EXPLORING EGGSHELL POWDER AS A SUSTAINABLE MEDIUM FOR TEXTILE PRINT DEVELOPMENT

PROJECT SUBMITTED

In partial Fulfillment of the Requirement for the

award of the Degree

MASTER'S PROGRAMME IN FASHION DESIGNING

BY

MEGHA A
(Register No. SM22MF010)

Under The Guidance of
Dr. VINITHA PAULOSE

DEPARTMENT OF FASHION DESIGNING

WOMEN'S STUDY CENTRE

ST. TERESA'S COLLEGE (AUTONOMOUS)

ERNAKULAM

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Name and Signature of External Examiner

Name and Signature Internal Examiner

EXPLORING EGGSHELL POWDER AS A SUSTAINABLE MEDIUM FOR TEXTILE PRINT DEVELOPMENT

DISSERTATION SUBMITTED

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ERNAKULAM

APRIL 2024

Name and Signature of Head of the Department

Name and Signature of Guide

DECLARATION

I **Megha A**, hereby declare that the project entitled **"Exploring Eggshell Powder as a Sustainable Medium for Textile Print Development"** is submitted in partial fulfilment of the requirement for the award of the degree of Master's Programme in Fashion Designing. This record is original research done by me under supervision and guidance of **Dr. Vinitha Paulose**, Assistant Professor, Department of Fashion Designing, St. Teresa's College, Ernakulam. This work has not submitted in part of fill or any other Degree, Diploma, Associateship/Fellowship of this or any other university.

Name and signature of the Candidate

Name and signature of the Guide

Place:

Date:

ACKNOWLEDGEMENT

I humbly thank **God Almighty** whose blessing enabled me to complete this venture successfully.

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I take this opportunity to express my heartfelt gratitude to **Rev. Sr. Emilene, Director, Rev**. **Dr.sr. Vinitha, Provincial Superior** and **Manager** and **Prof. Dr. Alphonsa Vijaya Joseph**, Principal, St. Teresas's College, Ernakulam.

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ABSTRACT

This research explores the potential of eggshell powder as a sustainable medium for textile print development. With growing awareness about sustainability in the textile, alternative printing materials are being categorized. Eggshell powder, a descendent of the food industry, holds covenant due to its lavish availability and eco-friendliness. This study look over the aesthetic feel and physical properties of eggshell powder in balancing to traditional textile printing mediums. It evaluates the environmental contact of eggshell powder usage, considering aspects such as resource utilization and waste production. Additionally, the chances of large-scale production and application of eggshell powder in textile printing is analyzed, along with potential challenges and solutions. The aesthetic qualities of textiles printed with eggshell powder are explored, neighboring consumer perceptions and acceptance. Through observation and analysis, this research contributes to the understanding of eggshell powder as a sustainable deputy for textile printing, offering insights into its potential benefits and innovation.

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INDRODUCTION

EXPLORING EGGSHELL POWDER AS A SUSTAINABLE MEDIUM FOR TEXTILE PRINT DEVELOPMENT

I. INTRODUCTION

Textile prints are important element of fashion designing. From ancient civilizations to modern-day couture, prints gives aesthetics with intricate patterns, vibrant colours, and symbolic motifs, reflecting cultural heritage, creative manifestation, and technological advancements. The textile industry is experiencing a renaissance in print development, evolving consumer preferences direct by innovative techniques and sustainable practices,

Prints in textiles includes a different array of methods, ranging from traditional screen printing and block printing to digital printing and sublimation techniques

Fashion houses and textile manufacturers continually push the boundaries of print development, experimenting with innovative materials, and cutting-edge technologies, sustainable practices. Each method brings its own unique characteristics, offering designers endless possibilities to create and attractive visuals various fabric substrates. Prints in textiles play a important role in shaping trends, influencing consumer behavior, and driving market demand.

In the situation of increasing environmental concern, call for the sustainable practices in the textile industry faces increasing pressure to reassess its traditional methods and embrace eco-friendly alternatives. With the fashion industry being one of the largest polluters globally, there is a pressing need to explore innovative approaches that minimize environmental impact while maximizing aesthetic appeal and functionality. The textile industry has faced increasing careful examination for its environmental impact, encourage the search for sustainable alternatives in various stages of production.

Sustainable prints in textiles icludes a range of techniques and practices that prioritize environmental handling, economic viability and social responsibility, throughout the production process. From the selection of raw materials to the application of printing methods and the disposal of waste, every step is explored to reduce resource consumption, reduce emissions, and promote circularity. sustainable prints in textiles embody principles of duration and versatility, challenging the fast fashion example of disposable consumerism. Sustainable prints encourage consumers to cherish and preserve their garments for years to come, thereby

reducing the need for constant consumption and minimizing textile waste. sustainable prints also address social and economic dimensions of sustainability. sustainable print development seeks to create positive social impacts for workers and artisans around the world, ensuring that ethical values are woven into the fabric of every garment. In an era marked by environmental awareness and ethical sourcing, there is a growing focus on sustainable print techniques, recycled materials, utilizing eco-friendly dyes, and novel resources to get colour and natural extracts.

Sustainable print development done by utilizing natural resources appropriate to minimize environmental impact. Examples of such resources include plant-based dyes derived from sources like turmeric, and beetroot, which offer good colour while reducing reliance on synthetic chemicals. Additionally, sustainable printing methods often join to recycled paper and eco-friendly inks made from soy or reducing waste, vegetable oils, and pollution. Eggshell, often overlooked, presents another interest option for sustainable printing due to its calcium carbonate content, offering a unique texture and potential as a natural pigment source. By use these diverse natural resources, the print industry can contribute positively to environmental conservation efforts while meeting the demands of a more eco-conscious consumer base.

Eggshell waste, abundant in poultry industries, poses environmental challenges if not properly managed. its composition rich in calcium carbonate presents an opportunity for innovative applications in textile printing. eggshell powder has emerged as a profivient and eco-friendly material with a verity of benefits across various applications. Derived from a byproduct of egg consumption, eggshell powder offers a compelling solution to environmental challenges while presenting unique advantages in diverse fields, including agriculture, healthcare, and cosmetics.

Eggshell powder serves as a valuable soil amendment, providing plants with a slow-release source of calcium and other micronutrients essential for growth and development. Its alkaline nature helps balance soil pH levels, improve soil structure, and enhance nutrient uptake, leading to healthier crops and increased yields. Beyond agriculture and healthcare, eggshell powder finds applications in various industries, including cosmetics, food additives, and wastewater treatment. Its biodegradable nature, abundance, and low cost make it an attractive alternative to synthetic materials, contributing to efforts to reduce waste and minimize environmental impact.

This research investigates the feasibility of incorporating eggshell powder into textile printing processes, considering its environmental, economic, and technical aspects. thesis aims to explore the multifaceted benefits of eggshell powder and its potential applications in textile print development. By making printing paste done by using eggshell powder is an innovative sustainable practice into textile industry.

1.1. OBJECTIVES OF THE STUDY

- To assess the viability of integrating eggshell powder in developing textile motifs.
- Exploring the potential for incorporating natural dyes with eggshell powder to enhance color.
- To develop motifs for textile prints inspired from Rogan Art and Aboriginal Western Art
- To design garments embellished with the developed motifs
- To construct and evaluate garments decorated with print developed utilizing egg shell powder as a textile medium.

REVIEW OF LITERATURE

2 REVIEW OF LITERATURE

The review of literature pertaining to the study tilted **"Exploring Eggshell Powder As A Sustainable Medium For Textile Print Development"** is discussed under the following heads**:**

2.1. HISTORY OF TEXTILE PRINT

India boasts a rich heritage of textiles, particularly hand-woven and hand-spun varieties, which have give increased income source for rural communities, second only to agriculture. Dating back to the 12th Century, India has been well known for its printed cotton garments, with creative processes grow under royal sponsorship. Various regions across the country have developed distinct design styles, with Rajasthan's District Barmer famous for its bold and vibrant motifs, known as 'Barmer hand prints'. These prints predominantly feature colours like red, blue, and maroon, adorned with floral and geometrical patterns

The origins of block printing are somewhat shifty, but it is believed to have emerged during the Middle Ages within several monasteries in the lower districts of Germany, spanning from the tenth to the fourteenth century.

