising as a result of increased environmental awareness among the world's population.The organic textile market in developing countries prioritised exports of its goods instead of the regional or global market. This article will give a clear picture on organic yarn preparation, weaving method to produce organic fabric and enzymatic Desizing process for warp yarns.

Keywords : Organic yarns, preparation of yarn, weaving, Desizing, Enzymatic desizing.

2. INTRODUCTION

Environmental issues have drawn more academic, political, and industrial attention as a result of escalating resource shortages, environmental pollution, as well as ecological degradation. Environmental protection has emerged as a critical issue that should not be ignored or disregarded in the development of a nation's or a region's economic growth. Older generations lived in nature's balance and closely guarded their environment; today, unfortunately, overuse of environmental assets has dramatically increased environmental pollution. Approximately 11% of industrial production, 14% of manufacturing, 4% of GDP, and 12% of total export revenue in India is contributed by the textile industry [Ferrigno et.al, 2017].

To accommodate the rising demand for fast fashion, the textile and apparel sectors are expanding quickly. The ecosystem is harmed by environmental pollution caused by the production of natural fibres based on agriculture or synthetic fibres from laboratories. For instance, cotton requires a significant amount of water as well as insecticides to thrive. Cotton currently ranks third in US [U.S. Department of Agriculture, 2019] and fourth globally in terms of pesticide usage when compared to all other crops. Additionally, it is estimated that 8000 different chemicals, including various dyes and auxiliary materials, are needed during the production of cotton apparel [Rajan, K. et.al, 2021].

India, one of the world's 17 mega diverse countries, has great prospects for commercial production of natural dyes. Using plants and their derivatives to treat skin diseases, burns, and wounds is made easier by traditional knowledge. Every day, the world changes, and so does the way we shop for clothing. Our awareness of the environment is growing. This has been the reason for the increase in popularity of organic fibres. Making sustainable clothing with various organic textile fibres is a focus for many fashion companies. The nature of the fibre is influenced by a variety of things.

Herbal textiles are clothes that have been finished or coloured using various medicinal herb extracts. Particularly in urban India, textiles and apparel infused with therapeutic herbs are growing in popularity. Utilizing such goods, protects the users from a variety of biological poisons and infections. Due to the growing trend in the enhancement of beauty, customers are demanding new technology that offer greater aesthetics coupled with enhanced health and a feeling of happiness and pleasure while using organic textile. [Rangari NT. et.al, 2012].

3. ORGANIC YARNS

Numerous working practises in the textile sector combine to generate flow processes. The environment as well as human wellbeing are both affected differently by each procedure. Consequently, a variety of environmentally friendly yarns that don't require the usage of herbicides or pesticides have been developed. When no toxic pesticides nor insecticides are employed in its production, natural fibres like cotton are contaminant free [Devi.et.al, 2020].

Nevertheless, even when they are generated without any of the dangerous elements, the numerous textile compounds that are applied to them throughout the processing stage of turning them into yarn and fabric might lead them to become "polluted." Similar circumstances apply to animal fibres including wool, that further can become polluted as a result of pesticides present in sheep dipping or a number of medications used to treat animal ailments.

3.1 Types of Eco-friendly or Organic Yarns

3.1.1Aloe Vera

Aloe vera is an African native plant. The water content of this plant is 96%. The plant's leaf contains more than 75 nutrients and bioactive molecules, including vitamins, minerals, and amino acids. The plant's components aid in the rejuvenation of skin cells, the development of a healthy dermis, and the defence against skin injury. Aloe vera's benefits for preventing skin ageing, rejuvenating skin cells, and protecting skin from microbial pathogens have been incorporated into clothing through advances in the textile industry. Clothes are manufactured of a microfibre including an open mesh design that enhances moisture transfer to the skin. Aloe Vera possesses antimicrobial characteristic which helps to prevent the spread of infections, stains and deterioration of fabrics, as well as other adverse effects of harmful microbes. With the least amount of chemical consumption during production, it is one among the greatest eco-friendly fibres.

3.1.1.1 Preparation of Aloe Vera Yarn

Preparation of aloevera yarn comprises of the following steps:

a. Blending:Ultra-fine aloe vera powder are combined in a ratio with recovered rubber stoste, and thorough stirring creates a mixture and creates a mixed solution

b. Spinning: Step one of the spinning process involves forming a thread from a mixed solution using a spinning equipment. The thread then enters a coagulation bath containing to create a neutralised, solid strand.

c. Drafting: During the drafting process, a swollen strand is stretched to produce plastic fibre;

d. Following desulfurization and depickling, final fibre is obtained by washing plastic fibre. The obtained fibre is finally spun into yarns

Aloe vera is added to fabrics with the use of microencapsulation technique, opening up a world of possibilities for the textile industry. Aloe Vera is contained in airtight, water-resistant microcapsules. Such microcapsules are tiny containers with a melamine shell or a protective polymeric covering. Until they are released, the shells can guard their contents against contamination and evaporation. During the process of creating the fabric, the capsules and fibres are linked together. Whenever the garment is touched as well as rubbed, the capsules pop open.

3.1.1.2 Properties

a. It degrades naturally. Their chemical and physical properties are comparable to those of cotton.
b. It can be recycled.
c. It provides great moisture management as well as breathability.
d. It gives skin nourishment. reduces discomfort in muscles, joints, and other tissues.
e. Aloe vera functions as an anaesthetic and a natural cleanser.
f. It works as a natural humidifier to supply moisture to all strata of human skin and to promote regular cell growth, which quickens the healing process' regenerative stage.

