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DESIGNING FASHION PRODUCT WITH NATURAL MATERIAL AND PURPLE SWEET POTATO PEEL DYE

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Abstract. The fashion industry is one of the industrial sectors that produces the highest levels of pollution in the world, through waste that can pollute the air, water and soil. Pollution also occurs when the product's lifecycle is ended. When fashion products are no longer used, there will be a huge amount of waste that is difficult to decompose. During the COVID-19 pandemic, public awareness of environmental sustainability has increased. Therefore, an alternative fashion product that is more environmentally friendly is needed. The use of natural materials and dyes is one step in producing eco-friendly alternative fashion products. In this study, the natural dye explored and analyzed was purple sweet potato peel extraction, which was applied to silk fabrics. This research is qualitative research with experimental methods. The fashion products produced are dresses with simple cuts that can be worn on various occasions, semi-formal or formal. In addition, a simple dress cut is expected to have a longer use lifetime, because it does not refer to a particular trend.

Keywords: fashion, purple sweet potato, natural dye

Introduction

The fashion and textile industries are the most polluting industries for the environment. During the production and distribution process, the fashion and textile industries produce waste that can pollute the air, water and soil. Textile production process including the dyeing step has yielded toxic pollution to the environment. As we know, currently in the textile industry synthetic dyes are widely used. According to Helmiati (2020, 22-23), the use of synthetic dyes is easier because the composition is fixed, the coloring results are brighter and have better fastness. However, synthetic dyes have the potential to increase environmental pollution in the area around the production site, especially since many industries have not managed their waste properly. In addition, fashion trends continue to change in a short period of time. This has resulted in fashion products from large industries piling up just like that in a condition that is still very usable, but no longer sells when thrown into the market, then ends up in the landfill. As stated by Maity (2020, 242), that the textile industry is part of a fashion system that promotes mass and fast consumption. People buy clothes to wear in a short period of time, so these fashion products quickly become textile waste, and these huge amounts of waste are difficult to decompose. Fundamentally, textiles are composed of fibers made up of synthetic and naturally occurring polymers. Historically, textile fibers came from plants and animals. Natural fibers are renewable by virtue of their biological origins and exhibit biodegradability in their natural forms (Egan 2021, 4). But unfortunately nowadays almost all textile products are made of synthetic or mixed fibers. According to Jönsson (2021, 2), only 27% of textile waste is recycled, and the remaining 73% is disposed of.

Furthermore, the textile and fashion industry also has a negative impact on the environment indirectly, workers in these industries spend long working hours, in an unhealthy work environment. In many cases, these workers put their health at risk to be able to produce more clothes at a lower cost (Maity 2020, 242). In order to change the cycle of fashion products to be more environmentally friendly, it is necessary to implement a better system, based on a perspective that prioritizes environmental sustainability. As stated by Siderius (2020, 1), this perspective entails a shift throughout the supply chain, from material science (e.g., non-toxic, regenerative biomaterials) to novel logistical systems (e.g., low-carbon reverse logistics).

Fashion is a representation of various aspects of human life (Andriana 2013, 16). This definition does not limit fashion as the application of habits and styles in one particular aspect. So it can be said that fashion is related to various aspects of human activity both in terms of social, political, economic and artistic power possessed by each era. In the current era, human awareness of environmental sustainability is increasing, as is their awareness of the negative impact that the fashion industry has on the environment. Furthermore, the COVID-19 pandemic has created a sense of uncertainty of tomorrow, the general public began to be more concerned with sustainable well-being and the environmental and social resources of the planet (Pereira 2021, 73). Based on this phenomenon, the fashion that adequately represents the current aspects of people's lives is eco-friendly fashion. In this case, the relationship between fashion and people's lifestyles can be the opposite. Fashion products can be an effective strategy in shaping new views and lifestyles (Sari, 2021 2). The output of this study is expected to form people's awareness on environmental sustainability.

