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Exploring the Resurgence of the Eco-Printing Technique, Regaining Its Lost Art and Soaring Popularity in Recent Times

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Abstract

The niche garment sector is set for an era of fascinating innovations as trends like organic clothes, handloom crafts, and handmade outfits increase in popularity. Textile craftsmen are rediscovering historic techniques and merging them with new ingenuity to create environmentally conscious artworks as consumer awareness of eco-friendliness rises. Amidst the rise of trends such as organic clothing, handloom creations, and artisanal garments, the specialized apparel industry is poised for an era of captivating developments. The persistent push for adopting more environmentally friendly practices has exerted a substantial influence across all sectors of the economy over the course of many years. This shift is not driven by mere trendiness, but rather by the imperative to veer away from the trajectory inevitably leading to environmental deterioration. One notable sector, Is the textile printing industry, bears a significant share of responsibility in this regard. The utilization of resources like trees, water, electricity, Dye stuffs, waste management and materials that impact ecosystems, such as printing dyes, demands careful consideration. If ecologically sound solutions have not yet been integrated, the time to do so is rapidly diminishing. Among these revivalist techniques, eco-printing is, currently under exploration by both brands and skilled artisans. Eco-printing is one such step towards an artistic process that captures the intricate shapes, colours, and imprints of plants, leaves, and flowers onto fabric. The eco-printing sector is now in its early stages, featuring just a few individuals and start-up businesses engaging in extremely limited-scale operations. They also ideally complement eco-conscious lifestyles, making them a go-to pick for slow fashion and safeguarding the environment from hazardous effluents emitted by
the synthetic colouring industry. This paper advocates for the adoption of eco printing as a catalyst for promoting environmentally responsible methods within the apparel sector, which has a huge scope in general, expanding this market niche which would give craftspeople a solid future as well as new skill sets, emphasizing a bright and sustainable tomorrow.

Keywords: Eco Friendly, Eco Conscious, Eco Printing, Eco Systems, sustainable practices.

1. Introduction

The global pandemic has unquestionably brought about a transformation in the way the world functions. Concurrently, consumers are displaying a heightened awareness of environmental concerns compared to any previous time. This has led to the rise of sustainability as a significant and burgeoning trend, focus on the idea of 'circularity' and the more environmentally conscious production of goods. The textile industry stands as a prominent contributor to global pollution. Worldwide endeavours are underway to establish a

sustainable supply chain within this industry. Noteworthy outcomes of these endeavours include the cultivation of organic cotton, water-conserving dyeing processes, closed-loop designs, sustainable garment consumption practices, and the development of self-cleaning textiles. The crux of the solution for all generations lies in harnessing natural resources responsibly to ensure their availability for posterity.

Within the realm of textile surface design techniques, printing has a long history, encompassing various methods and technologies. Similar to other operations, textile printing involves the application of potentially harmful chemicals. Eco-printing emerges as a promising approach for local artisans, enabling the creation of diverse surface designs using locally abundant flora. Water plays a pivotal role in these processes and is both heavily utilized and contaminated, particularly during the processing phase involving textile materials. This phase encompasses actions such as scouring, dyeing, printing, and finishing, each of which varies based on the textile substrate and final product requisites. Prominent names in the fashion industry are now establishing objectives to exclusively source products

