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An Overview on Eco Printing: A Natural and Sustainable Printing Technique on Handloom Fabric

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A B S T R A C T

Eco printing is a natural dyeing and surface design technique that offers a sustainable alternative to synthetic textile printing. This paper presents a comprehensive overview of eco printing, focusing on its integration with traditional handloom fabrics, which are emblematic of India's rich textile heritage. Eco printing involves direct contact of plant materials—such as leaves, flowers, bark, and seeds—with fabric surfaces. These materials are placed on pre-treated fabrics, then bundled and steamed or boiled, allowing the natural pigments, tannins, and acids in the plants to imprint their shape and color onto the textile in a completely organic manner.

This technique makes it possible to avert the use of synthetic dyes, toxic chemicals, and lots of water, enabling it to be very sustainable and safe for the environment. Handloom fabrics such as khadi – cotton are perfect substrates for eco printing because their natural fibers absorb botanical dyes better than synthetic fibers. The paper shows the step-by-step process, from the fabric choice and mordanting process, to collecting plant materials, design layout, bundling, steaming, and post print care.

In addition to technique, this overview outlines the aesthetic particularity of eco-printed textiles. Eco-printed textiles possess a particularity that is always unique and changeable through time and space based upon what plants are available within the context of season and geography. A discussion of eco printing also offers a glimpse of the potential challenges (colour fastness, durability, production scalability etc.), while also touching on possibilities for innovation in education, and in relation to working collaboratively; designers, researchers, and older and younger crafts persons.

In conclusion, eco printing on handloom fabric has the ability to simultaneously deal with challenges such as color fastness, durability, and scalability; and investigate opportunities for innovation, training, and co-creation between designers, artisans and researchers. Ultimately, eco printings on handloom fabric seeks to combine art, ecology, and tradition, and demonstrates a viable pathway for the textile sector to operate using circular design, reduce its environmental footprint, while also celebrating natural beauty and culturally influenced craft.

Keywords: Eco printing, sustainable, ecology, art, tradition, plant printing, handloom, durability, colour fastness, production scalability, natural pigment etc.

1. Introduction

The area of finishing or ennobling textiles is one of the most polluting procedures, mainly due to its high use of water, which is also polluted with chemicals that end up in rivers, affecting human health. There are various techniques to ennoble textile materials so that they can withstand usage and have an added value with respect to taste, beauty, and aesthetics. In general, these techniques are classified as chemical, physical, dyeing, printing, and finishing. To achieve a sustainable textile, it is necessary to develop alternative production processes that avoid the use of toxic synthetic chemicals, harmful to health and the environment. Non-woven fabrics are cheaper and easier to produce, but the potential to assertively present the use of procedural symbolism increases considerably with the use of longer textile structures, with more elaborate and beautiful outcomes.

Eco Print is a unique method of producing textiles, in which plant life provides the shape, color and design features (Fernanda Lema Ruano, 2017). The eco printing process transfers the natural design of leaves, flowers and other plant materials onto textiles. Three collections of textile accessories are developed and the technical process is described in this documentation. The finished products are unique bags, hats and scarves.

The eco print has a history of about 50 years. The gist of it was developing a technique that resulted in beautiful unique textiles, termed "eco prints". Because the pigments were derived from entirely biodegradable vegetable matter, I thought the title of the technique should stay, and for the textiles printed on, I can find no transaction against looking at their environmental effects. It must also be noted that industrial textiles can make large contributions of chemical additives because dyeing and printing generates masses of liquid waste to be treated. The eco print technique has been disseminated

internationally, with local vegetable matter, and has been one of the most widely adopted printing techniques in the world of artistic textile practice over the last 10 years. The amount of academic articles and books published about eco print has increased exponentially, certainly indicating its value in design and artistic research projects.

Furthermore, the incipient ways of implementing Eco Print in teaching learning are reported. This situation could be justified in the worldwide expansion of interest regarding textiles and plants, especially in their potential to produce prints and dyes (LARASATI &, 2019). Traditional printing practices are categorically incompatible with environmental respect because they naturally create a process of pollution to air, land, and water, in addition to large amounts of water and energy consumption, all of which are well understood in a majority of academic institutions, and are what has fueled the search for environmentally sustainable alternatives.

