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Research Article

Ulos batak natural dye paste from salaon leaf extract (*Indigofera tinctoria* L), ketapang leaf (*Terminalia catappa*), and cocoa fruit peel (*Theobroma cacao* L)

Nadia Givani Sihotang[1], Ruth Yohana Saragih[1], Dewan Dinata Tarigan[2], Mika Yohana Pakpahan[3], Dafit Ericson Sihotang[1], Saronom Silaban[1] and Murniaty Simorangkir[1]

[1]*Department of Chemistry, Universitas Negeri Medan, Medan 20221, Indonesia*
[2]*Department of Computer Science, Universitas Negeri Medan, Medan 20221, Indonesia*
[3]*Department of Economics, Universitas Negeri Medan, Medan 20221, Indonesia*

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Keywords

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Corresponding author:
E-mail:
murniatysimorangkir@unimed.ac.id
(Murniaty Simorangkir)

Abstract

Ulos is a type of traditional woven fabric that is often used for traditional ceremonies in the Batak tribe. Although ulos with natural dyes are more valuable, ulos weavers have switched to synthetic dyes due to the difficulty of the dyeing process with natural dyes. This research aims to make natural dyes from extracts of plants. Salaon plants (*Indigofera tinctoria* L), ketapang (*Terminalia catappa*), and cocoa (*Theobroma cacao* L) are types of plants that are easily available in the North Sumatra region and can be used as natural dyes. BATAK-Co (BATAK-Colour): ulos batak natural dye paste is a dyeing product in the form of a paste that can be used to dye yarn to be woven into ulos. The product is made through an extraction and fixation process with whiting, tunjung, and alum, as well as deposition and filtering processes, so that a BATAK-Co product is obtained: Ulos Batak Natural Coloring Paste with 3 color choices, namely blue from salaon leaf extract, black from ketapang leaf extract, and red from cocoa fruit peel extract. The spectra of the three dyestuffs have been identified using FT-IR. Through the entrepreneurship student creativity program, BATAK-Co: ulos batak natural dye paste products have been produced, packaged, and marketed both directly to ulos weavers and through social media, and have a great opportunity to become new entrepreneurs.

Introduction

Along with the development of technology and the advancement of the times, one of the problems that continues to be faced and is increasing is waste, both in terms of volume and type, in Indonesia. Waste can be generated from many sources, such as household waste, industry, and textiles. In terms of volume, the textile industry does not generate much waste in the form of solid waste, but it does generate waste in the form of dyes, which are later channeled into waters, both rivers and sewers. Liquid waste from the textile industry is mainly generated from the remains of chemicals used during the textile dyeing process (Enrico, 2019). In commemoration of river day on July 27, 2021, the Central Statistics Agency (BPS) noted that at least 46 percent of rivers in Indonesia are in a heavily polluted condition. In Jakarta, National Geographic (2020) noted that of the 57 percent of existing waste, 8.2 percent is textile waste. Meanwhile, in North Sumatra in 2020, the liquid waste produced reached 20.97%.

One of the famous textile products from North Sumatra is ulos. Ulos is a traditional woven cloth typical of batak which is closely related to the culture of the batak tribe used in traditional ceremonies of the batak tribe which is considered sacred or very important because it has a special meaning in it (Abdillah and Irwansyah, 2020). Based on research conducted by Firmando (2020), new weavers in the Lake Toba area continue to emerge

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along with the increasing public consumption of the need for ulos. Not only that, based on a survey conducted by Nur (2022), weaving ulos is used as the main livelihood that is highly relied on by the residents of Meat Village after the village on the outskirts of Lake Toba was determined to be one of the tourist villages by the Ministry of Tourism. Initially, people used natural dyes from plants used traditionally in yarn dyeing. However, with the development of the times, natural dyes are slowly being replaced with synthetic dyes because the process takes longer, is less practical and it is difficult to obtain ulos thread dyeing materials derived from plants (Manurung et al. 2020; Siagian, 2016).