from facilities equipped with zero liquid discharge capabilities. They are also embracing novel technologies to curtail water consumption during these processes. The entire textile industry, inclusive of technology and chemical suppliers, is engaged in a ceaseless collaborative effort to diminish water usage throughout textile procedures. Notably, practices like waterless dyeing and digital printing have already entered commercialization. However, their adoption rate remains sluggish due to the substantial initial investment and operational expenses involved. Chemical dyeing often involves harsh chemicals that can release harmful toxins into the environment and pose health risks to workers and consumers. Natural dyes are generally safer and have lower toxicity. Natural dyeing offers artists and designers an opportunity to explore unique patterns and effects that cannot be easily replicated with synthetic dyes, Natural dyeing promotes the cultivation and use of a wide variety of plants, which contributes to biodiversity and supports local ecosystems. Natural dyeing offers artists and designers an opportunity to explore unique patterns and effects that cannot be easily replicated with synthetic dyes. A variety of printing methods, including block printing, screen printing, stencil printing, hand printing, and others, may be employed to decorate clothing. The most recent method is eco printing. One of the most recent methods that prioritizes environmental friendliness is eco-printing. So now the question is what is Eco printing? It's a method in which plants, leaves, and flowers imprint their shapes, colours, and patterns onto fabric. This involves enclosing plant materials within cloth, which is then subjected to steaming or boiling. This process extracts the natural dyes present in the plants, resulting in a print that mirrors the form of the utilized leaf or flower. These imprints are commonly termed "eco-prints." The origin of using natural components to imprint patterns onto fabric dates back to the Middle Ages, coinciding with the emergence of herbalism. Historical evidence even points to botanical printing being documented in pharmacological manuals of Ancient Greece.

The contemporary practice of eco printing was pioneered by India Flint, an acclaimed textile artist hailing from South Australia. In 2008, she published the book titled "Eco Colour: Botanical Dyes for Beautiful Textiles." This handbook serves as a remarkable guide to the eco printing techniques she innovated, marking a significant stride in democratising sustainable pattern creation for everyone. Flint's first sources of inspiration were European folk customs using plant-based egg colouring. Her subsequent usage of the phrase "eco print"

has now become customary among international enthusiasts who are creating environmental print methods at home and sharing their work with a booming online audience.

Through the formation of distinct and vivid traces, textures, and colours, it enables plants to adhere to cloth. Mordants widened the colour spectrum, altered colour tones, emphasised plant patterns, and enhanced colour output in print. The predominant colours created by copper, iron, and alum were cinnamon, brownish, greenish, dark khaki, mink, brown, and navy, as well as more pinkish, reddish, and yellowish lighter/softer tones. Successful creating patterns requires technical expertise, practical experience, repetition, and precise recipe formulation. Process settings can be changed to provide attractive surface effects. Even a single parameter adjustment results in tremendous diversity and a completely new design. With eco-printing, the possibilities for patterns, textures, and creating are unlimited, and the finished result is just as exceptional and amazing as nature itself.

2. The significance of this study

Unfortunately, the fashion industry uses a lot of synthetic and chemical dyes that have negative social and environmental effects. Since synthetic dyes are cheap, produce bright colours, and are dangerous to human health, they are primarily used in the textile industry. Old eco-practices are now being reviewed in an effort to lessen the industry's environmental impact. We are all aware of how environmentally friendly, biodegradable, and non-toxic natural materials like flowers, and leaves Eco-printing and eco-dying are crucial to developing a long-term sustainable fashion sector since they minimise waste and unneeded environmental harm. Therefore, the environment should be protected by using natural ingredients. Eco-printing is a kind of art that uses natural colourants found in plants, flowers, insects, fruits, vegetable by-products, etc. to produce graphic effects. Boiling, heating, and pounding these materials' inherent colourants into paper or cloth. It enables designers and artists to freely express their thoughts, opening the door to unanticipated outcomes, patterns, colours, and visual effects. Flowers might be categorised as natural dyes and are appropriate for eco-printing since they are produced from nature and include natural biodegradable colouring ingredients.

3. Objectives

- Environmental Sustainability: Eco-printing aims to reduce the ecological footprint of textile processes by using natural dyes and minimizing the use of chemicals and water.
- Health and Safety: By utilizing natural dyes and processes, eco-printing contributes to the health and safety of both workers and consumers by minimizing exposure to harmful chemicals.
- Unique Aesthetic: Eco-printing often produces distinctive and unpredictable patterns on fabrics, making each piece unique and promoting creativity.
- Cultural Preservation: Some eco-printing techniques involve traditional methods and dyes that can help preserve cultural heritage and traditional textile practices.
- Reduced Water Usage: Eco-printing methods can minimize water consumption, which is a significant concern in traditional textile dyeing processes.
- Local Economy Support: Many eco-printing materials are sourced locally, supporting local economies and reducing the carbon footprint associated with transportation.
- Educational Value: Eco-printing can raise awareness about sustainable textile practices and encourage people to make more informed choices as consumers.
- Innovation in Textiles: Researchers and designers often explore new techniques within eco-printing, driving innovation in the textile industry.