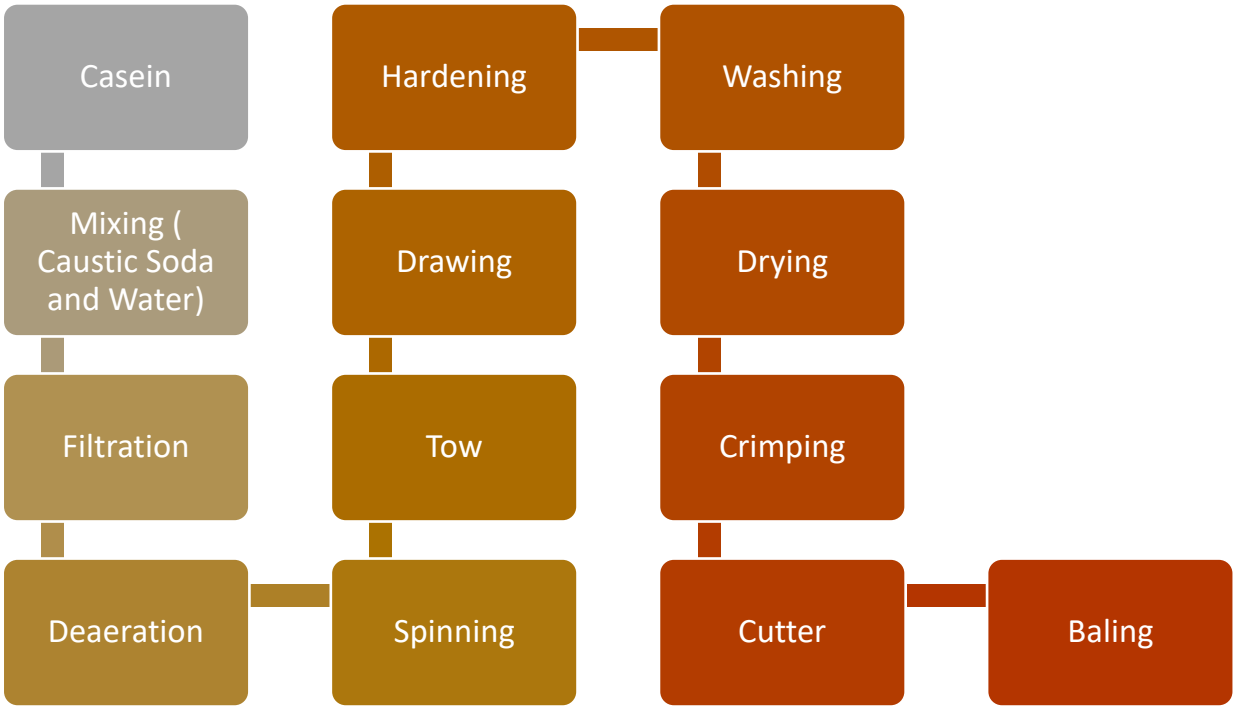
g. When used in high quantities for several hours in close contact with the germs, it is bactericidal.
h. Its anti-pruritic decreases coagulation and bleeding in inflamed bodily regions.
i. It reduces inflammation.

3.1.2 Milk Yarn

Antonio Ferratti synthesized milk fibre in Italy in 1930s. To challenge wool, it was produced from milk casein. Milk yarn is a modern form of fibre that has evolved with the advancement of technology. Modern milk fibre is more superior over man- made fibres in terms of quality, strength, and environmental friendliness, Since this is a protein fibre, not only is it safe for the body but is also beneficial.

3.1.2.1 Milk Yarn Production

The production of milk protein yarn is separated into three stages: casein preparation, spinning dope preparation, and draught spinning. Cow's milk is the primary raw material for yarn, and because cow's milk has greater than 80% water, dehydration is required. Skimmed milk is treated with acid to produce casein. The casein forms a curd that is cleansed, dried, and thereafter powdered to a fine consistency. In a solution of caustic soda, casein is dissolved. The mixture is filtered and then deaerated after being left to mature until it achieves the proper viscosity. A coagulating bath including sulphuric acid, formaldehyde, glucose and water is used to wet spin the spinning mixture by extruding it via spinnerets. Similar to the formation of viscose filaments, the streams of solution aggregate into filaments.



Steps in milk yarn production

Furthermore, the following step is crucial since the fibre needs to undergo chemical treatment in order to harden. Many hardening processes are based on formaldehyde treatment. As bundles of filaments exit the coagulating solution, they are gathered in to tow and immersed in the formaldehyde solution. At this point, the filaments undergo drawing. The treated tow is then mechanically crimped, dried, and chopped into staple fibre which are twisted together so as to solidify them in to yarn.

3.1.2.2 Properties

a. The yarns have a distinct warmth and richness of feel, and the fibres are inherently crimped.

b. It offers effective thermal insulation. Like wool, they are robust.
c. When examined under a microscope, casein appears smooth and rounded but burns similar to wool and smells like burned hair.
d. It is quickly damaged by alkalis and is susceptible to mildew. Casein also lacks the surface scales that wool possesses.
e. The surface of the filaments are smooth, white in colour and bean-shaped in cross section.
f. Milk fibre has a propensity to rapidly absorb moisture, which causes the fibres to swell and soften.
g. When the temperature is increased, they could turn plastic as well as sticky. On extended heating at temperatures above 100 degrees Celsius, the fibres turn brittle as well as yellow. In air, it burns slowly with flammability more like wool.
h. As a result of the lack of regular channels in the fibers base body, milk fibre has greater moisture absorption than synthetic fibres and as fine an absorption of moisture like a natural fibre.
i. Caseins must be handled delicately when wet even though they can be cleaned with the same care as wool. It cannot be left damp for very long since mildewing might develop very quickly.