Ulos batak natural dye paste, made from plant extracts that are easily available, especially in the North Sumatra area, has a considerable opportunity for entrepreneurship. The natural dye paste ulos batak BATAK-Co is available in 3 colors, namely black, red, and blue which are the dominant colors in ulos batak. The black color is obtained from ketapang leaf extract (*Terminalia catappa*) which is known to contain tannins that produce coloring agents (Irhami et al. 2017), the blue color is obtained from salaon leaf extract (*Indigofera tinctoria* L.), which produces indigo blue dyestuffs (Gultom et al. 2017), and the red color is obtained from cocoa fruit peel extract (*Theobroma cacao* L.) which contains catechins that can produce a red color. BATAK-Co products of this ulos batak natural dye paste can be an alternative for ulos weavers to obtain natural dyeing materials so that ulos are produced which are of higher value, are safe for the environment and preserve ulos as a batak culture itself.

Method

Materials

The materials used in this study were salaon leaf, ketapang leaf, fresh cocoa fruit skins, water, fixation materials in the form of alum, whiting, and tunjung, sodium benzoate, and cotton threads that are usually woven into ulos.

Sample Preparation

Raw materials in the form of salaon leaf, ketapang leaf, and fresh cocoa fruit peels are washed thoroughly, then dried by aerating at room temperature, and then cut into small pieces.

Extraction of Salaon Leaf

Extraction is carried out by the maceration process. Every kilogram of sample is soaked in 7 liters of water. Soaking is carried out for 48 hours, then the leaf are removed and blurred by taking the solution little by little and lifting it into the air to get oxygen so that an oxidation process occurs, and then the addition of whiting as much as 40 grams for 1 liter of soaking water is carried out. Re-fertilization is done to get the desired color. After that, deposition is carried out for 34 hours so that two different phases are formed, with the lower phase being a precipitate of salaon leaf extract paste (Gultom et al. 2017).

Extraction of Ketapang Leaf

Extraction is carried out by the maceration process. Every kilogram of sample is soaked in 7 liters of water. Soaking is carried out for 48 hours, then the leaf are removed and blurred by taking the solution little by little and lifting it into the air to get oxygen so that an oxidation process occurs, and then the addition of whiting as much as 40 grams for 1 liter of soaking water is carried out. Re-fertilization is done to get the desired color. After that, deposition is carried out for 34 hours so that two different phases are formed, with the lower phase being a precipitate of ketapang leaf extract paste (Gultom et al. 2017).

Extraction of Cocoa Fruit Peel

The cocoa fruit peel is steamed for 5 minutes at a temperature of 100°C and then soaked in an oxalic acid solution for 1 hour at room temperature. Extraction is carried out by adding 5 liters of water to 1 kg of samples at a temperature of 100°C for 3 hours. After 3 hours, the extraction results are waited to cool and then the fruit skin is removed and 70 grams of alum are blurred and added for 1 liter of soaking water. Re-fertilization is done to get the desired color. After that, deposition is carried out for 34 hours so that two different phases are formed, with the lower phase being a precipitate of cocoa fruit peel extract paste (Haerudin et al. 2020; Gultom et al. 2017).

Pasta Making

The paste precipitate that has been obtained is filtered, and the addition of sodium benzoate is carried out until a BATAK-Co paste is obtained that is ready for use.

Results and Discussion

The product of BATAK-Co: ulos batak natural dye paste has gone through various tests to find out the quality of the color and threads of ulos that have been dyed. As for BATAK-Co products: ulos batak natural coloring paste made from salaon leaf extract, Ketapang leaf extract, and cocoa fruit peel extract is shown in Fig.-1.

(a) (b) (c)

Fig.-1. BATAK-Co: Ulos Batak (a) blue Natural Coloring Paste from Salaon Leaf Extract; (b) Black from Ketapang Leaf Extract; (c) Red from Cocoa Fruit Peel Extract.

Spectra analysis FT-IR BATAK-Co Products: Ulos Batak Natural Dye Paste

The FT-IR analysis results of the three colors of BATAK-Co products: Ulos Batak Natural Dye Paste blue shown Fig.-2, black shown Fig.-3, and red color variants shown Fig.-4.

