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NATURAL-COLOR CREATION FOR DYEING CALATHEA STRIPS FORCLEAN TECHNOLOGY APPROACH

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ABSTRACT- This study examines the properties of Calathea in basketwork and the process of dyeing Calathea strips with natural materials.It adapts clean technology principles to reduce energy consumption and waste in the production process.Further, it evaluates the community's product designs to test the market by consumer groups and area, which is a group of farmer housewives living in Thung Fon District, Udon Thani Province,thatuse Calathea for basketwork. The data were collected through surveys observation, test materials, publicized design works in exhibitions, and designs evaluated by 1,000 selected tourists.The results indicate that strips from Calathea barks are shiny. When woven as a food container, they can be used and cleaned with no weevils, termites, and molds infestations. Natural color from wood vinegar can be dyed faster, whichreducesthe duration by up to 60 hours. Clean technology principles in the production process dependon a management system that the community can practice by complying with three principles,which are saving, waste reduction, and reuse;these principlesfocus on pollution reduction at source. Wicker is used for products in the traditional way of the community, such as for woven bags and key chains, emphasizing simplicity and minimalism. Theevaluation of product designof1,000 tourists revealed that they were satisfied with the design work for whichthe overall satisfaction level was the highest (average = 4.69), whereasthe satisfactiontoward the beauty of natural-colored wicker products or wood vinegarhad the highest opinion level (mean = 4.72).

Keywords: creativity, natural color, Calathea strips, clean technology

I. INTRODUCTION

Calathea has a soft long-segment trunk, making it more flexible than bamboo. When it is exposed to moisture, it does not get infested with mold, and when it is used tostore rice, the rice does not stick to the kratib (woven container). It can preserve heat for a long time and can be used longer than popular bamboo kratib made by the villagers. Peopleuse Calathea to weave rice kratib they use in their households, and in the dry season, they sell them to serve as another source of income. Calathea is commonly found in the ranches or can be cultivated. Calathea that would be used to make kratib should be more than 1-year-old because, at that time, its trunk size would be more than 50 meters in length, which is suitable for making basketwork strips. After cutting Calathea, it is exposed to sunlight for about 1 week, then the gut is scraped off to leave the bark to be used as weaving strips. When weaving, the strips are dipped into water periodically. This makes it easy to weave.

Basketwork from Calathea is increasingly playing an important role as a substitute for basketwork from bamboo in consumer groupsthat like basketwork. Regarding its physical properties, Calathea will not have insect and weevils infestations. Calathea barks that are used to make strips have smooth and shiny properties. When Calathea is used to weave rice kratib, it reduces the problem of rice sticking to the container, and it is easy to clean. A group of farmer housewives living in Thung Fon District, Udon Thani Province thatmake basketwork from Calathea establishedan association (henceforth group)on April 9, 1999. Mrs. Yupin Kannakham learned how to weave rice kratib from her grandparents in her former village and was initially weaving rice kratib for her personal use in her household. When she wove a higher number of kratibs, many people noticedthem through word of mouth and became interested in her products, so they purchased them because of their beautiful appearance. As Mrs. Yupin continues to develop her expertise andthe number of customers, theorders she receives increases.

In 1999, the Subdistrict-Municipal Office of Thung Fon District, Udon Thani Province, supported a group of farmer housewives who make basketwork from Calathea to establish a basketwork group. However, at that time, only a small number of them were interested in this group. The group had only 5 members, which made it weak. In 2003, the Department of Farmer Promotion in Thung Fon District started to support the group and organized training on making basketwork from Calathea for the members, which motivated many people to register. Mrs. Yupin Kannakham served as a trainer for the group, which increased the strength of the group of farmer housewives thatmake basketwork from Calathea. As a result, aside from rice kratib, the group expanded its product linesand was making other items, such as bags, baskets, trays, coasters, wallets, and toilet paper holder, to sell in the community.

When the group developed more products, it increased the number of customers and products purchased. The members made more products, leading to more income. Additional skills and products were developed to increase the alternatives available to the members. Currently, the group has 56 members who are from the community. The group has been set up and sells products at 182 Moo9, Baan Nonsaard, Thung Fon District, Udon Thani Province (Yupin Kannakham, 2018, Interview)

Through its operation, the group is well-known and has received several awards to accredit its products. Some organizations are providing several kinds of assistance to the group,and interested people often tour the group office and around the facility. In addition, the group members are invited to serve as trainers for basketwork in other groups.