- Carbon Footprint Reduction: Natural dye materials and eco-friendly processes can lead to a lower carbon footprint compared to conventional dyeing methods.
- Connection to Nature: Eco-printing can foster a deeper connection between textiles and the natural world, as many of the materials used come from plants.
- Biodegradability: Natural dyes used in eco-printing are generally biodegradable, reducing the long-term environmental impact of textiles.
- Experimentation and Collaboration: Eco-printing encourages experimentation and collaboration among artists, designers, and artisans to create sustainable and visually captivating textiles.

4. Materials and method

Roughly 25 years in the past, India Flint pioneered the eco-printing technique. This method enables the transfer of leaf impressions from various plants onto a range of materials like paper, fabric, clay, and stone. This approach gained widespread popularity among a diverse community of artisans, inspiring them to explore a multitude of materials and techniques.

Eco printing is a technique for printing textiles that uses diverse plant components. In this method, pigments that are found in various plant sections are extracted and printed directly into cloth. There are two widely used eco-printing techniques, notably the hammering or bind and steam method and the pounding or hammering approach. Different plant parts are bound between layers of fabric in the bind and steam method, while in the hammering or pounding method, the plant material is first beaten with a soft hammer over the fabric layer before the fabric is wrapped and steamed to develop the print.

4.1 Materials and Equipment required

The equipment needed for eco-printing might vary, depending on the exact process and materials being used however some fundamental tools that are frequently utilised include:

- Fabric: The material—such as silk, cotton, or wool—that will be printed.
- Natural printing materials: These include the leaves, flowers, and bark that will be utilised in printing.
- Mordant: A material, such as alum, iron, or tannin, used to bind the dye to the cloth.
- A big pot or pressure cooker is typically used as the dye pot to heat up the cloth and natural ingredients.
- To press the natural materials onto the cloth, use a rolling pin or press.
- To bundle the fabric and natural materials together before dying them, use string or rubber bands.
- To mould the natural materials into the required form, use scissors or pruners.
- Apron, mask, and gloves for protection: to shield your skin and clothing from the dye and mordant.
- A heat source, typically a burner or hot plate, to heat the dye pot.

4.2 Safety measures

To safeguard both you and the environment, it is crucial to adhere to safety procedures during the process.

- To protect your skin and lungs from harmful irritants or chemicals, always use gloves and a mask when handling mordants and dyes.
- To prevent breathing in fumes when steaming the cloth, use a space that is well-ventilated or put on a mask.
- Keep children and pets away from the natural materials and colours.
- Any leftover dye, mordant, or natural materials should not be disposed of in a way that endangers the environment.
- Know the toxicity of the plants you're utilising; certain plants might be harmful or allergic.

4.3 Natural materials required for Eco printing is listed below

The natural materials that are most commonly used for eco-printing can vary depending on location and the time of year.

Some examples include:

- **Leaves:** Maple, eucalyptus, oak, sumac, and ferns are some of the most commonly used leaves for eco-printing.
- **Flowers:** Many flowers can be used for eco-printing, including roses, pansies, marigolds, and violets.
- **Bark:** The bark of certain trees, such as birch, cherry, and willow, can be used to create unique patterns on fabric.
- **Berries:** Berries such as elderberries, currants, and blackberries can also be used for eco-printing.
- **Other materials**: Some other materials that can be used for eco-printing include onion skins, avocado pits, and herbs like sage or mint.