Evidence of early wooden block printing practices dates back to the fourth century, with the discovery of small wooden blocks in Egypt. The hand printing industry multiply

throughout India, with traditional techniques being preserved in regions like the desert belt, including Jaipur, Pali, Chittorgarh, Muthaura, Jodhpur, Jaisalmer, Barmer, Sanganer, and Bagru in Rajasthan, a northwestern state known for its vibrant dyed and printed textiles. (Vats, 2013)

2.2 SOME TRADITIONAL TEXTILE PRINTS

- Bandhani print
- Ajrakh print
- Ikat print
- Dabu print
- Block print
- Kalamkari
- Batik print
- Matani Pachadi
- Sanganeri print

2.2.1 BANDHANI PRINT

'Bandhani', originating from Sanskrit, signifies 'to tie', encapsulating both the notion of prepared material and the intricate procedure involved. This age-old craft entails binding the fabric before subjecting it to dyeing using blocks, commonly referred to as tie-dye. Typically executed on cotton knit or woven textiles, tie-dye employs vivid hues to fashion an array of uncomplicated to elaborate designs on odhanas . An assortment of patterns including circular, square, wavelike, triangular, and speckled are meticulously crafted, with Rajasthan boasting renowned styles such as suwabil tribundi, line sangam, and peela laddu Chundari, among others. One noteworthy variation is the "Bajri band," characterized by delicate dots scattered amidst motifs. Mainly employing earthy tones like brown, red, maroon, rust, yellow, and black, artisans generate ornamental designs with distinctive border elements and overall jaal patterns. (Datt, 2018)

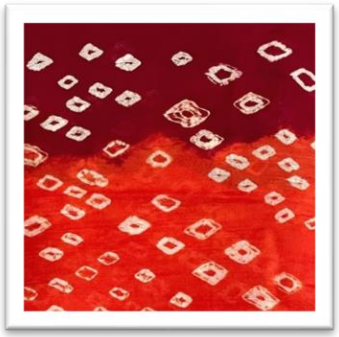


Fig.1
Bandhani Print

2.2.2 AJRAKH PRINT

The western region of Gujarat has long been a significant hub for India's textile exports, renowned for its high volume and quality of printed cloth.

Fig.2
Ajrakh Print

2.2.3. IKAT PRINT

The art of the Ikat technique represents one of the oldest and most ancient methods of fabric embellishment, executed with meticulous handcraftsmanship. Fundamentally, Ikat in yarn resist entails a distinct method of adorning fabric, differing significantly from fabric Ikat. The process of yarn resist embodies a widely embraced approach to ornamentation, characterized by intricacy, delicacy, and artisanal skill throughout the design evolution, contrasting with fabric Ikat ornamentation. The inception of double Ikat fabric, known as "Patalika," dating back to the 4th century B.C., is linked to the Potola of Patan in Gujarat, referring to a bedspread adorned with floral motifs. Subsequently, it evolved into a bridal sari woven with 8-ply silk yarn, renowned for its durability lasting 80-100 years of use. Tie and dye, a complex resist dyeing technique, constitutes yet another intricate method of textile ornamentation. (R, 2024)

Fig.3
Ikat Print

2.2.4. DABU PRINT

'Dabu' or 'Daboo' exemplifies this tradition, featuring block-printed textiles with mud resist techniques, showcasing intricate designs and traditional patterns in rich, earthy tones on natural fabrics. The craft was documented through purposeful sampling, selecting artisans who adhere to traditional practices. Dabu sets itself apart from Ajarakh prints by utilizing black clay (mud) instead of lime. Recognizing the value of Dabu as a heritage craft, efforts are underway to conserve the precious wooden blocks used in printing. Conservation efforts entail meticulous documentation of the craft's history, processes, motifs, vibrant colour palette, and associated by-product. (C, 2022)

Fig.4
Dabu print

2.2.5. BLOCK PRINT

Examples include the Dabu print of Rajasthan, employing a mud printing technique; the Ajrakh print of Gujarat, renowned for its geometric motifs; and the Kalamkari of Andhra Pradesh. These diverse styles of block printing serve as symbols of the country's illustrious heritage and rich cultural legacy. (R, 2024)

Fig.5
Block Print

2.2.6. KALAMKARI

Kalamkari, a complex block printing technique originating in Machilipatnam, Andhra Pradesh, stands as one of the earliest forms of this craft. It flourished under the patronage of the Golconda sultanate at Pedana near Machilipatnam, as well as the Mughals. The primary tool utilized in creating these painted cloths is the 'Kalam,' a specialized brush crafted from a bamboo stick. The brush features a pointed end and a thicker opposite end, with wool or jute yarns wound around the middle to form a ball shape, secured by twine in a crisscross pattern. Natural dyes, specifically Divakala and Vasantha, are exclusively employed in this craft. (C, 2022)

Kalamkari, originating from Andhra Pradesh, refers to a hand-painted or block-printed cotton textile. India boasts two distinct styles of Kalamkari art: the Srikalahasti style and the Machilipatnam style. The term "Kalamkari" finds its roots in the Persian language, with "Kalam" translating to "Pen" and "Kari" representing craftsmanship. In the Srikalahasti style, artisans employ a pen to create freehand patterns and apply colors entirely by hand. On the other hand, the Machilipatnam style, the earliest form, involves a composite process of vegetable-dyed block printing on fabric, originating during the Mughal Empire's rule under the Golconda Sultanate and subsequently spreading along the eastern coast to Tamil Nadu. Initially referred to as the Pedana style, it gained popularity as Coromandel Chintz. Cotton serves as the primary fabric for printing, which undergoes several preparatory steps for optimal results. The fabric is treated with buffalo milk to fix colors, while "Harad" is utilized to mitigate any residual odors from the milk. Following this treatment, the cloth is washed and dried under sunlight. Colors utilized for printing and dyeing are derived from vegetables, flowers, and minerals, with black, red, blue, and yellow sourced from iron ore, tamarind seed, indigo, and turmeric, respectively. (Pandey, 2022)

Fig.6
Kalamkari

2.2.7. BATIK PRINT

Indonesia boasts a rich cultural tapestry, with batik standing as a prominent example. Among the varied styles of Indonesian batik is the eco-print batik, originating from Bantul, Yogyakarta. This particular type of batik is crafted using natural dyes extracted from leaves, roots, or stems, which are applied to fabric. Eco-print batik is celebrated for its eco-friendly nature, drawing upon the potential and indigenous knowledge of the local community.(H, 2023)

Batik, a traditional Indonesian textile, has undergone a functional transformation, now serving as an aesthetic element within interior design. This evolution in the role of batik creates a harmonious relationship between traditional textile art and interior decor, influencing personal interactions with art. Batik motifs are employed as aesthetic elements in urban interior settings, such as cafes, restaurants, public spaces, and hotels, bridging the gap between traditional symbolic meanings and contemporary functional aesthetics. (M., 2023)

Fig.7
Batik Print

2.2.8. MATA NI PACHADI

Mata ni Pachedi, also known as the Kalamkari of Gujarat, employs techniques akin to Kalamkari and holds religious significance for the Vagri community. This craft involves two primary methods: wooden block printing and painting. Block printing is utilized for borders and specific figures, while painting, executed with a brush, allows for freestyle drawing and embellishments by the artist. The patterns typically feature symbols such as the sun and the moon positioned in the upper corners, alongside depictions of singers, musicians, sages, animals, and birds, all dancing and flying in reverence to the goddess. The intricacy of these designs relies on the carving prowess of the block maker and the artistic flair of the painter. (R.,2024)