Currently, the number of Calathea in the community is increasing due to the high demand for Calathea. Due to consumer demand for products from Calathea, the community is introducing more Calathea species. Most Calathea in the community are planted by members who own an entire area. In addition, the people in the Thung Fon community have realized the importance of Calathea and bring Calathea species to propagate, which has increased the number of Calathea in the community. Basketwork has continued to develop. Calathea strips can be dyed with various colors, but its production is quite difficult because its strip is a part of its shiny bark. Color absorption is hard, which makes theduration for the dyeing processlong. When the strips are dyed through a hot dyeing process with chemical colors, they bend. The followingconcerns have been raised bythe group of farmer housewives in Thung Fon that use Calathea to weave:

1. The difference between the strength ofbamboo and Calathea for basketwork. How is Calathea stronger and sticker than bamboo and other materials?

2. While dyeing, it is difficult for the colors to cling to Calathea strips. When they are used or exposed to sunlight, the colors fade. The group of housewives need to learn how to dye Calathea that will not fade or how to dye Calathea with natural colors.

OBJECTIVES

The following are the objectives of this study.

1. To study the characteristics of Calathea from the perspective of making basketwork and search for a process to dye it with natural materials.

2. To apply clean technology principles to reduce energy use and waste from the production process.

3. To evaluate the results of the community product design to test the market by customer groups.

II. MATERIALS AND METHOD

- SCOPE OF RESEARCH ACCORDING TO OBJECTIVE 1

1. Content Scope: Review the literature on Calathea from the perspective of making basketwork.

2. Area Scope: A group of farmer housewives in Thung Fon, Udon Thani Province 182 Moo9, Baan Nonsaard, Thung Fon District, Udon Thani Province, that use Calathea to weave.

3. Analyze the basic characteristics of Calathea and test its physical characteristics by comparing it withbamboo from the perspective of basketwork. Find the strengths and weaknesses of the materials.

4. Search for a process to dye Calathea with natural materials.

5. Analyze the color used to dye Calathea with natural materials and organize training for the members of the community group to set up further guidelines for developing basketwork products.

- **SCOPE OF RESEARCH ACCORDING TO OBJECTIVE 2**

6. Evaluate the waste in the production process based on clean technology principles by studying it from the first to the last stage. Analyze and find causes of the waste and provide recommendations to reduce the waste. The criteria for evaluating the adaptation of clean technology principles at the community level focuses on a management system that the community can practice by complying with 3 principles, which are saving, waste reduction, and reuse.

- **SCOPE OF THE RESEARCH ACCORDING TO OBJECTIVE 3**

7. Publicizing the design results by organizing an exhibition at Central Plaza Shopping center, Nakhonratchasima. The activities comprised of the following:

1) Research exhibition

2) Selling community products that manufacturer groups madeas part of this research to test the market.

8. Evaluating the designs and responses from 1,000 tourists on community products through purposive selection (Yamane, 1973).

9. Summarizing the research results.

III. DATA ANALYSIS

From the community product standard comparison to guiding the community in preparing for the certification of community product standards (CMU) by the Thai Industrial Standards Institute, the researcher identified the suitable properties of Calathea by comparing the products from Calathea (CMU. 188-2016) with bamboo products (CMU. 40-2016).

The physical properties of Calathea and bamboo from the perspective of weaving are different. The properties of the barkof Calathea enable the strips to shine on its own. When Calathea is woven as sticky rice kratib, it can be used instantly after cleaning, because Calathea strips or strands cannot be infested with weevils, termites, and molds, unlike bamboo that can be easily damagedby moths and termites.Therefore, when the community do basketwork, they fumigateagainst insectsinfestation. Regarding dyeing with chemical colors, bamboo has better properties than Calathea because bamboo absorbs color better than Calathea, which makes the color lastlonger, darker, and brighter. When products from Calathea and bamboo are exposed to water, their colors come off. Regarding weaving techniques, the assembling and sewing of products made from Calathea and bamboo are not different.

The shiny and smooth texture of Calathea makes dyeing its strip difficult. The chemicalsused to dye are silk or reed dyeing color. Some of the problems are as follows: the color stains the hands while weaving, the color fades after using the products for some time, and if dyeing is not good enough, the color comes offwhen the products are exposed to water. The group of farmer housewives in Thung Fon District that use Calathea to make basketwork raised a concern. The group has customers from overseas markets,such as Japan. The researcher experimented dyeing with natural colors from materials in the community or other communities for mutual integration.

