**An Exploration of Local Clay and Soil for Batik Block Dyes**

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| ARTICLE INFO |  | ABSTRACT |
| *Article history:*  Received  Received in revised form  Accepted  Available online | Malaysian batik can be further be extended by bringing in various new batik colouration techniques that are attractive, trendy and more versatile with today’s lifestyle. This research focuses on the production of batik dye from clay and soil that was obtained from the local environment. Nowadays, the high-demand in batik product affected the batik production led to choose synthetic dyes, and use chemicals that impact the environment. Therefore, the alternative was explored and stand other options in colouring process, which used the natural dyes. On the other hand, the manufacturing practices effectively solve few environmental issues in minimising emissions of wastes. The environmental problems are the challenge faced by the batik industry has initiated the interest of this research. This research used practice based on an experimental approach. The objective is to study the potential of any type of clay that is to be used as a textile colouration. Then, follow with the analysis of how the colouring effect is shown from the clay and soil through the batik block technique and process. The novelty of this research is to produce various types of dye in batik making. The importance of this study is to introduce alternative batik dye to the local batik industry that is eco-friendly. |
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**1. Introduction**

The textile industry uses large quantities of synthetic dyes to produce articles in different market areas, compared to natural dyes in which demand is relatively minor and for niche areas. This outcome is linked to the fact that synthetic dyes are more economical, have superior colour fastness, wider colour variety, and greater reproducibility(Bulut and Akar, 2012). However, some of these dyes have the potential to generate toxically and adversely affect the aquatic ecosystem. Sometime, the threat may have mutagenic, carcinogenic, toxicological properties and, despite the low incidence, some are associated with contact dermatitis (Sinha, Kaha and Datta, 2012; Malinauskiene et al., 2012). Therefore, the alternative over the new dye is to replace synthetic dyes either derived from toxic precursors or prone to forming toxic metabolites. The profit of the natural dyes has increasingly been contemplated because of their biodegradability, low incidence of allergic reactions, and low toxicity (Malinauskiene et al., 2012; Komboonchoo and Bechtold, 2009). The approach is aligned with the growing movement in our society towards sustainability, green and environmentally friendly products, in addition to government intervention in favour of reducing environmental issues (Bechtold, Mahmudi and Mussak, 2007; Rossi et al., 2017).

However, in the present context of globalisation and rapid technological changes, Batik process is stricken with many challenges as the batik products are continuously using direct chemical substances in the colouring process. Hence, there is a demand to strengthen this sector given the employment potential and market need for natural colouring products. On the other hand, Environmental considerations are now becoming additional essential factors during the selection of consumer goods including textiles all over the world. The affairs referred to environmental preservation and control of pollution have renewed interest for industrial consumption of natural dyes for the colouration of textile materials all over the universe, especially in the developed nations. In the past few decades, batik work on textile materials has gained popularity among the young generations who quickly adapted the easy-to-do method for individualising their clothing . Consequently, product diversification through batik making with natural dyes is one of the ways to create fancy effects on the batik products for the ever-changing fashion market. A greater emphasis on using natural dye in the textile industry could make a valuable contribution to the environmental sustainability (Legino, 2012). Therefore the outcomes of this research are to experiment and develop a framework in colouration technique utilise natural dye from local clay and soil as an alternative way to colour fabric without using traditional colour comes from the chemical.

The textile industry is evolving in Malaysia especially among the batik industry in Peninsular Malaysia, which contributed positively to the economic growth (Dhas, 2008). The utilisation of batik dye significantly changes after the advent of technology in synthetic colouring. Formerly batik dye used natural colours. Natural dye includes pigments that have been found in the materials or formed in the heating process, storage, or processing (Sheares, 2009). Also, how to create them have ed changed. The growing use of batik product in Malaysia, boosted the batik industry. The high demand led to the production of batik, which used chemical element in the coloring process.

A major problem related to the batik industry is the discharge of wastewater produced during the soaking, boiling, and rinsing steps without proper treatment. This problem involves large volumes of water and chemicals such as waxes, dyes, and fixing agents like silicate, resulting in a high Ph (Kwartiningsih et al., 2009); (Khalik et al., 2015) and (Forgacs, 2004). This is because the presence of various chemicals in the effluents could threaten aquatic organisms due to their toxicities and non-biodegradability, it is more difficult to treat the water because of the complexity of the pollutants (Syuhadah, 2011) and (Manan and Mamat, 2011). In the batik block process, the four major sequential steps, stamping, soaking, boiling, and rinsing, which each have their contaminants, lead to the complexity of wastewater treatment. The release of chemical dye into the environment during and after the dyeing processes of making batik is a major source of pollution. Each waste treatment through physical, biological, or chemical methods is often very expensive (Rashidi, Sulaiman and Hashim, 2012).

