

# Innovation of Batik Textile Works Using Wax Printing Technique: Insights from Indonesia

## Abstract

Batik is a type of decorative patterned cloth ~~that is~~ made by applying hot wax to the surface of the cloth with a canting or stamping tool, which is a time-consuming process. To speed up the batik production process, the wax inscribed on the cloth is now cold-wax with a screen tool measuring the width of a piece of cloth (115cm x 250cm).

This research examines the steps for making batik-patterned textile crafts using the cold wax printing technique, as well as the equipment used and the steps for making the dough ingredients. It was carried out by batik-patterned textile craftsmen using a participatory follow-up study method. A batik entrepreneur, a motif designer, a printed wax maker, three printers, two color craftsmen, and two batik artisans were among the ten study participants. It was carried out at the Dewi Ratih batik enterprise in Sragen, Central Java, Indonesia.

It concludes that the production stages begin with cloth preparation, motif design, *afdruk* motifs on the screen, wax printing process, coloring, and *melorod* wax processing. The steps for producing batik-patterned textile crafts using a new technique (cold wax printing technique) are as follows: the first step is to make a master batik motif design on paper then the master design is arranged according to the pattern created, applying *afdruk* (print) motif design on the screen, making dough printing wax, printing motifs on cloth with cold wax media, drying the printed wax, dyeing the first stage of fabric, the process can also be combined with wax batik that applying writing techniques, second stage of cloth coloring, *pelorod* wax processing, and finally washing the fabric so that it is produced batik-patterned textile craft products.

**Keywords:** batik textile craft, printing, cold wax

## Introductoion

Batik is a traditional pattern of cloth with various decorative patterns made using a strain dyeing technique with "batik wax" as a color straining material (Doellah, 2002). Batik-It is a cloth-based work of art that uses a strain dyeing technique with hot wax as a color strainer (Sarwono, 2021). Thus, a cloth is referred to as a batik creation if (1) the strain dyeing technique employs hot wax, (2) the method of incising the wax employs a canting tool and/or a hat, and (3) it contains various decorative patterns typical of batik (Mandegani, 2018).

The cloth creations used in this study have various decorative patterns typical of batik, but the process of coloring the cloth motifs uses cold wax blocks rather than hot wax as is the common practice. Then, instead of a *canting* or stamping device, a screen is used to attach cold wax to the cloth. Therefore, whereas this work does not comprise batik, it is classified as a batik-patterned textile craft (Erwantoro, 2023).

Color screen printing or full print textiles, color removing screen printing textiles, resin removing screen printing textiles, and cold wax screen printing textiles are the various types of batik-patterned textiles. Cold wax screen printing textile production can be integrated with the written batik technique. The following is a comparison of cold wax textile screen printing and writing technique batik with written technique batik. (1) The production capacity of batik-patterned textiles is approximately 150 to 1, indicating that the wax-screen textile production

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This paper examines an interesting issue. However, it has some issues.

### Abstract

An abstract must say what the issue is, how it was investigated and what the conclusions are, succinctly. This abstract does not do so. It does not explain how the data has been collected.

### Paper

1. The introduction must explain the issue, its background and say what the aims and objectives are. Here, the issue is clear. It is understood that there are innovations in Batik production. However, there are no clear aims and objectives. Please provide them.

2. After the introduction, three aspects must be presented with the following sub headings. Theoretical framework, Review of literature and Research methodology.

3. Theoretical framework must discuss the ideas of innovation as related to batik or other arts. This should not be written by the author in his/her words, but by engaging theoreticians and their voices.

4. Review of literature. Any research paper must present a critical review of previous significant research dealing with the issue: in this case, innovative productions of batik. There are a lot of such research and most major ones must be discussed, particularly those that have dealt with such issues in Indonesia. 12-15 references are needed. Please download the guidelines from the website and follow suit. Just listing or mentioning them is not enough. It should be a 'critical review'. Use the authors voice with statements such as 'according to Rapoport (1969) or as Oliver (1989) says.'