- **NATURAL-COLOR TESTFOR CALATHEA STRIP DYEING**

Groups in the community and nearby areas that have colored water were selected. The researcher testedthree methods in three communities:

1. Indigo color from local weaving group in Ban Chiang District Municipality, Ban Chiang Subdistrict, Nong Han District, Udon Thani Province

2. Natural colors of marigolds, lac, and rambutan bark with natural indigo by the Ikat weaving group dyeing in Ban Dung Subdistrict, Ban Dung District, Udon Thani Province

3. Color from burning byCharcoal Burning Group, Thung Fon District, Udon Thani Province

The results show that when they aredyedwith natural colors, colors from the weaving group in the nearby communities, indigo color (cold dyeing) and colors from marigold, lac, and rambutan bark (hot dyeing), Calathea strips absorb the color solution well in both cold and hot dyeing.When washed with clean water, the color that adheres to the inside of the Calathea strips come off, especially the color from indigo dyeing.

Regarding Calathea bark with hot dyeing, the colors stick well but the bark bendswhen it is soaked or boiled for a long time. When it is washed with plain water, the color comes off completely.However, when

Calathea bark is dyed with indigo color (cool dyeing), the indigo color does not stick to the bark completely.

Natural color from lac dyeing produces pink red color. The production process is difficult since it is a hot dyeing process. When Calathea strips are boiled in lac water or are boiled for a long time, they bend.Moreover,as shown in Picture2, when they are washed, the color gradually fades.

Calathea strips—inside part Calathea bark

Figure1 Calathea strips from natural-color dyeing withlac

If it is dyed with natural color from indigo dyeing, the color comes off when it is washed. In conclusion, as shown in Picture 3, natural-color dyeing process is not appropriate for weaved Calathea strip products. However, when it is dyed with lac from natural material, the color does not stick well to Calathea. The researcher observed that lac has an oily rubber property, so it was used as a guide to find natural colors that are rubber or oily.

(1) (2) (3)

Figure 2 Calathea strips from natural-color dyeing with indigo(1) Calathea strip is dyed with indigo color (cold dyeing) (2) When the inner part of Calathea is taken off, the color comes off. (3) Indigo color does not stick to Calathea bark.

Dyeing test from working with the charcoal burning group in Thung Fon District, Udon Thani Province to obtain wood vinegar.

Wood vinegar is a clear brown liquid that smells like a woodsmoke. It is obtained from condensing smoke from charcoal production. During the process of turning wood to charcoal, heat is transferred from the chimney to the air. Moisture in the smoke around the chimneycondense to form drops of water. Most of the components are reddish brown and have low acidity.

Benefits of wood vinegar:First,it can add more flavor to a fruit, stimulate the growth and metabolism of plants, and increase the sugar level in plantswith sweet taste. Second, it accelerates fermentation. Wood vinegar that has low concentration of 1:100 will help increase the amount of fungi and bacteria that are beneficial in the fermentation of biological substances. As a result, this can reduce the time required for fermenting biological substances by 50%. Third, it can be used to reduce bad smell in the stall.Fourth, it repels poisonous insects, such as centipedes, because concentrated wood vinegar is made up of high amount of tar oil and resin that emit smoke-like smell. Fifth,it can be used as a supplementary diet for pet. When wood vinegar is mixed with animal diet, it will help decrease the level of bacteria in the colon of animals to help in the absorption of nutrients. Sixth, it can be used to repel flies because it has a pungent smell.Finally, tar oil isone product from charcoal burning. It is sticky, easily ignited, and has a strong pungent smell when it is poured into post hole of wooden house or painted on wood surface to be used in house construction to prevent termites or moths from destroying the wood (Wood Vinegar,2011).

The researcher testeddyeing Calathea strip with100% raw wood vinegar from the community group. The stages of the dyeing process are as follows:

1. Prepare both the peeled and non-peeled Calathea strips to be dyed anddip them into the wood vinegar. This will result in consistent colors. A 1.5-liter water bottle was used for the experiment.However, the most suitable container is a long water tank in which the entire Calathea strips can be submerged.Placing the heavy material over it again to sink all the wood vinegarhelps achieve consistent color.

