The use of Siam weed (*Eupatorium Odoratum l.*) as natural dye in eco-print with pounding technique

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Abstract. To reduce the negative impact caused by synthetic dyes, development and exploration are carried out with the use of Siam weeds (*Eupatorium odoratum L*) as an alternative. It has main component such as tannin, phenol, flavonoids, saponins and steroid. The method in the study used a quasi – experimental design with a control group research design with descriptive analysis. To make the color solutions by hot extraction, pre-mordant using alum was carried out in 15 times. The post mordanting process used 3 types of mordant; alum, quicklime, and *tunjung*. Organoleptic test used to test the contrast, the suitability of the dyeing result, and the color of eco-print motif using the pounding technique. The result showed that Siam weed can be used as natural dyes for textile. The color direction of dyeing with mordant alum fixation produce dawn blue, quicklime produced silver cloud, and *tunjung* produced dusty olive. While the color result of eco-print on alum fixation was tea color, quicklime was mistletoe and olive branch, and *tunjung* was deep lichen green. The dark color result on the *tunjung* fixation and the lightness color on alum fixation.

1. Introduction

Batik is a widely known art of decorating which has been recognized by UNESCO as a cultural heritage. Shibori (Japanese art of cloth folding and dyeing) is popular and has become one of favoured fashion items. Nowadays, eco-print (a natural print art) is also becoming popular since it is naturally manufactured [1]. Dyes are divided into 2 types, which are natural dye and synthetic dye [2]. In order to reduce the negative impacts on the environment caused by synthetic dyes, natural dyes are developed and applied. Further exploration is conducted to discover the potential of colours and the plants that can be used as sources of natural dyes, thus natural substances will always be available and sustainable [3]. Eco-print is a technique of transferring colours and motifs directly to fabrics through direct contact using natural materials [4].

Siam weed (*Eupatorium Odoratum L.*) is a flowering shrub species of the sunflower family. This native American plant is well known in Asia, Africa and half of Australia. In Indonesia, this weed can live in mountains, swamps and other type of lands. This weed has also been used as traditional medicine. Its main compounds such as tannins, phenols, flavonoids, saponins, and steroids can heal wounds, sore throats, coughs, malaria, diarrhoea and so on. Siam weed competes in absorbing water
and nutrients in the soil. Therefore, the growth of this weed affects the achievement of agricultural and plantation production.

The use of natural dyes in textile fabrics has a positive impact on the environment. Its waste is biodegradable and can be decomposed [5]. However, it also has weaknesses such as low binding level to washing, low fading and low resistance to sunlight. Natural dyes substances derived from plants include anthocyanins, carotenoids, betalains, chlorophyll and curcumin [6]. They are extracted through a boiling process which left half of the initial volume of water used [7]. The immersion stage is divided into 3, which are: (1) diffusion of dyes, (2) adsorption of dyes, (3) penetration of dyes. The immersion process is repeated 8-10 times. The more process is done, the more concentrated the colour will be [8].

In order to produce a good colour strength, it is necessary to carry out a fixation or mordanting process on dyes, which is the process of putting the dye into the colour-fast fibre. The dyes used to evoke colours are alum, quicklime and tunjung [7]. There are 3 types of mordant, namely metallic mordant, tannin acid and oil mordant [9]. Most natural dyes do not have substantive for textile fibres and require the help of a mordant to increase their affinity to the fibre [10]. Cotton, linen, silk and rayon have good absorbency.

Therefore, this study aims to discover the colour contrast and colour fairness produced by boiled extraction and the use of leaves as eco-print motifs using the pounding technique. The use of 3 mordant (alum, quicklime and tunjung) that affects the colour and motifs produced from Siam weed leaves produce handicrafts that are environmentally friendly, aesthetic and economical in the creative industry.

2. Method
Experimental method is an activity that is planned and carried out to collect the most convincing evidences about the effect of one variable on another variable [11]. The experiment carried out in this study was a quasi-experimental design. The test is carried out using sensory test instruments with descriptive data analysis technique.

The dependent variable in this study was Siam weed (Eupatorium Odoratum L). The independent variables in this study were different indicators of mordant. They were alum mordant, quicklime and tunjung. The control group design was only post-test. The control variables are (1) 150 cm of primissima mori, (2) mordant alum, quicklime, and tunjung with a ratio of 1: 10- and 30-minutes soaking time, (3) 1 kg of Siam weed for extraction, (4) 15 times immersion frequency with immersion time of 15 minutes, (5) eco-print motif with pounding technique.