5. Afterwards, explain the research methodology adopted. This must explain tools of gathering data. Say who did what when and where to get data. Be specific. Avoid vague terms such as 'some', 'different' and 'various'. All the data gathering procedures must be detailed in such a way that another researcher can repeat the same and ascertain if the same results can be got.

6. Introduce the previous techniques and then the 'innovations'

7. Findings are reasonably clear. Focus on 'innovations.' Please produce data from each of the research techniques mentioned in the research methods: interviews are mentioned but there is no data. Please acknowledge sources more fully.

8. Conclusions are reasonably good. However, the issue is innovations, which should be explained clearly. List them.

9. Please check all the references for compliance with the ISVS e-journal, and completeness. Make sure that all the references listed here are cited in the text and vice versa.

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process can produce 150 products in one week or six working days, whereas written batik can only produce one product. (2) Because the combined textile process also employs the writing technique, the crispness of the motifs and colors produced is nearly identical (Sholikhah and Nurrohmah, 2021; Salma and Eskak, 2020).

Reactive dyes or remazol, indigosol dyes, and naphthol dyes are some of the most common dyes used to color batik (Aprilia and Adriani, 2022). Reactive dyes can react and bond directly with the fiber, becoming a part of it. Remazole is a reactive dye that is frequently used in batik coloring. Technically, remazol batik staining can be applied by dipping, dabbing, or brushing. These dyes are water soluble, have brilliant colors, are fast, and have a low affinity (Rashidi, 2012).

Indigosol dye is a type of water-soluble vessel dye. This dye solution is clear and colored. The expected color is not obtained when the cloth is dipped in the dye solution. The desired color will be obtained after being placed in an acid solution (HCl or H<sub>2</sub>SO<sub>4</sub>). Indigosol has molecular formula C<sub>16</sub>H<sub>10</sub>N<sub>2</sub>Na<sub>2</sub>O<sub>8</sub>S<sub>2</sub>.

Naphthol dyes are common water-insoluble dyes. Costik soda auxiliaries were required to dissolve it. Naphthol dyeing is done in two stages. First dyeing with naphthol solution yielded no color. The desired color will be obtained after the second stage of immersion in a diazodium salt solution. Cold naphthol dyes for batik are naphthol dyes that must be generated with a color generator, specifically Diazo Salt.

A screen is a type of cloth that is used for screen printing. Thick, abbreviated as T, is the density of the woven screen threads and is used to indicate screen size. For example, T54 denotes that every centimeter of screen fabric is made up of 54 threads. Thus, the larger the T number, the more threads or the tighter the threads on the fabric. Screen sizes include T36, T40, T48 (T12), T54 (T14), T61 (T16), T77, T90, T120, T150, T165, T180, and T200.

*Rakel* is a broom made of synthetic rubber (Suparman, 2017). There are several types of *rakel*, which are as follows. (1) Taper *rakel*, in which both sides of the slanted *rakel* are symmetrical. The taper rack's objective is to ensure that the pressed ink produces detailed and clear images. (2) Taper *rakel* type with flat tip, its function is to make the ink pressed wider and more. The large number of this type of *rakel* is used for screen printing on parachute or ceramic cloth. (3) *Rakel* box is a box with a 90-degree angle. This *rakel* is commonly used in screen printing on rough-surfaced paper or textile material. (4) Slanted *rakel*, which has one side with a sloping surface. This *rakel* is more commonly found in screen printing machines. (5) Round *rakel*, a round *rakel* surface, is typically used for screen printing with contrasting or bright ink. (6) Blunt *rakel*, which has a blunt shape at both ends of the elbow, making the *rakel* comfortable to use in screen printing on surfaces such as t-shirts, blankets, and towels.

The mass textile production process in this study used screen printing, whereas the production of motif designs used digital printing technology (DfG printer). Both technologies have advantages and disadvantages, as well as different roles and market segments (Supatmo, 2015). The textile production process in this study used a more cost-effective technology, namely screen printing. The manufacturing of industrial printing plates is a very expensive process (Andri, 2022). The active use of *cetak saring* (screen printing) techniques in the industrial sector promotes the advancement of this technique, both in terms of tools and materials. Screen printing techniques are also developed more specifically by small industries in Klaten to meet their specific needs (Battenfield and Tunnikmah, 2017).