The use of natural materials, ranging from raw materials to dyes, is the first step in producing fashion products that are more environmentally friendly. In this study, the raw materials used were natural textile materials, which is silk and natural dyes from purple sweet potato peel. In Indonesia, 89% of sweet potato production is used as food with a consumption rate of 7.9 kg/capita/year, while the rest is used for industrial raw materials, especially sauces and animal feed (Qinah in Fatimatuzahro 2019, 1). Meanwhile, in the fashion industry and textile industry, purple sweet potato is used as a natural dye because of the anthocyanin content in the peel and tuber. However, more in-depth research is still needed on the quality of textile coloring using purple sweet potato peel, this causes the use of purple sweet potato peel as a natural textile dye is still relatively rare.

Furthermore, fashion always involves rapid change, to be able to strive in the fashion industry we have to offer valuable products. This study aims to produce creative and valuable fashion products, as stated by Ramadhan (2022, 192) creativity is one of the strengths in designing fashion products in order to produce fashion items that are innovative, have the value of novelty, have uniqueness or originality, and have a high aesthetic value. The output of this research are dresses with a simple cut that can be easily combined and matched with other fashion items, so that it can be worn on various occasions, semi-formal or formal. The simple silhouette also aims to make the product have a longer use lifetime, because it has no relation with any particular trend.

Methods

Location of Study

This research consists of purple sweet potato peel exploration as a textile dye and followed by a product design process. The main object of the experiment was purple sweet potato peel, collected from a traditional market located in Gunung Putri, Bogor, West Java. The raw material for fashion products, namely silk cloth, is obtained from batik craftsmen in the city

of Solo, Central Java. While all the design stages are carried out at the Product Design studio, Trilogy University, Jakarta.

Data Analysis

In the approachment process, this qualitative research uses an experimental method. According to Hadi (1985) in Payadnya (2018, 2) experimental research is research conducted to know the consequences of a given treatment intentionally by the researcher. Experimentation process in this study is by conducting a series of explorations in order to obtain a color scheme resulting from dyeing silk fabrics with dyes from the extraction of purple sweet potato peel. In addition, the experimental process was carried out at the design stage in order to identify the appropriate fashion product design. The design exploring process is carried out by considering structure of fashion elements (Elnashar 2018, 2) as follow:

1. Material and shape (raw-color-shape) include: textile filaments yarns, colors, fabrics, models, patrons, fashion, accessories, fittings;
2. Subject: fashion trends such as back to nature, nostalgia for the past, memories of the past, Scandinavian, dark asphalt colors, military uniform, Canadian woods, precision and elegance;
3. Expression: a way of expression on fashion trends using different types of filaments, threads, fabrics, colors, materials, accessories and equipment that achieve the direction required according to the vision of the designer and the community in which they live;
4. Signification: the values that will get through fashion in general and for fabrics in and fashion special bouquet which, for example:
 - a. Economic values to open new markets for the product and a huge financial return.
 - b. Social values - customs - traditions - ethics,
 - c. Technical values
 - d. Religious values
 - e. Political values
5. Philosophical values

Result and Discussion

The exploration stage started with the process of extracting purple sweet potato peel. The color pigment extraction process carried out in this study is the extraction method using water, namely aqueous method (Nugraha 2020, 31). Following are the steps of the purple sweet potato peel extraction process:

1. Wash the sweet potato from the soil that sticks to it
2. Peel the sweet potato, from 500 grams of sweet potato produces about 50 grams of sweet potato peel
3. Boil sweet potato peel (50 grams of sweet potato peel: 500 ml of water), boil until the water is only half.
4. Wait until cool, then strain. Use the water to dye the fabric

Before going through the color dyeing step, silk fabric goes through a mordanting process using alum solvent water. The following are the steps of the mordanting process:

1. Soak the cloth with alum solvent for 1 night (30 grams of alum: 3 liters of water)
2. Rinsed the cloth with clean water, then soaked in alum solvent again and boiled for 1 hour
3. After 1 hour, wait for the alum solvent to reach room temperature. Remove cloth and rinse thoroughly
4. Dry the cloth



Once the silk fabric is dry, cut it into 24 pieces. Then dip all the pieces into the purple sweet potato peel extraction, then boil over low heat. Take 4 pieces of cloth every 10 minutes.