3.1.3 Lotus Yarns

Lotus fibre is a sustainable textile fibre that is derived from the lotus plant's stems. It is the sole microfiber made of natural fibres and therefore is environmentally beneficial. A spinner can generate about 250 metres of yarn each day, while 1 metre of cloth requires 40000 lotus stalks. The user of lotus yarn clothing experiences a state of calmness, mindfulness, and peace in addition to being cured of lung disorders, heart problems, asthma, headaches, and other maladies.

3.1.3.1 Preparation of Lotus Yarns

a. **Harvesting lotus plants**: When the flowers are fully open, the plant's stalks are harvested. High-quality fibres are found in the deep pink blossom.
b. **Fiber extraction**: It is a laborious and time-consuming process for lotus plants. A knife is used to slice and then repeatedly snap lotus stems five to six times. 20–30 tiny fibre filaments of fibre are seen after cracking it. After they have been removed from the stem, the filaments are dried by hanging them up before being coiled into a single thread.
c. **Yarn preparation**: To make warp yarn, the removed fibres are wound onto a skein. To prevent tangles, threads are produced to lengths of 40 metres. Weft yarn is coiled onto bobbins made of bamboo. Weft yarn is coiled onto bobbins made of bamboo.
d. **Weaving:** The strands should be weaved before 24 hours from being extracted because they are sensitive and must not deteriorate. Using a conventional Combidian loom, weaving process can be carried out.
e. **Dyeing:** Fabrics are coloured with natural colours after weaving. Dyeing yarns in skein form is another alternative.

3.1.3.2 Properties

a. It is the finest aquatic cellulosic fibre. (Water-resistant fibre)
b. It has the ability to resist pilling, resembles unprocessed silk or linen, is milky yellow in colour.
c. It has the ability to clean itself.
d. It is firm, cool, light, wrinkle-free, stain- and crease-resistant, water-proof, smoother, eco friendly, and sustainable.
e. It is cosy and permeable to air, stretchy in a good way , It absorbs moisture.
f. It performs best when mixed in varying amounts with banana, kapok, silk, and cotton fibres.

3.1.4 Orange yarns / Fabric

Citrus juice byproducts which would ordinarily be discarded are used to make Orange Fibre. This implies that millions of tonnes of orange peels are put to excellent usage as ethereal materials that are ideal for high-end textiles and clothing. The very first patented product manufactured from

citrus juice leftovers is Orange Fibre. A 100% citrusy sustainable, and lightweight fabric can be created using only the lighter orange cellulose yarn.

3.1.4.1 Preparation of Orange Yarn

The cellulose from the peels is extracted using a proprietary procedure, and it is spun into the finished yarn. Any sort of currently available yarn can be used to spin the biodegradable yarn. To be capable of extracting the cellulose that would create the finished yarn, the wet citrus residue, known as pastazzo, must be treated. The residues that are often thrown away after squeezing an orange are used to remove the cellulose, which is then processed specifically. Additionally, using nanotechnology, essential oils are placed within in the shape of capsules which dissolve when in touch with the skin and smooth it.

3.1.4.2 Properties

a. The material has the appearance and feel of silk: it is smooth to the touch and lustrous.
b. The cloth has health-promoting qualities, making it healthy for the person in as well as the environment.
c. Citrus-based, the fabric's natural oils are rich in vitamins A, C, as well as E. The cloth transforms into a wearable body lotion when these vitamins come into touch with the skin and are secreted and absorbed.

3.1.5 Rose petals

The utilisation of natural materials for the apparel industry is experiencing a renaissance of interest as a result of the outset of climate change and global warming. Rose petal fibre is of the regenerated variety and is produced from the organic waste of rose petals as well as bushes, namely a mixture of cellulose and rice protein. In addition to being associated with fibres that seem soft and silky to the touch but are actually just viscose derived from at least 60% polyester, the term "rose fibre" also relates to the fibre derived using authentic rose plant debris. It is categorised as a form of bast fibre, also known as phloem or skin fibre, and is obtained from dicotyledonous plants' phloem, inner bark, also known as skin, enclosing the stem.

3.1.5.1 Preparation of rose petal yarn

Rose petals and bushes naturally produce waste, which is used to make rose petal fibres. The fibre is then stripped and processed to produce a rich, soft spinning fibre that resembles silk. Because rose petal fibre is so delicate and slippery, it must be spun with quite a tight twist in order to produce the desired fabric. The wheel with the shortest whorl size is used to produce Rose Petal Fiber. The short forward draws used in woven spinning involves delicately pulling out a tiny fragment of fibre at a time while preventing the twist from entering the fibre bundle. The best way to use these delicately woven rose petal fibre yarns is to ply them. Although it takes a longer time, plying aids in producing a secure as well as balanced yarn which won't stretch or pull apart.

3.1.5.2 Properties

a. Rose petal silk is less expensive than regular silk, and its textile qualities include being machine washable, pill-resistant, and reasonably durable.
b. It can biodegrade in soil and is versatile enough to be utilised both alone and in combination with other fibres.
c. The fibres made from rose, which serves as a natural skin toner, assist with skin inflammatory issues and resolves prickly heat problems in the skin. The skin becomes supple, radiant, and smooth.
d. It is biodegradable and green, and is environmentally beneficial.

3.1.6 Soyabean Yarn / Fabric

Soyabean is primarily grown for its seeds. For thousands of years, soyabeans have been a mainstay of eastern cuisine. They contain a significant amount of a protein that resembles casein.SPF, or soy protein fibre, is a type of regenerative plant fibre. Instead of using animal sources, it is created entirely from plants. It is the only plant-based, renewable protein fibre that is currently available. The 16 amino acids are good for people's skin and nutritious.