This screen printing technique is also used on objects that come into contact with the value of local wisdom in our lives. Thus, in this work, we attempt to collaborate between graphic art representing modern art and visual objects based on local wisdom representing tradition (Adi, 2021).

Many batik artisans in Sragen Regency, Central Java Province, are currently producing cold wax screen printing textiles and/or combining them with writing techniques. Therefore, the aim of this research is to.....

Its objectives are:

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1. To investigate cloth creations using various decorative batik typical patterns, but the process of coloring the cloth motifs used cold wax blocks rather than hot wax blocks, as is common practice.
2. To explain various aspects of the textile manufacturing process that employs a color barrier with "cold wax" that is attached to a screen tool or screen printing technique. Cloth preparation, motif design, *updruk* motifs on the screen, wax printing/screen printing process, coloring process, color locking process, and wax *melorod* processing are the first stages of production.

The study explains how to make batik-patterned textile crafts using the cold wax printing technique, as well as the equipment needed and the steps for making the dough ingredients. These aspects include the production of raw material dough, the type of equipment used, and how each stage is carried out.

### Review of Literature

Several studies ~~were have been~~ conducted ~~in the same area on the same issue~~ with the present study. Asmah et al. (2015) ~~and;~~ Asmah (2016) ~~have~~ revealed that innovative batik prints are significantly vital for contemporary batik design concepts to improve batik cloths in the Ghanaian fashion industry. Belfer (2012) ~~has in his book~~ explored the history dye in batik cloth and traditional tie dye techniques. Liu and Chen (2015) ~~have-~~ studied the computer simulation of batik printing patterns with cracks with a more modern device, and the results ~~have~~ proved effective in that it can realize various satisfying vivid batik printing patterns with cracks.

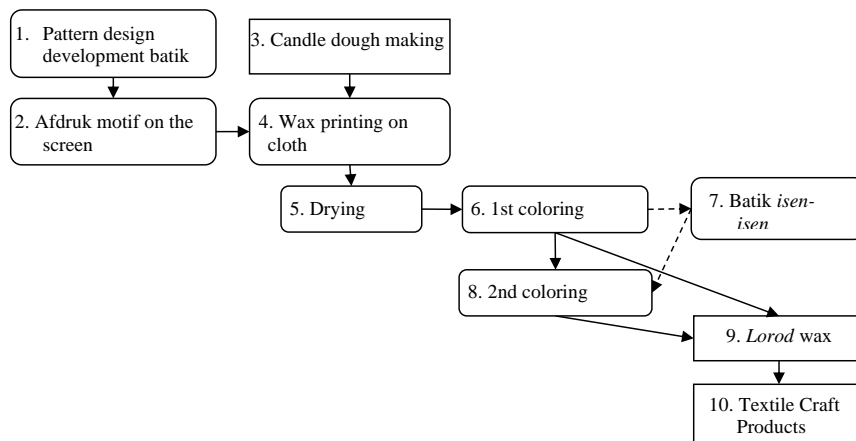
### Research Methods

This action research was conducted at the Dewi Ratih Batik Business in Sragen Regency, Central Java Province, Indonesia, in 2021. To create batik-patterned textiles, the batik industry employed the cold wax printing technique. Data on the batik textile craft production process includes the steps of the batik-patterned textile craft production process carried out by employees as well as the priority aspects of each process in achieving optimal product quality.

Informants, the location and process of textile craft production, and documents were used to collect data. There were ten informants, including one entrepreneur, one motif designer, one printed candle maker, three printing employees, two dye employees, and two batik artisans. Data on the production process was collected through interview techniques and observations of the events of the process of designing motifs, making printed wax dough, printing activities, coloring activities, and wax dropping activities.

~~The f~~ollowing diagram represents the flow of the batik-patterned textile production process using the wax printing technique -(Mulyanto, 2020).

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**Figure 1:** The flow of the wax printing textile crafts production process  
Source: author

### Findings and the Discussion

This study on batik-patterned textile crafts using screen printing or cold wax printing examines the process as well as the tools and materials used. Making motif designs, processing with ufdruk, making printed wax raw materials, printing wax on fabrics, drying waxes, dyeing fabrics, and waxing processes are some of the production processes.