Fig.8
Mata Ni Pachedi

2.2.9. SANGANERI PRINT

Sanganer, a town in Rajasthan is known globally for its block printed textiles. The unique motifs and design configuration are the characteristics of this hand block printed textiles. Literature revealed that this technique of printing was developed between 16th and 17th century and is still popular. Even though there has been so much of technological development, political ups and down and societal changes, this art has survived without losing much of its original form. (A., 2023)

Region of Rajasthan (Sanganer) in the dye industry, where it is used as mordent of dye. Dyeing, including block painting is a method which imparts beauty to the textile by applying various colors on to a fabric. Dyeing of Sanganeri Printed Cloth is by use of natural vegetable colors. But with change of times, synthetic products have found their way into the dyeing

process. It is estimated that 25% population of Sanganer is directly or indirectly dependent on Sanganeri Print Industries for their livelihood. (K., 2013)

During the 16th and 17th centuries, the Calico prints from India experienced overwhelming demand across European nations, emerging as a primary export for the East India Company. Sanganeri prints gained notable acclaim and prestige for their stylish motifs, featuring captivating and intricate patterns and hues. Predominantly floral in nature, these designs exhibit elaborate detailing, with an execution so creatively rendered that they resemble embroidery rather than traditional printing. The extensive array of floral motifs encompasses sunflowers, narcissus, roses, and other blossoms adorned with lush foliage. Furthermore, these prints are embracing various tinsel printing techniques, resulting in colors that are exceptionally elegant and stylish, setting them apart within their class. (Pandey, 2022)

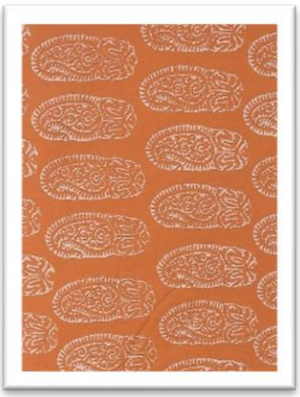


Fig.9
Sanganeri

2.3 ROGAN WORK

Documenting the revered tradition of rogan painting, which teeters on the brink of extinction, has been the primary focus. The key aims encompassed a thorough documentation of the craft of rogan painting, meticulously examining the alterations that have occurred in manufacturing processes, color palettes, motifs, and resultant products. Purposive data collection was employed, sourcing craft documentation from five artisans practicing rogan painting in the traditional method at the time of data collection. The art of rogan craft, a traditional hand painting technique, has undergone significant transformations in production processes, tools and equipment, as well as the motifs and colors employed. (Pandya, 2010)

In Rogan Art, the materials needed for this intricate process involve boiling castor oil for a minimum of 4 hours until it thickens into a gel-like consistency, followed by the mixing

of colors to form a unique paste. However, these materials are not readily available, posing a significant challenge. The primary drawback of this art lies in the necessity to create the materials from scratch, a process that could potentially be streamlined by making them readily available in the market, to the use of ready-made colors for dyeing Rogan paste. (Chaturvedi, 2022)

Fig.10
Rogan Art

2.4 ABORIGINAL WESTERN ART;

Various perspectives on Aboriginal art are examined, encompassing viewpoints from diffusionists, art critics, and social anthropologists. Distinctive regional styles within Aboriginal art, such as those of Kimberley, the Western Desert, and Pilbara, are highlighted. These regional variations are posited as enduring features of Aboriginal artistry. The study of rock art is proposed as a means to underscore the intricate nature of Aboriginal cultures, revealing a continuous evolution within these cultures that may not be as evident through either anthropological or archaeological investigations**.** (Crawford, 1972)

In recent years, Australian Aboriginal dot painting has experienced a surge in popularity overseas. Works by leading Australian artists have fetched millions of dollars at auctions and have been prominently featured in major international exhibitions such as the Venice Biennale. Leveraging the Western intrigue surrounding the perceived 'secret/sacred' content concealed within these dots, Aboriginal artists have successfully cultivated an international market for their works. Despite enduring economic disadvantages, Aboriginal communities in Australia have found vital support through the sale of Aboriginal art, which not only serves as a means of economic sustenance but also plays a crucial role in preserving their cultural heritage and asserting their sovereignty. (M, 2022)

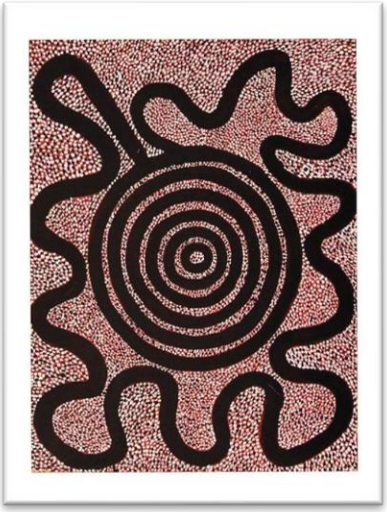


Fig.11
Aboriginal art

2.5 SUSTAINABILITY IN PRINTING

The textile industry produces considerable waste, including yarn/fiber fluffs, fabric scraps, and offcuts. These waste materials can be recycled and repurposed for screen printing, a versatile and cost-effective technique that yields high-quality prints. In this study, colored waste particles were incorporated into a commercial printing paste and applied onto cotton fabrics via screen printing. Chemical changes in the printed textile fabrics were observed using Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD) analysis, and energy dispersive spectrometer (EDS). The printed fabrics underwent evaluation for color, wash/rub fastness, tensile strength, surface wettability, tactile properties, and air permeability. The dispersion quality of the waste particles on textile fabrics was assessed using light microscopy and scanning electron microscopy (SEM) images. These findings demonstrate significant potential for advancing sustainable coloring applications within the textile industry through the utilization of colored pre-consumed textile wastes while maintaining the production of high-quality fabric products. (O., 2024)

The textile processing industry stands as one of the oldest and most technologically intricate sectors. Its foundational strength lies in a robust production base encompassing a wide array of fibers and yarns, ranging from natural to synthetic, along with various chemicals With more stringent regulations anticipated in the future, effective control measures are imperative to mitigate effluent pollution. Textile manufacturing processes encompass a range of activities, including pretreatments, dyeing, printing, and finishing operations. These processes not only

consume substantial amounts of energy and water but also generate significant quantities of waste products. (M. A. A., 2022)

Hand block printed fabrics have been in demand in different part of the globe due to its unique fusion of traditional designs, arts and exclusive color patterns. The global acceptance has increased the demand of hand block printed fabrics as well as increased sustainability challenges for artisans to rethink their production process.

2.6 NATURAL DYES IN TEXTILE

Recently, there has been a surge in enthusiasm for utilizing natural dyes in textile dyeing, attributed to their biodegradability and harmonious interaction with the environment. Experts suggest that the potential for incorporating natural dyes is substantial, even to the extent of replacing synthetic counterparts in certain regions effortlessly. From an environmental standpoint, substituting synthetic dyes with natural alternatives represents not only a risk and pollutant reduction strategy but also an avenue for fostering new markets and employment opportunities. (Jordeva, 2020)

Natural dyes are the heritage of the history to human being. Although they were used for the colouration of goods from the ancient time, it is not common to use natural dyes commercially now. But at least in some special goods it is saving its popularities too. On the other hand, it can be foreseen that the demand on the ecological, natural and organic products in all consumable articles will make natural dyes popular again. Owing to this, it is important to continue the studies on the usability of natural dyes in textile colouration techniques. (Bahtiyari, 2013)

