Readiness of the Community and Customer Attitudes towards Making Packaging from Coconut Residue: A Case Study of the Kala Ake-Ban Krachom Thong Group

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Abstract

Business and scientific knowledge were integrated with the experience of the community to add the value of coconut residue and reduce the waste problem. Discussions were conducted with the "Kala Ake-Ban Krachom Thong" group in Ban Phaeo district, Samut Sakorn province during the COVID-19 pandemic to evaluate the readiness of preparing packaging from coconut residue using an onsite questionnaire. The attitudes of customers toward coconut residue packaging were determined by informants in Bangkok using an online questionnaire. The statics data was computed, and the Likert scale was used to integrate the result. Results showed that 102 respondents had economic and health problems, with 44% agreeing to prepare packaging from local materials during the pandemic with $\bar{x}$ = 4.26 score. The community then prepared the packaging from coconut residue. The attitudes of customers toward packaging were evaluated (n = 159) by the design, preparation, and pattern attitudes. The design was identified as a priority with $\bar{x}$ = 4.47. The natural look of the product was attractive, and fewer amounts of chemicals were used for packaging preparation. Natural materials; corn starch (adhesive agent) and CMC (formation aid); were added to the coconut fiber residue. The obtained coconut pulp paper was characterized following the Thai Industrial Standard (TIS. No. 170) with properties equivalent to Kraft paper. The coconut paper was optimal for packaging. The packaging prototype was designed, and it was developed further.

Keywords: Community Development, Customer Attitude, Coconut Fiber, Packaging, Agriculture Waste

Introduction

Community enterprises are small business groups in rural areas that organize activities for social benefit. Higher education creates new careers or products by integrating knowledge and technology with local wisdom. The unique goods and products of community enterprises, called "One Tambon One Product"; OTOP, are well-established in Thailand and produced according to local wisdom and community knowledge. Outstanding OTOP products and goods from each community showcase the local potential, knowledge, and different resources (Community Enterprise Promotion Division, n.d.). These products include handicrafts, cotton and silk garments, pottery, fashion accessories, household items, and foods. OTOP products use local wisdom processes, styles, and patterns but market competition has resulted in an economic downturn and purchasing slowdown. Products are no longer attractive to consumers because technological knowledge and skills are outdated. Moreover, the outbreak of the pandemic has impacted economic growth and caused the 'new normal' as unemployment with increased health and economic problems. The exploration of the COVID-19 crisis has negatively impacted on the economy of Thailand. The harsh economic impact of the pandemic and lockdown restrictions is felt mostly to the poor daily earners and those working in private sectors, informal jobs, private business, etc., due to the closure of all business and shopping centers, restaurants, food stalls, and so on, comprising about 7,000,000 workers (Laiphrakpam, Aroonsrimorakot, & Paisantanakij, 2022). The impact community enterprises, for example, decreasing production,

reducing income, losing a job, or laying off employees. Some community enterprises do not expect economic conditions and more difficulties in operating their situations like the economic shock in the crisis. Outside the aid or government funding have played a significant role in supporting community enterprises in economic conditions, including up-skill and re-skill to remain a productive experience during the crisis. Training and activities during the outbreak have encouraged community enterprises to find work, upgrade their skills and gain technical knowledge for future endeavors.

