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Brief Communicaiton

Application of Natural Dyes and Sodium Alginate From *Sargassum* Sp. Sea weed In Coloring Bima Woven Fabric

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ABSTRACT

This study aims to extract dye and alginate from seaweed *Sargassum* sp. as a dye paste in the coloring of Bima woven fabric. The concentration of sodium alginate used was 0%; 1%; 3% and 5%. The results showed that the absorbance value of the dye extract from seaweed *Sargassum* sp at maximum λ = 203 nm obtained A = 3.899. The effect of variations in the concentration of sodium alginate in the dye paste was determined by comparing the FTIR absorption pattern of Bima woven fabrics. Based on the FTIR absorption pattern data, it was found that a mixture of dye and sodium alginate of 3% had a stronger intensity, namely the wave numbers 3448.72 cm^{-1} and 1635 cm^{-1}; 2900.94 cm^{-1}; 2337.72 cm^{-1}; 1381.03 cm^{-1} and 1064.71 cm^{-1}. The results of the morphological analysis showed significant differences in surface structure on Bima woven fabrics before and after the dyeing process.

Keywords: Dye, Alginate, *Sargassum* sp, Coloring, Bima Woven Fabric.

INTRODUCTION

Weaving is one of the cultural arts of Indonesian traditional fabrics that are produced in various regions of the archipelago in the form of human hand skills using traditional weaving tools. One area that has traditional woven fabrics is Bima Regency, West Nusa Tenggara Province. The woven cloth from the Bima area is named songket Bima or cloth Mbojo. The raw material for making woven fabrics is used cotton, but currently it is decreasing, and now no one uses this material anymore, because there are already many raw materials for higher quality yarn produced by the textile industries. While the manufacturing process goes through several stages, namely the yarn spinning process, the dyeing process, the dyeing process, the weaving preparation process and the weaving process[1]. In the manufacture of Bima woven cloth, the dyeing process is carried out, namely soaking/ dipping the threads in the dye, this process takes one week of soaking to get the desired color. Dyes are usually used by utilizing natural materials such as tree trunks, roots and leaves of plants. One of the obstacles that still needs research is getting the diversity of colors and maintaining the colors so that

they are in accordance with the desired color, so that the woven fabrics do not fade easily[2].

The abundance of natural resources in the form of sea weed *Sargassum* sp. in Bima Regency is very promising, but has not been used optimally. Seaweed *Sargassum* sp is a species of seaweed that can produce alginates[3,4]. In the industrial world, alginate is used as a thickener in the fabric printing process. Besides producing alginate, seaweed *Sargassum* sp. also contains dyes or pigments that can be used as natural dyes. Several types of pigments contained in brown seaweed include fukosantin, chlorophyll, carotene and other pigments, but fukosantin is very dominant which gives dark brown to yellow brown in the dyeing results. Sea weed type *Sargassum* sp. gives a golden brown color and fastness test results show good value[5]. In this study, the use of dyes and alginates from sea weed *Sargassum* sp. in coloring Bima woven cloth. The scope of the problem in this study is related to the effect of alginate concentration on the coloring of Bima woven fabrics.

MATERIAL AND METHODS

Materials

The materials used in this research are: Sea weed type *Sargassum* sp. taken from the waters of Wane Bima Beach, HCl p.a., technical ethanol and aquades. The tools needed in this research are scissors, blender, basin, analytical scales, glassware, pH paper, thermometer, microwave, electric stove, filter paper and UV-Vis spectrophotometer, FTIR and SEM.

Preparation of Sea weed *Sargassum* sp.

Sea weed *Sargassum* sp. washed with water until clean then soaked with 1% HCl for 2 h and rinsed with water until the pH is neutral. Furthermore, the sea weed is dried and then blended until the seaweed powder is obtained.

Extraction of Dye

A total of 10 g of *Sargassum* sp. put in a beaker then macerated with 100 mL of distilled water for 1 day. The mixture is then filtered and the absorbance of the filtrate is measured.