2. Review of Literature

Eco Printing is the process of using natural dyeing processes to print natural objects, for example, leaves onto fabrics. Eco printing is one of the most sustainable, earth-friendly printing methods, and progresses in creating fabric with natural colors. Eco printing is now a very popular form of printing originating from India, since many variables can be changed to create many different results. Eco printing is a lot of a waiting game, along with many experiments that need to be done with an assortment of leaves and fabric. Eco printing is meant to create a one of a kind piece of artwork on fabric, supporting apparel, home furnishings, or artwork to hang on walls made with local material, which means from where you live. Eco printing can be called leaf printing, or printed with leaves. Eco prints happen when fresh or dried leaves are wrapped up in either a scarf or in a piece of fabric that is to be printed on using the eco printing process, (Pizzicato et al., 2023).

It is a waiting process when done with Steam Heating, as a good eco print needs a effective pressurizing while it is pressed, otherwise if the print smudges, it is wasted; so I would like to share the good prints come from cotton fabric that have been dyed and mordanted olive with different methods prior. Many different plants will provide with proper dies for a variety of colors beside all the prints. There is a correct method with each plant for obtaining the dye. There are many other different methods like rusting, compression or stuffing that can be used with Eco Printing. In this study fabric will be printed with different plants leaves, from the locally sourced area. Different plants were studied using a UV-protection test to test their coloration on the cotton fabric.

India is the largest producer of natural dyes with an annual forecast of growth of 9%. Though the color range and fastness to required standards could not be achieved, the safety and health aspects of natural dyes made them last. A significant portion of textile shipments from countries like India and Bangladesh is rejected by the western world due to the presence of synthetic azo dyes that include heavy metals. Natural dyes can provide a solution to this. Before printing and dyeing fabrics, it needs processing to achieve soft fabrics free from impurities for absorption.

Fig.1: Eco Printing on Fabrics

Dyeing is a process of absorption, where the dye attaches itself to the fiber and gives it a quality of color. The common method of dyeing is that of an alkaline chemical pre-mordanting, where the dye is either cudgel or boiled with a chemical nano-particle, and thus the cotton absorbs the color. Environmentalists felt the danger of pollution from synthetic chemicals, which cased further research in the area of natural dyes.

2.1. Historical Background of Eco Printing

Eco printing is a technique that stems from natural dyeing languages that join designers and natural dye users from the south-western subtropics to temperate zones (Fernanda Lema Ruano, 2017). Because the eco-printing technique makes it possible to imprint only traces of leaves and plants, objects that go unnoticed in everyday life become beautiful works of art. Recent research is being carried out on eco printing techniques to employ them in industrial textile products. The eco-printing technique is intriguing because it is distinctive and one-of-a-kind in each execution. Likewise, the vibrant coloration of eco-printing using leaves that are native or exotic to Indonesia is worth to study.

Nevertheless, the bio-printing and natural dyeing process takes longer than using synthetic dyes. In Indonesian textiles, soybeans, sappan wood, mangosteen peel, sappan, turmeric, and pandan leaves are examples of natural dye plants. Meanwhile, grey and wild hibiscus plants can be used to reduce

color intensity and create grey textiles. Practically all regions in Indonesia have local resources that have not yet been studied as eco-printed materials or to produce DIY natural dyes in the community.

Fig.2 and 3: Eco Printing on paper

It can be used either as colorant or as hot mordant, eco printing employs natural dye plants or their by-products. Also, this method is an environmentally friendly method that can be carried out mildly without water or steaming treatment. In this way, eco printing textiles can be produced simply and quickly into attractive craftworks (LARASATI &, 2019). In addition to being applied to natural fabrics such as silk and wool, it is also possible to eco-print on synthetic fabrics. Unfortunately, because of its novelty, the ecological impact of the eco-printing process on the quality of the final garment product has not yet been researched. The use of insulation media such as cotton, held monomer chemicals, and less absorbed mineral dyes are the dyeing materials with the highest environmental impact.

