International Journal of Scientific & Engineering Research, Volume 8, Issue 1, January-2017
ISSN 2229-5518

Inventory of Forest Products From Various Production Forests As Natural Dye

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Abstract— The development of the use of natural dyes as textile dyes has recently increased. This is related to environmental standards and the prohibition of the use of synthetic dyes containing azo groups as well as to reduce the negative impact of environmental, water and air pollution from synthetic dyes. as an alternative to natural dyes that are more environmentally friendly. This research was carried out in August 2022. This inventory activity was carried out in the South Wilangan BKPH Area, Saradan KPH, Madiun. Bark taken in production forest areas has a very good opportunity to be used as a natural dye. From the results of the research conducted, there are several obstacles faced. These obstacles include, among others, several potential species from the initial experiment, protected plant species were obtained. In addition, on species that have high economic value, the manager does not allow exploration. The type obtained is a type that does not have a high value. The types of bark include Secang (Caesalpinia sappan); Mahogany (Swietenia macrophylla King.); Angsana (Pterocarpus indicus); and Pine (Pinus merkusii). While the type of fruit obtained by mangosteen skin (Garcinia mangostana L.) and Manjakani fruit (Quercus infectoria).

Index Terms— Forest Products, Inventory, Natural Dyes, Production

1 Introduction

THE development of the use of natural dyes as textile dyes has recently increased. This is related to environmental standards and the prohibition on the use of synthetic dyes containing azo groups (Fadilah Ahmad & Hidayati, 2018), such as in Germany and the Netherlands which require the use of environmentally friendly textile dyes and do not require the use of synthetic dyes. With the prohibition of the use of synthetic dyes containing azo groups, this is the right moment to reintroduce natural dyes that have long been abandoned.

The use of synthetic textile dyes containing heavy metals will have environmental impacts, including soil, water, air pollution and direct impacts on humans such as skin cancer, brain damage and others (Setiyanto et al., 2015). Natural dyes with a coloring pre-treatment process and the coloring process does not use heavy metals, iron, chemicals, toxins and salts. In addition, natural dyes can be extracted from plant parts requiring only water as the solvent, and the remaining solid waste produced can be degraded in nature or can be used as compost.

Natural dyes can be produced from plants, such as stems, roots, leaves, flowers, bark and so on. There are about 150 types of plants that intensively produce natural dyes (Heyne, 1987). The resulting colors include basic colors (red, blue, yellow) and combination colors such as brown, orange, and indigo.

Natural dyes added to food have another purpose, namely: to emphasize the color that already exists in the product, to ensure uniformity of color from stage to stage and to maintain coloration. original product. As for flavonoid pigments, especially anthocyanins, not only play a role in contributing color to food, medicine and cosmetics. The potential effects of flavonoids include reducing the risk of heart disease, cancer, and other chronic diseases.

According to (Visalakshi & Jawaharlal, 2018). states that the extraction of natural dye pigments is enough by soaking the material in cold water for 24 hours, if the water used is contaminated with minerals such as iron, a color shift will occur. To avoid discoloration, distilled or deionized water can be used. Then heated to boiling (98-100 ° C), for heat sensitive dyes (usually flower dyes) to a temperature of 70-80 ° C, and maintained for 1-2 hours depending on the dye extracted. After the liquid cools, it is immediately filtered.

Extraction of flavonoid group compounds is recommended to be carried out in an acidic environment because it can denature plant cell membranes, then dissolve anthocyanin pigments so that they can leave the cells and prevent flavonoid oxidation. Anthocyanins can be extracted well in acidic solvents, especially tartaric acid (Wulaningrum, 2018).

The extraction process for all materials is basically the same, namely taking the pigment or dye contained in the material. Extraction treatment by heating by boiling the natural dye carrier using water is the most widely used method. Water added for the extraction of a certain amount of color carriers for the purpose of efficiency and to obtain color requirements. Boiling is carried out until the volume of water becomes half, if you want a thicker dye solution, boiling can be continued so that the remaining volume of boiling becomes one-third of the initial volume (Pujilestari, 2016).

