



A STUDY ON ICE DYEING USING REACTIVE DYES ON SINGLE JERSEY KNIT FABRIC

M.Sowmiya¹, Dr R Divya², M. Sharmila³

¹ PG Student, Department of costume Design & Fashion, PSG College of Arts & Science, Coimbatore

² Associate Professor, Department of costume Design & Fashion, PSG College of Arts & science, Coimbatore

³ PhD Research Scholar, Department of costume Design & Fashion, PSG College of Arts & science, Coimbatore

ABSTRACT

“Ice dye” is the process of creating patterns on cloths or fabric. It is an easy way to add a variety of colourful designs and vibrant styles to the fabric. Ice dyeing is a captivating textile art form that has gained popularity for its ability to produce mesmerizing and unpredictable patterns on fabric. This study delves into the realm of ice dyeing, focusing on its application using reactive dye powder on single jersey fabric. Reactive dye powder bonds chemically with the fabric fibers during the dyeing process, resulting in excellent colorfastness and durability. The fabric is then covered with ice cubes, allowing the melting ice to gradually dissolve the dye and create a unique marbling effect as it permeates through the fabric. Single jersey fabric retains its soft and stretchy texture even after ice dyeing. Unlike traditional dyeing methods that require large volume of water for immersion dyeing, ice dyeing consumes minimal water in the dyeing process. The understanding of ice dyeing techniques with reactive dye powder on single jersey fabric, providing insights into the factors that influence the outcome of the dyeing process. The findings of this research have the potential to inspire further exploration and innovation in the field of textile arts, opening new avenues for creativity and expression in fabric dyeing techniques.

Keywords: Single jersey fabric, Ice dye technique, Pretreatment, Reactive dye, Women Garment

1. INTRODUCTION

Ice dyeing

Ice dyeing offers a captivating display of vibrant colours seamlessly mingling on fabric. In this process, the dye pattern is entirely dictated by the melting ice, resulting in a charming watercolour effect as it flows across the fabric. Ice dyeing employs ground fabric dye and ice, making it a distinctive and visually stunning technique in textile art. ^[1] Dyeing involves imparting color to textile items such as fibers, yarns, and fabrics. This process typically occurs within a specialized solution comprising dyes and specific chemical agents. ^[5]

Reactive dye

The reactive dyeing process itself, as well as different finishing techniques used after dyeing, have an impact on the materials like mechanical, handling, comfort, and functional qualities. Thus, this study's primary goal was to ascertain how the dyeing and finishing procedures affected the knitted fabrics' quality- performance attributes. ^[2] Properties of single jersey fabric is when compared to woven fabrics, knitted fabrics are renowned for their exceptional comfort, attributed to their high extensibility, air permeability, and heat retention properties. However, Single jersey knit fabrics (SJKF) often exhibit reduced dimensional stability, particularly after undergoing repeated washing cycles. This characteristic can impact the overall durability and appearance of the fabric overtime. Hence, despite their comfort advantages, addressing the dimensional stability issues in

SJKF is crucial for ensuring the longevity and quality of knitted garments [3]

Fabric spirality

Fabric spirality in single jersey fabrics presents various quality issues, including pattern misalignment, challenges during sewing, displacement of side seams, and distortion of garment. These issues not only affect the overall appearance of garments but also impact their functionality and comfort. [4]

Pre-treatment

Pre-treatment procedures were applied to single jersey knit materials with varying distinctive qualities. Among the pre-treatment procedures were optical brightening, bleaching, and scouring. Pre-treatment, bleaching, and dyeing refers to the process of achieving the desired colour, lightness, chroma, levelness, repeatability, and stability of the cloth in addition to imparting and appealing hue or whiteness. [11] Many contaminants are removed after scouring; however, pigments are still present and the look is not sufficiently white. Bleaching is used to get rid of colours and give the fabric required, stable whiteness without causing any fibre damage [6]

TESTING

The ability of a material to maintain its colour fades or resist having its colourants transfer to nearby materials is known as colourfastness. When a colour fades, it lightens and changes in hue. The transfer of colour a secondary, coordinating fibre material is known as bleeding [7] The durability of textiles is critical for both clothing and technical applications. Initially, wear or abrasion may only impact appearance, but ultimately, it could result in the deterioration of the textile item. Consequently, wear of abrasion resistance has been extensively researched. Specifically concerning fabrics knitted from staple fibre yarns, addressing pilling behaviour presents a significant challenge. [8]

MECHANICAL PROPERTIES OF TESTING

Abrasion testing: Abrasion resistance is the fabric's ability to withstand damage caused by rubbing or friction. [10]