#### Textile Product Planning

Typically, the textile manufacturing process begins with product planning. The planning is related to several aspects such as the production technique to be used, the type of motif created, the pattern type used, the use of cloth, and so forth.

Textile production techniques include full color printing, color removal printing, resin removal printing, cold wax printing, and a combination of printing and writing techniques. Motifs include repetition motifs, fried rice motifs, machete motifs, symmetrical motifs, asymmetrical motifs, and abstract motifs. Patterns include long cloth patterns, shirt patterns, shirt-finger patterns, and others. Textile applications include, for example, women's and men's clothing, as well as accessories.

#### The Process of Boiling the Cloth (*meloyor*)

The primary aim of boiling, meloyor, or mordanting cloth is to remove starch and dirt that has abided to the cloth. The alum element used to slough off will bind iron (fe) to the fabric. Therefore, the cloth can easily and strongly bind dyes, especially natural dyes. Here is how to make a loyor or mordant solution mixture. *Loyor* dough = 120 g alum + 40 g soda ash + 20 liters water. The solution is then boiled for 1 hour, or if the solution for melting cotton cloth has a boiling point of up to 100°C, while the solution for softening silk cloth is boiled to a temperature of about 70°C.

The following is a simple method for applying meloyor method to cloth. (1) TRO water or detergent is used to wash/clean the cloth. (2) The cloth is boiled or dissolved in boiling water for one hour before the heat is reduced. (3) After soaking for 24 hours (1 day), the cloth is washed with clean water and drained.

The more the cloth is stretched during the refining process, the more cracked the thread will be and the cloth will become more sticky, limp so that if dyed, the dye will stick more easily and be stronger/not easily faded. Additionally, the cloth's character will be more flexible and weak, making it easier to make batik and color.

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### The Creation of Motifs and *Ufdruk* Motifs

It is as follows in designing a batik motif that is intended to be applied to the screen and the screen to print cold wax. If the motif is geometric in nature and the pattern is as lengthy as the cloth, the master motif is made measuring 115cm x 60cm, and the motif is printed on a screen measuring 150cm x 80cm. If the pattern is made of long cloth and printed in pieces, arrange the motifs in a size of 115cm x 250cm, then apply *ufdruk* on a screen measuring 150cm x 300cm. The number 115cm represents the width of the cloth to be worked on.

If the motif is intended for shirt clothing products with motifs that are intended to be very sharp, the master motif is 70cm x 90cm in size (the size of the broken pattern on the back of an adult). The master motifs are then arranged on the selected pattern in accordance with the broken shirt pattern. Short sleeve shirt patterns measure 115cm x 200cm, long sleeve shirt patterns measure 115cm x 250cm, jumbo long sleeve shirt patterns measure 115cm x 270, and long sleeve shirt patterns measure 115cm x 210cm.

### Wax Printing Process

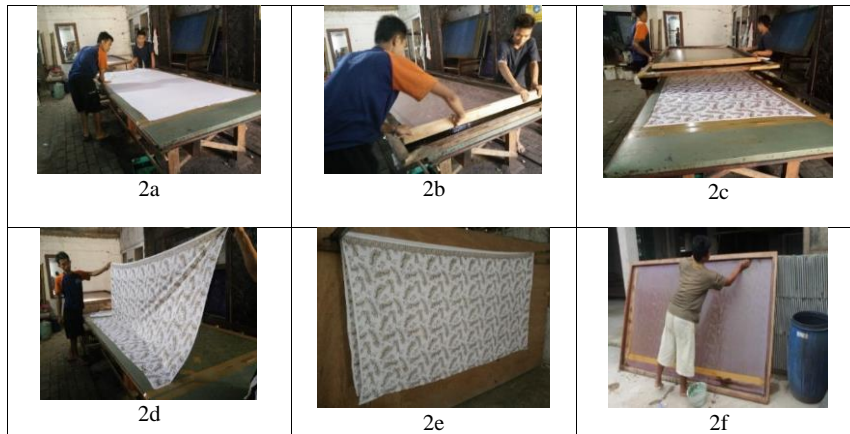
The stages of printing batik-patterned textile crafts with cold wax printing/screen printing techniques are as follows. First, prepare the printing table by ensuring that the table surface is clean and flat so that the wax prints penetrate the fabric evenly. If the table is dirty during the printing process, the cloth may become damaged or torn, and the color may become bloated. The table's surface is then smeared with super glue using a brush or scrap to glue the cloth to the table so that the surface of the cloth is arranged flat on the table and the cloth does not shift when waxed (Fig. 2a).