3.1.6.1 Production of Soyabean fabric

In the United States and other eastern nations, soyabeans are widely produced and contain an increased protein content of roughly 35%. Soybean can be used to make soy fibre. 40 kilogramme of protein can be converted into 100 kg of soyabean residue. Soybean fabrics are produced in five major stages [https://sewport.com/fabrics-directory/soy-fabric]:

a. **Extraction of oil:** Oil is extracted to produce a meal free of oil by first cleaning, cracking, decorticating, and dehulling the beans. The beans are then soaked in hexane to extract the oil following a conditioning phase at about 70 degrees Celsius. By compressing and extraction, the oil can be obtained. Oil is recovered out of the hexane solution . Because the oil is a useful byproduct, it is removed out. The solvent is eliminated by passing the remaining oil-free soybean meal via a steam-jacketed conduit.

b. **Protein extraction**: By soaking the oil-free meal in diluted alkalis such as sodium sulphite, it is possible to separate the protein from the meal. This process dissolves the protein, which can then be separated using a filter. By using acid, the protein gets precipitated. Sulfuric acid is injected, and the solution's pH is raised to 4.5. This is close to the iso-electric point of soybean protein, which means it is least soluble and will precipitate.

c. **Spinning solution preparation**:. The isolated protein is dissolved in an alkali solution to create the spinning solution. To get rid of all undissolved objects and air bubbles, the solution is vacuum filtered as well as deaerated. The solution is aged at the appropriate temperature after filtering. The solution thickens and acquires the ideal texture for spinning during the ageing process.

d. **Fibre formation:** Wet spinning is used to produce soyabean fibre. The process of spinning involves pushing the spinning solution into a spinneret which has several holes, and emerges from the coagulation bath. In the coagulating bath, which contains sulfuric acid as well as sodium sulphate and perhaps sodium chloride enabling dehydration, the liquid jet crystallises as thin filaments.

e. **After treatment**: Additional treatments are necessary to develop the fibres' properties including stretching as well as hardening. Stretching can indeed be executed in a different bath even as the filament is still pliable. This generates orientation by rearranging the molecules and increases the filaments' strength and resilience. Formaldehyde hardening can be used to provide the filaments extra strength and flexibility. After being dried at a specified temperature and humidity, it is then cut to the required lengths ready for spinning

f. **Weaving**: The soy fibres are spun into yarns and the yarns are dyed without using chemical bleaching agents. Finally, the yarn is woven into various fabrics.

3.1.6.2 Properties

a. Improved fineness, lower specific gravity, strong tensile elongation, as well as good acid and alkali resistance are all characteristics of this material.

b. It resembles natural fibres like silk and wool.

c. This can partially replace silk and is significantly less expensive than actual silk

d. Its ability to absorb moisture is on par with cotton's, and it has significantly superior permeability, making it more comfortable.

e. The lower strength and moisture sensitivity of soyabean fibres cause them to lose majority of their tenacity when wet.

f. It is quickly and easily washed and dried, and the anti crease ability is also excellent. The Soyabean protein fibre (SPF) binds to human skin well.

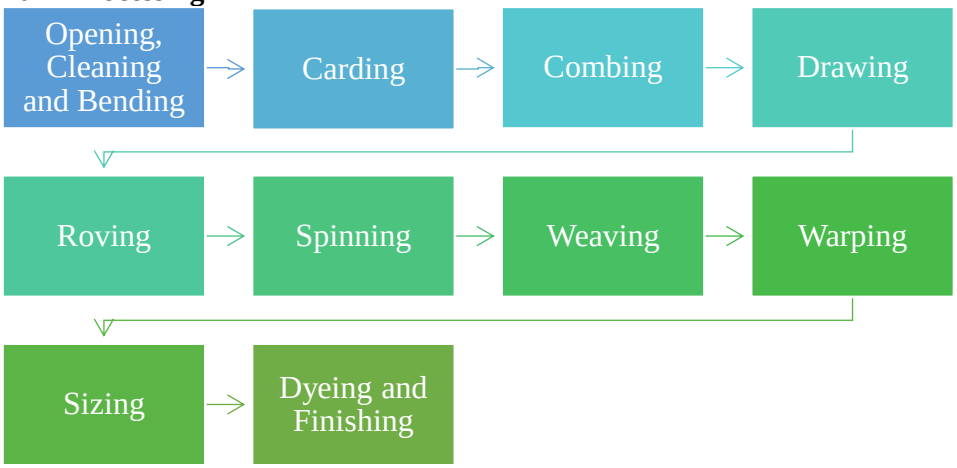
3.1.7 Corn Yarn/Fabrics

A man-made fibre formed entirely of renewable resources is corn fibre. These fibres complement natural items like cotton as well as wool and offer significant benefits frequently attributed to synthetic materials. Lactic acid, which makes up corn fibre, is created by first transforming corn to sugar and afterwards fermenting to produce lactic acid.

3.1.7.1 Manufacturing Process

Wet milling is mostly used as the first stage of the procedure of extracting starch from biomass. By utilising bacteria in a fermentation procedure, the starch is transformed to dextrose, which is later fermented into lactic acid. Condensation-collected monomer lactide that has been vacuum-distilled to remove impurities. Solvent at high pressure and vacuum is needed to create the polymer from the D-L isomer utilising direct condensation. So, L isomer is employed. First, lactic acid is condensed to create short chained PLA. Thereafter, vacuum distillation transforms it into lactic acid. Distillation doesn't need a solvent. Ring opening polymerization constitutes the last phase. There is no requirement for an infrastructure investment because corn fibres may be produced on traditional machinery throughout all phases of the production process.