2.2. Eco Printing Techniques and Materials

The eco printing technique utilizes a process of thermal fixation with the addition of natural chemicals that serve as natural mordants, binding agents, and fixers for the dye extracted from plant material. Circulation water is used as a pH modifier. In the dyeing process with the natural eco print, material pre-fixing is carried out using diverse procedures of soaking the material in a solution of local and natural materials, in addition to mordants, namely: a mixture of plant elements determined as waste from food cooking, and iron nails; besides the pre-fixatives it is also used in the bio-mordant auxiliary dyeing process, which serves to regulate the pH of the water. These bio-mordants include: unripe fruit, lime aq. Addition and/or subtraction of the bio-mordant in the eco printing process affects environmental and product quality, namely the depth of color and permanence to washing fastness (Fernanda Lema Ruano, 2017).

Fig. 4 &5: The process of Eco Printing with flowers and leaves

The pad/sample both of which are in contact with the dying material are put together in a plant-based print or print face to face, then wrapped in a bush fabric steamed. The two faces of the printing pad/sample were subjected to 100C excess vapour for twenty-five minutes. The purpose of printing/dyeing steaming is to remove the starch on the pad that is used as a print and fix the dye in the fabric (LARASATI &, 2019). Other methods of dyeing human-made synthetic-based fabrics using synthetic dyeing agents such as acid dyes, reactive dyes, and direct dyes also embody sustainability and trends of colorant coloring abstraction on the fabric. A technique for making a sponge print block using a lathe machine creating a sponge blotter has been eco-printed on a cotton fabric dyed with turmeric dye. The theme of this eco slab print lifting artwork process on the material as media prints not only as commodities on the market but also as a fine art based on the depth of an abstract coloring pattern.


Fig. 6 & 7: Equipment used while printing

2.3. Environmental Impact of Eco Printing

The rapidly increasing concern regarding climate change is consistently drawing attention towards the environmental impact of all production processes, including textiles. With the continuously growing market for textiles, the impact of this industry on the environment is getting larger, which in turn is drawing the attention of both academics and practitioners. The textile dyeing and finishing sector alone is responsible for 17-20% of water pollution globally, accounting for, on average, 200 tons of water per ton of textile dyed. While the developed world, at least publicly, seems to be recycling and recovering content with the voluntary laws in place, the emerging economies continue to be the hub for fast fashion and the production sites for major brands. It has remained an impossible task for brands to audit the entire layers of outsourcing in a supply chain that is worldwide. This issue notionally seems simple: finding eco-friendly alternatives to the synthetic dyes, occasionally banning a few hazardous ones.

India has a longstanding history of natural dyes—not only for textiles before the invention of synthetic dyes but also many different processes and uses of natural dyes that are simply not employed anymore with the invention of synthetic dyes. Most people have a very limited knowledge of natural dyes and their processes. The country is regularly still seen using synthetic dyes in a random and careless manner.

The harmful effects of synthetic dyes are now generally recognized: eco-toxicity which is harmful to flora and fauna, bio-accumulation in the human body, and serious health effects ranging from allergies to skin ailments to cancers? The easiest and most direct means of addressing dyeing in a sustainable way is to promote natural dyeing through awareness campaigns through which the information about plant dyeing benefits can reach a wide audience. These campaigns have been used in regions with an abundance of good (beneficial) herbs growing locally; women were trained in the techniques of dye preparation and dyeing.

2.4. Comparative Studies on Eco Printing and Conventional Printing

Eco printing is a remarkable natural and sustainable printing technique on handloom fabric. The result of eco printing can have colors from the fabrics dyed as background color. The printed color on the fabric can last long and become more beautifully aged over years. Eco printing can be done in any conditions including home kitchen with anything available there. Substantial work has been done on eco-printing techniques on cardboard, paper, silk, cotton, wool, and other fabrics, but studies on eco-printing techniques on un-dyed handloom and naturally dyed handloom fabrics are rare. The main aim of this study is to demonstrate the eco-printing technique on un-dyed handloom fabric and on handloom fabric dyed with natural materials (LARASATI &, 2019). Handloom cotton fabric samples, leaves, and flowers were collected from different places of Kolkata.