PHYSICAL PROPERTIES OF TESTING

Colourfastness testing: Colourfastness refers to a dye's ability to maintain its original depth and tone of colour through the lifespan of the product [9]

1.1 OBJECTIVES

- To Express unique designs on single jersey knit fabric.
- To Achieve vibrant and dynamic colour in reactive dye powder to the fabric
- To Generate unpredictable and abstract design through the melting process of ice, Creating visually striking a distinctive pattern
- To Transform ordinary knit fabric into personalized, wearable masterpiece that showcase the fusion of creativity in natural process of ice melting

2. METHODOLOGY

Fabric used: Single jersey knit fabric Dye : Reactive dye

The methodology for assuring the impact of ice dyeing using reactive dye powder on knit fabric involves a systematic approach to studying various aspects of the dyeing process and its effects on the fabric. This includes fabric preparation, dye preparation, the ice dyeing process, fixation of the dye, washing and finishing

procedures, and finally, the evaluation of the dyed fabric samples and making into nightwear.

Single jersey knit fabric with 160 GSM and 30's count is sourced from Export company, Tirupur. The cost of the fabric depends on the quality. The cost of 1 meter fabric is around 200- 300 approximately. Then the pre-treatment process is carried out by the following scouring and bleaching process.

2.1 SCOURING

Scouring process is essential, because it removes impurities from the fabric, Greige fabric have more impurities like wax, dirt etc. And this process has to be done. By doing this process the fibres get open up and it increases its absorbency and its crucial for dyeing process. And it improves overall quality of the fabric. And it helps to achieve the fabric brighter.

SOLVENTS	RATIO	GRAMS
Sodium hydroxide (NaOH)	2%	9g
Sodium carbonate (Na ₂ CO ₃)	2%	9g
Wetting agent	2%	9g
Water	40%	11 848ml

Table. 1 Scouring

After taking the weight of the fabric, the material is subjected to scouring bath, which typically contains a combination of solvents, such as Sodium hydroxide 2%, Sodium carbonate 2%, Wetting agent 2%, and water 40%, Stir these ingredients properly, and keep the temperature at 90. After 45 minutes take and wash the fabric and flat dry



Figure 1. Scouring the fabric

2.2 BLEACHING

The bleaching process involves treating textiles with chemical agents to remove natural or artificial colourants, stains, or, impurities

SOLVENTS	RATIO	GRAMS
Soap solution	2%	9ml
Hydrogen chloride	2%	9g
Water	20%	11 848 ml

Table 2 . Bleaching

The bleaching process involves treating textiles with chemical agents to remove natural or artificial colourants ,stains ,or ,impurities. Then the knit fabric was weighted after the scouring process. Then need to measure the liquor, it was taken in the beaker. And the add required recipe to the fabric in 2:40 ratio. After preparing the solution stir it properly and then immerse the single jersey knit fabric into the vessel. And then keep 90-degree temperature. After which the treated fabric has to be washed in running cold water. Then finally the fabric is flat dried after that dyeing process has to be done.



Figure 2. Bleaching the fabric

2.3 PROCESS OF ICE DYEING

Ice dyeing is the cool variation on the traditional tie-dyeing technique that creates stunning watercolour designs. Instead of liquid dye and squeeze bottles, instead use powdered dye and sprinkled over a pile of ice cubes to make a magical pattern of the fabric.

➤ After doing the pre-treatment of scouring and bleaching process, start with dyeing process. First need to add alum in water and sock the fabric for 20-3- mins. Because it helps the dye adhere better to the fibres and create move vibrant colours, Next to this process, start with ice dyeing.



Figure 3. sock the fabric into aluminium potassium sulphate water

- In venture outdoors keep the dish tray drainer, fabric, and ice cubes. Put the dish drainer on the ground, then wet the fabric, arrange the fabric in dish tray, then scrunch the fabric in the same tray to create dye patterns



Figure 4. Arrange the fabric in the tray

- Then put the ice cubes on the top of the fabric, Arrange ice cubes evenly in overall area of the fabric. Then, using with spoon, start sprinkling the dye powder on every section evenly



Figure 5. Placing ice cubes on top of the fabric

- Here's where need to get creative and combine multiple colours and quantities of the dye pigment. Try using three to four colours for colour variation, and then sprinkle all around the areas over the ice cubes. Leave it for 3-4 hours



Figure 6. After sprinkling the dye powder

- Allow the fabric to sit for several hours or overnight to let dye fully penetrate to the fabric. As the ice cubes melts, then it creates unique patterns on the fabric. Then rinse the fabric under cold water until it removes the excess dye



