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Analysis of Resist Printing Using Pigment Dyes

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ABSTRAK

Pencapan rintang merupakan salah satu teknik pencapan tekstil yang memanfaatkan perbedaan afinitas antara zat warna dan bahan resist untuk menghasilkan motif atau pola pada kain. Dalam penelitian ini bertujuan untuk mengevaluasi efisiensi metode ini dalam menghasilkan pola dengan ketahanan warna yang baik serta ketajaman motif yang optimal. Bahan resist yang digunakan yakni Diamonium Fosfat (DAP). Zat warna pigmen dipilih karena memiliki karakteristik tidak larut dalam air, sehingga memerlukan pengental emulsi untuk melekat pada serat kain. Studi ini melibatkan penggunaan variasi konsentrasi zat warna reaktif 2% dan 4% masing-masing penambahan alkali saat proses pencelupan dan setelah proses fiksasi. Hasil pengujian ketahanan luntur warna terhadap pencucian sabun dalam kategori sangat baik dengan nilai ketahanan luntur 4-5 dan nilai penodaan 5 yang mana hasil pencapan rintang stabil setelah pencucian berulang kali. Selain itu, hasil pengujian ketahanan luntur warna terhadap gosokan dalam kategori baik dengan nilai ketahanan gosokan kering 4 dan gosokan basah 4 yang mana kuat terhadap gesekan. Dengan demikian, metode pencapan resist yang digunakan dalam penelitian ini dinilai efisien untuk menghasilkan pola dengan kualitas ketahanan warna yang tinggi.

ABSTRACT

Resist printing is one of the textile printing techniques that utilizes the difference in affinity between dyes and resist agents to create patterns or motifs on fabric. This study aims to evaluate the efficiency of this method in producing patterns with good color fastness and optimal motif sharpness. The resist agent used is Diammonium Phosphate (DAP). Pigment dyes were chosen due to their water-insoluble characteristics, requiring an emulsion thickener to adhere to the fabric fibers. This study involves the use of variations in the concentrations of reactive dyes at 2% and 4%, with the addition of alkali during the dyeing process and after the fixation process. The results of color fastness test against soap washing are in very good category with a color fastness value 4-5 and a coloring value 5, which means that the resist print results are stable after repeated washing. In addition, the results of color fastness test against rubbing are in good category with a dry rubbing fastness value 4 and a wet rubbing fastness value 4, which means that it is strong against friction. Thus, the resist printing method used in this study is considered efficient in producing patterns with high color fastness quality.

1. INTRODUCTION

Lately the development of printing methods must become more creative and innovative. One of the printing techniques that has evolved with the need for fabric motif creation is resist printing. Resist printing is a technique that protects certain parts of the fabric from dye absorption or coloration. The purpose of this technique is to create a contrast between the design and the colored areas (Sunarto, 2008).

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The development and application of resist printing techniques aim to create visual design variations on fabric and can also serve as cultural and symbolic value in society. This technique is expected to allow designers to produce more complex and detailed motifs using various types of fabrics and textile dyes. Additionally, the use of wax resist provides flexibility in the dyeing process (Suliyanthini, 2017).

In the world of batik, resist techniques are often used in the production of stamped and hand-drawn batik. For example, motifs created with wax resist are followed by the process of applying color to the motif, then covered with wax to protect it during the overall dyeing process. This technique has continued to develop and has become a cultural identity of Indonesian society (Hakim, 2018).

Pigment printing techniques have become very popular in the community (Utami et al., 2013). One of the additives frequently used in T-shirt printing is rubber ink and plastisol ink (Tobroni, 2011). Meanwhile, natural thickeners commonly used in the printing process include manuteks (Taufik et al., 2021). According to research (Kuntari, 2020), types of emulsion pastes such as Minasol M, Pertasol CA, and Pertasol CB can also be used in the printing process on cotton fabric.

In this study, reactive dyeing was also used. Cotton fabric dyeing generally utilizes reactive dyes because they have good absorption properties on cellulose (Kurniati et al., 2020). Alkali compounds and NaCl also play a role in the dyeing process using reactive dyes (Pradana et al., 2023). Alkali compounds can also be used in the discharge process after dyeing with reactive dyes (Babsel et al., 2024). Additionally, in terms of color fastness on textiles, the type of binder used also affects the results of these tests (Luciana & Oktaviani, 2022).

Previous literature in resist printing has experienced significant advancements. Resist printing using metal chelation with variations of copper sulfate has been researched (Luciana, 2020b). Furthermore, sodium carbonate can be used as a material in the alkali-discharge printing process (Luciana, 2020a). Contemporary batik making, which combines screen printing and cold wax resist, has been developed as a form of resist technique innovation (Afriansyah et al., 2020).