Fig. 1 Dyeing Process. Source: Author's Documentation

After the dyeing process, the cloth goes through a fixation process using 3 different fixatives and also without fixative to determine the difference in color produced. The fixatives used were alum, FeSO_4 and lemon. The following are the steps in the fixation process using alum:

1. Dissolve 70 grams of alum in 1 liter of water
2. Soak the cloth using alum solvent for about 30 minutes
3. Rinse the cloth under running water, then dry it under the shade, do not dry it directly under the sun

Following are the steps in the fixation process using FeSO_4 :

1. Dissolve 20 grams of FeSO_4 in 1 liter of water
2. Soak the cloth using FeSO_4 solvent for approximately 30 minutes
3. Rinse the cloth under running water, then dry it under the shade, do not dry it directly under the sun

























Here are the steps in the fixation process using lemon juice:

1. Dissolve 100 ml of lemon juice in 1 liter of water
2. Soak the cloth using lemon solvent for about 30 minutes
3. Rinse the cloth under running water, then dry it under the shade, do not dry it directly under the sun



Fig. 2 Fixation Process, from upper left clockwise: Alum, FeSO_4 , without fixative, lemon juice. Source: Author's Documentation

Table 1. The result of dyeing silk fabrics with dyes from purple sweet potato peel extraction

No.	Duration	Without Fixative	Fixative Lemon	Fixative FeSO4	Fixative Alum
1	10				
2	20				
3	30				
4	40				
5	50				
6	60				

From the table above, it can be concluded that the dyeing of silk fabric using purple sweet potato peel extraction produces a grayish purple, pink, dark gray and purplish pink color scheme. The color results differences were affected by fixative and dyeing duration. It also can be concluded that silk fabric absorbs the pigment of sweet potato peel optimally, even though the color resistance needs to be analyzed further.

At the stage of design exploration, the first thing to do is compiling an image board as a reference in determining market segments, the shape and silhouette of the prototype, the color scheme to the function of the prototype. Before designing a product, it is necessary to prepare a concept first, starting with the drafting of an image board. According to Liu (2020, p2), in the design transformation process, designers generate image associations through visual stimulation of images before further converting them into design concepts. The following is an image board that has been compiled.

**Fig. 3** Image Board Color Scheme. Source: Author's Documentation

The image board contained pictures as follows: flowers, pointed high heels, a handbag, a book, a scarf and young women with feminine look outfits. According to the image board, the

target market segment are young women aged 20-30 years, with feminine, gentle, calm and elegant characters. They tend to wear comfortable outfits, simple silhouettes with flowing fabric. They love to wear feminine color schemes, and wear accessories with a romantic look. They are working in a slow paced working environment. In her spare time, love to stay at home, read a book and have a cup of tea. Their hobbies are arranging flowers for home decoration, and making DIY accessories such as crystal bracelets, silver chain necklace, and a simple hair pin. Quality over quantity is their principle for making friends. They have a few close friends that last for years.

Based on the color image scale (Kobayashi in Andriana 2017, 7) the color scheme displayed in this image board is in the elegant scope, and represents emotional, graceful and delicate characters. The prototype that was produced is a dress made of silk which is soft and slightly shimmering. The dress can be worn as an outfit for both semi-formal and formal occasions.