Textile printing entails creating a predetermined colored design on fabric, typically with a repeating pattern. In India, the tradition of dyeing and printing with natural dyes has been long-standing. Presently, there is a notably optimistic and promising trend in the promotion of natural dyes. Scientists and textile technologists from various institutions have begun exploring natural dyes as a viable method for producing environmentally friendly products that appeal to environmentally conscious consumers. Recognizing the significance of natural dyes in the textile industry, a study was conducted to print cotton fabric using kachnar bark dye with Cassia tora gum. The cotton fabric underwent scouring to eliminate impurities. Kachnar bark was dried and ground into powder, from which 8 percent dye was extracted by boiling in water and

then strained to obtain the dye extract. The extracted dye was evaporated to produce a 10 ml dye concentrate. Two concentrations of Cassia tora gum powder, 2.5 and 5 percent, were utilized as natural thickeners. A paste of the thickener was prepared by mixing it with lukewarm water and then added to the dye concentrate to create the printing paste. Copper sulphate and ferrous sulphate were employed as mordants. (YADAV, 2016)

While conventional textile dyeing processes contribute significantly to the residue in wastewater from textile finishing companies, the popularity of dyeing with natural dyes has been increasing recently. This approach not only conserves water and prevents water pollution but also offers a wide array of colors, presenting new opportunities for textile designers. However, natural dyes typically yield less intense colors and are more susceptible to fading due to mechanical stress, washing, or UV exposure. Here, we provide an overview of various combinations of natural dyes used for dyeing various textile materials, with and without pretreatment of the fabric. The resulting fabrics exhibit a diverse range of colors, primarily influenced by the textile material and, in some cases, by pretreatment methods. While washing and UV exposure have relatively minor effects, Martindale abrasion tests significantly alter some colors. (Fröse, 2019)

2.6.1 TURMERIC DYE

The utilization of natural dyes holds significant importance in the textile industry due to the necessity to replace synthetic dyes, which often pose environmental challenges. Developing natural dyes offers benefits to all stakeholders as they are more environmentally friendly for the dyeing process. The extraction of natural dye involves optimizing parameters such as temperature, solid-liquid ratio, and time, employing a one-factor-at-a-time (OFAT) approach followed by response surface method (RSM) optimization using Design Expert V8.0.6. Turmeric is chosen as the primary source of natural dye in this study, containing the pigment curcumin. The absorption of curcumin increases with rising extraction temperature, peaking at 60°C. Equilibrium for curcumin extraction is reached at 25 minutes, while the optimal solid-liquid ratio for turmeric extraction is found to be 1:10 before reaching equilibrium. (Mohd Zamri, 2016)

Fig.12
Turmeric

2.6.2. MANJISHTTA

Rubia cordifolia commonly referred to as Manjishta or Indian Madder, stands out as a highly valued herb in Ayurveda, boasting significant potential for pharmaceutical advancements. Its natural antioxidants are particularly noteworthy for their ability to combat free radicals and mitigate the onset of chronic illnesses. (Aswathi, 2023)

Fig.13
Manjishtta

2.7. USAGE OF EGGSHELL POWDER

2.7.1. AS A BIO-MODIFIER

The study explores the potential of eggshell powder as a bio-modifier for both asphalt binder and mixture, considering aspects of workability and mechanical properties. The research investigates the impact of different dosages (3%, 6%, 9%, and 12%) of eggshell powder on the workability, rutting resistance, and susceptibility to moisture damage of both asphalt binder

and mixture. Various tests were conducted, including viscosity, multiple stress creep recovery, and bitumen bond strength tests on asphalt binders, followed by Superpave gyratory densification indices, wheel tracking, and indirect tensile strength tests on asphalt mixtures. Results indicate that the addition of eggshell powder renders the asphalt binder stiffer, heightens susceptibility to moisture damage, and diminishes pumping ability, regardless of the dosage rate. Additionally, the inclusion of eggshell powder reduces workability while enhancing resistance to rutting and moisture damage properties of asphalt mixtures, regardless of the dosage rate. (Huang, 2022)

METHODOLOGY

3. METHODOLOGY

The methodology of the project **'Exploring Eggshell Powder as a Sustainable Medium for Textile Print Development'** discussed under the following heads:

3.1 Preparation of the medium for print development

3.1.1 Egg shell collection

3.1.2 Preparation of egg shell powder

3.2 Application of natural colors to the developed medium

3.3. Motif Development

3.4 Application of the developed motifs into garment sketches

3.4.1. Designs in kid's frock

3.4.2. Designs in men's shirt

3.4.3 Designs in female kurta

3.4.4. Designs on men's kurta

3.5 Finalizing Garments.

3.6 Garment Construction

3.7 Application of the developed print medium to the garments

3.7.1 Tracing the motifs into the garments

3.7.2 Applying the printing paste on the traced motif

3.1. Preparation of the medium for print development

3.1.1 collected Eggshell

Plate 1
Eggshell collected

3.1.2 Preparation of egg shell powder

Plate 2
Egg shell powder

3.2 Application of natural dyes to the developed medium

Plate 3
Turmeric powder

Plate 4
Manjishtha powder

Plate 5
Mixing of turmeric with eggshell and fabric glue

3.3 Motif Development

Inspired from the Aboriginal Western Art and Rogan Art, three motifs were developed which is shown in Fig No. 14

