International Journal of STEM Education for Sustainability, Vol.3, No.1, 2022, pp. 1-21
e-ISSN 2798-5091. DOI. 10.53889/ijses.v3i1.112

Ulos Fabric Dyeing Process as Ethnoscience-Based Science Learning Resource

Submitted 22 April 2022, Revised 18 July 2022, Accepted 18 July 2022

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Abstract

This study aimed to identify the science concepts in the dyeing process of Ulos woven fabrics that will be used as a science learning resource for junior high schools. An ethnoscience study by exploring the original science contained in a community group based on scientific science. This study used a qualitative method with an ethnographic approach through the process of data reduction, data presentation, conclusion drawing, and verification. The location of research was carried out at the Ulos Batak By Gallery at Manjunjung Hutabarat, Jl. Major General. Y Samosir No, 76, Partalijulu Village, Tarutung District, North Tapanuli Regency, North Sumatra, Indonesia. The instruments used were observation sheets, interview guidelines, and questionnaires. Collecting data through participatory observation, in-depth interviews, documentation, and questionnaires. To test the validity of the data using triangulation techniques (source, technique, and time). Based on the results of the study, it is known that the natural dyeing process in the manufacture of Ulos fabric includes the preparation of materials (plants), the plant processing stage, the dissolving stage of natural dyes, the dyeing stage, the drying stage, the fixation stage, the washing stage, and the final drying stage. The science concepts in the curriculum 2013 are in accordance with the process of coloring Ulos cloth, and namely plant classification, solid pressure, heat transfer, physical changes, energy in living systems, separation of mixtures, boiling points, temperatures and their changes, chemical changes, elements, compounds, mixtures. It can be concluded that the manufacture of Ulos woven fabric in this study is a learning resource that can integrate learning materials in various fields of science fabrics (physics, biology).

Keywords: Ethnoscience, Ulos woven fabric, Junior high school

INTRODUCTION

Science is learning that deals with nature, human life, and objects with a broad overview. Science consists of a collection of concepts, principles, laws, and theories formed through scientific studies and process skills (Puspasari et al., 2019). Through science learning, students get hands-on learning experiences that involve their daily lives.

Science involves a constructivist approach that is supported by an educational curriculum. This has become one of the trends in the education curriculum in the world (Gunduz & Hursen, 2015). This approach starts from students' ideas that support the development of thinking (Bada & Olusegun, 2016). Therefore, creativity in science learning needs to be highlighted (McCauley et al., 2018). In the science learning process, creativity is not only needed by students but also by educators. Educators constantly face the challenge of how to teach the material in science so that students can easily understand it (Mutonyi, 2016). In addition, the need for effective science learning has been increased by the current reform efforts that require science educators to have different knowledge and skills (Dogan et al., 2015).

According to Kind and Osborne, (2017), science education has experienced a setback, causing a gap between the goals of science education and the reality in the classroom/school. So that in reality, science learning in schools still tends to focus more on the form of formulation rather than emphasizing the natural aspect itself. Science learning is more synonymous with reading, remembering, and memorizing subject matter (Wahyuni, 2015). Science itself should not be rote, supporting creativity (Maksić & Spasenović, 2018; Ulger, 2019). Science learning activities should be carried out contextually so that they are more meaningful and provide direct experience to students (Parmin & Fibriana, 2019; Putri & Aznam, 2019).

To implement contextual learning, it can be done by including local culture-based learning programs (Risdianto et al., 2020). According to Nguyen and Truong (2016), culture is a set of values, beliefs, and behavioral norms that are generally maintained and owned for generations by a community group. In other words, local wisdom is a representation or reflection of a wider culture, where local wisdom is defined as a philosophy of life that is embedded in people's hearts, which is manifested in the form of practical wisdom, way of life and customs (Eko & Putranto, 2019). Therefore, learning using a local culture that is applied to science learners is called ethnoscience (Sarwi et al., 2020).

According to Sudarmin (2014), ethnoscience is the knowledge possessed by an ethnic group or community group. Ethnoscience is an activity to convert original knowledge consisting of original science or the local culture of a society derived from hereditary beliefs with scientific science (Novitasari et al., 2017). Ethnoscience will make it easier for students to explore facts and cultural phenomena that exist in society and can be integrated with scientific knowledge (Wati et al., 2021). According to Ogawa (in Snively et al., 2001) that each culture has its own knowledge and refers to science as original science. The original science consists of all knowledge related to facts in society, which comes from beliefs that are passed down from generation to generation (Rahayu & Sudarmin, 2015).