2. In the first experiment, the Calathea strips were soaked for 15 minutes, washed with clean water, and dried. When Calathea strips soaked in wood vinegar are exposed to air, their colors change to light brown, although its color was almost the same as the former one. The experiment was conducted for 12 hours and both peeled and non-peeled Calathea strips were tested. The resulting colors are shown in Pictures 3 and 4.

3. When Calathea strips are soaked for the desired time and are then washed with clean water and the water is collected,the water collected can be used to water trees to repel insects.

4. The clean Calathea strips are dried. Calathea changesits color when exposed to air.The color becomes very dark when Calathea strips are dried. Then they can be used to weave the products.

Calathea was peeled and dyed for 12 hours

Calathea was not peeled and dyed for 12 hours

Figure 3Calathea strips that were dyed with wood vinegar for 12 hours

Based on the color value obtained from the experiment, it can be observed that the Calathea color derived from wood vinegar got darker with time; its gut or flesh and bark has the same color value.

An experiment of preparing Calathea strips for weaving was conducted.When Calathea strips thatare dyed from wood vinegar are used for weaving, the color does not stain the hands like chemical color. However, the wood smoke scentproblem is still present. After the strips have been woven and dried, the scent goes away. The materials used as fuel in burning results in different color values. Wood vinegar from wood burning results in dark brown color, whereas wood vinegar from paddy burning results in orange red color.

(1) (2)

Figure 4 Calathea strips color from wood vinegar(1) Dark brown color from wood vinegar from burning (2) Orange red color from wood vinegar from paddy burning

- **COMPARING CALATHEA STRIPS: NATURALCOLOR VERSUSCHEMICAL COLOR**

From the dyeing of Calathea strips with natural-color experiment, the comparison of natural color and chemical color can be summarized as follows:

Table1 The comparison of Calathea strips: natural color and chemical color

	Dyeing with chemical colors		Dyeing with natural colors
	Silk dyeing color	Reed dyeing color	Wood vinegar color
Problems during dyeing	1. After dyeing, Calathea twists because it is exposed to heat for a long time. 2. Dip Calathea strips and dry with sunlight to make Calathea	1. The twist of Calathea strips is less than that of boiling with silk dyeing. 2. Dip strips and then dry with sunlight; they will slacken faster than silk dyeing for about 1–3 days.	After dyeing, dampen Calathea strips into water, then then brings them to weave for workpieces instantly.

	slacken for at least a week. 3. Dampen Calathea strips into water, then bring them out to be used for weaving.	3. Dampen the dried Calathea strips until slacken then then bring them out to be used for weaving.	
Problems after weaving	1. During weaving, the color stains the hands but not as much as dyeing with reed. 2. When products from silk dyeing color are used, their colors will fade. 3. When the products are exposed to water, the colors will not come off.	1. During weaving, much color stains on the hands. 2. When products from reed color dyeing are used, their colors will fade. 3. When the products are exposed to water, the colors will not come off.	Whenthe dyed Calathea strips are cleanly washed, the color does not stain the hands during weaving but they have a wood smoke scent. While the products are been used, their colors do not fade, and the scent of wood smoke will disappears.

According to Table 1, dyeing Calathea strips with chemical color causes several problems. During dyeing, when the Calathea strips are boiled for a long time, they twist. For them to slacken for weaving, they have to be dippedinto clean water and dried with sunlight for many hours. While weaving, the colors come off and stain the hands. The most significant problem is the durability of Calathea strip color. The color of products woven with Calathea fades.

The natural colors from wood vinegar are beautiful but produce only two colors, dark brown and yellowish orange. This provides few alternatives for customers to choose from, but it is suitable for customers that like natural colors. The dyeing process is not complicated because it can be done together with the community groups that make charcoal in the village area. The process reduces discoloration while weaving. In addition, the weaved product can be exposed to sunlight without fading. For the wood smoke scent, if Calathea strips are completely dried in the sunlight, the scent goes away.

