The coloring of batik stamp using songgolangit (Tridax procumbens) weeds with different fixation

K N Dwicahya, M Musdalifah and S Nurmasitah
Department of Home Economics, Faculty of Engineering, Universitas Negeri Semarang, Indonesia

Corresponding author: kurniawatinoviadc@gmail.com

Abstract. Natural dyes are from parts of plant, such as leaves, fruit, flowers, seeds, roots and bark. Weed is one of the plants that can be used as natural dyes. This study aims to determine the potential of Songgolangit weeds as natural dyes on batik stamp. This research is an experimental research. The objects of this study are Songgolangit weeds, batik stamp and the fixation (tunjung, alum, and quicklime). The data was collected by looking at the catalog of textile dyes to find out the direction of the resulting color. The sharpness of the motif was tested by using organoleptic tests. The result of the color direction analysis of alum fixation is Hazelwood. The quicklime fixation result is Bone and the tunjung fixation result is Hazelnut. The sharpest motif is produced from tunjung fixation. In conclusion, Songgolangit weeds can be used as natural dyes of batik stamp. The direction of the color produced differs depending on the fixation substance used.

1. Introduction
Batik is one of authentic Indonesian culture which is admired by people from all over the world. In the past, natural dyes were used to dye threads and fabrics derived from natural fibers. The difficulty of making natural dyes is causing the change of the synthetic dyes usage [1]. Synthetic dyes contain chemicals that can pollute the environment and can cause a cancer. So, the use of natural dyes is an alternative to substitute the chemical dyes. This is in line with the prohibition of using chemical dyes since August 1, 1996 in developed countries. This prohibition refers to the CBI (Center for the promotion of imports from developing countries) Ref, CBI / NB-3032 dated June 13, 1996 concerning coloring substances for clothing, footwear, and bed linen [2].

Weeds are one of the plants that can be used as natural dyes. Some weeds can be used for dyeing the textiles. It can manage the uncontrolled growth of the weeds as well as save the other useful plants [3]. Weed types are very diverse, one of which is Songgolangit (Tridax procumbens). Songgolangit is a type of wild plant which belongs to the Asteraceae. It is originally from the United States [4]. Actually, it can be used as a medicine because it produces chemical compounds that are useful as a healing [5]. This plant is known as a weed that can grow in various places, for example on roadsides, fields, or mountains. Songgolangit is usually found in places that are not muddy, with lots of sun exposure or only a little shade, especially on sandy or rocky soils, in grass fields, dry rice fields, roadsides or railways, river banks, and others. Songgolangit weeds contain natural pigments, alkaloids, tannins, flavonoids and saponins [6]. Songgolangit contains natural pigments, flavonoids, which
produce yellow color in plants. Exploration of natural dyes as textile coloring has been done before [7,8].

Figure 1. Songgolangit (Tridax Procumbens) weeds

Referring the previous research, Songgolangit weeds can be used as natural dyes in primissima and rayon clothes [9]. The making of natural dyes from Songgolangit weeds was carried out on a plain cloth which was going through the mordan process with alum, then dipped into a dye solution that had been extracted. The extraction in this study was boiled and fermented weeds by immersing 15 times and fermented with alum, tunjung, quicklime, hydro and vinegar to see the quality of the dyeing from the aspect of color direction result. This research was conducted on the primissima clothes which was previously going through the mordan process with alum and then stamped. The stamp was made from paper with a Songgolangit motif. The clothes then dipped in Songgolangit weeds natural dye solution for 12 times and fixed using alum, tunjung and quicklime. The last process was removal of the wax to get the result quality of the color direction and the motif sharpness.

Figure 2. The batik stamp motif in Songgolangit weeds

2. Method
The method used an experimental research. Experimental research has at least one independent variable, called the experimental variable, which is deliberately manipulated by the researcher [10]. The experimental method is strict, steady, and unchanged during the study. The experimental method in this study is a one-shot case study [11]. The results of the coloring were tested from the aspects of
the color direction and the motif sharpness. The method of collecting data on color direction was carried out by looking at the textile dyes catalog.