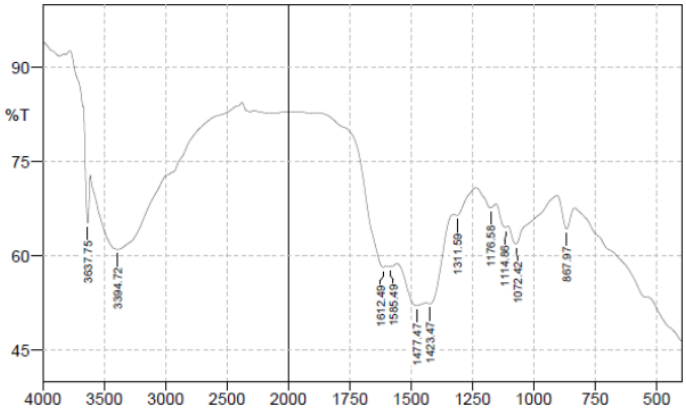

Fig.-2. Spectra FT-IR BATAK-Co Natural Dye Paste Ulos Batak Blue variant

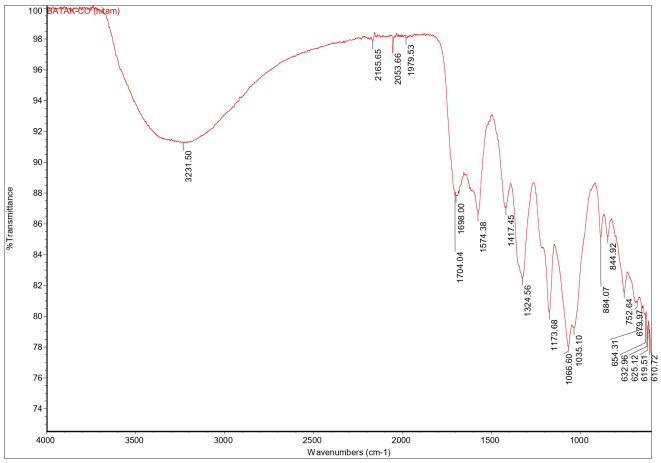

Fig.-3. Spectra FT-IR BATAK-Co Natural Dye Paste Ulos Batak black variant

Based on IR spectra data (Fig.-2) on BATAK-Co products: ulos batak natural dye paste blue variant, it is suspected that the compounds contained in the natural dyes of salaon leaf extract paste are leuco indigo compounds with the following interpretation: the presence of wide and strong absorption at 3300 cm-1 is the N-H range; the sharp and strong absorption at about 3600 cm-1 is the C-H (sp3-s) range of methyl and methylene (CH_2); the weak absorption of about 1600 cm-1 is alkenes; the weak absorption of 1450 cm-1 is the aromatic range; and about 1300–1000 cm-1 is carbonyl C=O (Gultom et al. 2017).

Based on IR spectra data (Fig.-3) on BATAK-Co products: the black variant of ulos batak natural dye paste has the following interpretation of the presence of a strong absorption of about 675–995 cm-1 is an indication of the presence of an aliphatic C-H bond, the presence of absorption with a strong intensity of about 1050–1300 cm-1 indicates the presence of a free –OH group and an aromatic ether group. In areas around 1180 –1360 cm-1 there is an uptake with a strong intensity, indicating the presence of an amine group (NH_2). The presence of absorption with moderate intensity in the area of about 1340 – 1470 cm-1 indicates the presence of a C-H bond, in an area of about 1690 – 1760 cm-1 indicates the presence of a C = O group of aldehydes with a strong intensity, while in an area of about 3200 – 3600 cm-1 indicates the presence of an –OH group (Silverstein et al. 2005). The black color is obtained from ketapang leaf extract (*Terminalia catappa*) which is known to contain tannins that produce coloring agents (Irhami et al. 2017).