Table 2 Summary of a comparison the characteristics of natural dyeing colors

		Dyeing with chemical colors		Dyeing with natural colors
		Silk dyeing color	Reed dyeing color	Wood vinegar color
A comparison of the time for color dyeing of Calathea	Preparation of color water	Color boiling for 5 –10 minutes	Color boiling for 5 – 10 minutes	Color from the community group that burns for charcoal.100% wood vinegarcan be used to dye instantly.
	The duration of the color dyeing	1.30 hours	30 minutes	More than 1–12 hours, depending on the darkness of the color needed. If a dark color is needed, the duration will increase.
	The duration to slacken before using the Calathea strips to weave	At least 1 week	About 1–3 days	Can be used to weaved instantly
Total duration		169.4 hours or 7 days 1.40 hours	72.40 hoursor 3 days 40 minutes	12 hours

According to Table 2, the duration for dyeing Calathea strips with chemical color is 72–169 hours, whereas that of wood vinegar is 12 hours. This reduces the time by at least 60 hours. In addition, the experiment shows that Calathea strips dyed with wood vinegar are dried in the sunlight for 1 month and their colors do not fade. In summary, in terms of their duration for dyeing and durability, color from wood vinegar has better Calathea dyeing properties than chemical color.

- **THE RESULTS OF COMMUNITY SATISFACTION ANALYSIS OF THE DYEING PROCESS FOR CALATHEA WITH NATURAL MATERIALS**

On February 25, 2019, a workshop project of color dyeing of Calathea with natural materials was organized. The community satisfaction of the color dyeing process of Calathea with natural materials from 30 members of the farmer housewife group in Thung Fon District, Udon Thani Province who make basketwork with Calathea was evaluated.

Table 3 Evaluating the training of color dyeing with natural colors

Item	Description	$\bar{X}$	S.d.	Opinion level
1.	The beauty of Calathea strips dyed with natural color	4.68	0.46	HIGHEST
2.	The pattern of strips when woven (reduction in twisting, bending, and harshness)	4.59	0.54	HIGHEST
3.	Reduction in colors stain on hands during weaving	4.68	0.46	HIGHEST
TOTAL		4.65	0.48	HIGHEST

According to Table 3, the community group was satisfied with the experiment of weaving Calathea strips with natural colors, with the highest mean of 4.65. Based on the suggestions from the group, the group desired to organize additional training on pattern creation, techniques for weaving design, and other natural colors. As shown in Picture 5, the training allowed the group members to weave coasters.

Figure 5Woven coasters from Calathea with natural colors

- **CREATIVEWORK**

A group of farmer housewives in Thung Fon District, Udon Thani Province that make wickerwork with Calathea has expertise in creating various kinds of wickerwork, such as kratibs for sticky rice, baskets, trays, panniers, and several types of bags (including handbags, shoulder bags, and backpacks) from Calathea. A group also designs and develops bags by designing 12 sketches of ideas.

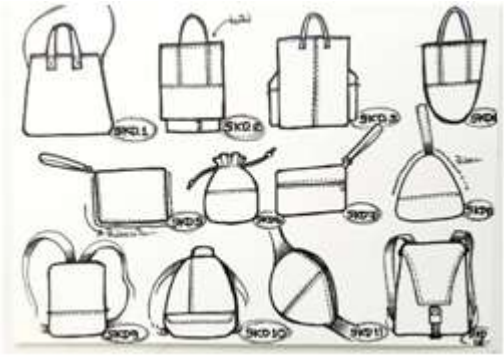

Figure 6 12 sketches of ideas of bags

Based on the 12 sketches of ideas we asked the community group, it can be concluded that 4 sketches that the group was interested in selecting to produce wicker bags are Sketches2, 5, 6, and 9 with emphasis on weaving themas sheets and then sewing it into a bag which is possible to produce.

Sketch2 was inspired by the shape of rice kratib. Then adds the beauty with Ban Chiang pattern and dyes with natural color, making tote bags look more interesting. The design was further developed by reducing the size of the bag and changed from attaching zipper at the mouth of the bag to cloth drawstring techniques. The bags then looked more modern and reduced the sewing process. The members in the community group can produce them because the weaving method is similar to that of rice kratib weaving.

The shape of Sketch5 is simple and can be woven into any pattern. It can be sewed into a bag that is not complicated and can be easily produced. The group can adjust the size and pattern of the bag so that

tablet, laptop, and other documents can be put inside. The target group is both male and female. It is designed to have an arm strap like that of a wristlet bag and the strap can be detached when not in use.