![Textile dyes catalog](image)

**Figure 3. Textile dyes catalog**

The method of collecting data on the motif sharpness used organoleptic or sensory test which used human senses as the main tools for assessing the product quality. Research instrument is a tool or facility that are used by the researcher for collecting data in order to make the work easier and have a good result [12]. This research used check list observation sheet with the panellists’ involvement for responding the questions. The lists consisted of research subject and factors. The analysis method used in this study is descriptive statistical analysis to describe or provide an overview of the research object.

The object of this research was Songgolangit weeds, batik stamp, and fixation substance. The research variables consisted of independent variables (tunjung, alum and quicklime), dependent variables (color direction and sharpness of the motif), and control variables including:

1. Songgolangit weeds; 2 kilograms with 10 liters of clean water.
2. The primissima clothes which was manipulated with a stamped batik motif.
3. The batik process was carried out by one person.
4. The time used for the dye soaking was 10 minutes.
5. The frequency for each sample was 12 times.
6. The process of coloring or dyeing used the pre-mordanting and fixation methods.

3. **Result and Discussion**

3.1. **Result**
The color direction produced by batik stamp coloring using Songgolangit weeds can be seen in table 1.
Table 1. Songgolangit (*Tridax procumbens*) weeds color direction

| Material       | Alum     | Quicklime | Tunjung   |
|----------------|----------|-----------|-----------|
| Hazel Wood     | Bone     | Hazelnut  |

The resulting color of each fixation was different. Fixation with tunjung resulted in a yellow green to grey color, namely Hazelnut color. Meanwhile, the resulting color from quick lime fixation was yellow to light grey, namely Bone color. The treatment with alum fixation resulted to a yellow to white/ faded color, namely Hazelwood color.

Table 2. Result of motif sharpness

| Fixation      | Mean  | KM Score | Criteria   |
|---------------|-------|----------|------------|
| Tunjung       |       |          |            |
| TP            | 3,8   | 76       | Sharp      |
| KO            | 3,6   | 72       | Sharp      |
| Total         | 3,7   | 74       | Sharp      |
| Alum          |       |          |            |
| TP            | 2,6   | 52       | Quite sharp|
| KO            | 2,4   | 48       | Quite sharp|
| Total         | 2,5   | 50       | Quite sharp|
| Quicklime     |       |          |            |
| TP            | 2,8   | 56       | Quite sharp|
| KO            | 3     | 60       | Quite sharp|
| Total         | 2,9   | 58       | Quite sharp|
| Total         | 3,07  | 61,33    | Sharp      |
| KO            | 3     | 60       | Quite sharp|
| Total         | 3,03  | 60,67    | Quite sharp|

Note
- **TP**: Level of line whiteness
- **KO**: Continuity
- **Skor KM**: Motif sharpness

It can be seen in table 2, the use of the tunjung fixation resulted sharp motif. While alum and quicklime resulted quite sharp motif.

3.2. Discussion

The results of the color direction test of primissima clothes dyed with Songgolangit weeds which were carried out by looking at the textile dye catalog showed that all samples produced different colors depending on the type of fixation used. Samples from Songgolangit weeds immersion with alum
fixation produced the lightest color. The quicklime mordan sample produced a darker color, while mordan tunjung produced the darkest color.

The use of alum, tunjung and quicklime fixation to strengthen the color does not pollute the environment because it is an environmentally friendly substance, does not contain toxins and harmful substances so it is safe for the users. The use of tunjung resulted the most visible color changing because there was a reaction between tannins and Fe^{2+} metal which produces complex salts (ferro tanates) to produce black color during the process of dyeing the fabric. While the use of alum produced a brown color and quicklime produces a reddish brown color. The clothes with quicklime fixation showed a darker color than alum because of the ionic reaction between tannins and Ca^{2+} ions in quicklime which resulted in yellow sediment. The clothes with alum fixation showed the lightest color among the other two fixations due to the ionic reaction between tannins and Al^{3+} ions in the alum. In contrast to tunjung, the two reactions (quicklime and alum) do not produce complex salts, but ionic bonded compounds.