3.1.7.2 Yarn Processing



Steps in Yarn processing

Using the ring spinning technique, corn fibre is converted to pure corn yarn as well as combined with natural fibres and synthetic fibres like polyester and viscose, among others.

3.1.7.3 Properties

The yarn or fabric made exclusively using corn, is completely eco-friendly, and possesses remarkable quality attributes. The characteristics include:

a. The counts of corn fibre range between micro denier for lightest materials and higher counts for most durable uses. It is available both in spun as well as filament form.
b. It is produced from sugars found naturally in plants. Contrary to hydrocarbon products, that could indeed be discarded through thermal or physical recycling, and via landfill, they can always be recycled back into the environment.
c. In textiles, corn fabrics strikes a balance between durability and strength with comfort, smoothness, and drape.
d. Incredibly, corn is inherently flame resistant and requires zero chemical additives nor surface modifications.
e. It claims to have exceptional moisture regulating capabilities and no odour retention, providing the wearer with the utmost comfort and assurance.
f. According to reports, corn fibre thread has a soft sheen as well as fluid draping including a natural feel, making it a refreshing material to inspire creativity.
g. By using corn fiberfill instead of polyester or nylon blends in padded clothing, manufacturers of outerwear may provide a more eco friendly option.
h. It is reported to function better than other synthetic materials in terms of UV light resistance, maintaining strength, colour, and characteristics over time.
i. Independent, easy-care laundry and dry cleaning trials have demonstrated that the garment made of corn fibre can be cleaned in a conventional washer and dryer.
j. Additional research has proven that corn fabrics outperform polyester in the most important active wear application domains.

3.1.8 Eucalyptus Yarn

A family of nearly 700 species of woody blooming trees and shrubs, eucalyptus is primarily found in Australia as well as southeast Asia. Eucalyptus is a very environmentally friendly product. There is no competition with the food sector because the area used for eucalyptus is unfit for food crops. When compared to the production of cotton, eucalyptus only needs 2.8percent of total water.

3.1.8.1 Preparation of Yarn

The manufacturing of eucalyptus yarn is a closed-loop technique in which the finishing chemicals are totally biodegradable and the water used in the manufacturing is recycled. The process for creating eucalyptus fibre is the same as that used to create numerous different semi synthetic organic fibres, like viscose or bamboo . Eucalyptus wood is ground into powder, condensed down into a cellulose viscous solution, which is pressured through spinnerets, and then spun together into smooth, lighter weight, breathable, and lipophilic fabric. The only non-toxic solvent utilised in the production of Tencel is amine oxide, which enables closed-loop treatment and allows close to 99% of this chemical to be continuously reused while reducing environmental effect as well as saving water and energy. Additionally, there are very little and generally non-harmful manufacturing waste products in the water and the atmosphere.

3.1.8.2 Properties

a. Excellent for sensitive skin
b. A comfortable indoor environment can be achieved thanks to the fibres' inherent capacity to both absorb as well as release moisture.
c. It is a strong fibre, making it excellent for a wide range of applications
d. Additionally, it is naturally anti-bacterial, making it suitable for individuals with allergies.
e. Naturally and effectively manages moisture while reducing electrostatic charge.
f. The fibre from eucalyptus decomposes completely.
g. The yarn made from eucalyptus is completely sustainably dyed.

3.1.9 Bamboo Yarn

Bamboos are perennial blooming evergreen plants. A special rhizome-dependent process makes bamboo one of the plants with the quickest growth rates in the entire planet. One amongst nature's greatest renewable resources, bamboo is 100 % biodegradable with a built-in ability to regenerate itself. Bamboo may grow up to one foot every day. Interestingly, because the fibres are aligned in longitudinal orientations, it is referred to as natural glass fibre. Additionally to being inherently anti-microbial, hypoallergenic, thermally regulating, and an effective absorbent, it also features thicker, stronger fibres that boost its longevity. It possesses the ability to compete with cotton's extensive variety.

3.1.9.1 Preparation of Bamboo Yarn

There are two main chemical processes that can be used to make bamboo yarn depending on the type of cloth. Most bamboo fibres are created using the viscose rayon processing technique. It has certain negative environmental effects yet is inexpensive to make. Actually, this technique is used to treat regenerated or semi-synthetic fibres.

A. Closed loop solvent spinning: Contrary to the procedure used to create viscose rayon, the manufacture of closed-loop rayon doesn't often chemically change the composition of the cellulose that is employed, producing a fabric that is entirely organic. Although the solvent being used in conventional viscose manufacturing is wasted and typically ends up in the environment, the solvent used in closed-loop rayon synthesis may be recycled 99.5% of the time.

B. Mechanical Process: After being removed from the plants, bamboo is crushed, and natural enzymes are then used to breakdown the bamboo sidewalls into something like a pulp, allowing the natural fibres to be mechanically sorted out and woven into yarn using a variety of procedures. This method produces bamboo fabric that is frequently referred to as bamboo linen. In reality, bamboo yarn is processed naturally.

3.1.9.2 Properties of bamboo fibre

a. Being 100% cellulosic, it is naturally biodegradable. Decomposition of bamboo yarns or fabrics doesn't pollute the environment.
b. Compared to cotton, bamboo fabric is finer and softer. Micropores as well as microgaps are present in the cross section of bamboo fibres. As a result, it has improved ventilation and moisture absorption.
c. Bamboo naturally has antibacterial properties. The smell of body sweat is significantly reduced by bamboo viscose fabric.
d. Bamboo Kun, an anti - microbial biological agent, gives bamboo viscose garments a special antibacterial characteristic. Kun may be present in the growing bamboo fibre organically. Bamboo fabric is frequently claimed to be inherently anti - bacterial, anti - fungal, and odour resistant because to the "Kun" component.