Original science and scientific research activities produce scientific concepts that can be used as learning resources. This concept becomes closer to students. The learning process in schools involves several interacting components, namely educators, students, and learning resources (Samsinar, 2019). According to Cahyani (2019), learning resources are all sources used by students to make it easier for students to achieve certain learning goals or competencies. Currently, learning resources can be in the form of audio, video, images, text, activities of living things, and others (Shu et al., 2017). Human activities can be used as a

source of learning, for example, the culture of the Batak people in making Ulos woven fabrics, especially in the natural dyeing process of woven fabrics.

North Sumatra is one of the regions in Indonesia that has many tribes in it, one of the largest is the Batak tribe (Jiniputri et al., 2022). Batak is a tribe in North Sumatra that has many cultural heritages, one of which is Ulos woven fabric (Zulkifli & Ridwan, 2019). Ulos is the cultural identity of the Batak people who have been part of the life of the Batak community since birth (Nugroho et al., 2021).

According to the Batak people, Ulos woven cloth is a cloth or scarf that has special meanings and philosophies and is one of the objects that is considered sacred and very important, especially in traditional Batak ceremonies (Abdillah & Irwansyah, 2019). The manufacture of Ulos woven cloth is made traditionally which is passed down from generation to generation. The process of making Ulos cloth is carried out using a weaving technique, where the yarn is tied and dipped in dye before being woven (Jiniputri et al., 2022). The yarn coloring process in the manufacture of Ulos woven fabric is done naturally. Natural dyes are dyes obtained from plants and animals with or without chemical processing and have no adverse effects on human health (Naveed et al., 2020).

Based on the distribution of the questionnaire responses of class VII, VIII, and IX students in one of the junior high schools located in North Sumatra, it was found that many students were familiar with the Ulos woven fabric. From the information obtained, the Ulos woven fabric has never been implemented in science learning. In addition, from the information obtained through interviews with science teachers at the junior high school they have never applied science learning based on local wisdom using an ethnoscience approach because science teachers do not know how to apply science learning based on local wisdom. So far, learning has been carried out only by using science textbooks and answering questions from these books.

According to Hadi et al, (2019) there is a lot of Indonesian cultural diversity that has not been explored as a science learning resource for junior high schools. This is due to the lack of insight and knowledge possessed by teachers. So that many students do not know about the science concepts contained in the process of making products found in the community. Even students often encounter them in everyday life, such as the process of dyeing threads in the manufacture of Ulos woven fabrics. According to (Fasasi, 2017) there is a major challenge in the implementation of science learning with an ethnoscience approach, namely how teachers can enable all students to study science simultaneously by aligning students' ideas and thoughts. In addition, teachers also need to start learning by determining the initial knowledge

that students have from their respective cultures. The statement above is in line with the opinion of Sudarmin (2014) that wise teachers must be able to involve local cultural wisdom, especially local culture, in the science learning process or other learning.

Scientific publications regarding the coloring of Ulos woven fabrics have not been widely carried out by previous researchers. In fact, if it is reviewed in depth, it can be found steps or procedures related to the concept of science. Considering the science concepts contained in the natural yarn dyeing process in the manufacture of Ulos woven fabrics, not many science education researchers have taken up this topic. So, the researcher intends to conduct a research entitled "Identification of Ethnoscience in the Coloring Process of Ulos Woven Fabrics as a Science Learning Source for Junior High School". The purpose of the study was to identify the science concepts contained in the dyeing process of Ulos woven fabrics that would be used as a science learning resource for junior high schools.

METHOD

This study used a qualitative research method with an ethnographic approach. Qualitative research is defined as an investigation of a phenomenon, usually packaged in depth and holistically, through a process of collecting as much narrative data as possible and using a flexible research design (Moser & Korstjens, 2017). The purpose of qualitative research is to gain knowledge about the experiences, events, and interactions of a phenomenon from an insider's point of view (Bradshaw et al., 2017).

This research was conducted in one of the traditional Ulos woven fabric production sites in the Ulos Batak By gallery at Manjunjung Hutabarat, Jl. Major General. Y Samosir No. 76, Partalijulu Village, Tarutung District, North Tapanuli Regency, North Sumatra Province. The subjects involved in this study were material experts, namely two supervisors and Ulos woven fabric craftsmen. The object of this research is the natural process of dyeing yarn in the manufacture of Ulos woven fabric. The focus of this research is to analyze the ethnoscientific content contained in the yarn dyeing process in the manufacture of Ulos woven fabrics.