Currently, the major conventional methods for treating textile dye wastewater are physical and chemical treatments, because biological treatments are difficult to operate and usually require a long retention time, nor are they applicable for toxic heavy metal containing wastewater (Aouni et al., 2009). A conventional technique for the manufacture of chemicals and especially batik dyes from wastewater is a difficult and time consuming. Treatment using membrane filtration can reclaim water and chemicals. However, these are quite expensive and have significant fouling problems(Lau and Ismail, 2009). There are various studies conducted on batik fabric dyes that are environmentally safe, but dyes there have chemical elements are more likely to be used in the process of making batik.

This problem which is the backbone of the study on the coloring of batik block which used natural sources of clay and soil which has a distinctive color. The resulting color has its own identity and is able to provide added value to the production of batik block. The difference clay and soil content type will generate different colors depending on the level of substances contained in the sources. Also, the advantages of using natural dyes derived from clay and soil to reduce environmental pollution, accessible and cost of production is lower than the synthetic colors. Thus, to promote nature dyes and the explorative research on the medium without chemical should be encouraged, so as the potential of Malaysian batik products could be enhanced in accordance with the modern stage. This study aims to explore a textile colouration using local clay and soil that have potential to be introduced as textile coloration especially in batik block making. The objectives of this experimental research are: a) To identify the types of local clay and soil that have potential to be produced as a dye. b) To analyze the coloring effects resulting from the local clay and soil to using various type of fabric.

**2. Literature Review**

**a)Natural Dyes**

Natural dyes are dyed colourants derived from plants or minerals. The majority of natural dyes are vegetable dyes from leaves, stems, roots of flowers and seeds. Archaeologists have found evidence of textile dyeing dating back to the Neolithic period. In China, dyeing with plants, and mineral has been traced back more than 5,000 years (El Nagar et al., 2005). The essential process of natural dyeing changed little over time. Typically, the dye material is put in a pot of water, and then the fabric to be dyed are added to the pot, which is heated and stirred until the colour is transferred. Often, natural dyes require the use of mordant to bind the dye to the textile fibres. Natural dyeing techniques are also preserved by artisans in traditional cultures around the world. In the early 21st century, the market for natural dyes in the fashion industry is experiencing a resurgence (Calderin, 2009). Western consumers have become more concerned about the health and environmental impact of synthetic dyes in manufacturing, and there is a growing demand for products that use natural dyes. The European Union, for example, has encouraged Indonesian batik cloth producers to switch to natural dyes to improve their export market in Europe (Faizal, 2011).

b) **Natural Dyes from Mineral**

The clay and soil is a natural substance that has reddish, yellowish, brown and blackish colors formed naturally. There is a wide range of colors found in clay and soils of different origin and history. Black, grey, red, brown in all their varying shades and intensities are found in profusion, and occasionally white, yellow and slaty-blue types are encountered. The three most potent factors in determining clay and soil color are the proportion of silica, iron, and humus that they contain. The predominance of brown and red clay and soils is due to the presence of iron and degree of its oxidation to highly colored compounds. According to Purwowidodo (1991), soil color is derived from the transition of various types of mixed particles to give color to the soil content. Red soil samples also show high oxidation content on iron content; more iron content causes reddish-brown soil (Purwowidodo, 1991). Land with a certain color can be used as a natural dye.

**c) Potential Dyes from Clay and Soil**

Most natural dyes are derived from plants like leaves, fruits, trees, roots, fibre and bark. Natural dyes are very limited variation in colours and require a long process. Therefore, there is a need to be a research on potential types of natural components that are potentially used as textile dyes, as long as natural dyes originate from plants which are often used. This study is experimenting with the potential of staining from the clay and soil. The soil and clay is a natural substance that has reddish, yellowish, brown and blackish colors formed naturally. Soil color is derived from the transition of various types of mixed particles to give colour to the soil content (Sheares, 2009). Red soil samples also show high oxidation content on the iron element; more iron element causes reddish-brown soil. Soil with a certain colour can be used as a natural dye. Through a study conducted by the alumina, lime, and vinegar materials have a bond between dyes and fibres that can apply as a soil coloriser (Subki and Rohasliney, 2011).