3.1.9.3 Bamboo Viscose Fabric

Bamboo can also be produced chemically through regenerating the cellulosic fibre, creating bamboo viscose. All cellulose-based fabrics, whether made from bamboo, shrubs, or trees, constitute rayon. Since its main source is a naturally regenerable plant, bamboo viscose is regarded as environmentally beneficial.

3.1.10 Banana Yarn

Musa fibre, commonly referred to as banana fibre, is among the most strongest available natural fibres. Banana fibre yarn is made from inner bark of banana plants. It is an extremely eco-friendly product that is also entirely biodegradable. The yarn is commonly referred as banana silk because of the lustrous and silky appearance of the most valuable fibres, because the banana plant belongs to the Musa family. At first, just the fruit seemed to be valuable, but over time, the complete plant was discovered to be beneficial. The stem of the banana plant is used to make fibre cloth, and the stalk can indeed be turned to ropes. To access the intermediary layers that are best suited for fibre separation, wall of the stems must first be removed. The fibres have densely layered cell walls and are bound together by natural gums. The most inner sheaths of the plant are often rejected because they comprise pulpy material, while the outermost part produces coarse, extremely brittle fibres. It is simple to combine it with cotton or even other fibres.

3.1.10.1Preparation of banana fibre yarn

Banana fibre was formerly harvested manually, which was laborious and time-consuming. An anaerobic procedure was developed in India to extract banana fibre.

a. Peeling: The peeling of plant's outer section is the first stage in the synthesis of banana fibres. A metal scrapper is used to remove the stem covering, and the fibre is then separated.
b. Retting: Banana fibers are available in the phloem as strands of cellulose, hemi - cellulose, lignin, containing close to 2% pectin as well as wax. Hence, the extraction and isolation of cellulosic fibres from the remaining elements is the initial stage in the manufacture of banana yarns. This is referred to as retting. Presently, retting is frequently accomplished by immersing the banana bark in water or sodium hydroxide , sometimes with other chemicals. This is obviously undesirable because the ensuing chemical baths must be handled, purified, and disposed away into the surroundings. Biological processes, including submerged or solid-state fermentation processes, are a more environmentally benign solution. These procedures also avoid damaging the fibres.
c. Drying: The obtained fibers are generally grouped together and sun dried. During this stage, all fibres are mixed around each other; there is no distinction among high-quality and low-quality fibres.
d. Grouping: When the fibres become dry, they are much easier to separate and classify depending on thickness as well as quality. To make a lengthy strand, fibres from the same cluster are twisted together. At an industrial level, banana strands can be combined with any type of yarn, either natural or synthetic. To make such blended yarns, fibres are first split using a short fibre cutter and thereafter carded with new yarn to give the fibres some stability.

e. Spinning: The final phase is spinning. Fibers are converted into yarn and prepared suitable for use. The fibre that is produced in this way is completely white. This procedure is inexpensive, pollution-free, and doesn't harm fibres.

3.1.10.2 Properties

a. Banana fibre has a high capacity to absorb moisture. The water is soon absorbed and discharged.
b. Owing to its shine, affordability, and environmental friendliness, banana fabric is a favourite among designers and manufacturers.
c. These yarns are produced without the use of chemicals or pesticides, are entirely biodegradable, and are more environmentally friendly.

4.WEAVING (HANDLOOM)

Woven, knitted, and non-woven fabrics are only a few of the several types of fabrics created by the textile industry. Preparation steps before to weaving any cloth include winding, warping, sizing, drafting, denting, and ultimately weaving.

4.1 Winding

The technique of winding involves transferring yarn from a ring or a bobbin into an appropriate container. The various machines are classified based on package, type of winding, drive and types of yarn used.

4.2 Warping

The warping process, used in the textile handloom industry, is the parallel wrapping of warp ends from numerous winding packages, such as cones or cheese, onto a single box (warp beam). The equipment that is utilised in the warping process is either a High-speed or sectional warping equipment.

4.3 Sizing

Sizing is the technique of coating the surface of the yarn with a protective sticky layer. Sizing the yarn has a number of important benefits, including an increase in the yarn's elasticity, strength, weight, smoothness, and friction resistance. The warp yarn is exposed to significant abrasive stresses while weaving in the textile manufacturing process. As a result, the yarn needs to be strengthened with a polymer coating, or size. The weaving loom's high cycle rate (up to 700 revolutions per minute) accounts for its high productivity. As a consequence, the associated costs with single-warp yarn breakup rise with increasing speed. The right sizing and climatic control of the weaving floor are therefore of great economic importance.

4.4 Warp Yarn Sizing

The purpose of a sizing machine is to attach a size to the warp that is best suited for the specific fibre type being used as well as the final fabric composition. This allows the weaving process to be carried out easily and efficiently.

According to the treatment method, warp yarn sizing techniques can be divided into conventional wet, solvent, cold, and hot melt sizing. The major components of a traditional wet sizing method are the size components as well as a solvent, typically water. The three main categories of sizing materials are adhesive, softeners, as well as auxiliaries.