The research data were collected by using in-depth interviews, participatory observation, documentation, and questionnaires. Researchers made direct observations in the yarn coloring process from start to finish. In order to get complete information, the researcher conducted interviews with the Ulos woven fabric craftsmen and also the owner of the Ulos woven fabric production.

The data analysis process used in this research is using a descriptive qualitative data analysis process by following the model from Miles and Hubermen quoted from Shidiq and Choiri, (2019) through the process of data reduction, data presentation, conclusion drawing,

and data verification. Data reduction is the process of summarizing data that has previously been obtained through interviews and observations. After being summarized, the data is presented in the form of tables and descriptions. Furthermore, conclusions can be drawn and verified, conclusions in the form of new discoveries that have never been found before.

In testing the validity of the data in this study using triangulation techniques. The triangulation technique aims to improve the quality of research validity by using several approaches, one of which is source triangulation (Korstjens & Moser, 2017). Source triangulation was carried out to test the validity of the data obtained through interviews and observations with other sources such as journal articles or websites. The final result of this research is the acquisition of scientific concepts found from the dyeing process of Ulos woven fabric, which can be used as a science learning resource.

RESULTS AND DISCUSSION

Based on the results of participatory observations, in-depth interviews, and documentation that have been carried out, it is found that the original science in the community is in the process of dyeing threads naturally in the manufacture of Ulos woven fabrics. The original science obtained was then transformed with scientific methods to produce junior high school science concepts relevant to the natural yarn dyeing stage in the manufacture of Ulos woven fabrics.

Table 1. The relationship between the original science of the community, scientific explanations, and the content of science concepts in the stages of natural yarn coloring in the manufacture of Ulos woven fabrics.

No	Coloring Stage	Community Original Science	Scientific Explanation	The relevant Science Concepts for junior high school
1.	Stage of preparing materials (plant)	The plants used are mahogany bark, jalawe fruit, hunik (turmeric), bulung hatapang (ketapang leaves), boang narara (shallot skin), teak wood, tingi tree, and salaon (Indigofera).	Scientific names of plants used as natural dyes: • The scientific name of mahogany is S, macrophylla belongs to the family Meliaceae (Manueke et al., 2020). • The turmeric plant has the scientific name Curcuma domestica, belonging to the Zingiberaceae family (Santa et al., 2015). • The ketapang plant has the scientific	Plant classification

No	Coloring Stage	Community Original Science	Scientific Explanation	The relevant Science Concepts for junior high school
			name Terminalia catappa belonging to the Combretaceae family (Berlin et al., 2017). • Shallots have the scientific name Allium cepa L. including the family Liliaceae (Rijal et al., 2016). • The teak plant has the scientific name Tectona grandis L.F belonging to the Lamiacae family (Lestari et al., 2018). • The scientific name of the salaon plant is Indigofera tinctoria belonging to the Fabaceae family (Lestari et al., 2018).	
2.	Stage of washing yarn and plants	The bonang (thread) is washed using well water and soap to remove dust and dirt attached to the thread. The plants to be processed are also cleaned using well water to remove dirt.	Cleaning the threads with soap will remove any dirt on the threads. Because the molecules in soap have hydrophobic properties (physical properties of a molecule) where the molecules in the dirt are surrounded and bonded. The process is called emulsification where an emulsion is formed between soap molecules and dirt, so that the molecules in the dirt will come out when rinsing with water and make the cloth turn clean (Fauzi et al., 2019). Hydrophobic materials can be used to lift oil through water.	Base molecule
3.	Steps to reduce plant size	Plants such as ketapang leaves, mahogany skin is chopped first using a	The process of reducing the material size is carried out using a knife	• Solids pressure • Extraction