4.4 Mordants in Eco Printing

To increase the colour fastness and durability of natural dyed fabrics, mordants are compounds that are applied to the cloth before dying. They make it easier for dye molecules to attach to cloth fibres, preserving colour vibrancy and preventing easy fading over time. Environmental and health concerns can also apply to some mordants. As a result, environmentally conscientious dye experts may look for other mordanting techniques or restrict their use. In the field of natural dyeing, mordants are crucial tools that enable craftspeople to produce stunning, long-lasting colours on fabrics while honouring the environment and conventional methods.

4.5 Various Mordants Used in Eco Printing

1. Aluminium-based mordants are known as sunny mordants because they bring out vivid yellows and greens when they mix with the natural tannins in leaves and dye.
2. When ferrous sulphate interacts with the natural tannins found in natural dye or leaf pigment, often known as the "sad mordant," it brings out the greys and blacks. WOF 1%
3. A depressing mordant, copper sulphate enhances the greener and bluer tones when used with natural dyes, tannins, and leaves. When WOF is 4%.
4. A relatively recent mordant, titanium oxalate was originally used in the leather industry as a less harmful substitute for the highly polluting chrome mordants. When it interacts with tannins, it brings out the orange and yellow tones.
5. Tin, often known as the red mordant, is not used very frequently in Eco printing, mostly because it is quite expensive. In the past, using 2% WOF was sufficient for natural colouring.

5. Three techniques of Eco-Printing Methods

5.1 Steaming Technique : In eco printing, the steaming technique is a prevalent and effective technique to transfer natural pigments from flowers, leaves, and other plant materials onto fabric. This technique enables delicate and detailed impressions, and it uses heat and moisture (not boiling water immersion) to extract and fix the natural dyes. Prepare in advance the different instruments and supplies required to generate eco print masterpieces using the steaming or steaming process.

5.2 Beat or Pounding Technique : The Eco print method is the easiest since it only involves placing some flowers or leaves on the fabric and whacking them with a hammer. Here are some actions you may take to get the best eco print outcomes.

5.3 Fermentation of leaves :In addition to the two procedures mentioned above, leaf fermentation methods may also be used for eco-printing.

The three techniques are explained in detail

The leaf fermentation technique in eco-printing involves using leaves and plant materials that have undergone a fermentation process before being applied to fabric or other surfaces. In this technique, the leaves are allowed to naturally ferment, breaking down cell walls and releasing their pigments and tannins. This fermentation process can enhance the transfer of colours and patterns onto the fabric during the eco-printing process.

5.3.1 Bundling Technique

Bundling entails a technique wherein leaves, stems, berries, and flowers are methodically positioned onto mordanted fabric to achieve the desired design pattern. Prior to bundling, fabric intended to be paired with petals or plant components undergoes mordanting using alum or other metal salts to enhance dye absorption. Alum acetate and alum sulphate are the commonly employed mordants for cellulose and protein fibers respectively. Following mordanting, the fabric is moi stened in water for a duration of thirty minutes. Leaves and petals are then meticulously arranged within a predefined area, following a designated outline pattern. The fabric, once folded and bound according to this arrangement, is exposed to sunlight for a minimum of 24 hours, or an extended period, to facilitate thorough dye extraction. Steaming also contributes to the effective extraction of dye.

Some of the elements impacting Output bundling includes:

- The placement of the flowers and leaves on the plants
- The method of folding the cloth
- Fabric pre-treatment
- Items' contact pressure
- The sun's heat
- Time
- Post-treatment

5.3.2 Pounding Technique

Plant pounding presents an alternative method to capture the intricate details of leaves, flower stems, and flowers in various patterns. In this procedure, mordanted fabric is positioned on a firm, smooth board. Petals, leaves, and stems are meticulously arranged in a predetermined manner and held in place with tape. The fabric is then flipped and gently hammered until the dyes and patterns are transferred onto the fabric surface. This process generates an immediate printed pattern, offering designers an exhilarating experience. At times, employing diverse combinations of pounding and bundling techniques results in a captivating array of outcomes.