4.5 Weaving

One of the most popular methods of creating a two-dimensional weaved cloth is weaving. A robust machine called a loom is used in the weaving process to interlace two or more pairs of yarns to create a fabric. When weaving, the threads are woven together at a right angle to one another; the horizontal yarn is known as the weft yarn and the vertical yarn as the warp yarn. The **warp yarn** is also known as the grain line since it runs vertically along the lengths of the garment. The **weft strands** wrap all around warp yarns at the edge of a woven fabric, and this is known as the selvedge.

The weaving is carried out using a loom; if the weave is straightforward, a shuttle loom will be used; if the weave is intricate with multiple weaves, a Jacquard loom will be employed.

Fabric Count: Fabric count is the same as yarn count . The thickness as well as fineness of yarns are described as yarn count (number). The finer the yarn is, the higher the count.

Fabric Width: According to ISO, overall width is the distance between the piece's farthest warp threads measured perpendicular to the fabric's length. The width of a narrowest point minus width of any useless selvedge equals the width of the usable space. It is sized in terms of inches, cm, meter, etc. Fabric width is the space between the fabric's two selvedges.

Healdshafts: A heald shaft is made from wood or metal, such as aluminium. The endpoints of warp sheet slide through a number of wires that it supports. "heald shafts" and "heald staves" are also used to describe the shafts. The total number of heald shafts largely depends on the weave's warp repetition. The weave's drafting strategy during weaving determines them.

a. Heald shaft has the following weaving-related purposes:
b. It aids in the development of weaving sheds.
c. It also keeps the warp threads in the proper order or succession.
d. The quantity of heald wires / inch defines the warp thread thickness / inch, and the heald shaft defines the density of the warp threads in a fabric.
e. It determines when to decrease or raise the required number of healds for a selection. It aids in creating a fabric's design or pattern.
f. When weaving, the heald shaft is helpful in recognizing damaged warp threads.

4.6 Weaving machine types

The tool or machine used to create woven fabric is called a loom. It is the focal point of the entire production of fabric process. A loom is, in other words, a device or equipment used to weave yarn as well as thread into textiles. There are numerous sizes available for looms. Small hand-held frames, enormous mechanically operated tools, and massive free-standing handlooms are all examples of their range. The primary function of looms is to tightly grasp the twist threads to facilitate the development of weaving of the woof threads. The loom's method and precise form can vary to a certain degree, but it still accomplishes the basic task [Mamidipudi, Annapurna, 2016].

The different Handloom machines used are listed below.

a. Vertical or primitive loom
b. Pit loom
c. Frame loom
d. Hattersley loom
e. Chattaranjan loom

5.DESIZING PROCESS FOR WEAVED ORGANIC FABRIC

The grey cloth must go through a number of chemical processes during the traditional textile wet treatment in order to become a completed fabric. All of these processes involve the usage of quite harmful substances. Non-cellulosic and foreign components are partially or entirely eliminated during the different pre- and post-operational procedures that are performed during the manufacture of fabrics [Churi, R.Y, 2014].

5.1 Desizing

The first stage in wet processing of textile finishing techniques is desizing, which is used to remove the sizing material out of the fabric. To ensure consistency during wet processing, the size should be eliminated prior to bleaching or dyeing.

Enzymatic processing of textiles began in the mid - nineteenth century. The first time that enzymes were used for de-sizing purposes was in 1857, but the enzymatic de-sizing technique wasn't established until 1912 [Bruna Lyra Colombi. Et.al, 2021]. Around the world, biotechnological studies are being carried out to develop more environmentally friendly methods of processing textiles in the modern industry.

5.2 Enzymes used in De-sizing processes

The following enzymes are typically utilised in textile processing, based on substrate specificity. Amylases are typically used for Starch. Cellulases are enzymes that break down cellulose. Catalases are enzymes that degrade hydrogen peroxide. Pectinases break down pectins. Proteases are enzymes that digest proteins.

5.3Agents used in Desizing operations

The sizing agents are chosen based on the yarn quality and fabric design. Natural starch and modified starch derivative products, polyvinyl alcohol, carboxy methyl cellulose and other size agents are commonly utilised. However, the imposed surface covering on yarn must be removed out from woven fabric during the production process, which includes bleaching, colouring, printing, as well as finishing. Desizing is the process of removing starch from the surface of a yarn. As a result, desizing is regarded as a critical parameter that affects the effectiveness of subsequent processing.

Despite the fact that many other substances have been utilized to size fabrics all through the years, starch has remained the most often used sizing agent for over a century and remains so today. Because of their efficiency and specificity, enzymes (amylases) have been favoured for desizing. Amylases remove the size completely without harming the underlying cellulosic fibre. Although amylases' particular action towards starch splitting was discovered earlier, industrial level enzymatic desizing first commercialised mostly in late 1960s. The ratio of the copolymers, amylose and amylopectin, is determined by the starch supply [Athalye, Ashok. (2020]. Wheat starch, for instance, has about 25% amylose with 75% amylopectin. These enzymes break down starch into smaller polymeric fragments called dextrins and maltose, the disaccharide with two glucose molecules. Micro - organisms, plants, and mammals all contain alpha-amylases. Alpha-amylases are small proteins with molecular weights ranging from 50 to 60 k daltons.

5.4 Advantages of Enzymes In Textile Industry

The application of enzymes in textile industries has had a significant positive influence on the environment as well as quality of products. Only roughly 75 of the 7000 known enzymes are commonly utilized in operations in the textile industry. The main enzymes used in the garment industry are oxidoreductases and hydrolases. After weaving, starch-based sizes are mostly removed from fabrics using amylases.