No	Coloring Stage	Community Original Science	Scientific Explanation	The relevant Science Concepts for junior high school
		knife (knife) to make it easier for the color of the plant to come out when boiled.	because the knife has a sharp part on the side that is used to apply pressure, making it easier for the knife to cut plant material. The small size of the material will facilitate the extraction process. Because the smaller the size of the material, the wider the contact area between the material and the solvent attracts the active compound (extract color) on the material (Aji, 2018).	
4.	Plant drying stage	Plants such as the skin of boang narara (shallots) are dried in the sun to reduce the moisture content of the onion skins.	During the drying process, physical changes occur, reducing the water content contained in plants due to sunlight (Harefah, 2019).	• Heat transfer • Physical changes • Solar energy
5.	Stage of smoothing turmeric	The turmeric is ground until smooth first using a mortar to make it easier for the turmeric to remove the color.	The process of smoothing turmeric is done using a wooden pounder (lumpang), the blunt part of the pounder can smooth the turmeric. The finer the size of the turmeric, the easier the extraction process. Because the smaller or finer the size of the turmeric, the wider the contact area between turmeric and water (solvent) attracts the color extract contained in turmeric (Aji, 2018).	• Solids pressure • Extraction
6.	Plant boiling stage	The boiling process is carried out to remove the color contained in the material (plants). The boiling process is carried out using a pan and gas stove.	The boiling or extraction process is carried out using high temperatures, by using a solvent medium in the form of water to dissolve the dyes contained in plants (Widagdo, 2017). During the boiling process there is also a	• Temperature and its changes • Heat transfer • Extraction • Boiling point

No	Coloring Stage	Community Original Science	Scientific Explanation	The relevant Science Concepts for junior high school
			convection heat transfer event where the heat from the fire moves to the color extract so that evaporation occurs. This is because the heated water will expand so that its density decreases and the water moves upwards (Wardhani et al., 2015).	
7.	Filtering stage	The color of the boiled plants is filtered using a sieve (filter) to separate the color liquid from the dregs.	Separation of the mixture by means of the filtration method, to separate the color extract (filtrate) from the residue (dregs) using a filter media (Sausan et al., 2021)	Filtration
8.	Yarn dyeing stage	Dyeing is done to give color to the yarn, by immersing the yarn in plant-colored liquid. The colors produced in plants are: ketapang leaves (brown), teak wood (brown), salaon (blue), turmeric (yellow), onion (brown), mahogany seeds (reddish brown), wood tingi (dark brown), fruit jalawe (yellow). Immersion is done in a bucket, from the color liquid is still hot until the color liquid cools down	Plants used as natural dyes contain substances that can produce color • Ketapang leaves contain tannin compounds that can be used as natural dyes (Aprilia & Hendrawan, 2020). • Mahogany plants contain tannin and flavonoid compounds that produce a brown color (Laili & Suganda, 2015). • Indigofera plants contain indigo compounds and indikan glucose (indoxyl-□-D-glucoside) (Ariyanti & Asbur, 2018). • Turmeric produces a yellow color because it contains curcuminoid pigments (Kusbiantoro & Purwaningrum, 2018).	• Additives (natural dyes) • Concentration of solutions and molecules. • Color change.
9.	Drying stage	The yarn is dried by	• Yarn drying process by	• Physical changes

No	Coloring Stage	Community Original Science	Scientific Explanation	The relevant Science Concepts for junior high school
		drying the yarn on a jomuran (linen). Yarn should not be dried in the sun, but only in the wind. Because if the yarn is dried in the sun it will damage the color of the yarn.	utilizing wind energy. During the drying process, physical changes occur due to reduced moisture content in the yarn (Harefah, 2019).	• Wind energy
10.	Fixation stage	Based on the original knowledge of the community, color locking aims to bind and strengthen the color on the thread so that it does not fade, the color locking process is carried out using alum, tunjung and chalk.	Color locking or fixation is a dyeing process that aims to bind the dye that enters the yarn fiber so that the resulting color does not easily fade or fade. Fixation is done by adding materials containing metal ions, including: • Tunjung/ferrous sulfate (FeSO4) is a compound of iron (II) sulfate in the form of crystalline powder and is blue-green in color. This compound dissolves in water and forms Fe(H2O)62+. The addition of tunjung (FeSO4) in the yarn fixation process can change the color of the dyed results (Amalia & Akhtamimi, 2016). • Alum Al2(SO4)3 is a colorless, crystalline compound of aluminum sulfate. This compound is soluble in water. The addition of alum compounds in the fixation process can strengthen the color more strongly than other fixators and does not change the resulting color (Amalia &	• Concentration of solutions and molecules • Ions, elements, compounds and mixtures.