Coconut is an important economic crop with 70% exported to China and 30% consumed within the country (Bangkokbiznews, 2021). Samut Sakhon is ranked in the top three provinces for planting good quality coconut for export. Ban Phaeo District is an important agricultural area of coconut plantations producing the unique and sweet taste of coconut, called "Maphrao Namhom Ban Phaeo" (meaning aromatic coconut). Coconut products include coconut water and coconut milk to make savory and sweet foods. Other products from coconut include bags decorated as souvenirs, furniture (Panalee, Phungpong, & Rodklongtan, 2016), and cosmetics (Penprapai & Chanwan, 2019). Coconut is then one of the crops of Thailand, producing massive residues as waste biomass causing environmental problems. This agricultural waste contains cellulose which can be changed to coconut pulp cellulose for various applications as bio-block, -film, or -concrete), including bio-packaging. We interested to utilize this biomass in the hometown and discussed how to add value to coconut waste for bio-packaging production with the Kala Ake-Ban Krachom Thong community enterprise group in Lak Song Sub-District. This group makes products from coconut shells (Community Enterprise Promotion Division, n.d.). They faced problems of reduced income during the pandemic and wished to create new products from coconut. Somboonpol (2021) stated that community enterprises lack managerial skills, business planning, and specialized knowledge. Marketing knowledge must be applied and integrated with the h know-how to develop coconut residue for a new packaging product as part of the communicational (i.e. promotional) mix (Draskovic, 2007), while packaging also has functional and perceptual components (Hawkins & Mothersbaugh, 2015). Balancing the environment with packaging functions is productive because consumers now show increasing recognition of the impact of packaging on the environment (Silayoi, Malai, Rajatanavin, & Speece, 2003), while green packaging or eco-packaging has become more popular (Azad & Hamdavipour, 2012). Marketing knowledge can help producers to better understand the needs of consumers (Hawkins & Mothersbaugh, 2015). Product presentation should attract consumers, while scientific knowledge can be applied to meet National Standards. This study clarified provider readiness and consumer attitudes toward developing opportunities to produce eco-packaging from coconut residue.

Higher education creates knowledge for the modern-age student in institutes and also serves other functions in all areas of community development of the country and globally (Apostolakis, 2011). In Thailand, the current decrease in student numbers from the changing population structure is a big problem in the education system. Higher education's functions do not only to provide knowledge for students in their institutes and also to serve people in all activities to upgrade their life, both economically and in society. According to the policy of the Ministry, higher education should be driven to increase the ranking of the international standards in a sustainable manner and promote higher education. Many projects of higher education have been funded by government units of the Ministry and others to increase knowledge, technology, innovation, and work in their field of expertise for the country's development. To help solve unemployment and the economic system in local communities from the crisis, the Ministry has launched the integrated Sub-District Economic and Social Upgrading Project, called 1 University 1 Tambon (meaning Sub-District). The project is a big program to serve the role of higher education

in community development by promoting jobs, community-based tourism, environmental conservation, and strengthening community enterprises. The project has helped to resolve student unemployment and provided the budget for the development of the community during the COVID-19 pandemic (Ministry of Higher Education, Science, Research and Innovation, 2021). Higher education integrates their knowledge, technology, and design to develop communities and re-skill/up-skill according to their problems and requirements.

The objective of this research were to apply marketing knowledge of business and science to study the readiness of the community to perform activities during the COVID-19 pandemic, and to reduce waste by adding the value of coconut waste for packaging production. The evaluation of attitudes of consumers towards bio-packaging made from coconut residue. The preparation of coconut waste for packaging was performed via a scientific process that the community enterprise can up-skill in paper making to gain experience during the crisis. The coconut pulp paper was compared to the Thai Standard of Kraft paper to certify the quality of the paper for packaging. Packaging production from coconut waste gave people in the Kala Ake-Ban Krachom Thong community enterprise the opportunity to upgrade their skills, while also reducing pollution from waste biomass in the hometown.

Materials and Methods

This packaging study integrated marketing and scientific knowledge to create a new product for the community enterprise and comprised four parts, as shown in Figure 1. First, we surveyed the readiness of respondents in Ban Phaeo District towards the problems and requirements of preparing coconut pulp paper from biomass residue during the COVID-19 pandemic (August, 2021-March, 2022). Second, we evaluated the attitudes of customers towards bio-packaging and the preparation of coconut pulp paper. Third, the preparation process of coconut pulp paper was designed as training to upgrade skills for the Kala Ake-Ban Krachom Thong community group. Finally, the coconut pulp paper was characterized following the requirements of the Thai National Standard for packaging preparation and produced as a prototype.