In this research, resist printing with variations in the use of reactive dyes as a material for the dyeing process and variations in the method of alkali addition becomes the subject of our study to determine the results of using resist printing with pigment dyes for better outcomes in the future. This research was conducted at the Batik Craft Laboratory of Universitas Pekalongan.

2. METHOD

Research Variables

The method used involves the wax resist process with pigment dyes and the dyeing process with reactive dyes. The dyeing process is carried out using the padding technique. The variations include different concentrations of reactive dyes, 2% and 4%, with the addition of alkali during the dyeing process and after the fixation process, as independent variables, as shown in Table 1. The dependent variable is the cotton fabric. The selection of dye concentration variations aims to determine the range of absorption capacity of reactive dyes on the fabric which the optimum absorption capacity of cotton fabric being around 5% of dye relative to the dyeing solution.

Table 1. Variable Variations in Research Method

No	Reactive Dye Concentration (%)	Dyeing Process	Description
1	2	Initial Alkali	2%IA
2	2	Final Alkali	2%FA
3	4	Initial Alkali	4%IA
4	4	Final Alkali	4%FA

Research Flow

Figure 1 explains the sequence of the research process, starting from the preparation of the emulsion thickener, preparation of the printing paste, printing process, dyeing process, padding process, fixation process, and color fastness test.

Preparation of Emulsion Thickener

In the preparation of the emulsion thickener, the materials used include an emulsifier, water, and kerosene. The procedure begins by slowly mixing the emulsifier with water until the solution turns white. Then, kerosene is gradually added to the solution while stirring continuously.

Preparation of Printing Paste

The materials used for making the printing paste include Diammonium Phosphate (DAP), pigment dye, water, binder, and emulsion thickener. The preparation starts by dissolving DAP with the pigment dye and water, stirring the mixture evenly. Then, the binder is added to the solution, followed by the emulsion thickener, and the mixture is stirred until homogeneous.

Printing and Drying Process

The material used is cotton fabric, which is placed on a printing table. A patterned screen is positioned over the fabric in the desired location. The printing paste is poured into the screen and spread evenly using a squeegee until the motif is formed on the fabric. The fabric is then dried in the sun until the motif is fully dried.

Dyeing and Padding Process

Reactive dye, baking soda (alkali), and water are used in the dyeing process. After the fabric has been printed and dried, it undergoes uniform dyeing. Variations in the dyeing process include dyeing with alkali and dyeing without alkali, where alkali is added after the fixation process. After dyeing, the fabric undergoes padding using a padder machine.

Fixation Process

The fixation process is carried out using a curing machine at 120°C for 5 minutes. The purpose of fixation is to ensure that the pigment dye is well absorbed into the fabric, and it improves the fabric's color fastness after the fixation process.

Color Fastness Test

The color fastness test to washing and rubbing is conducted to determine whether the pigment resist printing process yields good color fastness. The color fastness to washing test follows the SNI ISO-C06: 2010 method, while the color fastness to rubbing test uses the SNI ISO-105-X12-2013 method.

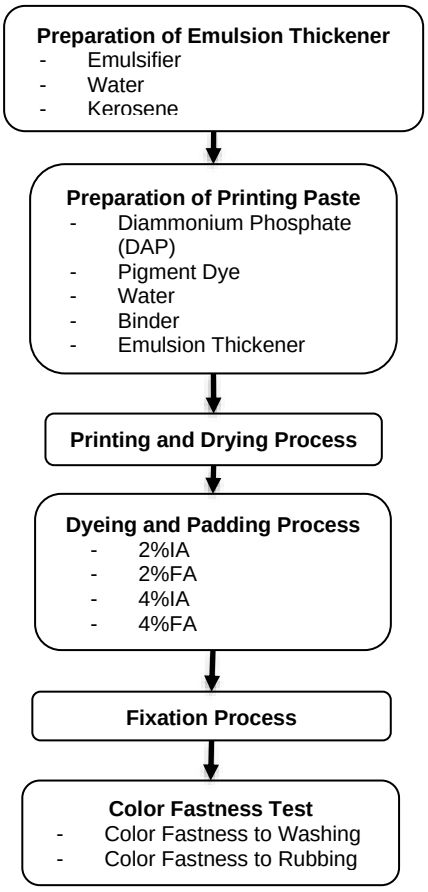

Figure 1. Research Flow Chart

3. RESULT AND DISCUSSION

The results of this study indicate that the addition of alkali at the end of the process produces better outcomes than adding alkali during the reactive dyeing process, as shown in Figure 2. This is caused reactive dyes without alkali remain non-reactive due to the acidic nature of DAP on the resist-printed motifs. Meanwhile, reactive dyes to which alkali is added during the dyeing process undergo fixation and thus penetrate the printed motifs.