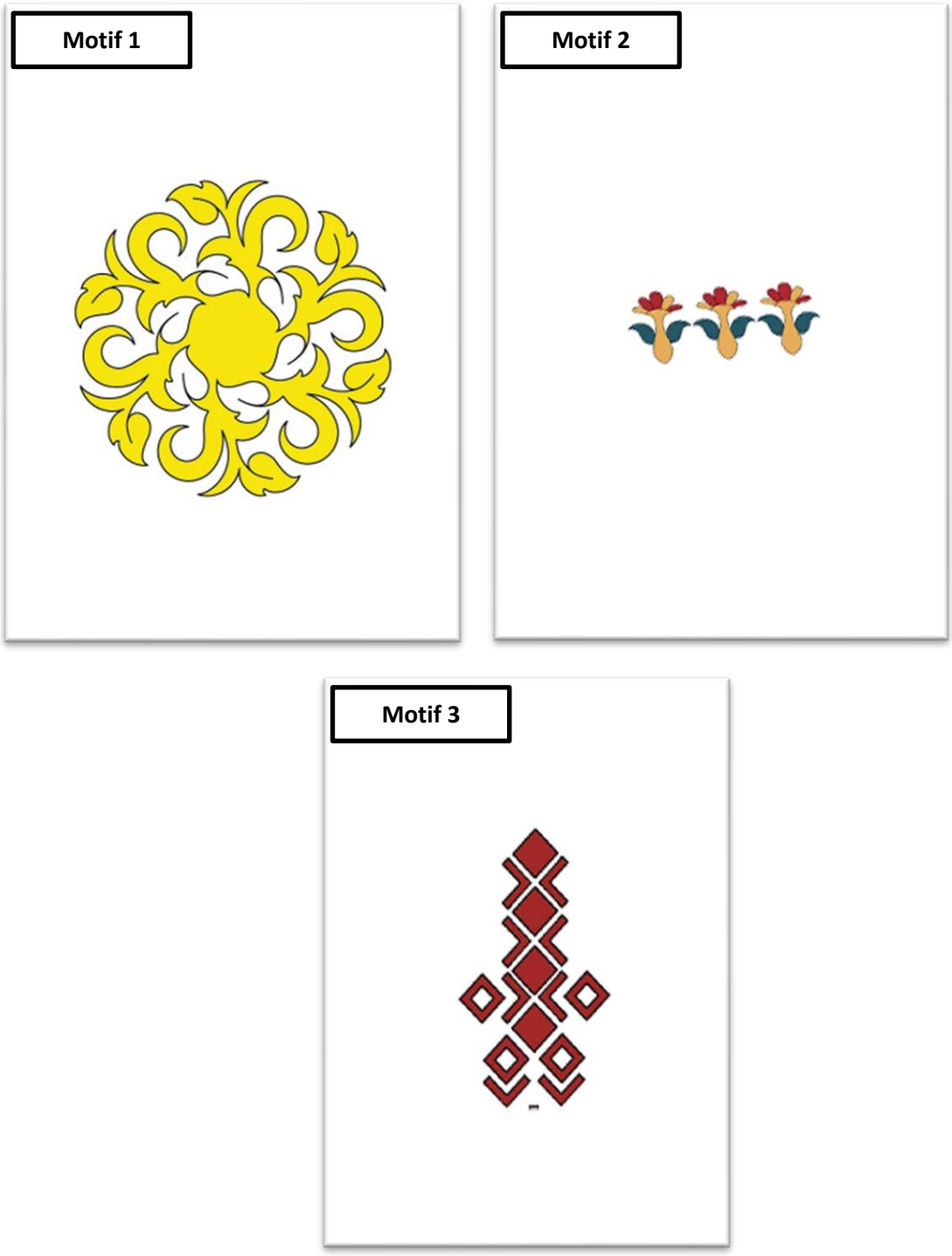


Fig.14
Developed Three Motifs

3.4 Application of the Developed Motifs to Garment Sketches.

Five categories of garments namely, Kids frock, Men's Shirt, Mens Kurta, and Women's Kurta were sketched. The developed motifs were placed on different areas of the five garments as seen from Fig.15 No to Fig No. 18

3.4.1. DESIGNS IN KID'S FROCK

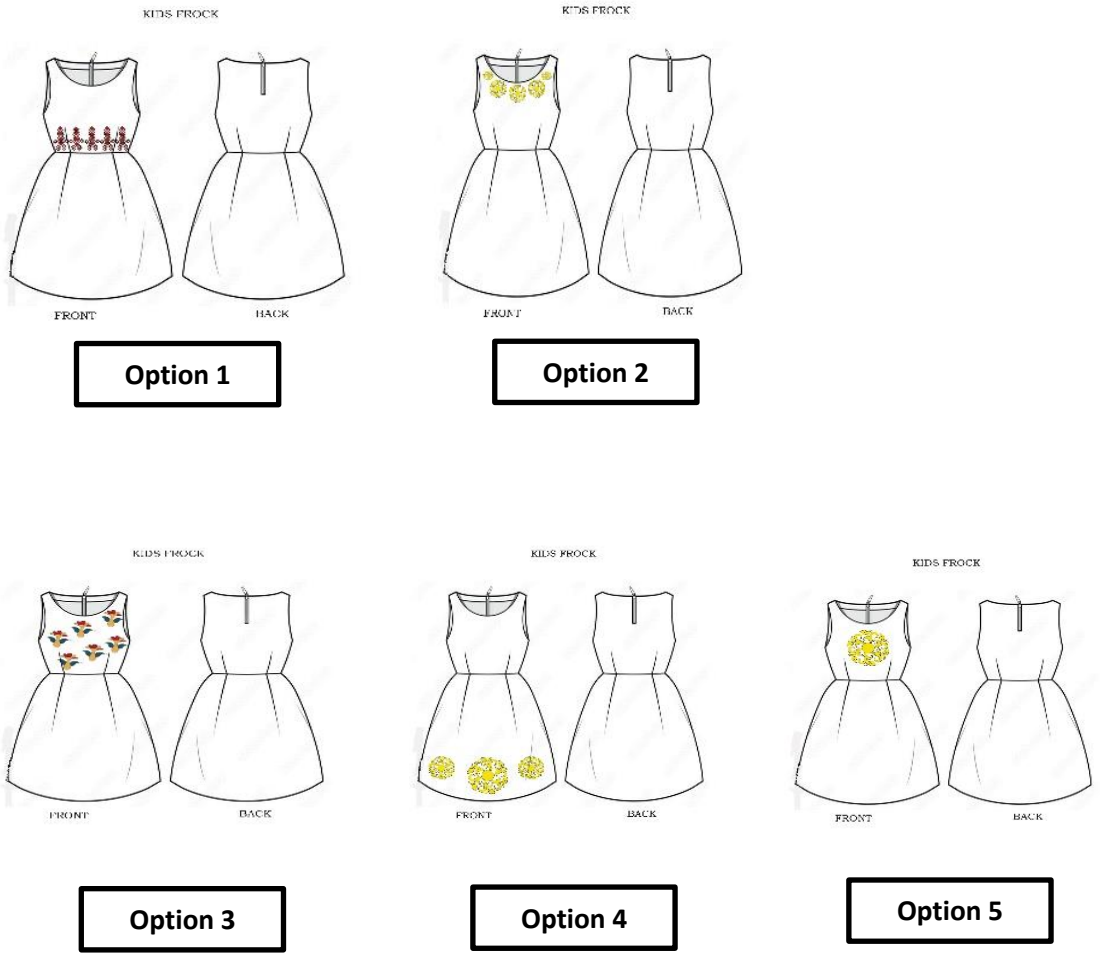
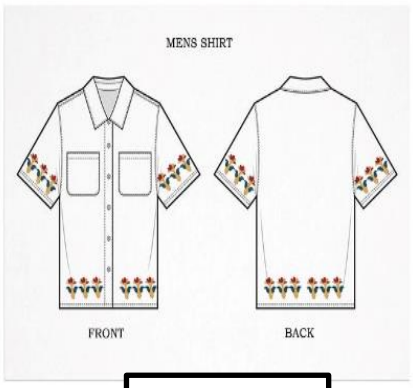