To reduce the negative impact of environmental, water and air pollution from synthetic dyes, and in an effort to improve the economic level of communities around plantation forests, it is necessary to solve the problem by exploring natural dye plants in production forest areas as an alternative to natural dyes that are more environmentally friendly.

2 DEFINING NATURAL DYES

Natural dyes obtained from plant, animal or mineral sources. Plants have colors that can be used as natural colorants in food

3 LITERATURE REVIEW

3.1 Exploration

Exploration is the activity of tracking, exploring, searching for and collecting certain types of genetic resources to be utilized and secure them from extinction. Exploration is carried out in areas that are relatively far from urban areas or villages that have not been touched by technology, or villages where farmers are technologically savvy but are very fanatical or trying to maintain local varieties (Munthe, 2020).

Exploration activities are very necessary to be carried out with the aim of recording, protecting, and preserving existing plants, as traditional knowledge and intellectual property of the community, so that at some point they can be used as references to produce phytopharmaca.

3.2 Pigment

The dye is an unsaturated organic compound containing a chromophore group and an auxochrome group. The chromophore group is a part of the molecule that can absorb certain wavelengths of visible light and reflect certain colors. Generally, the chromophore group contains nitrogen, oxygen, or sulfur atoms. The three atoms can form a single bond or a double bond. A colored compound can be used as a textile dye if it meets the following requirements (Pujilestari, 2016):

1. Easily soluble in the solvent.
2. Easily absorbed into textile materials.
3. Stable, durable, and not easy to fade.

Dyes can be classified into several groups. Classification of dyes based on dyeing properties is divided into two types, namely (Marwati, 2017):

1. Direct dyes (substantive) are dyes that are easily soluble in water and easily dye fabric fibers.

2. Indirect (adjective) dyes are dyes that are difficult to dissolve in water and require auxiliary substances to be able to color fabric fibers.

The classification of dyes based on the source obtained is divided into two, namely synthetic dyes (ZPS) and natural dyes (ZPA). Synthetic dyes are compounds derived from aromatic hydrocarbons such as benzene, toluene, or naphthalene obtained from chemical synthesis processes. Natural dyes are dyes obtained naturally from plant parts either directly or indirectly. Plant parts that can be used as a source of natural dyes can come from leaves, stems, roots, flowers, or seeds (Marwati, 2012).

3.3 Synthetic dyes

Synthetic dyes began to develop when the synthesis of organic compounds was discovered. The first synthetic dyes to be synthesized were picric acid by Woulfe and aurine by Runge. However, these two dyes are not produced commercially because of the high price of raw materials. Synthetic dyes were first produced by William H. Perkin. The color that was successfully synthesized was mauveine. Until now, many synthetic dyes have been produced.

3.4 Natural Dyes

Natural dyes can be classified based on the basic colors that can be generated, namely (Antonius, 2015):

1. The base color is red

Most of the red color is stored in the roots or bark of a plant. This red color generally appears due to the presence of anthraquinone compounds and their derivatives. This color is stable on washing and light testing. Examples of plants that give a red base color are secang (Caesalpinia sappan sp), madder (Rubia tinctoria sp). Mahogany (Swietenia mahagoni sp) and camellia (Camellia sinesis sp).

2. Yellow base color Y

ellow is the color that occurs most often and is abundant in nature. About 90% of the yellow color in nature is due to the presence of flavonoid compounds. In general, the resulting color is a pale yellow color and easily dulls except for the yellow color of turmeric. Examples of plants that give a yellow base color are turmeric (Curcuma longa sp) and jackfruit trees (Artocarpus heterophylla sp).

3. Blue base color

The basic blue color is usually found in indigo plants and woad plants. The blue base color is resistant to light and washing. An example of a plant that gives a blue base color is tarum (Indigofera tinctoria sp).

4. Black base color

In general, the black base color is found in plants that contain a lot of tannin compounds. The black color can be applied for staining on cellulose and protein fibers which gives a coloring effect that does not fade or dull easily. Natural dyes can also be classified into three types based on the original source or the source of raw materials, namely vegetable origin, mineral origin, and animal origin. Vegetable origin is a source of raw material for dyes derived from roots, leaves, bark, or other parts of plants.