Table 2 explains that in the color fastness test to washing and staining, the results show values ranging from 4-5 to 5, it means it will not fade and will not bleed onto other fabrics, making it suitable for future applications. Additionally, the dry and wet rubbing fastness tests predominantly yielded scores 4, signifying excellent rub fastness. However, further development of printing and dyeing techniques is still needed to achieve better visual results and improved color fastness.

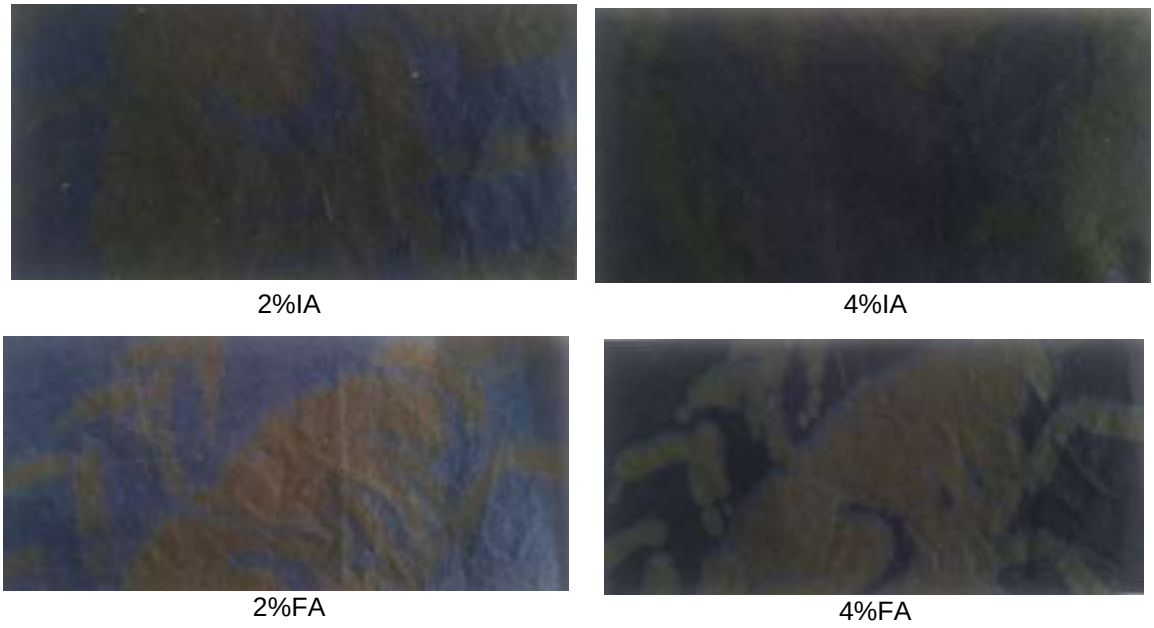

Figure 2. Results of the Resist Printing Process with Pigment Dyes

Tabel 2. Results of Color Fastness Tests to Washing and Rubbing

	Color Fastness to Washing		Color Fastness to Rubbing	
	Color Fastness Value	Staining Value	Dry Rubbing	Wet Rubbing
2%IA	4-5	4-5	4	4
2%FA	4-5	5	4	4
4%IA	4-5	4-5	4	4
4%FA	4-5	5	4	4

4. CONCLUSION

The resist printing process using pigment dyes proves quite effective in creating clear and sharp motifs on cotton fabric. The use of resist materials such as Diammonium Phosphate (DAP) combined with pigment dyes results in precise pattern creation with good visual contrast between printed and unprinted areas. The best results were achieved with a 4% concentration of reactive dye and the addition of alkali after the fixation process. Adding alkali at the end of the fixation process results in better color fastness compared to adding alkali during the reactive dyeing process. This is caused alkali helps in the fixation of dyes into the fabric, whereas alkali added at the end of the fixation process prevents dyes from being affected by the acidic nature of the resist agent, DAP. The

fabric exhibits good color fastness to washing, with values ranging from 4-5 to 5, indicating that the colors remain stable after repeated washing. Additionally, the color fastness to rubbing shows excellent performance, with both dry and wet rubbing scores at 4, demonstrating strong resistance to friction. Although the current results are promising, further optimization of the printing and dyeing techniques is recommended. Improvements in these methods could lead to even better visual results and higher color fastness.

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