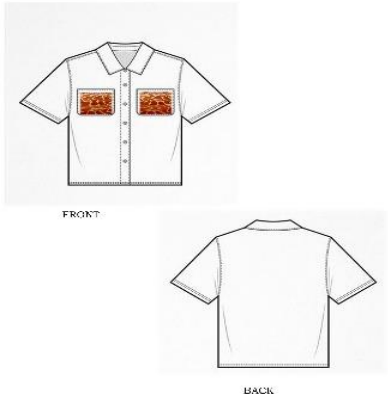
Fig. 15
Kids Garment

3.4.2. DESIGNS IN MEN'S SHIRT

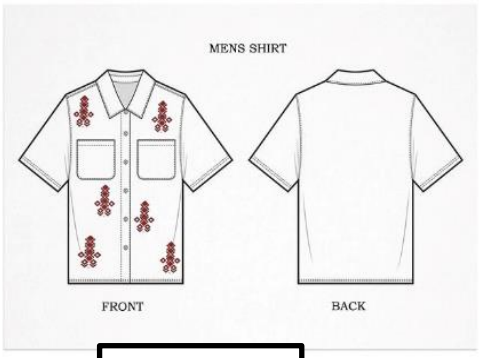


Option 1

Option 2



Option 3



Option 4

Option 5

Fig.16
Men's Shirt

3.4.3 **DESIGNS IN FEMALE KURTA**

Option 1

Option 2

Option 3

Option 3

Option 2

Fig.17
Female Kurti

3.4.4. **DESIGNS ON MEN'S KURTA**

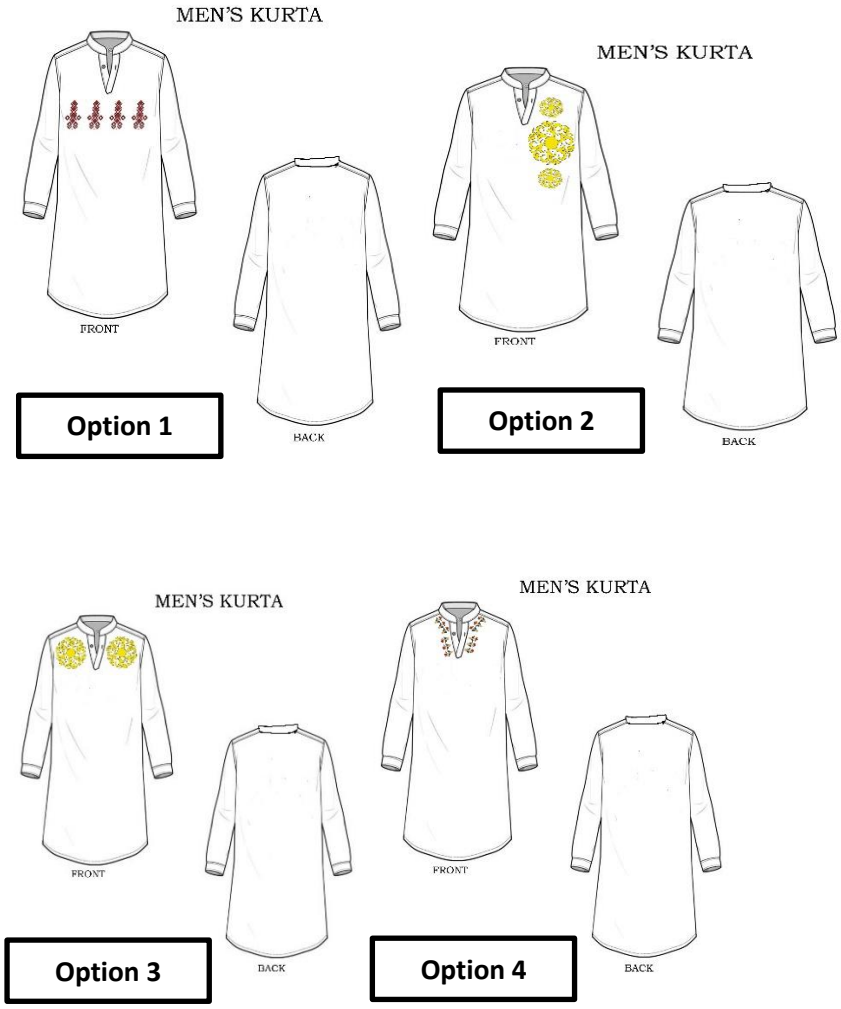


Fig. 18
Men's Kurta

3.5 Finalizing the Garments

A survey was conducted among 50 people to understand the preference of motif placements in the selected category of garments the results of the survey and the final selected garments for construction is given in Results and Discussion

3.6 Garment Construction

Based on the result from survey 4 garments was selected to stitch.

A kid's frock,

Women's kurti

Men's shirt

Men's kurta**.**

3.7 Application of the developed print medium to the garments

After finishing all the processes of stitching the developed motif s were printed on the garments by hand.

3.7.1 Tracing the motifs into the garments

With the help of tracing paper, the designs were traced on the placement preferred in the survey.

Plate 7
Tracing the motifs from paper into garments.

`

3.7.2 Applying the printing paste on the traced motif

Application of the prepared paste on the traced motifs in garments by using brush.

Plate 8
Application of print on garment

Selected motif in female kurti is a single motif on the center of the garment, the application of printing paste was done carefully without spreading the paste into other area of the center and also keep a bond paper inside the kurti to prevent the chance of printing paste spreading.

Plate 9
Application of Print on female kurti

After tracing the selected design on shirt on the basis of survey result, the printing paste apply on the traced motifs.

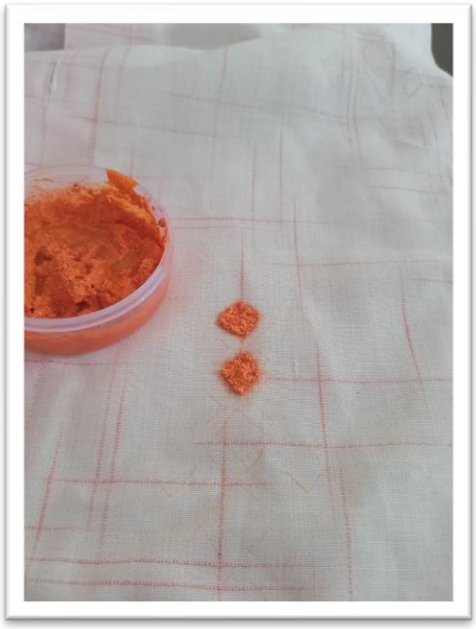


Plate 10
Applying Printing paste on men's shirt

Application of printing pate on the men's kurta in the placement were selected on the basis of survey result. The printing paste application done by using brush and a bond paper inside the garment to prevent the chance of spreading the printing paste into the back of the garment.

Plate 11
Application of print on Men's Kurta

RESULT AND DISCUSSION

4. RESULT AND DISCUSSION

The Results and Discussion of the study tilted "**Exploring Eggshell Powder as A Sustainable Medium for Textile Print Development**" is discussed under the following heads**:**

4.1 Results of the survey to know the preferences of motif placement in the selected garments

4.1.1. Result of the selection of motif placement for kid's frock

4.1.2. result of the selection of Motif placement for Men's shirt

4.1.3. Result of the selection of motif placement for women's kurti

4.1.4. Result of the selection of motif placement for Men's kurta.

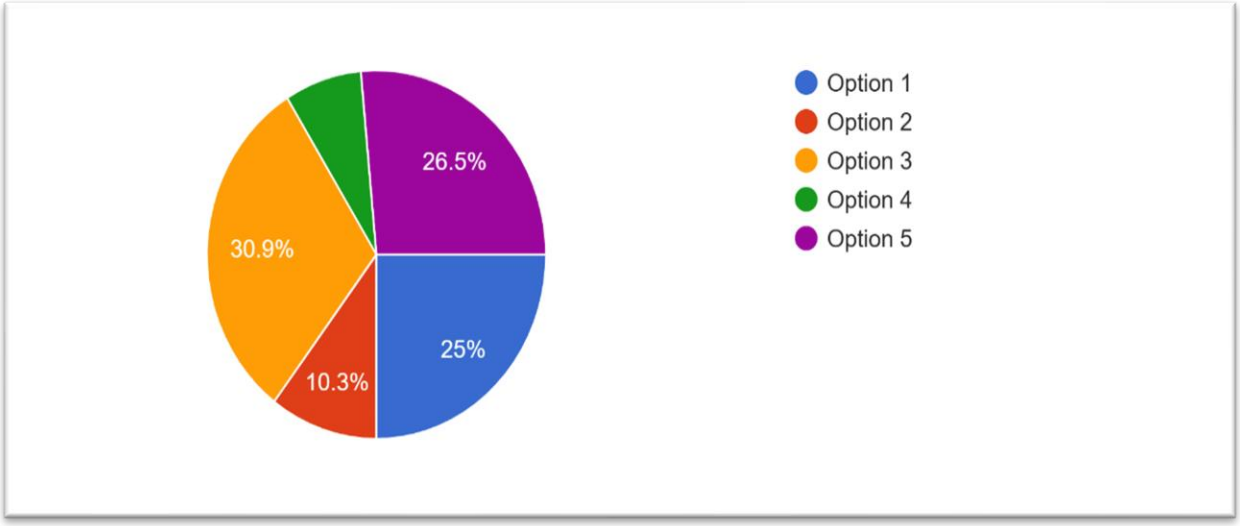
4.2 Evaluation of the developed garments

4.3 Costing of the Developed Garments

4.1. Results of the survey to know the preferences of motif placement in the selected garments.

From the survey conducted among 80 people, one garment was selected from each category for print development and construction. Thus 4 garments were embellished by the print medium and finished. The design sheet/ flat sketch of the finalized garments is shown from Fig No:18 to Fig No: 21

4.1.1. Result of the selection of motif placement for kid's frock



Graph 1
Result of kid's frock design selection

Out of the 80 responses from the survey option number 3(Fig.No.19.) is selected for motif placement in kid's frock.