Natural dyes can also be classified based on the chemical content that gives the color effect, namely (Ferreira et al., 2016):

1) Indigo dye is a dye that arises due to the presence of indigo or indigotin compounds. Woad plant is a source of blue color with indigo compounds as the main component.

2) Anthraquinone dye is the source of the most abundant red color found in nature.

3) Flavonoid dye is a source of yellow color obtained from derivatives of flavones, isoflavones, aurone, and chalcones.

Some organic compounds of natural ingredients that are widely contained in plants include:

1. Alkaloids

Alcolloids are compounds that contain aromatic nitrogen and are the most commonly found in nature. Almost all alkaloids found in nature have certain biological activities, some are very toxic but some are very useful in medicine. The content of alkaloids in each plant is 5-10% and the effects are only in small doses. The levels of alkaloids in plants generally vary according to environmental conditions and alkaloids are generally scattered throughout the plant (Harborne, 2016). Alkaloids are used as antitumor, antiseptic (fever-reducing), antipain (analgesic), stimulate the nervous system and lower blood pressure and fight microbial infections.

2. Saponins

Saponins are plant glycosides characterized by the appear-

ance of foam on the surface of the water when mixed or stirred, which have been known and recognized as natural soaps and have caused several plants such as soapwort (Saporina officinalis sp) to be commonly used as soap for a long time (Gunawan, 2018). Saponins have a wide range of pharmacological activities including: antitumor, anti-inflammatory, antibacterial, antifungal, antiviral, hypoglycemic, and hypocholesterolemic effects. Saponins also have various properties, for example: taste sweet, some are bitter, can stabilize emulsions and cause hemolysis.

3. Flavonides

Flavonoids have distinctive properties, namely a very sharp odor, mostly a yellow pigment, soluble in water and organic solvents, easily decomposed at high temperatures. Flavonoids have many benefits including as antioxidants, antimutagenic, antitumor, vasodilators. Antioxidants in flavonoids play a role in preventing oxidative damage caused by free radicals so that flavonoids can be used to control a number of diseases in humans. A total of 1 ml of plant extract was given a few drops of dilute sodium hydroxide (NaOH 1%). The appearance of a clear yellow color in the extract solution and becoming colorless after the addition of dilute acid (HCL 1%) indicates the presence of flavonoids (Azizah et al., 2014)

4. Terpenoids

Terpenoids are a group of hydrocarbons that are widely produced by plants and are mainly contained in sap and cell vacuoles. Terpenes and terpenoids make up many of the essential oils produced by plants, thus influencing the use of spice products as spices, healing ingredients, and health ingredients. Terpenoids contain many active components of natural medicine that can be used as a cure for diabetes and malaria. Terpenoid-producing plants function as anti-predators, antibacterial, antiviral, fungicides and insecticides (Harborne, 2016).

4 Research Methodology.

4.1 Research time and place

This research was conducted in August 2022 in the BKPH Wilangan Selatan area, KPH Saradan, Madiun. Analysis of natural dye resistance was carried out at Screenhouse, Faculty of Animal Husbandry, University of Muhammadiyah Malang.

4.2 Tools and materials

The tools used in this research are location maps, GPS, knife or machete, digital camera as documentation, meter, raffia rope used as plot boundaries, plastic bags to store samples taken from the field, stationery, herbarium tools, label paper.

4.3 Research procedure

1. Aspect of Local Knowledge

Primary data was collected by using direct observation or survey techniques in the field and conducting non-formal interviews with information identifying specific types of natural dye plants that grow in production forest areas regarding the number and types of natural dye plants, while secondary data was collected by means of a literature review on the general condition of the research and research area. -Supporting research. The key informants selected in this study were local field guides, forest area rangers and the community.

2. Diversity Aspect

Data collection analysis of vegetation of natural dyes in the field using a sampling method plot in the form of a square plot, where the determination of the starting point is carried out by purposive sampling, namely based on places that are considered many natural dye plants around KHDTK (Puspitojati, 2014).