**3. Methodology**

These research conducted using studio-based practice research, which starts with the experiment of nature dyes that made from clay and soil. The systematic process is show in Fig. 1. Then, in the Table 1, Table 2 and Table 3 stated in how the outcome of experiment based from several phases.

Results

Data Analysis

Experiment & Sampling

Product

Design Process

**Fig. 1:** The research design flow charts

**Dyeing Method**

**Purpose:** To determine clay colour absorption by fabrics.

**Equipment:** Basin plastic, container, measure, and pot.

**Nature used:** Reactive dye from (sample A) soil from paddy field, (sample B) laterite soil and (sample C) terracotta clay.

**Material:** Cotton viscose

**Method:** The dyes from clay and soil are needed to mix with water to identify the right coloration scheme. The dyeing process started with material preparation. There are two colours used for coloration process: the first sample was dyeing with stoneware coloration, sample two was dyed with terracotta coloration. Below is the calculation for sample one and sample two.

**Sample 1, 2 and 3 –Soil and Clay**

1. 1000g clay or soil + 3000ml water.

2. Mixed clay or soil into water for 20 minutes.

3. Stir until it turns to colour.

**Coloration process:** Soak the fabric for 18 hours.

**Fixing Process:** After coloring process rinse the sample of fabric by using the nature mordant from lime stone paste.

**Result:** The dyeing process was a success by using soil from paddy field, laterite soil and terracotta as a coloring agent. Reactive dyes of this process also reached the samples. The fabric has the potential to absorb colour. The disavantages of this dyeing process are complex and complicated in the preparation process. The volume of material must be carefully measured to get accurate results. Futhermore, all sample must be done through the fixing process.

**Table 1:** Types of clay and soil

|  |  |  |  |
| --- | --- | --- | --- |
| Number | Types | Description | Material |
| 1 | Stoneware | Stoneware contains fine silica and fine aluminum content. These elements mix naturally and settle into the crust of the earth. Stoneware is formed by sedimentary rock sediments by carbonate and partly generated from earth heating activity. |  |
| 2 | Terracotta | Terracotta clay is determined by the type of dominant mineral particles. Terracotta minerals are grouped according to the arrangement of silicon oxide layer and aluminum oxide that form crystalline chunks. |  |
| 3 | Soil from paddy field | Soil from paddy field is a mineral accumulation that has no or weak bonds between its particles, formed due to weathering of the rocks. Land is defined as a material consisting of unorganized solid aggregates of one another and from organic materials. |  |
| 4 | Laterite soil | Laterite soil color is derived from the transition of various types of mixed particles to give color to the soil content. Red soil samples also show high oxidation content on iron content; more iron content causes reddish-brown soil. |  |

**Table 2:** Coloring result on Different fabric

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Stone  ware | Terra  cotta  clay | Soil from  paddy field | Laterite |
| Rayon |  |  |  |  |
| Cotton Drill |  |  |  |  |
| Spun |  |  |  |  |
| Jacquard    Silk |  |  |  |  |
| Cotton Viscose |  |  |  |  |
| Habotai Silk |  |  |  |  |
| Calico |  |  |  |  |

**Table 3:** The result of experiment

|  |  |  |  |
| --- | --- | --- | --- |
| Number | Terracotta clay | Soil from paddy field | Laterite soil |
| 1 |  |  |  |

**4. Results and Discussion**

The research method is to do testing on the different experiment for material, colour and fabric. During the experiment, this batik colouration wants to know the effect of colour on a different type of fabric. This taken to identify the type of clay and soil used are suitable for the final product. Also, this research is also carried out to find the most appropriate colouration substance in the fabric. After that the colouring process rinses the sample of fabric by uing the lime stone paste. The table 2 and table 3 shows the colouration material in experimentation process and result. This research had identified suitable medium for natural colouration method. The experiment conducted is to collect the result. The potential dyes from laterite, soil from paddy field and terracotta clay is prominent in batik colouring. There are the several samples generated from this processThis study can improve and provide a new approach in the textile industry on innovation undertaken on the effect of staining using natural dyes of clay and soil colours. Scientific and detailed studies need to be carried out to perceive the potential of producing batik fabrics using colour from clay and soil. The use of mineral colouration in the industry is still none. Batik production using naturally needs to be diversified to provide added value in the production of the high quality product.

**5. Conclusions**

This study attempted to determine the characteristics of local clay as an alternative way of producing batik using nature dyes and its differences with traditional batik. The research will be based on an interview with batik entrepreneur, practitioner and batik designer. Data analysis of the findings will be used to explore various types of colouration from local clay that suitable into various fabrics.

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