Figure 7 After four hours

- Then wash the fabric using mild detergent to remove any excess alum or dye in the fabric. And finally dry the fabric either by hanging or by flat, depending on the fabric type



Figure 8. After the fabric is dried

2.4 PRODUCT DEVELOPMENT

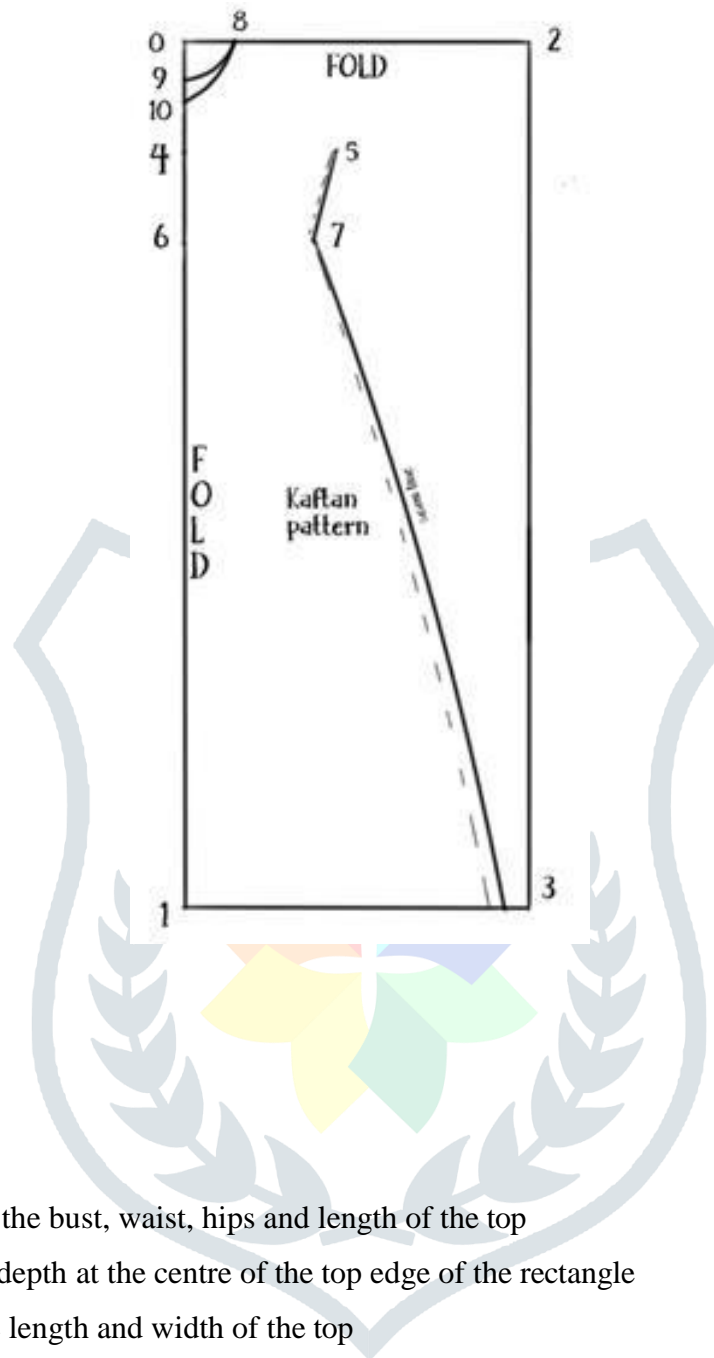


Fig .9 Pattern making

2.4.1 Drafting procedure:

- Measure and mark the bust, waist, hips and length of the top
- Mark the neckline depth at the centre of the top edge of the rectangle
- Measure the sleeve length and width of the top

2.4.2 Fabric cutting:

- Place the pattern on the fabric, pin it and cut the fabric accordingly



Figure .10 Cutting

2.4.3 Sewing



Figure. 11 Sewing

- First finish the seam overall the fabric
- And sew the side seams from sleeve to bottom hem
- And finish the neck binding

FINAL GARMENT



Figure .12 Kaftan top

5. TESTING

5.1 Colourfastness Test

Testing for ice dyeing primarily focuses on assessing the colourfastness, Wash test, Abrasion and other testing.

- Washing Fastness: Assessing the fabric colour retention after washing using standardised procedures.
- Rubbing Fastness: evaluating the fabric's resistance to colour transfer during rubbing or friction against other surfaces.
- Light fastness: Testing the fabric's ability to retain colour when exposed to light over time, preventing fading or colour change.