Fig. 8 & 9: Eco Printing v/s Chemical Digital Printing

In this unique study a very simple eco-printing technique on hand-woven light colored cotton fabric using raw kitchen items and flowers is demonstrated. This eco-printing technique can also be used for other light colored cotton fabric. The kitchen items used in this study are turmeric powder, tamarind, and onion and for flower petals free flowers are used. Eco printing can be achieved from any plants either fresh or dry. The printed cotton fabric has a beautiful

texture left by the kitchen raw items and flower petals. It is worth mentioning that eco-printed handloom light colored cotton fabric can be a highlight of the successful zero waste traditional craft. Eco-printing is a remarkable natural printing technique. The history of botanical printing dates back to Second World War. It is based on the natural characteristics of many plants (Pizzicato et al., 2023).

Eco printing can be considered one of the sister techniques of eco dying. The resultant products of both these techniques are stunning. Some beautiful and unique eco-printed products are created by this technique. Eco printing is an amazing sustainable printing technique. The resultant products of eco printing can not only have the color of the fabrics dyed as background but can have the color of the leaf or flower printed on it. The printed color on the fabric can last for a long time and become not only beautiful but also age worthy after years.

3. Methodology

Eco Printing is a technique that allows for unique, one-of-a-kind prints on fabric using various materials available in nature, just by transferring the pigments. It is a technique that facilitates the recycling and 2R (Reuse and Recycle) of natural materials. It is also environment-friendly, allowing for creations without causing pollution or harm to the earth. Eco-Printing could be applied to common and traditional handloom cotton fabric which is supported by the need of added value to the product. Eco-printing on handloom cotton fabric is a potential exploration because of the uniqueness of the fabric. Eco Printing allows the natural reproduction of the designs available in nature just as compression prints (Fernanda Lema Ruano, 2017) (LARASATI &, 2019).

It needs to be supported by the availability of abundant plants. It also needs to consider the timing of the design reproduction because it needs to be almost fresh, preferably picked and used in that day. The additional usage of chemicals in the dyeing process is avoided to get the pure, one of a kind product which is adopted by the current trend of go green campaign.

The state-of-the-art methods used in Eco Printing on handloom cotton fabric

(1) Depilation using an alkaline solution,

(2) Pit dyeing using a tannic extract of a batch of pre-treated pit raw material,

(3) Compression printing on the dyed cotton fabric,

(4) Bundled tie-dyeing to get a solid dye on the background,

(5) Finishing process using potassium alum.

A series of experiment shows that this technique is feasible to apply in reality because it is easy yet yield a variety of beautiful and unique prints.

Fig. 10 & 11: printing through natural flowers

3.1. Selection of Handloom Fabrics

Eco printing is a technique of historical significance during the time around 1900. Both Alfred F. Heller in Switzerland and another artisan in Tänna, Sweden, were dyeing training silk with different types of leaves. Three acidic substances were also applied and were tested on handling sizes and freezing. Alda L. Coombes, a textile artist, successfully collaborates each plant material to create lovely effects for which she is highly acknowledged till date. First packs revealing after 8 hours boiling can be seen. The Anglo-American eco print technique is a faster variant to the classical as some results show and Silky is also expected to be applied (Fernanda Lema Ruano, 2017).

The coloring of the fabric is the least inherent one which makes timely re-measurement necessary (LARASATI &, 2019). Eco printing is essentially a method of stamping and dyeing fiber with the pigment and design of natural plants (leaves, flowers, vegetables). Such methods will create texture, patterns, and designs, thus resulting in natural eco-printed textile. Because the fabric is soaked in mordant and a variation of pound and boil methods with leaves. The oxide materials from the leaf stain and organic waste such as the cotton cloth, which is treated with just mother earth are placed on Ayu enriched mud and buried. The result is simply given by a natural stamp of leaves which are botanical.

Fig. 12: Eco Printing on handloom fabric

The fabric used in this process is cotton. Dyeing Eco printing on cotton and paper is another new endeavor. Eco printing on handloom cotton fabric had 87-91% efficiency using minimum 30 leaves and less water and time than the dyeing method. It is also noted that folding the leaves, single ply threads, and the paste application improved shading. Hence, the proper identification of fabric and process was assured. Cotton and Lyocell, having good absorbency with natural mordants and alternate pre-mordanting, all worked best for Eco printing on this type of fabric.