No	Coloring Stage	Community Original Science	Scientific Explanation	The relevant Science Concepts for junior high school
			Akhtamimi, 2016). Alum has alkaline-base properties which result in a more even fixation of the yarn (Angendari, 2014). • Quicklime (Ca(OH)2) is a chemical compound of calcium hydroxide in the form of powder or crystals and is white in color. Similar to alum, whiting also does not change the color of the dyed yarn but only strengthens the color of the yarn.	
11.	Yarn washing stage	Washing is done to remove the color that does not blend in the yarn. Washing is done using water and soap.	Cleaning the threads with soap will remove any color that doesn't blend in the threads. Because the molecules in soap have hydrophobic properties (physical properties of a molecule) where the molecules in the dirt are surrounded and bonded. This process is called emulsification, where an emulsion is formed between soap molecules and dirt, so that the molecules in the dirt will come out when rinsing with water and make the cloth clean (Fauzi et al., 2019). Materials containing hydrophobic molecules can be used to lift oil through water.	• Base Molecule
12.	Drying stage	The yarn is dried by drying the yarn on a clothesline. The yarn should not be dried in the sun because it can damage the color of the	The final drying process on the yarn remains by utilizing wind energy, so as not to damage the color of the yarn. During the drying	• Physical changes • Wind energy

No	Coloring Stage	Community Original Science	Scientific Explanation	The relevant Science Concepts for junior high school
		yarn. The drying of the threads is only done by aerating the threads.	process, physical changes occur due to reduced moisture content in the yarn (Harefah, 2019).	

1. Coloring Stage

Based on data obtained through data collection techniques such as participatory observation, in-depth interviews, and documentation that the natural coloring of Ulos woven fabrics consists of 12 stages, as follows:

a. The first stage is to collect materials such as plants. Plants used as natural coloring agents, such as: ketapang leaves, mahogany bark, teak bark, jalawe fruit, onion skin, Indigofera leaves, and turmeric.
b. The second stage is washing the threads and plants. The threads that will be dyed are first washed using water and soap to remove dust that sticks to the threads. Not only plant threads that will be processed into dyes are also washed first using water.
c. The third stage is to reduce the size of the material. Plants such as ketapang leaves and mahogany bark are chopped into small pieces using a knife to facilitate the boiling process.
d. The fourth stage is drying the material; plants such as onion skins that were previously washed are then dried by drying them in the sun until they are completely dry.
e. The fifth stage is smoothing the ingredients; plants such as turmeric are mashed first using a mortar (pulverizer) until smooth to make it easier for turmeric during the extraction process.
f. The sixth stage is boiling the ingredients; plants such as ketapang leaves, onion skin, mahogany bark, and teak are boiled until the color of the cooking water changes. This boiling process is carried out to remove the dye contained in the plant.
g. The seventh stage is filtering; after going through the boiling process, the boiled plants are filtered to separate the plant dyes from the waste.
h. The eighth stage is dyeing the yarn; the plant dye, which is filtered, is placed in a large container, then the yarn is dipped into the dye liquid. Yarn dyeing is done from the dye liquid in a hot state until the liquid becomes cold.

i. The ninth stage is drying the yarn; after going through the dyeing process, the yarn is dried. The yarn drying process is carried out by drying the yarn indoors or not in the sun because it will damage the color of the yarn.
j. The tenth stage is fixation or color-locking; after the yarn is dried in the sun, and completely dry, then the thread is carried out in the fixation process. This fixation process is carried out to strengthen the color on the thread so that it does not fade easily; besides that it can also beautify the color of the thread. In this fixation process, additional materials such as alum, tunjung, and lime are used.
k. The eleventh stage is washing the thread; after going through the fixation process, the thread is washed using water and soap to remove the color that does not blend in the thread.
l. The twelfth stage is final drying; after washing, the yarn is dried by drying it indoors or not in the sun, so the yarn is only aired so as not to damage the color of yarn.

2. Relationships and Contained Science Concepts

In order to obtain valid research results, the researchers validated through the data triangulation process by involving the supervisor as an expert. The data obtained through participatory observation and in-depth interviews with Ulos woven fabric craftsmen were then compared with other sources such as journal articles. Based on the data obtained through data collection techniques that in the process of dyeing threads naturally in the manufacture of Ulos woven fabrics contained junior high school science concepts that can be used as learning resources.

In the process of collecting materials, plants used as natural dyes can be implemented in junior high school science learning on plant classification materials. The plants used as natural dyes in dyeing yarn can be seen in Table 2.