5.2 Abrasion test

The abrasion resistance test in textiles evaluates a fabric's ability to withstand wear and tear caused by rubbing or friction. This test is particularly important for fabrics used in clothing, upholstery, and where durability is essential.

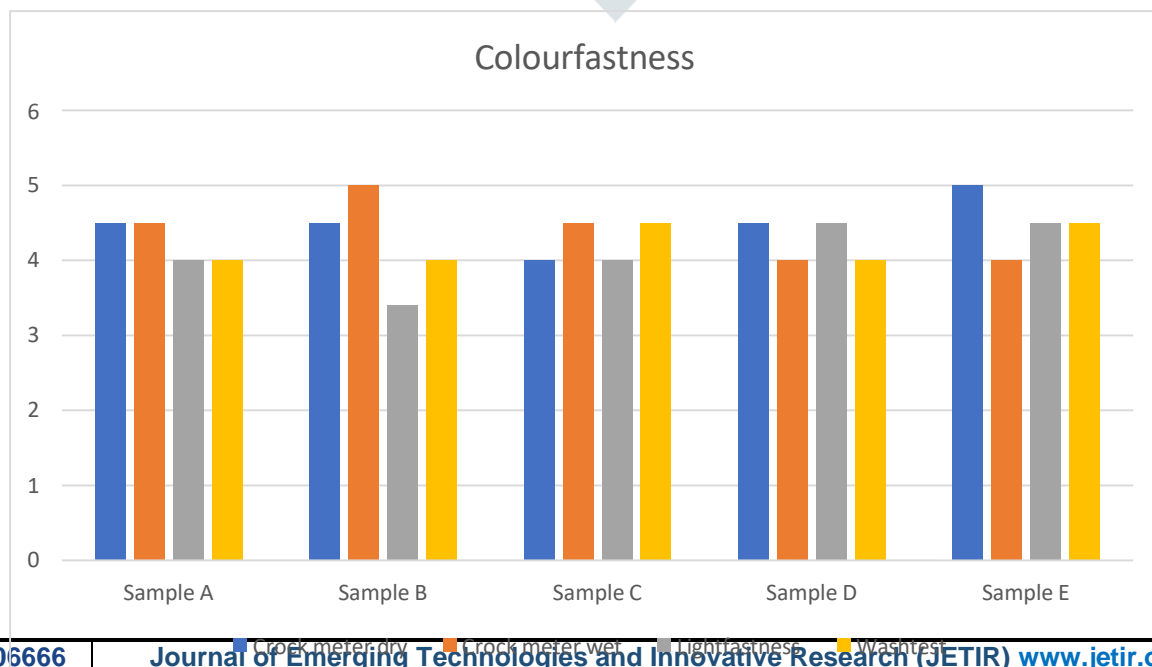
- The abrasion resistance on single jersey knit fabric assesses its resistance to wear and tear caused by friction
- During the test, the fabric is subjected to repeated rubbing against a rough surface under controlled conditions. This process stimulates the everyday wear that the fabric might experience during its use
- The extent of damage or pilling that occurs on the fabric is evaluated to determine its durability and suitability for specific application.

6. RESULT

6.1 Colourfastness test

S.NO	SAMPLE	CROCK METER		LIGHT FASTNESS	WASH TEST
		Dry	Wet	24 Hours	Basic
1	A	4-5	4-5	4	4
2	B	4-5	5	3-4	4
3	C	4	4-5	4	4-5
4	D	4-5	4	4-5	4
5	E	5	4	4-5	4-5