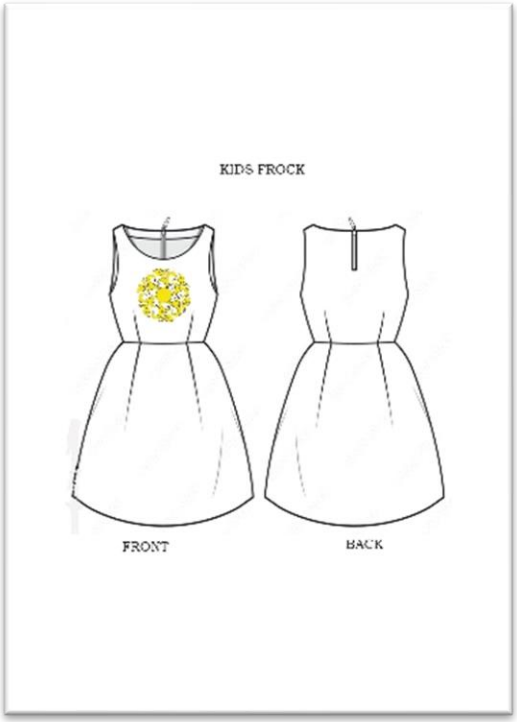
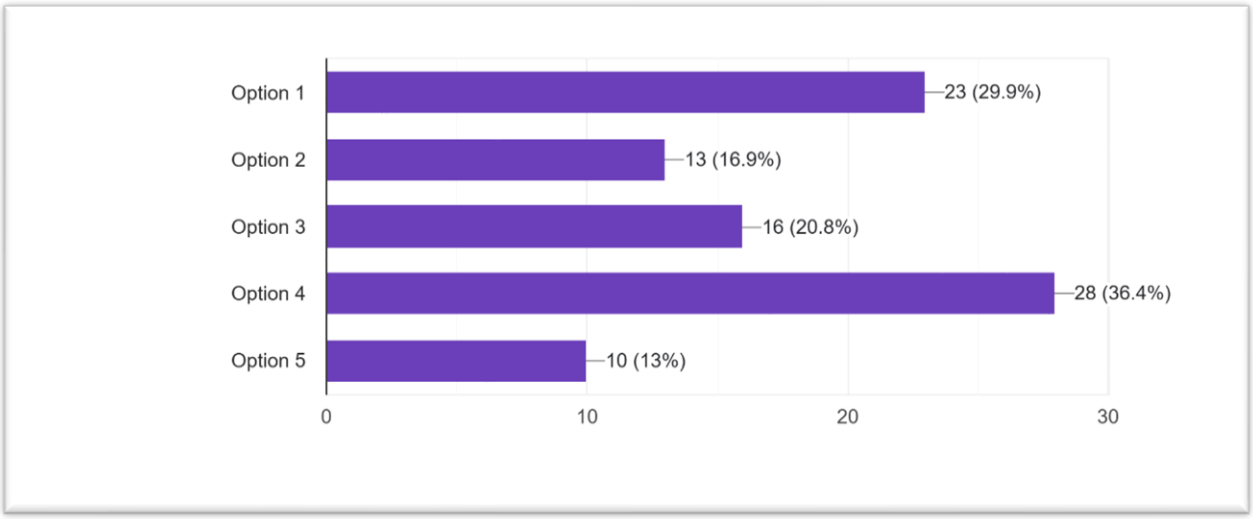


Fig.No.19
Selected Kid's frock design

Fig.No.20
Kid's frock

4.1.2. result of the selection of Motif placement for Men's shirt



Graph 2
Result of men's shirt design selection

Out of the 80 responses 36.4% were of opinion that motif placement for option number 4 (Fig.No.20) is selected for motif placement in men's shirt

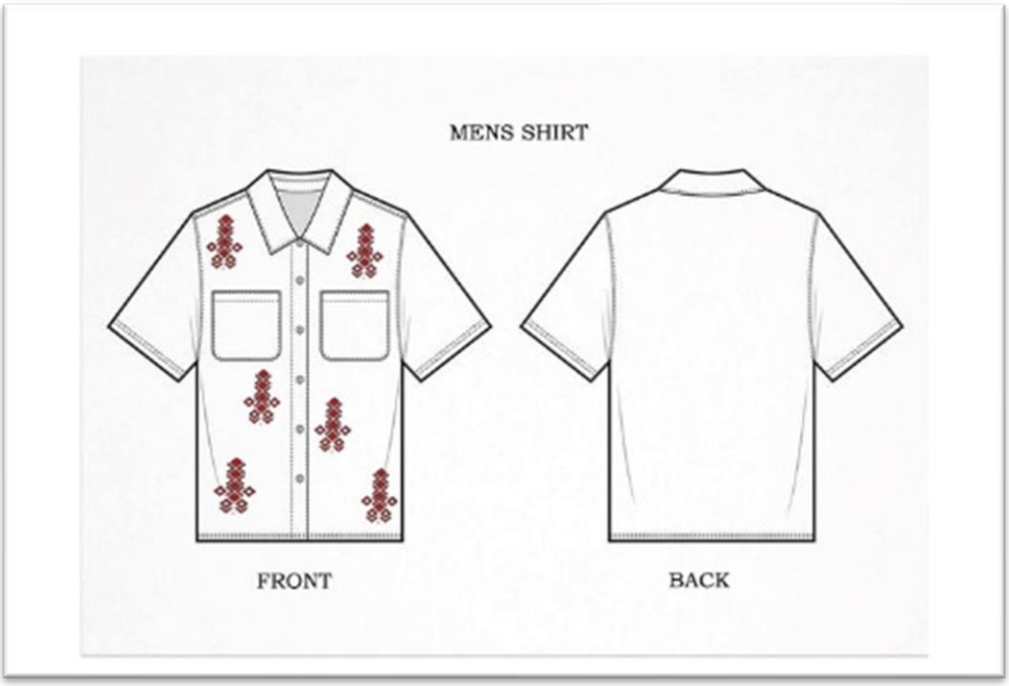
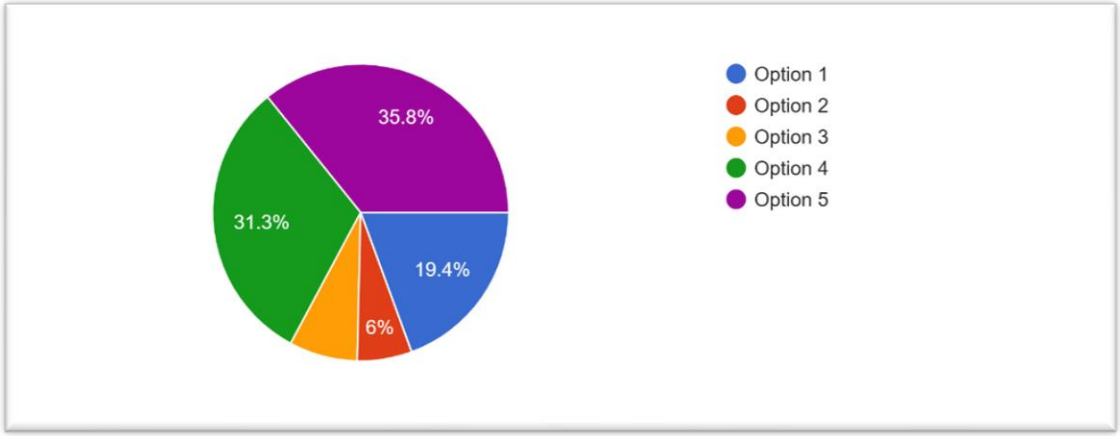


Fig.No.21
Selected Men's shirt design

Fig. No. 22
Men's shirt

4.1.3. Result of the selection of motif placement for women's kurti



Graph 3
Result of women's kurti design selection

Out of the 80 responses from the survey option 5 (Fig.No.21) is selected for motif placement in women's kurti.