3.2. Preparation of Natural Dyes

Eco-printing is a sustainable and chemical-free printing method on textiles, using natural materials (leaves, flowers, and bark) to transfer colors and patterns to fabric. The eco-printing process is aligned with slow fashion and sustainability. By using handloom fabrics, the handcrafted nature remains intact, and the use of natural dyes minimizes environmental impacts. The results are always unique, containing no two exactly alike. Importantly, unlike in chemical methods, eco printing does not use synthetic mordants or toxic dyes, meaning it is less harmful to the environment and safer for artisans. Eco-printing also embraces zero-waste design approaches, making it most aligned with the slow fashion and sustainable craft efforts. Eco-printing methodologies best fit handloom fabrics like, cotton, silk and wool that absorb natural dyes, and are paired with traditional textile practices of India. In eco-printing, leaves, flowers, stems, and bark are arranged on fabric and put through processes like bundling, steaming, or boiling, allowing all the natural pigments and tannins to be transferred to the surface of the textile.

Here's a detailed table format that outlines the eco-printing methodology on handloom fabric, with specific plant/leaf examples, their color outcome**,** mordant use**,** and application notes. This chart can help you plan an eco-printing process with more clarity and practical use:

Table 1: Eco-Printing Methodology on Handloom Fabric – Detailed Table

Step	Details
1. Fabric Selection	Handloom Cotton, Khadi, Tussar Silk, Mulberry Silk, Linen – pre-washed and scoured. Natural fibres are essential for plant dye absorption.
2. Mordanting	Use **Alum** (brightens color), **Iron** (darkens tone), or **Tannin** (from myrobalan, pomegranate rind). Mordanting improves color retention and definition.
3. Plant Material	See table below for specific leaf/plant choices, their color outcomes, and mordants.
4. Layout	Lay plant materials flat on fabric. Fold/roll tightly and bind.
5. Steam/Boil	Steam for 1–2 hours. Avoid direct water contact unless boiling is desired.
6. Cool & Cure	Let bundles cool for 12–24 hours before opening to allow maximum dye transfer.
7. Wash & Dry	Gently rinse in cold water. Dry in shade. Iron to set the print.

Table 2: Plant/Leaf Examples for Eco-Printing

Plant/Leaf Name	Botanical Name	Color Output	Best Mordant	Application Notes
Eucalyptus leaves	*Eucalyptus globulus*	Orange, rust, brick red	Iron or Alum	Strong natural tannin; use fresh leaves; excellent definition in prints.
Rose leaves & petals	*Rosa* spp.	Soft green, maroon	Alum	Press leaves flat for good contact; petals bleed color.
Marigold flowers	*Tagetes erecta*	Bright yellow, gold	Alum	Petals can be sprinkled or pressed; gives strong yellow tones.
Onion skins (red/yellow)	*Allium cepa*	Bronze, orange, rust	No mordant or Alum	Peel outer layers; gives strong color; can be boiled or used in steam.
Pomegranate rind	*Punica granatum*	Pale yellow to grey	Iron	High in tannin; cut into small pieces or powder; can be added in steaming water.
Neem leaves	*Azadirachta indica*	Olive green	Iron	Leaves release color slowly; good for background tint.
Maple leaves	*Acer* spp.	Red, orange (in fall)	Alum	Seasonal; good for silhouette printing.
Castor leaves	*Ricinus communis*	Greenish-brown	Iron	Strong outlines; large leaf shape prints well.
Mango leaves	*Mangifera indica*	Deep brown, yellow-green	Alum	Works well with steam; mature leaves give more pigment.
Teak leaves	*Tectona grandis*	Red-brown to deep maroon	Alum or Iron	Excellent for large prints; textured surfaces create dramatic effects.