Tote Bag with Ban Chiang pattern Wristlet bag with Ban Chiang pattern

Idea Sketch 2 Idea Sketch 5

Figure 7 Creative work from Idea Sketch 2 and 5

Sketch 6 can be produced as a large or small bag by using scraps to design it to keep coins or make various styles of key rings. Sketch 9 is designed as geometric shapes, such as rounded rectangle, oval, and circle. Moreover, it has a shoulder strap that can be adjusted in many ways. It can be used by both men and women.

Coin purse and key ring Shoulder bag

Idea Sketch 6 Idea Sketch 9

Figure8 Creative work from Idea Sketch 6 and 9

- **EVALUATION OF THE DESIGN**

The design was evaluated by organizing two exhibitions

First exhibition: In the contest and dissemination of operational results of Knowledge-based OTOP: KBO. Outstanding Province of the year 2019. The farmer housewife group in Thung Fon District Udon Thani Provincethat make Calathea basketry was selected to represent Udon Thani Province in the contest. The exhibition was organized from August 10 to 12, 2019, at IMPACT Exhibition and Convention Center, Muang Thong Thani, Nonthaburi Province.

Figure9 The exhibition of Knowledge-based OTOP: KBO 2019

Received the 1st consolation prize from the KBO contest

According to the data about consumer needs collectedthrough the questionnaires administered to 500 people, the respondents highly valued the prototype product design. The mean is 3.78. When each element is considered by descending order, the overall product aesthetics mean is 3.97, the suitability of the color mean is 3.91, the convenience of use mean is 3.65, and care and maintenance mean is 3.61.

Second exhibition at the frontyard of Jaspal Shop at Central Plaza Shopping Center, Nakorn Ratchasima Province on October 8–10, 2019.

Figure 10 The atmosphere of the opening ceremony of research exhibition

The community product designs were evaluated to test the market by consumer groups. The number of people at the exhibition was 1,000. The overall satisfaction of the exhibition was high (mean = 4.48). The highest satisfaction was with the product design (mean = 4.69). The novelty of the product style had the highest opinion level (mean = 4.64). The overall satisfaction of the beauty of natural-color wickerwork (wood vinegar) had the highest opinion level (mean = 4.72).The respondents provided the reasons for satisfaction.First, the workpiece should be beautiful, neat, and modern. Second, the pattern should be beautiful andthe color setting on the work should be perfectly classic, wood vinegar color is well suited for wickerwork. Third,it should beautifully reflect the identity of Ban Chiang and the contemporary wisdom of the villagers.Finally, it should response to the need of the popular current generation that prefer natural-color products.

- **CLEAN TECHNOLOGY FOR NEW PRODUCT CREATION PROCESS**

Technology about natural-color dyeing from wood vinegar changes. As perthe operations of the charcoal burning group, charcoal is burned four times a year or once every 3 months, in which each burning of charcoalproduces 60–72 liters of wood vinegar. Approximately 8–10 liters of wood can be used for dyeing continuously. The dyeing must be done with 100% concentrated wood vinegar, and the Calathea strips should be soakedfor at least 1–12 hours. The longer it is soaked in the wood vinegar, the darker the Calathea strip color becomes. After soaking for the desired period, the strips should be washed with clean water once or twice. The remaining wastewater can be mixed with water used in household or agriculture for the following purposes:

Wood vinegar can be used in the household as a replacement for chemicals. The direction for use is as follows:it should be 1:20 mixed with water to destroy termites and ants; it should be 1:50 mixed with water to prevent termites, ants, small nonpoisonous centipedes, scorpions, and millipedes, and it should be 1:100 mixed with water to irrigate the base of a tree to treat mold and rot. It also prevents insects from laying eggsby spraying it on water bodies, and it can be sprayed on trash cans to prevent odors and flies. In addition, it can be used to deodorize bathrooms, kitchens, damp areas, and pet cages.

For agriculture use, a high concentration of wood vinegar has a strong antiseptic effect due to its high acidity, and it contains compounds, such as meranol and phenol, that can be used as a disinfectant when diluted in a 1:200 solution. The amount of ora3, which is beneficial and antibacterial microorganisms (antibacterial microbe), increases because they obtain nutrients from acetic acid.Wood vinegar can be used in agriculture.