Extraction of Na-Alginate

The remaining solids from the dye extraction were put into the container, then 2% Na_2CO_3 solution was added with a ratio of 1:30 (w/v). Then extracted using a microwave at a power level of 80 for 16 min then filtered. The filtrate obtained was added with HCl 10% (up to pH 2-3). Then do the bleaching with technical NaOCl diluted with 1: 1 water until white. Furthermore, the alginic acid gel is pressed until the water content is around 25%. Then converted to sodium alginate by adding Na_2CO_3 powder and stirring in a mixer. The resulting paste is soaked in technical ethanol and dried. Then the alginate fibers were dried in the oven for 12 h until the moisture content was 5%. Furthermore, it is ground to obtain sodium alginate flour[6].

Dyeing Process of woven/yarn

The yarn or woven measuring 20x30 cm^2 is first mordanting with alum and soaked in water for 24 h then put in a dye paste and heated at 70°C for 30 min then cooled and dried. The yarn/woven that has been dried is then fixed and then dried.

RESULTS

Extraction of dye from sea weed *Sargassum* sp. carried out by the maceration method. Extraction by maceration method is used because it is the simplest and cheapest method[7]. The extract obtained was then filtered and analyzed using a Genesys 10 UV-Vis spectrophotometer at a wavelength of 190-400 nm and a silica plastic cuvette. Graph of dye absorbance measurement results from sea weed *Sargassum* sp. as shown in Figure 1 below.

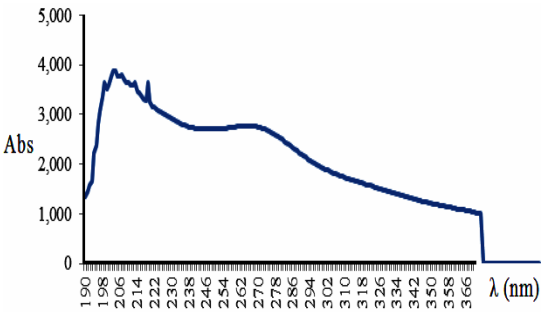

Fig. 1. UV-Visible absorption spectra of *Sargassum* sp. dye extract

Based on the graph in Fig. 1, it is found that the maximum wavelength is at 203 nm with an absorbance of 3.899. The residue produced in the maceration process is then used to extract sodium alginate. Sodium alginate extraction was carried out using the Microwave Assisted Extraction (MAE) method[3,4,6].

Dyeing Process of Yarn/Woven

Before dyeing the yarn and fabric, the dye paste is first made by mixing the dye extract with sodium alginate. In this process, sodium alginate is prepared with a concentration variation of 0%; 1%; 3%; and 5%. The yarn or cloth that has been dimordant and dried is then dipped into the dye paste at a temperature of 70-80°C for 30 minutes. The dyed yarn or fabric is then dried for 24 hours. The thread that has been dried is then fixed with a gazebo. The fixation process is carried out to tie the dye to the thread or fabric. The fixed thread is then dried in the sun for 30 min then repeated for three times the fixation. Based on the results obtained, the threads that are fixed with a tunjung produce brown thread.

Effect of Sodium Alginate Concentration

In this study, the effect of the thickener concentration in the form of sodium alginate was studied in the process of making dye paste. The concentration of sodium alginate used was 0%; 1%; 3% and 5%. The effect of variations in the concentration of sodium alginate resulted that all threads gave a dark brown color with an even distribution of colors. Meanwhile, the dyeing of the fabric shows different results with changes in the concentration of sodium alginate in the dye paste. At a concentration of 3% sodium alginate showed a better color.

Structural Analysis using FTIR

From the results of the analysis, it was found that the FTIR spectra of the yarn and fabric that had been stained using dye extract and sodium alginate from sea weed *Sargassum* sp. as shown in Figure 2 below.