3.3. Eco Printing Process

Eco printing is a natural dyeing / printing process developed by a artist named Jacqueline H. C. J. Van Der Kloet. During her work, she discovered that some plants are able to dye and able to leave impressions or images, or prints of their leaf forms or leaf shapes in fabrics and even papers. The process she invented is called Eco printing, where she combined dyeing / printing using heat and moist (water) + pigment (plant material) and a textile fabric that she selected to dye. While or after dyeing, she then sometimes added metal salts and other modifiers to influence the dyeing process in order for her the brighten or modify their natural colors. Printed textiles and papers could then become stitched, embroidered, woven, folded, and/or sewn into three-dimensional objects and exist as an art making both naturally and functionally and aesthetically (Fernanda Lema Ruano, 2017).

The best thing about eco-printed fabric is that each fabric will have a different texture, bubbling, and dull fading colors that depend on the amount of each elder used and how each elder touch every piece. Therefore, your fabric will each have its own character. No fabric will be the same which could be a good thing because it is unique. The process of eco-printing starts by grinding plant, wood; sand on the mortars until it becomes a smooth paste, and then the paste is smear on cotton fabric. The fabric is fan pleated and then put in a pot on top of ice cubes. With a little bit of fruit acid, lemon juice, finish the process by putting the pot on the stove for a low heat setting to simmer for approximately 20 minutes and the printing process is done. (LARASATI &, 2019)

Eco printing technique can also be used on cushion or any flat shape. The technique can go on any layer that can bend or tightly rolled. Additionally, to execute the printing technique, we could also use the shibori technique or stitching. Mask is one of the eco print products that combine eco print and stitching to make it. The fabrics printed with eco print we know that natural fabrics of both cotton and silk can be printed with eco print. Cotton and silk will show a different process since Cotton usually has finer weave and can show fine details more clearly, precisely the technique is simply to use the foil technique on cotton or using Cotton it slabbed in the shape the finer details stands out in detail. Silk is to smooth, shinier, and produce a softer look and with scrunching when foil is used. We think of smaller patterns, cotton is a better choice because of its detail. However, it should also be noted that the artisan can design a large pattern as large as global shapes the artist skill matters when it comes to the finished product.

4. Results and Discussion

Eco-printing is a coloring technique with leaves as a motif. Eco-printing is a technique of printing using natural materials such as leaves that are pounded on fabric. Eco-printing is a printing method used with organic matter using non synthetic dyes and plant material (leaves or flowers) for designs on fabric and paper. Eco printing uses flat plant material (vegetables) which are then pounded onto the media (fabric, typically cloth or paper). Eco-printed leaves and flowers can be leaves of edible or non edible or inedible trees. Eco printing media often using cotton cloth is a cloth made from the prickly cotton fibers which is from a seed from a Gossypium species. These prickly cotton fibers prepared by spinning process and woven by hand weaving process.

The cloth with patterns of earth leaves, banana-senggigi leaves, and gold leaf printing still felt from the point of producing patterned on cotton cloth before about 2 to 5 days. In addition, to immerse representative samples fabrics of patterned made on out flowed hot water boiling black tea added with diesel sugar and alum of 7 servings considered to the end time, and a photo. Successful eco printing motifs by selected featured, better distinguish motifs. The speed of produced motif printing viability indicates the accessibility and potential of eco-friendly printing practice through cotton fabric. From the exploration and observation of various edible vegetable leaf materials types for eco printing motifs as substitution for leaves that are not canvas, tannin and flavonoid are representative the chemical from polyphenols group. They characterize it has a better capacity stain based my relationships connecting from them.

4.1. Visual Analysis of Eco Printed Fabrics

Visual inspection was performed on eco-printed fabrics to evaluate the appropriateness of fabric options for the local kebaya or blouse dress. A dyebond-fabric dyed with turmeric was selected for the eco print and the strength (tenacity) of six assorted leaf species were also evaluated, which were dye plants bent for producing an eco-printed floral motif. Visual evaluations of eco-printed textiles encompass subjective perceptions given how many subjective elements may come into play on what we might perceive as an end product. Thus, visual apprehensions were formally and objectively accessed via a standardized black and white color gaze in its greyness and contrast values (Fernanda Lema Ruano, 2017). One other assessment, the main color, was done to assess it visually by surveying the hue and perception of the motif color. The registered eco printed fabrics were concluded in greyscale with its L*, a*, and b* values (LARASATI &, 2019).