3. Result and discussion
3.1. Result
In the research, plants can easily adapt to the environment and can be found growing in clusters on roadsides, vacant land, plantations, to rice fields. The results of the pre-survey in the Rehabilitation Zone in Wonoasri area showed that Siam weed plants grew in clusters [12]. The main compounds of Siam weed components that produce dyes are tannins, phenols, flavonoids, saponins and steroids. Siam weed natural dyes are extracted through boiling and repeated immersion process. Its leaves are used as eco-print motifs with pounding technique. Eco dyeing and printing do not focus on the standard results that have been set. This technique is largely possible for development [13]. Eco-print can be applied to materials such as canvas, cotton, silk, and linen [14]. Primissima mori is a good cloth for dyeing [15]. It has a good quality and there is not defective in its weaving.

3.1.1. Natural dyes analysis result. The colour on the primissima cloth appears after up to 15 times immersion process, with 15 minutes soaking time. Overall, the colour of dyeing and motif leaves show a “very contrast” result for quicklime treatment, which is (4). It shows “contrast” result for tunjung treatment, which is (3), while it is “average” (2) for alum treatment.
The pounding process or a process of beating the fabric using a wooden hammer produce colours and motifs that are directly printed on the fabric. The dyeing using quicklime produce different colours between young and old leaves, while in the dyeing using alum and tunjung, there is no visible change in the use of young and old leaves.

| Table 1. Colour direction of dyeing and eco-print of Siam weed |
|---------------------------------------------------------------|
| Overall result                                               |
| Colour direction of Siam weed dyeing (Eupatorium odoratum l)  |
| Alum              | Quicklime            | Tunjung             |
| Dawn blue         | Silver cloud         | Dusty olive         |
| Siam weed eco-print (Eupatorium odoratum l)                   |
| Tea               | Mistletoe            | Deep lichen green   |
| Olive branch      |                     |                     |

3.1.2. Colour resistance result. The test was carried out by washing the sample with a ratio of 15 ml of liquid detergent and 10 litres of water. The sample was lightly rubbed and soaked for 15 minutes. The highest decay rate was found in the sample using tunjung mordant and the lowest one was found in the alum mordant. The washing process was carried out for 3 times. After the drying process, there is a change of colour in the dyeing and eco-print results. The brightest colour was found in the alum mordant treatment and the darkest colour was found in the tunjung mordant treatment, while the quicklime treatment produced quite bright colour. Staining test was conducted by soaking the fabric for 5 minutes in the remaining washing water. As a result, the remaining washing water of alum and quicklime did not leave stains, while the remaining washing water of tunjung left stains.

3.1.3. Sensory test results. The test was carried out on 15 panellists to visually test the colour of the boiled extraction and the eco-print motif. The human senses were used as a measurement tool. The use of alum, quicklime and tunjung produced different colours. The test measures the colour contrast and colour fairness of the use of alum, quicklime and tunjung mordant with a minimum score of (1) and a maximum score of (4). The highest colour contrast result was found in the quicklime mordant treatment and the highest colour fairness result was found in tunjung mordant treatment.

3.2. Discussion
The content of chlorophyll, anthocyanins, flavonoids and tannins in Siam weed can produce colour pigments that can be used as natural dyes. The colour is extracted by boiling the stems, leaves and flowers of Siam weed. One issue of dyeing with natural dyes is that it requires a long and complicated
work. Natural dyes have a distinctive colour appeal, traditional colours, natural fragrances that come from the plants [8].

The fixation process of alum produced dawn blue colour, quicklime fixation produced silver cloud colour and tunjung fixation produced dusty olive colour. The eco-print pounding technique with alum treatment generated the colour of tea, while the process using quicklime produced 2 colours, that are mistletoe (using young leaves) and olive branch (using old leaves). The process using tunjung treatment produced a deep lichen green colour.

The use of alum in pre-mordant and quicklime in post mordant caused a colour change reaction. The acidic nature of alum and the alkaline nature of quicklime plus the colour pigment-forming compounds reaction produced different colours in the use of young and old leaves of Siam weed.

4. Conclusion

Based on the results of research and discussion, it can be concluded that Siam weed (Eupatorium Odoratum L) can be used as natural dyes and eco-print motifs using the pounding technique. The test on colour contrast, colour fairness and dyeing as well as eco-print motifs using 3 types of mordant - alum, quicklime and tunjung - produced different colours. The lightest colour is obtained from alum fixation, while the darkest colour is obtained from tunjung fixation.

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