Cellulases have mostly been introduced to textile industry to achieve the worn-in look of denim and many other clothes, as well as to be used to enzymatically reduce fibrils , fuzz threads from cotton materials. It has been effectively demonstrated that esterases can partially hydrolyze the surfaces of synthetic fibres, increasing its hydrophilicity and facilitating subsequent finishing processes. After bleaching, H2O2 can be removed using catalases, which utilizes less water [Hu, Q.P.et.al, 2021].

The advantages of using enzymes in textile processing are:

1. Reduced handling of dangerous chemicals by textile workers and less chemical and wastewater discharge.
2. Enhanced textile quality
3. Less energy use, reduced stone grit, and fewer broken machines.
4. More options for clothing, minimal damage to the original fabric results in extended garment life.
5. Reducing the chemical burden and using less water.

6. ENZYMATIC DESIZING (ED)

The most popular technique for desizing starch is enzyme desizing. The starch breakdown into dextrin and maltose can be accelerated by amylase. The benefit of such enzymes is that they are selective for starch, eliminating it without harming the support material. For amylase, an enzymatic desizing procedure at a temperature (30–60°C) and an ideal pH of 5.5 to 6.5 is necessary. The acceptance of thermophile amylases has grown as rising temperatures facilitate starch removal and shorten processing times. They can offer enhanced absorbency and high temperature effective starch removal.

6.1 Steps in Enzymatic Desizing

Three phases make up the enzymatic desizing procedure:

Impregnation: The fabric absorbs the enzyme solution. At temperatures of 70 °C or above, and using a fluid pick-up of 1 l per kilogram of fabric, this stage comprises thoroughly soaking the fabric with an enzyme solution. The size undergoes the maximum amount of gelatinization at this point.

Incubation: The enzyme breaks down the size during incubation. Lower concentration of the enzyme is maintained by a lengthy incubation period.
Afterwash: The fabric is cleansed of the size breakdown products. The size breakdown components must be removed out of the fabric before the desizing procedure is considered complete. The best way to achieve this is with subsequent detergent rinse at the maximum temperature.

6.2 Advantages of Enzymatic Desizing

As opposed to methods of desizing that are acidic or oxidative, the enzyme does not harm the cellulose because it simply attacks the starch. Below are some of the unique benefits of enzymatic desizing:

a. Starches are effectively dissolved and eliminated.
b. Remarkable biodegradability.
c. The substrate's tensile strength is preserved because no harsh chemicals are required.
d. Safe operation and handling.
e. Increased wetability
f. Improved quality of the fabric
g. Performance consistency and usability.

6.3 Drawbacks

Following are some drawbacks of enzymatic desizing:

a. Significantly reducing the impact of additional cleaning on other impurities
b. No impact on specific starches
c. Chemicals that act as poisons or enzyme deactivators may cause a loss of efficiency.

7. CONCLUSION

There are many types of organic fabrics available in the textile industry, and this article explains about organic yarn preparation, weaving method to produce organic fabric and enzymatic Desizing process for warp yarns. Customers' attitudes toward organic fabric items are more favourable as they grow increasingly health-conscious.In the years ahead, organicfabric may overtake conventional textiles as a major industry. The best method to embrace a healthy lifestyle is to combine organic and textiles in an environmentally friendly way. Organic fabric production is one of the best way to resurrect and grow the Indian hand loom industry's market share in the global textile industry.

REFERENCES

1. Ferrigno, S.; Guadagnini, R.; Tyrell, K. (2017, October). Is Cotton Conquering its Chemical Addiction? A Review of Pesticide Use in Global Cotton Production; Pesticide Action Network UK: Brighton, UK,.
2. U.S. Department of Agriculture. (2019). Agricultural Chemical Use Survey: Cotton. NASS Highlights. No. 2020-3. 2020. Available online: https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Chemical_Use/2019_Field_Crops/chem-highlightscotton-2019.pdf
3. Rajan, K.; Sundramurthy, V.P.; Merine, M.K. (2021). A Harmless Approach on Textile Effluent Detoxification: Bioremediation and Recent Strategies. In Strategies and Tools for Pollutant Mitigation; Springer Nature Switzerland AG: Gewerbestrasse, Switzerland, 195-219.
4. Rangari NT, Kalyankar TM, Mahajan AA, Lendhe PR, Puranik PK. (2012). Ayurvastra: Herbal couture technology in textile. International Journal of Research in Ayurveda and Pharmacy. 3(5):733-736.
5. https://sewport.com/fabrics-directory/soy-fabric
6. Devi, Oinam Roselyn. (2020). New Sustainable Fibres and their application in Textiles: A Review. International Journal for Modern Trends in Science and Technology. 06. 136-141. 10.46501/IJMTST0609S22.
7. Mamidipudi, Annapurna. Towards a Theory of Innovation for Handloom Weaving in India. Ph.D. diss., Maastricht University, 2016.

8. Churi, R.Y., Khadilkar, S.M. and Sule, S., (2014). Enzyme Systems for processing cellulosic textiles, Colourage, April 2004, 37-42.
9. Athalye, Ashok. (2020). Enzymatic desizing for effective processing.
10. Bruna Lyra Colombi, Rita De Cássia Siqueira Curto Valle, José Alexandre Borges Valle, Jürgen Andreaus, 2021, Advances in sustainable enzymatic scouring of cotton textiles: Evaluation of different post-treatments to improve fabric wettability, Cleaner Engineering and Technology, Volume 4,100160,ISSN 2666-7908, https://doi.org/10.1016/j.clet.2021.100160.
11. Hu, Q.P. and Liu, J.J. (2021) Production of α-Amylase by Bacillus subtilis QM3 and its Enzymatic Properties. *Open Access Library Journal*, **8**, 1-8. doi: 10.4236/oalib.1107291