Second, place the screen on a cloth, then place a cold wax mixture on top of the screen, and then the wax is wiped with a *rakel* by two people from one end of the screen to the other, and vice versa. If the cloth being worked on is a fine cotton *mori* cloth of the *prima* or *primisima* type, the wiping procedure is repeated 2-3 times back and forth until the wax penetrates the pores of the fabric evenly. If the cloth is doobby cotton *mori* cloth with a textured surface, the process is repeated 3-4 times back and forth until the wax has evenly penetrated the pores of the cloth. When the printing is finished, the screen is lifted and placed at the end of the table, and the cloth is cut (Fig. 2b and 2c).

Third, once the printing process is complete, the printed cloth is cut from the rolled cloth and lifted and removed from the table by two people (Fig. 2d). Furthermore, the wax is dried using a drained cloth that is hung lengthwise on a wire (Fig. 2e). The drying process for this printed wax is sufficient to drain it in the room; however, it should not be exposed to direct sunlight. When drying in direct sunlight, the wax that has been attached to the cloth could melt, allowing the motif to become damaged. The fabric is ready to be dyed once the printed wax has dried.

Fourth, after the printing process is complete, the table and screen are cleaned of the glue and wax mixture so that the screen pores are not coated with wax (Fig. 2f). The adhesiveness of the wax dough, the size of the wax grains, the condition of the table surface, the condition of the rubber *rakel* surface, the compressive power when printing, and the air temperature when printing all have an impact on the outcome of this wax print. Mesh type, screen rule, ink viscosity, and raster spacing are all factors that influence screen printing quality (Farida, 2021). The printing material is equally important as the screen printing process itself. The quality of screen printing material is determined by the composition, structure, and features of the printed matter, as well as the composition, viscosity, and other properties of the ink.

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**Figure 2.** Process flow of cold wax printing on cloth  
Source: author

### Printing Equipment and Facilities

The basic equipment required to print cold wax in the production of batik-patterned textile crafts includes a printing table, screen, rack, bucket, and drain cloth. The printing table considered necessary to print is approximately 150cm wide, with the length of the table determined by the needs and length of the location in multiples of the length of the cloth to be printed (2.0m or 2.5m). For example, if only one piece of cloth is to be printed at a time, a table length of approximately 2.5m or 3m (2m or 2.5m + 0.5m) is required. If only one print is required, two pieces of cloth are required, and the table length is 4.5m to 5.5m (2.5m+2m or 3m+2.5m). If only one print is required, three pieces of cloth are needed, and the table length is 6.5m or 8m 2.5m + (2x2m) or 3m + (2x2.5m). If it is only needed to print once, 10 pieces of cloth are required, so the table length is 22.5m or 28m 2.5m + (10x2m) or 3m + (10x2.5m), and so on.

The table's length is determined by the requirements of production capacity, the length of each piece of cloth produced, and the length of the location. To increase the efficiency of the batik-patterned textile production process with wax screen printing, use a long printing table; the longer the table, the more efficient the production process. For example, if a printing table measuring 50m long is used to print a piece of cloth that is 2m long each time, one can get 24 pieces of cloth every time one arranges the cloth on the table (50m: 2.05m = 24). As well as if it is used to print cloth, each piece measuring 2.5m, it takes every time the cloth is organized on the printing table to produce 19 pieces of fabric (50m: 2.55m = 19).