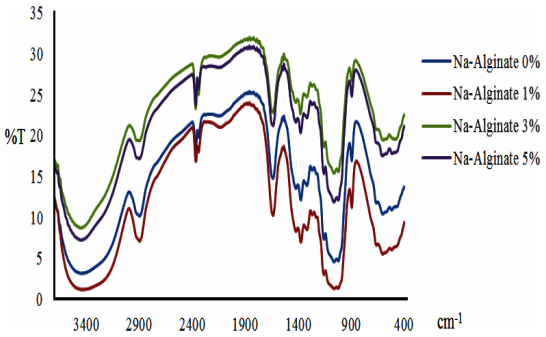

Fig. 2. FTIR spectra of yarn in the variation of Na-Alginate concentration

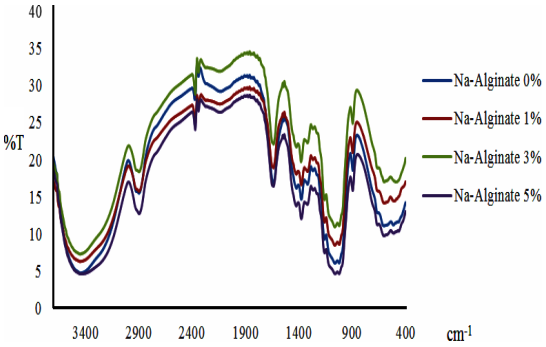

Fig. 3. FTIR spectra of Woven in the variation of Na-Alginate concentration

Based on the FTIR spectral data in Figs. 2 and 3, it shows that variations in the concentration of sodium alginate affect the intensity of the spectra that the greater the concentration of sodium alginate, the more the amount of dye absorbed in the yarn or fabric. Besides, the influence of variations in the concentration of sodium alginate causes a shift in the absorption band. The better absorption pattern at the variation of sodium alginate concentration is 3%.

Morphological analysis using SEM

The surface morphological analysis of the Bima woven fabric was carried out to determine the surface characteristics of the Bima woven cloth before and after dipping the dye and the concentration of sodium alginate. Fig. 4 is a scanning electron microscope (SEM) of Bima's woven fabric.

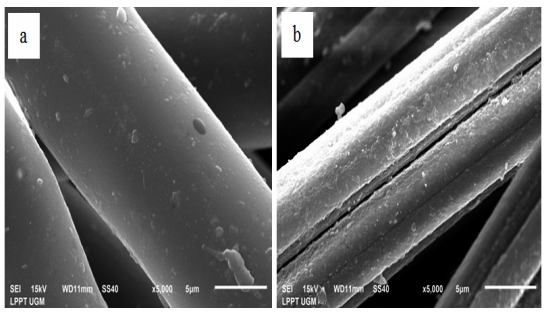

Fig. 4. Scanning Electron Microscope (SEM) of Bima Woven Fabric: a) before; b) after coloring

Based on the results obtained in Fig. 4, it shows that the SEM photos of Bima woven fabric before being immersed in dye and sodium alginate still look smooth and there are few spots which may be impurities or grease adhering to the fabric. Whereas in Fig. 4b. which is a SEM photo of Bima woven fabric after being immersed in dye and sodium alginate, it can be seen that all over the fabric surface

there is a layer of dye and sodium alginate which is firmly bonded due to the cross linking between cellulose on the fabric with fukosantin and sodium alginate compounds in the dye paste. This was confirmed by FTIR spectra data which showed a shift in the absorption band on the fabric before and after being immersed in the dye paste.

CONCLUSION

Based on the research results, it can be concluded that the sea weed *Sargassum* sp. can be used as a dye and sodium alginate. Dyestuff paste obtained from a mixture of dye and sodium alginate can be used as a dye in Bima woven fabrics. The concentration of sodium alginate affects the coloring of Bima's woven threads and fabrics. The higher the sodium alginate concentration, the thicker the dye and dye paste will be on the yarn or fabric so that the resulting color is stronger. Based on the FTIR absorption pattern data, it was found that the optimum variation in sodium alginate concentration was obtained when using sodium alginate as much as 3%. This data is supported by the morphology of Bima woven fabric after dipping it in the dye paste.

ACKNOWLEDGEMENT

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Conflicts of Interest

The authors declare no conflict of interest.

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