Visual Analysis of Eco Printed Fabric Before assessment with greyscale, the color of eco-printed fabric was firstly assessed with its design motif evaluation, followed by assessment with L*, a*, b* and hue, saturation, and lightness values. The design motif evaluation was based on the inherent consideration of eco printed fabrics including attractiveness, which was considered by the fabric depiction, and suitability to both kebaya and blouse dress style. The eco-printed fabric depicting the foliage design with unit linear was selected, whereas alternative design depicting either one motif per fabric or composed irregularly foliage design was rejected.

The final eco-printed fabric was the turmeric-dyed fabric with tenacity of equal to eleven or less out of twelve foliage species which was then stamped as a kebaya or blouse dress pattern. The tenacity of foliage plants to yield eco printed floral motif was evaluated based on whether one foliage produced a floral motif or not, while foliage plant to yield floral motif remained further assessed with the nectar containing flowers and the suitability of its floral size on the dress.

4.2. Durability and Wash Fastness Testing

The build-up of stains and the subsequent wash process can significantly affect the initial color strength of printed fabrics. Eight samples of cotton fabrics, printed with color inks under controlled variables, were evaluated using the AATCC Test Method 61-2010. The Explain the objective of the study in a complete manner. The study in textiles laundering has two commonly used laundering procedures: machine wash and hand wash. Different brands and washing settings were tested and matched to a few repetitive manual hand wash process (e.g., various lingering fabrics). The commercial brands of detergent were investigated independently to determine what stains could be removed, what discoloration occurred, and if regenerability was specified and significant. It was established that the wash processes are not the same. Although some machine wash settings provide appropriate wash fastness for color prints, there is significant room for improvement.

Hand washing has been shown to prove advantageous as well. Although we will be incurring a low entry cost, the cost paid until will be re-coupled due to an evaluation of longevity of wash fastness. In principle, for printed textiles that do not revert back to pre-test status after the first wash, wash fastness evaluation should hypothetically require alternate / replication of the build-up stains (Thompson et al 2016). The wash fastness associated with textile printing denotes the extent of any change in the color of the printed fabric after sufficient wash (as required, with bleach and detergent activations etc.) has been completed. Digital textile printing technology has brought together the transfer of a print (design intent) only on fabric, with a non-intrusive post treatment using an almost unexpected surface; this is what is mostly meant by pick up no, getting the pick up off the fabric with color (introduction in) but pigment inks are deficiently keyed with respect to the context of cotton. The contemporary solutions and their use associated with dyes and polymer binders produces serious testing issues for sustainable printing mediums on hand loom fabrics because their simulations being developed are related to serious sustainability issues in aqua related pollution, prior to them being taken into textile production.

4.3. Consumer Perception and Acceptance

Sustainable fabrics use organic natural fibres produced in regulated environmental conditions and socially acceptable and responsible, ethical work practices. Emerging economies are a treasure chest of sustainable natural textiles including, organic cotton, lyocell, bamboo, hemp, wool, linen, nettle, jute, khadi, and silk; natural fibres have a net zero impact and natural fabrics are biodegradable and recyclable that helped to reduce their eco-footprint. Natural fabrics bear no additional chemicals (Valentini, 2012). Examples of polyester, nylon, and acrylic made from synthetic sources are not sustainable (Ali, 2015). There are specific types of fabric made from synthetic sources, even in waste form that will remain in the environment for more than 200 years and create environmental pollution.

Natural materials and renewable-source materials are often from an animal (leather/silk), pulp (paper/straw), or mineral (stone) source. Use of plant-based textiles has existed since prehistoric times for clothing, art textile, and food uses (e.g. salty salad dressing and greens). The presence of assorted

natural fabrics as standard is commonplace. Natural fabrics such as cotton or silk tend to be more costly than synthetic fabrics because inconsistent fibres and low production. Their costs, and weaknesses, allowed synthetic fabrics to monopolize fashion for decades. Thankfully, as people become more aware of the consequences of non-sustainable fabrics and ethical textiles, the industry is now more focused on semi-synthetic or eco-friendly fabrics. However, many inconsistencies in how they perceive, acceptance, and purchase behaviour regarding this niche market of eco-friendly fabrics or naturally dyed textiles remains.