The size of the printing table is closely related to the printing facilities. A location approximately 3m wide and a minimum length of 7m is required to print 1 piece of cloth once. The location's 3m width is reduced by the 1.5m table width, leaving 1.5m of space. The table is then placed in the center, leaving 0.75m of space on the right and left sides of the table. The printer uses the 75cm wide space on the right and left sides of the table for cloth arranging and printing forward and backward.

The length of the printing space is 7m minus the table length of 3m, leaving 4m, which is used for the roll cloth to be printed at one end of the table, and the remaining 3.5m is used to put the screen after use to print. If the table is 5.5 m long, the location is approximately 9.5 m long; if the table is 8 m long, the location is 12 m long, and so forth. Table 1 shows the approximate length of the table and the length of the required printing location, as well as the number of printed cloth pieces.

**Table 1:** Relationship between printed cloth cut, table length, and required location length

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| No. | The number of cloth pieces in a single print | Cloth length 250cm        |   |
|-----|--|---------------------------|---|
|     |  | Table length (cm)         | Location length (cm)                        |
| 1   | 1  | 300                       | 700   |
| 2   | 2  | 550                       | 950   |
| 3   | 3  | 800                       | 1200  |
| 4   | 4  | 1050                      | 1450  |
| 5   | 5  | 1300                      | 1700  |
| 6   | 10   | 2550                      | 2950  |
| 7   | 15   | 3800                      | 4200  |
| 8   | 20   | 5050                      | 5450  |
| 9   | N  | $M = 50 + (N \times 250)$ | $L = 450 + (N \times 250)$<br>$L = M + 400$ |

Information:

N = Number of cloth pieces printed in a single printing process

M= Printing table length

L = Length of the table's location

A rough screen measuring T54 (T14) or T61 is used to screen cold wax (T16). Because the T61 screen produces less wax than the T54 screen, it is appropriate for printing candles during the rainy season, printing rather complex motifs, and printing wax on fine textured cloths.

T54/T14 screen sizes, on the other hand, emit more wax, making this screen excellent for printing candles during the dry season because the printed wax dries faster. Screen T54 can also be used to print wax on slightly rough or large motifs, as well as on coarse-textured garments like doobby cloths.

Rakel is a tool that is used to push and press the ink on the screen cloth so that it adheres to the screen printed media such as cloth, paper, plastic, wood, and glass. Rakel is made up of two parts: a rubber rakel and a wood or aluminum handle.

### Wax Print Textile Material

Cloth, printed wax dough, and fabric dyes are the raw materials required to make batik-patterned textile crafts using wax screen printing techniques. Cotton fabrics with an even texture and textured doobby cotton cloth are used to create wax print textile crafts. (See Fig. 3) In this study, a fine cloth of the Prima or Primissima type was used.



**Figure 3.** Cotton cloth  
Source: author



**Figure 4.** Dobby cloth  
Source: author

The raw materials for molded wax dough are wax, *gondorukem* (resina colophonium), resin, and turpentine (Fig.5). Comparison of these materials: 30 kg of wax + 2 kg of *gondorukem* + 2 kg of resin. To make molded wax dough, boil the three ingredients until they melt, then filter

the dough while it is still hot through a T61/T16 size screen (Fig. 6). The filter dregs or dirt are removed. After the dough has cooled slightly and the stove flame has been extinguished, it is mixed with 5-6 liters of gasoline and stirred until smooth, ready for printing.

The function of the wax in the printed wax mixture is to block the color in the cloth dyeing process. The *gondorukem* (resina colophonium) and resin serve to abide the wax to the cloth. Turpentine's function is to thin the dough and speed up the wax drying process.



**Figure 5.** The *gondorukem*, and resin waxes  
Source: author.



**Figure 6.** The process of boiling and filtering the wax material.  
Source: author

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If the dough will be used for printing, another 3 liters of turpentine was added. The thickness of the printed wax dough is determined by the type of cloth to be printed, the size of the motif (such as dots, stripes, and areas of the motif to be printed), and the printing room temperature. Runny wax dough is better suited for printing on cloths with tight pores and a rough texture (dobby cloth), printing complex motifs and small sizes, and printing in the dry season when the room temperature is high. A slightly thick wax mixture, on the other hand, is appropriate for printing cloths with large or sparse pores and a fine texture, for printing large motifs, and for printing in the rainy season with low room temperature so that the wax dries quickly.