5.3.3 Variation in Pounding Approach

Although plain cotton fabric adeptly absorbs dye chromophores, dyed cellulosic and protein fabrics can also be used in conjunction with the pounding technique. However, in these cases, comprehending the resulting colour from specific leaves or flowers becomes paramount. This is because the true colour of certain leaves and flowers might undergo transformations after the pounding process.

5.3.4 The steps for leaf fermentation eco-printing typically include:

Collection and Fermentation: Leaves and plant materials are collected and arranged on the fabric. The fabric is then rolled or folded with the plant materials inside. The bundle is left to ferment in a warm and moist environment, allowing the breakdown of cell structures.

Oxidation: After a period of fermentation, the bundle is unwrapped. The exposed plant materials are now rich in pigments and tannins, which have been released due to the fermentation process. These pigments are often more readily absorbed by the fabric.

Heat and Pressure: The fabric with the fermented plant materials is then rolled or folded again and often secured with string or bands. The bundle is then steamed or boiled to set the
pigments onto the fabric. Heat and pressure help transfer the colors and patterns from the plant materials to the fabric.

Cooling and Unveiling: After the steaming or boiling process, the bundle is allowed to cool down. Once cooled, the fabric is carefully unwrapped, revealing the unique imprints and colors left by the fermented leaves.

The leaf fermentation technique adds an additional layer of complexity and depth to the eco-printing process. The breakdown of cell walls during fermentation can result in more intense colors and intricate patterns on the fabric. This technique also allows for a longer interaction between the plant materials and the fabric, enhancing the transfer of natural dyes. It's important to note that the exact process and outcomes of leaf fermentation eco-printing can vary based on factors such as the types of leaves used, the duration of fermentation, and the fabric material.

6. Discussion

Eco printing stands as a compelling testament to the harmonious interplay between artistic creativity and sustainable practices. Through meticulous experimentation and thoughtful analysis, this research has illuminated the transformative potential of eco printing in the realm of textiles and design. By harnessing the intricate chemistry between plant materials and fabrics, Eco printing offers a unique avenue to imbue creations with both aesthetic beauty and environmental consciousness.

Like any evolving field, eco printing also presents its own set of challenges and opportunities. Future research can delve deeper into refining techniques, expanding the range of plant materials, and investigating the longevity of prints. Moreover, collaborations between artists, scientists, and industry experts can pave the way for innovative applications in textiles, fashion, and beyond. Overall, the objectives of eco-printing on fabrics encompass ecological responsibility, aesthetic appeal, cultural significance, and supporting sustainable practices in the textile industry.

7. Conclusions

The Study is focused on the contribution of Eco printing to environment sustainability and explore and document about Eco printing. Presently, the eco-printing market is in its early stages, with only a few individuals and start-ups engaging in this practice on a small scale.

Nevertheless, naturally dyed Eco-printed garments are poised to become a major trend in the sustainable clothing market. Furthermore, they align seamlessly with the eco-conscious
lifestyles of individuals, positioning them as a preferred choice for slow fashion and contributing to safeguarding the planet from the harmful pollutants discharged by the synthetic dyeing sector.

Eco-printing presents itself as a feasible substitute within this extensive domain. The extensive range of plants and flowers indigenous to the region offers producers a wide array of choices for dyes and designs. By cultivating a systematic and rich diversity of flora, local farmers can find economic benefits. In broader terms, fostering the growth of this specialized sector would not only equip artisans with new skills but also ensure a more secure future for them. The specialised apparel sector is set for an era of fascinating

innovations as trends like organic clothes, handloom crafts, and handmade outfits increase in popularity. Textile craftsmen are rediscovering historic techniques and merging them with new ingenuity to create ecologically responsible artworks as consumer awareness of eco-friendliness rises.

Eco-printing stands out among various revivalist approaches and is now being researched by both brands and expert artists.

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