This study considers more than sustainability; it also considers consumer behaviour, acceptance, fashion, and creativity in sustainable handloom fabrics. Sustainable fabrics are textiles produced from environmentally-friendly natural fibres that are produced in regulated environmental conditions and conform to socially acceptable, ethical work practices. Many eco-friendly natural fabrics are produced in developing countries; they have excellent natural resource and biological diversity due to many agro-climatic zones. Silk can be produced, beautifully hand-looped carpets can be made from cow's wool; we can also use a bio herbicide. All of these textiles use renewable resources and create lower eco-footprint.

4.4. Sustainability Assessment of Eco Printing

As the textile and fashion industry continues to expand, the number of issues in conjunction with pollution, carcinogenic and toxic chemical usage, waste, and unsustainability of the world of fashion and textiles is increasing. On a global scale, it is time to begin taking a serious look at sustainability on the planet humans are living on by prioritizing the prevention of pollution in the water, soil, and air, which is vital to sustain liveability on the planet. The textile and clothing industry is one of the many sectors identified as a major polluter, a threat, and an un-sustainable industry due to the relentless toxic chemical input and waste generation during the whole life cycle of textile products.

Dyeing textiles uses a lot of chemicals and has received lots of attention from the textile contaminating part of the water pollution story. Many developed nations have had lots of laws and regulations to eliminate textile discharge pollution and developing new laws are also in place to promote sustainability in dyeing. Natural dyes which come from natural sources that can include plants, insects, and animal are biodegradable and have less impact compared to synthetic dyes. The rise of global trends on sustainability due to the environmental concerns and the technological advances that have taken place now allow us a fresh perspective for the re-introduction of natural dyes as sustainable dyes for textiles.

The contemporary study and new limitations of natural dyes have been examined for enhancing their potential usage, and for the first time in the fashion industry as a fashion statement in response to synthetic dyes (Pizzicato et al., 2023). The eco-print sample was pathogenic being converted into a garment after finishing. After removing the complexity of finishing and completing the printing process with heat fixation, followed by rinsing washing, the incidental efflorescence and insolubilisation of the anthocyanins occurred. The garment type eco-printed with leaves of Piper beetle, betel leaf, and baby corn opens a new pathway, in which to prepare an eco-printed product which is beneficial for skin health. Eco-printing is a simple, economical home textile decorative craft that play an important role in developing a green technology of zero chemical waste (LARASATI &, 2019).

5. Conclusion

Eco-printing is a natural and sustainable printing technique on handloom fabric. All the raw materials used in eco-printing including the nature dyes are totally eco-friendly and biodegradable thereby making the process one of the most novel means of printing on fabric. Eco-printing is a botanical dye printing technique where the leaf prints on textiles are created by transferring the shape, color, and silica content from leaves to the fabric. The coloration pattern on fabric depends on a variety of parameters such as the leaf/flower used, its age and freshness, mordanting technique, fabric preparation and pre-treatment of fabric before printing (LARASATI &, 2019).

Eco-printing on fabric is a technique which is as old as environmentally friendly. With advancement of the mordanting technique there is a change in technique from fabric dyeing to fabric printing. Eco-printing on fabric can be done by either bio-mordanting method or synthetic mordants. But bio-mordants are used here. This is a new method as it provides an extremely rich, colourful and sustainable output. Further research can be carried out on fabrics such as silk or any other newer fabrics, such as satin taffeta, organza or polyester based fabrics (Pizzicato et al., 2023). In this fast fashion society we all produce a vast amount of textiles which ultimately end up in landfill sites. Eco printing can be a novel route for recycling waste textiles. Eco printing is a newly revived process in the textile industry with considerable future research and development potential. We print cloth in a natural context and provide a new life handloom/lawn and cotton waste textiles. This is a means of reciprocation and preserving the roots and culture. The raw materials used are totally biodegradable and eco-friendly.

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