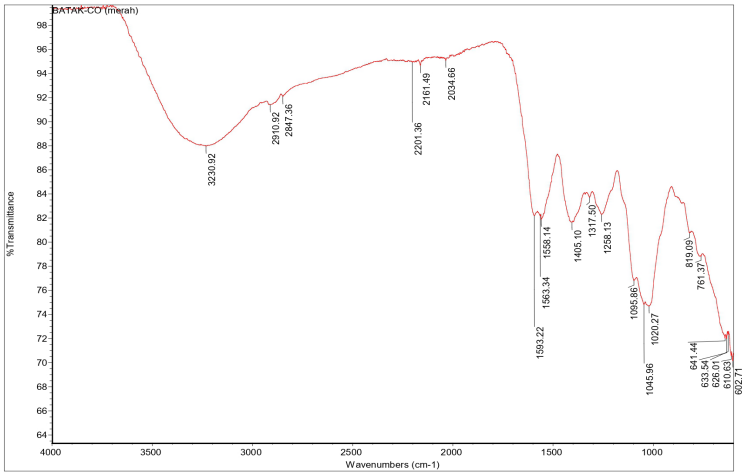

Fig.-4. Spectra FT-IR BATAK-Co Natural Dye Paste Ulos Batak red variant

Based on IR spectra data (Fig.-4) on BATAK-Co products: the red variant of ulos batak natural coloring paste has the following interpretations of the presence of phenolic compounds, aromatic rings, and ether. In an area of about 1050 –1300 cm-1 indicates the presence of a C-O group, in an area of about 1500 – 1600 cm-1 indicates the presence of an aromatic C=C bond, while in an area of 3200 – 3600 cm-1 indicates the presence of a hydroxyl group (C-OH) with wide absorption (Kim and Keeney, 1983). Warna red is obtained from cocoa fruit peel extract (Theobroma cacao L.) which contains catechins that can produce a red color.

Quality Analysis of Yarns from Dyeing BATAK-Co Products: Ulos Batak Natural Dye Paste

Quality of yarn from dyeing BATAK-Co products: ulos batak natural dye paste has been tested against the chemical dye ponceau GRB, which is a chemical dye that has been used by ulos craftsmen in North Tapanuli district (USU laboratory identification results, 2017).

The color quality test results of ulos threads showed that the natural dye of salaon leaf extract paste was better with a washing wear resistance value of 4 (good) and against irradiation 4-5 (good) compared to the chemical dye Ponceau GRB with a washing wear resistance value of 3-4 (sufficient) and against irradiation 3-4 (sufficient). Staining with indigo natural dyestuffs has good fading resistance results than chemical dyes (Gultom et al. 2017).

Meanwhile, the natural dye from ketapang leaf extract, which is fixed with tunjung, has the best color and good luciability against washing which is 4.5 (Faisal and Chafidz, 2019). For natural dyes from cocoa fruit peel extract, the value of fading resistance is 4, which is good (Haerudin et al. 2020). The value obtained from the quality test of the dyed yarn results proves that the natural dyes from salaon leaf extract, ketapang leaf, and cocoa fruit peels are not inferior to chemical dyes.

Marketing and Profits of BATAK-Co

Marketing carried out for BATAK-Co products is carried out through direct or indirect marketing through social media. Direct marketing is carried out in Samosir district, especially in Lumban Suhi-Suhi Toruan Village and its surroundings, where the majority of the population works as ulos weavers. Marketing is carried out both in the organization of ulos weavers' mothers, who dye their own yarn, as well as in galleries and kiosks. Meanwhile, marketing through social media involves the distribution of advertisements, video testimonials, and digital brochures through social media accounts.

BATAK-Co products also participated in the National Ulos Day event on October 17, 2022, at the event held by the Arga do Bona Ni Pinasa Cooperative in Medan. In that event, marketing of BATAK-Co products was carried out for the public and the Ulos Gallery owners who attended.

Conclusion

BATAK-Co: ulos batak natural dye paste has a great opportunity to be developed into a new entrepreneur in preserving ulos as one of the batak cultures and participating in protecting the environment by returning to natural dyes. BATAK-Co products: ulos batak natural dye paste has advantages, including: raw materials derived from plants that are quite available in North Sumatra; being produced and having been tested well; being packaged attractively and practically; being marketed directly or through social media; and participating in preserving ulos as a batak culture itself.

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Conflict of Interests

The author (s) declares that there is no conflict of interest in this research and manuscript.

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