Table 2. The name of the plant material used for natural dyes and the resulting color

Plant Figures	Description	Produced Color
 Ketapang leaf (*Terminalia cattapa*) Source: Personal documentation	Ketapang (*Terminalia cattapa*) or known as Indian almond tree from the family Combretaceae is a plant that is widely distributed in both tropical and subtropical countries (Kinoshita et al., 2007)	Brown

Plant Figures	Description	Produced Color
 Shallots (*Allium cepa L.*) Source: Personal documentation	Shallots or *Allium cepa* L. is a plant belonging to the Liliaceae family. Shallots include bulbous plants, single seeds and have fibrous roots.	Brown
 Turmeric (*Curcuma longa*) Source: Personal documentation	Turmeric or *Curcuma longa* is a plant belonging to the Zingiberaceae family. This plant can live both in the lowlands and highlands.	Yellow
 Jalawe (*Terminalia Bellerica*) Source: Personal documentation	Jalawe or *Terminalia Bellerica* is a plant belonging to the Combretaceae family. Jalawe is a tree-type plant with a height of up to 50 cm, the habitat of this plant is in the highlands (Indrayani et al., 2020)	Yellow
 Teak tree (*Tectona grandis L.F*) Source: Personal documentation	Teak tree or *Tectona grandis* L.F is a plant belonging to the Lamiaceae family. Teak tree is a plant that can live in both the lowlands and highlands.	Brown
 Mahogany tree (*S. macrophylla*) Source: Personal documentation	Mahogany tree or *S. macrophylla* is a plant that belongs to the Meliaceae family. Mahogany trees are plants whose habitat is in tropical climates (Azzahra, 2018).	Brown
 salaon (*Indigofera Tinctoria*) Source: https://www.yayasanlosari.org/si-biru-cantuk-yang-populer	Salaon or *Indigofera tinctoria* is a plant belonging to the Fabaceae family. Indigofera tinctoria belongs to the legume group. This plant is known as a natural indigo color producer, with habitats in tropical climates (Hariri, 2016).	Blue

The original science of the community is in the process of washing the bonang (thread) before being used in dyeing, and the thread is washed using water and soap to remove dust

and dirt attached to the thread. According to scientific science, cleaning threads using soap will remove dirt on the threads because the molecules in soap have hydrophobic properties (physical properties of a molecule) where the molecules in the dirt are surrounded and bonded. The process is called emulsification, where an emulsion is formed between soap molecules and dirt so that the molecules in the dirt will come out when rinsing with water and make the cloth clean (Fauzi et al., 2019). Materials containing hydrophobic molecules can be used to lift oil through the water.

The process of reducing the size of the material by chopping plants using a knife, it can be explored in junior high school science learning, which is about the material pressure of solids and extraction. Based on scientific science, the process of reducing the size of the material is done using a knife because the knife has a sharp part on the side that is used to apply pressure making it easier for the knife to cut plant material. The small size of the material will facilitate the extraction process. Because the smaller the size of the material, the wider the contact area between the material and the solvent attracts the active compound (color extract) on the material (Aji, 2018).

In the process of drying plant material to reduce water content in plants, it can be explored in junior high school science learning, namely about heat transfer material, physical changes, and solar energy. In the drying stage of, materials such as shallots by utilizing the hot sun to reduce the water content. The process of drying objects by utilizing sunlight includes radiation heat transfer events. The process of drying the material (plant), which aims to reduce the water content contained in the material (plant), is included in physical changes.

The community's original knowledge about smoothing turmeric using a mortar. The scientific science contained in the smoothing stage of turmeric is that the process of smoothing turmeric is carried out using a wooden pounder (lumpang). The blunt part of the pounder can smooth the turmeric. The finer the size of the turmeric, the easier the extraction process. Because the smaller or finer the size of the turmeric, the wider the contact area between turmeric and water (solvent) attracts the shutter extract contained in turmeric (Aji, 2018).

At the stage of boiling plants to dissolve the color extracts contained in plants, it can be explored in junior high school science learning, namely about the material temperature and its changes, the boiling point of heat transfer, and extraction. Scientific science contained in the process of boiling the dissolved color extracts contained in plants using water as a solvent. During the boiling process, heat is transferred from the fire to the pan, making the water temperature high until it reaches its boiling point. The heat from the fire is transferred to the

liquid dye extract, and evaporation occurs. Indigenous knowledge of the community about the process of filtering color extracts with their dregs using a filter. Separation of color extract (liquid) with the waste (solid) using the filtration method.