The total area of Special Purpose Forest Area has an area of 75.09 Ha. With a sampling intensity of 1% so that the area of research to be carried out is 0.75 Ha. The sampling plots made are in the form of square plots measuring 20m x 20m with an area of 400m per plot. So the number of plots is 19 plots. Observations of natural dye plants were carried out exploratively along the observation path.

5 RESULTS AND DISCUSSION

Potential of KHDTK natural dye plants

The BKPH South Wilangan, KPH Saradan, Madiun area is a type of plantation forest in the lowlands. There are many types of trees and plants that have been explored by researchers in Forest Areas with Special Purposes, but the sample selection using the sampling plot method where the point is determined by purposive sampling, the researchers determined 5 types of tree samples to be studied in this study. The five tree samples are pine trees, secang trees, mahogany trees, and Angsana trees because they are considered trees that have the potential as natural dyes. This statement is supported by research by Noor (2017) which states that avocado, mundu, pine, teak, mahogany, waru, and pulutan leaves are plant species that have the potential as natural dyes.

After determining the sample to be studied, the bark of the pine tree, sappan tree, Mahogany tree, and Angsana tree is then extracted to obtain the desired natural color results. The bark from which the samples were collected was washed and then dried, this is in accordance with the research of Hammado, N and Illing (2017) that before extraction the material must be dried first to reduce its water content. After being dried and then boiled, the dried tree bark is put into boiling water of 70 c˚ as in the journal Aulia, L. F (2014) that the dye sample extracted at a temperature of 70 c˚ showed the best results in color density. Boiling is carried out for one hour and then the bark is soaked for 24-48 hours.

Extract solution with brown color and dark brown residue resulted from the extraction process. Most of the extract solution was obtained from boiling the sample at a temperature of 70°C. The color produced by leaf litter is more concentrated. After boiling for an hour, the cooking water has been seen to give off the color of the bark extracted. It is known that at the same concentration each type of wood has a different color and even has a different density even with the same concentration. This raises the question of how the same concentration can have different colors and densities.

6 Findings And Inferences

There are many types of trees and plants that the researchers found in the plantation forest area, but the sample selection

was using the sampling plot method where the point was determined by purposive sampling, the researchers determined 4 types of tree samples to be studied in this study. pine trees, sappan trees, Mahogany trees, and Angsana trees. These four types of trees were chosen because they are considered as trees that have the potential as natural dyes. This statement is supported by research by Noor, R (2017) which states that avocado, mundu, pine, teak, mahogany, waru, and pulutan leaves are plant species that have the potential as natural dyes.

7 Conclusion

1. Bark from exploration in Production Forest Areas has a very good opportunity to be used as a natural dye.
2. Skin type affects color density with different concentration treatments.

Acknowledgment

We are very grateful to Kedaireka in the Mutching Fund program, University of Muhammadiyah Malang, DP2M, UMM Cultural Institute, Library, Internet Center (ICT) will assist in providing the facilities and references needed so that they can complete the activity.

References

[1] Antonius, H. (2015). Natural Coloring Plants and Their Traditional Use by the Marori Men-Gey Tribe in Wasur National Park, Merauke Regency. Biodiversity, Journal of Biological Diversity. https:/ / doi.org/ 10.13057/ biodiv/ d060414. Retrieved August 28, 2020.

[2] Aulia, F, and H. Irawan. (2014). Extraction of Secondary Metabolites of Seagrass Thalassodendron ciliatum in Different Solvents Aulia. Applied Microbiology and Biotechnology. https://doi.org/10.1016/j.bbapap.2013.06.007. Accessed August 27, 2020

[3] Azizah, D. N., Kumolowati, E., & Faramayuda, F. (2014). Determination of Flavonoid Levels by AlCl3 Method in Methanol Extract of Cocoa Fruit Peel (Theobroma cacao L). Kartika Scientific Journal Pharmacy. https://doi.org/10.26874/kjif.v2i2.14. Retrieved September 3, 2020.H. Poor, "A Hypertext History of Multiuser Dimensions," *MUD History*, http://www.ccs.neu.edu/home/pb/mud-history.html. 1986. (URL link *include year)