After compiling the image board and specifying the target market segment, the next step is sketching product designs. The following are a number of design sketches,



Fig. 4 Design Sketches. Source: Author's Documentation

Through the design exploration process, sketches 1 and 2 (from left) are selected and produced as prototypes. The choice of the two designs was determined with consideration of their simple silhouette line elements so that they are easy to mix and match with other fashion products, and can be worn on various occasions. In addition, simple dresses are expected to have a longer use lifetime, because they do not refer to a particular trend. It is suitable with the fashion that adequately represents the current aspects of people's lives, which is eco-friendly fashion. Moreover, the selected designs also matched with the targeted market segment which has a feminine, gentle, calm and elegant characters. Based on the elements of fashion structure, the design exploration process can be analyzed as follow:

1. Material and shape (raw-color-shape):
 Fabric: silk
 Fitting: flowy, falls following the shape of the body
 Colors: grayish purple
2. Subject:
 Young women aged 20-30 years, with feminine, gentle, calm and elegant characters. Working in a slow paced working environment. In her spare time, love to stay at home, read

a book and have a cup of tea. Her hobbies are arranging flowers for home decoration, and making DIY accessories.

3. Expression:

Fabric color: shimmering, grayish purple

Thread: grayish purple

Accessories: simple necklace and bracelet made of silver, simple strappy heels in gray color, simple rectangular clutch made of satin in lavender color

Fashion item for completing the look: simple cut blazer, cropped jacket

4. Signification:

Social value: these fashion products are designed to form people's awareness on environmental sustainability, to break the over polluted cycle of fashion products lifetime.

5. Philosophical values:

Environmentally friendly fashion product, made of 100% natural material and dyed in natural pigment. Simple cut for longer use lifetime, easy to mix and match and suitable for semi formal and formal occasions.

The following pictures are photos of the prototype that have been produced,



Fig. 5 1 Set Outfit and 1 Dress Made of Silk Fabric Dyed with Purple Sweet Potato Peel Extraction.

Source: Author's Documentation

Conclusion

Based on a series of exploration processes of extracting purple sweet potato peel, it can be concluded that purple sweet potato peel has a potential pigment to be a natural dye for fabric. Silk fabric can absorb purple sweet potato peel pigment optimally, with and without fixatives. It also shows optimal absorption using different types of mordants; lemon, FeSO_4 and alum. However, to obtain consistent color results, a series of further explorations are still needed. It also requires further research to analyze its color fastness.

The determinants of the dyeing results analyzed in this study were only the fixative and the duration of immersion. The fixative in the process of dyeing silk fabrics with dyes extracted from purple sweet potato peels affects the color produced. Without a fixative, the resulting color tends to be bluish-purple. With lemon fixative, the resulting color tends to be pink. With FeSO_4



fixative, the resulting color tends to be grayish green. With alum fixative, the resulting color tends to be purplish pink. The duration of dyeing affects the absorption of purple sweet potato peel pigment on the fabric. However, the dyeing process using FeSO₄ as a fixative produces a color that tends to be consistent, regardless of the duration of immersion. The effect of fixatives on the color resistance of silk fabric that has been dyed using purple sweet potato peel extraction has not been analyzed.

Silk fabric has a soft character and falls following the shape of the body wearing it. Therefore, the design that fits the character of the silk fabric is a dress with a simple cut, unstructured, falling to follow the shape of the body. According to its visual elements, the suitable market segment are young women aged 20-30 years, with feminine, gentle, calm and elegant characters.

In addition, silk fabrics have a natural shimmer so they are suitable for semi-formal and formal wear. In this design, the fashion product made are clothes that can be combined and matched with other fashion products, such as outer (blazers, cropped jackets, cardigans) belts, and necklaces, so that they can be adapted for semi-formal or formal occasions. Based on the design concept, these dresses perfectly match with simple necklaces and jewelry made of silver. On formal occasions, simple strappy heels and rectangular clutch bags made of satin with lavender color will elevate the look of the dresses. Mixing the dress with a plain blazer or a cropped jacket, simple low-heeled sandal and small sling bag are the perfect combination for a semi formal occasion.

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