Indigenous knowledge to the community about the process of dyeing yarn into the color extract, carried out from the color liquid in a hot state until it becomes cold. The scientific science contained in this process is the use of additives as natural dyes in the manufacture of Ulos woven fabrics by utilizing many types of plants. Plants used as dyes can produce color because they contain chemical compounds such as tannins, flavonoids, indigo, and curcumin. Tannins are complex organic compounds with amorphous textured crystals and dissolve in water to form colored liquids (Pasaribu & Winarni, 2020). Flavonoids are compounds derived from phenylalanine and coenzyme acetate esters and are mostly contained by groups of plants that have yellow flowers (isoflavones), dark yellow (flavonols), red and blue (anthocyanins) when extracted (Sanda & Liliana, 2021). Indigo or indigotin is a blue pigment that can be produced through a plant fermentation process containing appropriate precursor molecules, such as indican, isatin A, and isatin B (Rajan & Cindrella, 2019). Curcumin is a well-known bioactive compound and is the main component of the colorant in turmeric (Ma et al., 2020). Changes in temperature that occur in plant color extract liquids due to dyeing are carried out when the liquid is at high temperature to low temperature. In addition, there is a chemical change in this process due to the changing color of the yarn before and after dyeing.

The community's original cultural knowledge about drying yarn by drying it on a jomuran, by just letting it air or not under the hot sun because if it is dried in the sun, it will damage the color of the yarn. Based on scientific science, the use of wind energy in the drying process can be explored in junior high school science learning on energy materials in living systems. In addition, the occurrence of physical changes due to the drying process is carried out in order to reduce the water content contained in the yarn.

The stage of color locking or fixation binds the color so that the color does not fade. Based on scientific science, the fixation process uses additional solutions in the form of metal compounds that function to strengthen the color of the yarn. The compounds in question are tunjung (FeSo4), alum Al2(SO4)3 and lime Ca(OH)2. Tunjung, or in scientific language Fero sulfate (FeSO4) is a compound of iron (II) sulfate in the form of a crystalline powder and blue-green in color, the addition of tunjung in the fixation process will affect the color of the dyed results (Amalia & Akhtamimi, 2016). Al2(SO4)3 alum is a colorless and crystalline aluminum sulfate compound, alum has alkaline-base properties so that the fixation process with alum can strengthen the color of the yarn and compare it to other fixators. The alum

fixator will not affect the dyed color. In contrast, quicklime (Ca (OH)2) is a chemical compound of calcium hydroxide in the form of powder or crystals and is white in color. These three fixators are compounds often used as fixation compounds because they are safe to use. The above statement is in accordance with the opinion of Safapour et al. (2019) that most natural dyes generally show a very low affinity for textile fibers and have poor fastness properties. Therefore it is necessary to use metal materials such as alum, tunjung and kapor tohor as fixators.

The original science of community culture is about the process of washing and drying the yarn after the locking process, washing is done using water and soap to remove the color that does not blend in the yarn. Meanwhile, the drying is done by drying the threads on the jomuran and only letting it dry or not drying it under the hot sun. In addition, drying is done so that the yarn does not get wet during weaving. Scientific science contained in this process In addition, the use of wind energy in drying to reduce the moisture content in the yarn so that there is a change in the form of substances that occur in the yarn from wet to dry. The relationship between original science and scientific science contained in the process of washing and drying yarn can be explored in junior high school science learning on the material of physical change and wind energy.

CONCLUSION

Based on the results of research and discussion in general, the coloring process of Ulos woven fabric consists of eight stages, (1) the preparation stage of the material (yarn and plants), (2) the processing stage, (3) the stage of dissolving natural dyes or color extraction in plants, (4) immersion stage, (5) drying stage, (6) fixation stage, (7) washing stage and (8) final drying stage. From the yarn coloring process, the junior high school science concepts in the Curriculum 2013, namely: Classification of plants, solids pressure, heat transfer, physical changes, energy in living systems (wind energy and solar energy), separation of mixtures (filtration, extraction, and decantation), boiling point, temperature, and its changes, chemical changes (formation of precipitates and color changes), elements, compounds, and mixtures. The science concepts contained in the natural yarn dyeing process can be used as a source for ethnoscience-based junior high school science learning. So that the process of making Ulos woven cloth can be used as a theme in science learning in junior high school.

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