[4] Fadilah Ahmad, A., & Hidayati, N. (2018). The Effect of Mordant Type and Mordanting Process on Color Strength and Effectiveness of Cotton Fabric Dyeing Using Guava Leaf Dye . Australia. Indonesian Journal of Halal. https://doi.org/10.14710/halal.v1i2.4422. Retrieved On September 1, 2020.R. Nicole, "The Last Word on Decision Theory," *J. Computer Vision*, submitted for publication. (Pending publication)

[5] Ferreira, E. S. B., Hulme, A. N., McNab, H., & Quye, A. (2016). The natural constituents of historical textile dyes. Chemical Society Reviews. https://doi.org/10.1039/b305697j. Retrieved August 19, 2020.D.S. Coming and O.G. Staadt, "Velocity-Aligned Discrete Oriented Polytopes for Dynamic Collision Detection," *IEEE Trans. Visualization and Computer Graphics*, vol. 14, no. 1, pp. 1-12, Jan/Feb 2008, doi:10.1109/TVCG.2007.70405. (IEEE Transactions)

[6] Gunawan, D. H. (2018). Reduction of Saponin Compounds in Aloe Vera Gel by Boiling and Steaming Food Technology: Information Media And Scientific Communication Technology Agriculture. https://doi.org/10.35891/tp.v9i1.938.

[7] Harborne, J. B. (2016). Phytochemical Methods. In Phytochemical Methods. https://doi.org/10.1007/978-94-009-5570-7.

[8] Heyne, K. (2017). Useful Plants of Indonesia, vol. 3, translation of the Jakarta Forestry Research and Development Agency. In Sarana Warna Jaya Foundation, Jakarta.

[9] Illing, D. (2017). Photochemical Test of Fruit Extract With. Journal of Chemical Information and Modeling.

[10] Marwati, S. (2017). Extraction and preparation of natural dyes as indicators of acid-base titrations. In Proceedings of the National Seminar on Research, Education and Application of Mathematics and Natural Sciences.

[11] Munthe, H. M. (2020). Modernization and Social Change of Society in Agricultural Economic Development: A Sociological Review Hadriana Marhaeni Munthe. University of Northern Sumatra.

[12] Noor, R. (2017). Preparation of high school biology student worksheets (LKPD) through an inventory of plants that have the potential or as natural dyes in the metro city. BIOEDUKASI (Journal of Biology Education), 5(2), 94-104

[13] Pujilestari, T. (2016). Effect of Natural Dyes Extraction and Fixation on Color Fastness Resistance in Cotton Batik Fabrics. Dynamics of Crafts and Batik: Scientific Magazine. https://doi.org/10.22322/dkb.v31i1.11058

[14] Pujilestari, T. (2016). Review: Sources and Utilization of Natural Dyes for Industrial Purposes. Dynamics of Crafts and Batik: Scientific Magazine. https://doi.org/10.22322/dkb.v32i2.1365. Accessed March 28, 2021

[15] Puspitojati, T. (2014). The Problem of Definition of Forests and Forest Products in Relation to the Development of NTFPs through Plantation Forests. Journal of Forestry Policy Analysis, 8(3), 210–227. https://doi.org/10.20886/jakk.2011.8.3.210-227. Accessed March 28, 2021

[16] Setiyanto, S., History, I., & Kurniasari, L. (2015). Textile Dye Adsorption Using Coffee Pulp Xanthat Compounds. UNWAHAS Momentum Journal.

[17] Visalakshi, M., & Jawaharlal, M. (2018). Healthy Hues – Status and Implications in Industries – Brief Review . Research & Reviews: Journal of Agriculture and Allied Sciences.

[18] Wulaningrum, R. (2018). Effect of Organic Acids in Extraction of Skin Color Substances of Mangosteen (Garcinia mangostana). Indonesian Journal of Chemical Science.