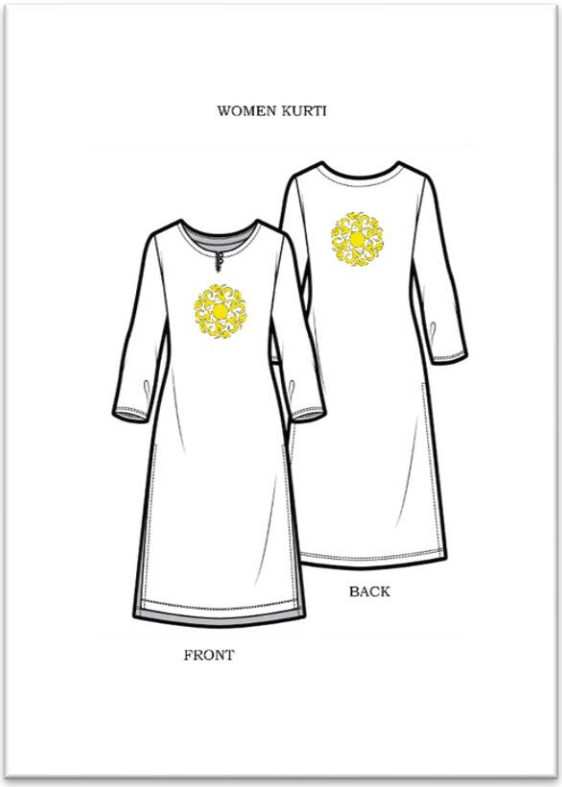
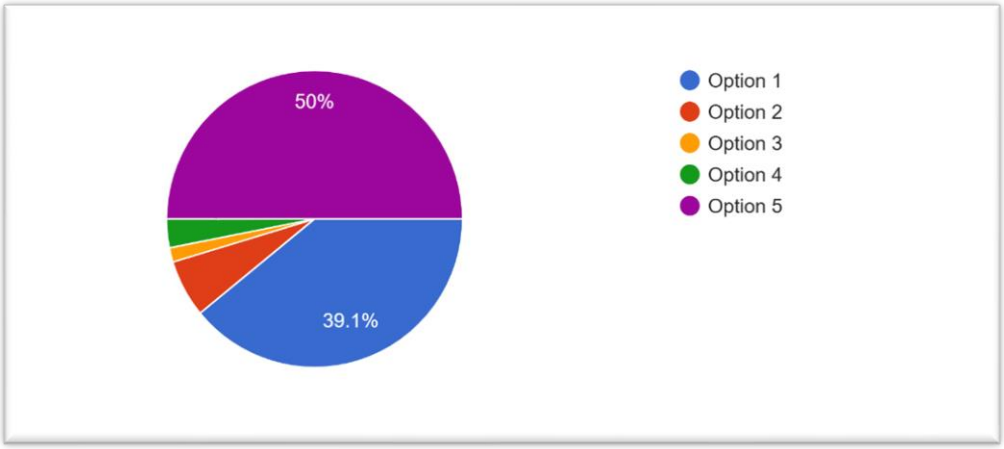


Fig.No.23
Selected Women's kurti design

Fig. No. 24

Women’s kurti

4.1.4. Result of the selection of motif placement for Men's kurta.



Graph 4
Result of men's kurta design selection

Out of the 80 responses from the survey option 5(Fig.No.22) is selected for motif placement in men's kurta.

Fig.No. 25
Selected Men's kurta design

Fig. No. 26
Men's kurta

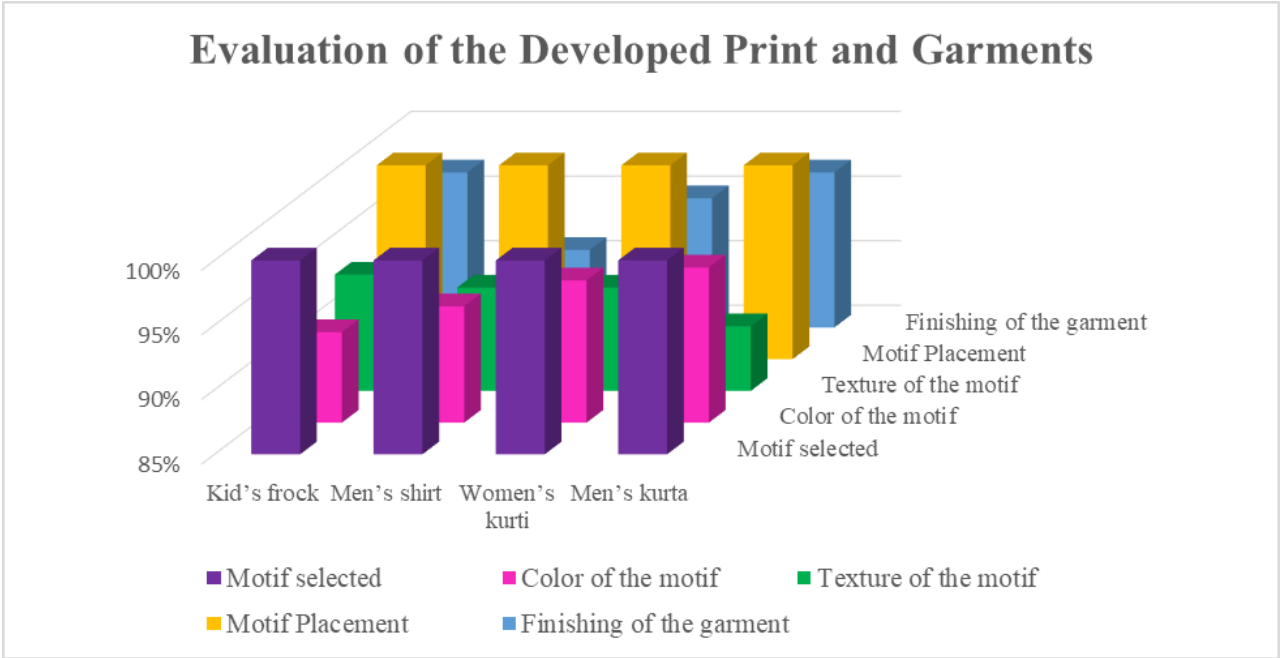
4.2 Evaluation of the developed print and garments

The evaluation the developed garments embellished with sustainable print medium is given in Table I, Graph 1

Table I

Evaluation of the Developed Print and Garments

Evaluation of the Developed Print and Garments					
Garment	Motif selected	Color of the motif	Texture of the motif	Motif Placement	Finishing of the garment
Kid's frock	100%	92%	94%	100%	97%
Men's shirt	100%	94%	93%	100%	91%
Women's kurti	100%	96%	93%	100%	95%
Men's kurta	100%	97%	90%	100%	97%



Graph 5
Evaluation of the Developed Print and Garments

4.3. Costing of the Developed Garments

Table II

Costing of Developed Garments

Product	Cost
Kid's frock	250
Men's shirt	450
Women's kurti	300
Men's kurta	350

SUMMARY AND CONCLUSION

5. SUMMARY AND CONCLUSION

This research paper explores the potential of eggshell powder as a sustainable medium for textile print development. It investigates the properties of eggshell powder, its feasibility for use in textile printing processes, and its environmental impact compared to traditional printing methods. The study evaluates the print placements in garments, and texture of prints creating using eggshell powder, colour, providing clarity into its suitability as an eco-friendly substitute in the textile industry. Not only does it offer a viable alternative to common printing materials, but it also addresses environmental awareness by utilizing a waste product that would may be discarded. Further research and development are entitled to improve print quality, identify printing techniques, and explore its capacity of applications across different textile substrates. With ongoing innovation and investment, eggshell powder could give to the ideal shift towards more environmental practices in the textile industry.

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6 BIBLIOGRAGHY

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APPENDICES

APPENDIX 1

Table for collecting the responses of developed product

Product	Motif selection			Colour			Texture			Motif placement			Finishing		
	Good	Average	Poor	Good	Average	Poor	Good	Average	Poor	Good	Average	Poor	Good	Average	Poor
Kid's frock															
Men's shirt															
Women's kurti															
Men's kurta															