Table no. 3 Colourfastness Test

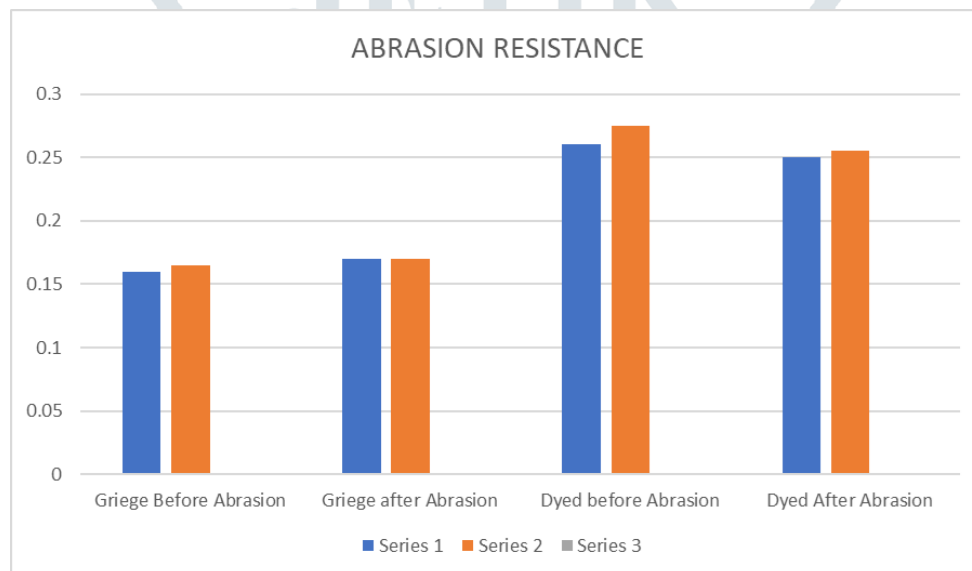


Thus, the chart represents, rubbing, lightfastness, Wash test for the dyed sample, it indicates good performance. This means the colour remains better and stable

6.2 Abrasion test

ABRASION TEST				
S.NO	Greige	Fabric	After dyed	Fabric
	BEFORE	AFTER	BEFORE	AFTER
1	0.160	0.170	0.260	0.275
2	0.165	0.170	0.250	0.255

Table no. 4 Abrasion Test



In this chart represents the abrasion of the greige fabric is less when we compared to the dyed fabric

7. CONCLUSION

The study on ice dyeing using reactive dye in single jersey fabric concludes that the process results in vibrant colour patterns. This process offers versatility and aesthetic appeal and making it suitable for various applications in textile. And the colorfastness revealed satisfactory results indicating good resistance. Additionally, the abrasion resistance demonstrated the durability of the dyed fabric against friction ensuring longevity and wearability. Overall, the ice dyeing creating visually striking and durable textiles in fashion and textile industry.

References

1. SANTHIYA. L ,Dr. G. MALARVIZHI, 2023,DEVELOPMENT OF ICE DYE TECHNIQUE IN HOME TEXTILES, 2023 IJRAR April 2023, Volume 10, Issue 2
- 2.M. Fatih Yüksel1, Durul Büşra Dilden2, Seda Keskin3, Uğur Ergünay4, Rıza Atav5

,2022,Determination of The Effect of Dyeing and Finishing Processes on Physical, Mechanical, Handle, Comfort and Functional Properties of Cotton Knitted Fabrics, <https://doi.org/10.56038/oprd.v1i1.173>, Vol. 1 No. 1 (2022): 2nd International Conference on Design, Research and Development (RDCONF 2022)

3. Amany Khalil1, Abdelmonem Fouda2, Pavla Těšinová1, Ahmed S. Eldeeb,2020, COMPREHENSIVE ASSESSMENT OF THE PROPERTIES OF COTTON SINGLE JERSEY KNITTED FABRICS PRODUCED FROM DIFFERENT LYCRA STATES, UTEX

Research Journal, DOI 10.2478/aut-2020-0020 © AUTEX

4. Pramod Raichurkar,2011, Study on Spirality of Single Jersey Knitted Fabric By: Vishal Desale, P.P.Raichurkar, Akhilesh Shukla & Ramkesh Yadav , See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/277565659>,

5. R Divya Sathyam,2016,Comparative study on ring spun yarn and compact spun yarn, International Journal of Home Science 2016; 2(2): 374-384

6. Textile Pretreatment Processes: Singeing, Desizing, Scouring, Bleaching, Mercerizing, <https://www.testextile.com/textile-pretreatment-processes-singeing-desizing-scouring-bleaching-mercerizing/>

7. Finishes to improve colour fastness,W.D. Schindler, P.J. Hauser, 2004,Chemical Finishing of Textiles Woodhead Publishing Series in Textiles 2004, Pages 144-156, <https://doi.org/10.1533/9781845690373.144>

8. Torsten Textor , Leonie Derksen, and Thomas Mayer-Gall,2019, Abrasion resistance of textiles: Gaining insight into the damaging mechanisms of different test procedures, <https://doi.org/10.1177/1558925019829481>

9. G. Thilagavathi, S. Viju, 2013, Process control in apparel manufacturing in Process Control in Textile Manufacturing, <https://www.sciencedirect.com/topics/engineering/colourfastness>

10. <https://textilestudycenter.com/abrasion-abrasion-resistance-test/>

11. “Cyril and Methodius” Faculty of Technology and Metallurgy, Skopje,Macedonia,2010, Pre-Treatment of Knitted Fabrics Made of Different Grade Cotton Fibers,www.fibre2fashion.com