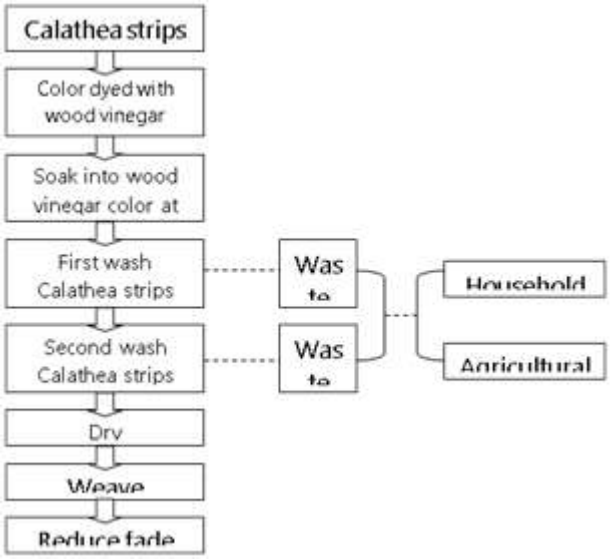

Figure 11 Disposal of waste water from Calathea dyeing with natural color

IV. DISCUSSION

The general physical properties of Calathea and bamboo from the perspective of weaving are different. Due to the properties of the bark of Calathea, the strips shine on its own. When Calathea is woven as sticky rice kratib, it can be used instantly after cleaning because Calathea strips or strands cannot be infested with weevils, termites, and molds, but bamboo strips can be infested with molds and termites, which eat the bamboo and damage them easily. Therefore, when the community do basketwork, they fumigate against insects. Regarding dyeing with chemical colors, bamboo has better properties than Calathea because bamboo absorbs color better than Calathea bark, which makes it the color lastlonger, darker, and brighter. If products woven by Calathea and bamboo are exposed to water, their colors come off. Regarding weaving techniques, assembling and sewing is not different for products made from Calathea and bamboo. This is consistent with the concept of proposed by Wiboon Leesuwan (1996: 8-11), who mentioned that making wickerwork is a traditional process that has been done from ancient time and commonly done in every part of Thailand.The word "machine" is normally defined as things that are produced by splitting materials into strips, weaving, knitting, etc. Material splitting is defined as making materials to be strands or streaks for easy weaving. Splitting materials into strips is the first stage of preparing materials for making wickerwork. Splitting materials into strips is normally done using different methods, depending on the characteristics of the material. Materials that areturned to strands or streaks from bamboo, rattan, or Calathea are called strips. Splitting materials into strips is an important step because the strips have to be congruent with the pattern and shape of wickerwork, such as weaving the bottom of the container, which is normally done by using flat strips to create smooth weaving pattern and that is convenient to weave. Weaving has also developed weaving pattern to make wickerwork suitable for use and beautiful. Thailand's weaving has lasted for a long time through transmission from family members been documented in any textbook.

Because the bark of Calathea is shiny and smooth, it is quite difficult to dye them. Dyeing Calathea strips with chemical colors, silk dyeing color,or reed dyeing color, causes several problems. Some of the problems related to dyeing Calathea strips are long hours of boiling, and they twist. If theyhave to be slacken for weaving, they have to be dippedinto clean water and dried with sunlight for many hours. The colors come off and stain the hands during weaving. The most significant problem is the durability of the color of Calathea strip. The color of the woven products of Calathea strips fades. From the experiment, the natural colors from wood vinegar are beautiful color, but they produce only two colors, dark brown and yellowish orange. This provides few alternatives for customers to choose from, but it is suitable for customers that like natural colors. The dyeing process is not complicated because it can be done together with the community groups that make charcoal in the village area. The process helps reduce discoloration while weaving. In addition, the weaved product can be exposed to sunlight without fading. For the problem of wood smoke scent, if Calathea strips are completely dried in sunlight, the wood smoke scent goes away. In summary, the duration of dyeing for Calathea strips with chemical colors is 72–169 hours, whereas that of wood vinegar is 12 hours. This reducesthe time by at least 60 hours. In addition, the experiment shows thatwhen Calathea strips dyed with wood vinegar are dried in the sunlight for 1 month,

their colors do not fade. Color from wood vinegar has betterCalathea dyeing properties than chemical color in terms of the duration and durability;this conclusion is consistent with that of the research of Supchai Jindawutthikun (2018 : 21-23). Currently, natural color is popular and in higher demand. The chemical color produces more eye-catching colors, but if we are concerned about health and environment, natural color does not cause these problems. Therefore, natural color is an alternative that best matches customer needs.

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