The identification test of the motif sharpness was carried out by 5 panelists from the lecturers of Fashion Design, Faculty of Engineering, Universitas Negeri Semarang, using observation sheets that had been validated by experts. The scores of the motif sharpness are; not sharp (0-20), less sharp (21-40), quite sharp (41-60), sharp (61-80) and very sharp (81-100). This total value is then used to find samples of the Songgolangit weeds batik stamp coloring which has the best quality from each of the fixations used. The score of the motif sharpness using the tunjung fixation is 74, alum 50, and quicklime 58.

4. Conclusion
The result of the research are; (1) Songgolangit weeds can be used as a natural dye in the batik stamp coloring process using various mordanting processes and types of fixators, (2) the use of the tunjung fixation resulted sharp motif. While alum and quicklime resulted quite sharp motif. The best sharpness of the motif is obtained by using tunjung fixation, (3) fixation with tunjung resulted in a yellow green to grey color, namely Hazelnut color. Meanwhile, the resulting color from quick lime fixation was yellow to light grey, namely Bone color. The treatment with alum fixation resulted to a yellow to white/ faded color, namely Hazelwood color.

References
[1] Susiati YT and Kartikasari E 2017 Natural Dyes Fixator SCIENCE TECH: Jurnal Ilmiah Ilmu Pengetahuan dan Teknologi 3 29-36
[2] Kwartiningsih E Setyawardhani DA, Wiyatno A, Triyono A 2009 Zat Pewarna Alami Tekstil dari Kulit Buah Manggis Ekuilibrium 8 41-47
[3] Bhandari B and Rani 2018 Dyeing of protein fabrics exploring locally available weed plant Journal of Applied and Natural Science 10 475-478
[4] Susilo E 2013 Tanggap Pertumbuhan Awal Jarak Pagar (Jatropha curcas L.) Terhadap Bokkasi Gulma Songgolangit (Tridax procumbens) yang Diperkaya Kapur Pada Tanah Ultisol Jurnal Agrovigor 6 63-72
[5] Kulkarni AG and Vedamurthy AB 2019 Studies On Phytochemical Screening and Antimicrobial Activity in Leaf and Flower Extracts of Tridax procumbens Linn International Journal of Recent Scientific Research 10 32693-32702
[6] Mundada S and Shivhare R 2010 Pharmacology of Tridax procumbens a Weed International Journal of Pharma Tech Research 2 1391-1394
[7] Kusumastuti A, Anis S and Fardhyanti D S 2019 Production of natural dyes powder based on chemo-physical technology for textile application IOP Conference Series: Earth and Environmental Science 258 012028
[8] Kusumastuti A, Selvia Fardhyanti D and Anis S 2020 Brachiaria mutica dyes powder for textile application: dyeing quality of cotton fabrics Journal of Physics: Conference Series 1444 012010
[9] Syamwil R, Sugiarto R, Rohidi TR, and Nurrohmah S 2019 Weeds as a source of development idea on batik motive *Vlákna a Textil* **26** 69-73
[10] Emzir 2008 *Metodologi Penelitian Pendidikan: Kuantitatif dan Kualitatif* (Jakarta: Rajawali)
[11] Sugiyono 2016 *Metode Penelitian Pendidikan Pendekatan Kuantitatif Kualitatif dan R&D* (Bandung: Alfabeta)
[12] Arikunto S 2013 *Prosedur Penelitian: Suatu Pendekatan Praktik* (Jakarta: PT. Rineka Cipta)