### Cloth Dyeing Process

The dyeing of wax-printed cloth can be accomplished in two ways: *colet* and dyeing. The *colet* technique involves dyeing the cloth horizontally on *spanram* before coloring it with a brush, sponge, or other tool. This *colet* technique is suitable for dyeing wax printed cloths, in which wax is generally difficult to penetrate through the pores of the cloth; additionally, this *colet* technique is appropriate for coloring small areas of motif.

The dyeing technique is the process of dyeing the cloth by immersing it in a color solution, dipping it in but not allowing the batik wax to break. This dyeing technique is appropriate for dyeing wax-printed cloths with good wax penetrating power in the pores of the cloth, as well as hand-drawn batik cloths (Kurniati, 2023).

Remazol dye with waterglass (sodium silicate) as the locking agent is used to color wax-printed batik cloths. Because remazol dyes have bright colors that are difficult to absorb in the cloth, they are best suited for cotton fabrics and not silk fabrics, and the drying process of cloths must be drained and should not be exposed to direct sunlight. Remazol is a reactive *procion* batik dye. The use of remazol dye is relatively simple because we do not need to give a mixture of substances to produce the color as we do with naphthol dyes.

There are three primary colors: blue, yellow, and red. These three primary colors are used in remazol color mixing. Remazol blue colors include KNR, RSP, and others. Remazol red colors include 3B, 5B, 6B, 8B, and others. Remazol yellow colorants include 7G, FG, and others. Green is made up of two primary colors: blue and yellow. Yellow 7G, FG, and others can be used to make these two *procion* colors, as can blue KNR, Black B, Turquoise, RSP, and others.

To make a dark green color, combine blue and yellow with a higher blue dose ratio (e.g., 60% blue and 40% yellow). To make a light green, mix less blue than yellow (for e.g., 20% blue

and 80% yellow). After measuring each dye, the two colors are mixed in a bucket with 1 liter of water. The dye is now ready to be used for the fabric coloring process, both dab and dye.



**Figure 7.** Cold wax printed cloth  
Source: author



**Figure 8:** Textile products dyed using the dyeing technique  
Source: author

### The process of boiling wax (*melorod*)

After the final coloring process is completed, the wax boiling process *melorod* begins, which involves cleaning the wax from the fabric with a *lorod* solution. How to make a wax *melorod* solution with 50 liters of boiled water and 1/2 kg of soda ash. The *melorod* wax method, in which one piece of cloth is inserted and dipped into a boiling *lorod* solution with a stick. After the wax is removed from the cloth, it is removed, inserted, and washed in a regular water bath, removed again, and washed in the next water bath, and finally drained.



**Figure 9:** The wax boiling process through *melorod* by dipping a cloth in boiling water  
Source: author

### CONCLUSION

The following are the steps for creating batik-patterned textiles using the cold wax printing technique: The first step is to create a master batik motif design on paper, which is then set up according to the pattern created, the printed motif design is printed on the screen, the process of printing motifs on cloth with wax media, the process of drying the printed wax by draining the cloth so that the wax does not melt, the process of dyeing the first stage of the cloth with the *colet* technique, the batik process, which can also be combined with the writing technique, the process of *melorod* wax, and finally the process of washing the cloth to produce a batik-patterned textile craft product. When compared to the writing technique process, the batik-patterned textile craft process using this cold wax printing technique can save 15,000 (fifteen thousand) percent of batik production costs, or one in 150. Hand-drawn batik requires

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two people to work for one week to produce two pieces of cloth, whereas batik wax print requires 350 people to produce 350 pieces of cloth.

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### Acknowledgements

We thank the Minister of Education, Culture, Research, and Technology for funding Applied Research 2021-2022 for these 2 years through the Assignment Agreement for the Implementation of the Ministry of Education, Culture, Research, and Technology Fiscal Year Number: 469.1/UN27.22/ PT.01.03/2022 dated March 21, 2022, and the first year contract number 221.1/UN27.22/HK.07.00/ 2021 dated March 10, 2021.

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