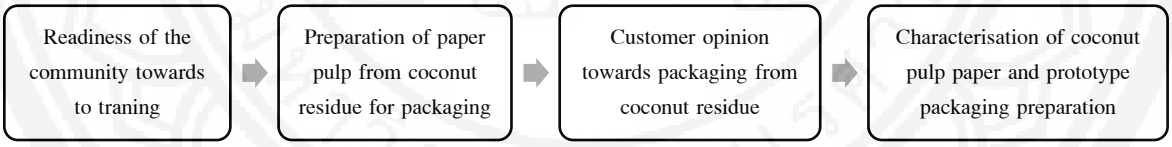

Figure 1 The Conceptual Work.
Source: Designed by Authors.

1. Survey of the Readiness of the Community

Members of the Kala Ake-Ban Krachom Thong community group and residents in Ban Phaeo District (n = 102 samples) were sampled using the Yamane equation to determine sample size. An onsite questionnaire was used which was divided into two parts as follows:

Part 1 asked for demographic information of the respondents including gender, age, education level, occupation, income, expenditure, and identified problems.

Part 2 asked for opinions on problems encountered during the pandemic and readiness to receive training and prepare packaging from coconut residue.

Basic descriptive statics (percentage, mean and standard deviation) were computed for each factor and interpreted using the Likert scale as follows:

(1) Mean 4.51-5.00 means strongly agree.

(2) Mean 3.51-4.50 means agree.

(3) Mean 2.51-3.50 means neutral.

(4) Mean 1.51-2.50 means disagree.

(5) Mean 1.00-1.50 means strongly disagree.

2. Evaluation of Customer Attitudes on Packaging from Coconut Residue

This evaluation investigated consumer attitudes towards bio-packaging and information using an online questionnaire. Data were gathered from 159 informants who lived in Bangkok via purposive sampling. The questionnaire was divided into two parts as follows:

Part 1 asked for demographic information of the respondents.

Part 2 comprised static data evaluated under the three packaging criteria of production, pattern, and production process, interpreted using the Likert scale as described above.

3. Preparation of Coconut Pulp Paper

To evaluate the readiness of the Kala Ake-Ban Krachom Thong community enterprise and customer attitudes, the preparation of coconut pulp paper was first started in the laboratory following Apostolakis (2011), and the coconut pulp paper was second designed as a packaging for holding the tumbler. The preparation procedure was conducted by members of the Kala Ake-Ban Krachom Thong group as follows:

The preparation of coconut pulp paper: Coconut residues were collected in the Ban Phaeo District. The coconut fiber was dried in the air and cut into 1-inch pieces. For pulping, 25.0 g coconut fiber and 5.0 Molar of NaOH (AR grade) solution were mixed. The mixture boiled for 2 hours at 90-100 ^{0}C. After bleaching, the paper pulp was washed with water and the draining was adjusted to pH 7 with hydrochloric acid. Natural materials following the survey recommendation as 5.0% w/v corn starch (from the local market) and 0.5 %w/v carboxymethyl cellulose (CMC, AR grade) was added to coconut pulp. The mixture was blended for 3 minutes to obtain a homogeneous flask of ice. The coconut paper was panned on the sieve and dried in air for 1-2 days. The coconut pulp papers were characterized according to the National Standard Thai Industrial Standard (TIS) No. 170 for Kraft paper.

4. Characterization of Coconut Pulp Paper According to TIS. No. 170

The Thai Industrial Standard (TIS) No. 170 for Kraft paper is the National Standard of paper for packaging. Coconut pulp paper from the community was sent to the Department of Science Service, Ministry of Higher Education, Science, Research and Innovation for characterization and compare the quality to the Kraft paper. Because Kraft paper is used in many products of packaging, the obtained features of coconut pulp paper were used as the packaging design concept.

5. Production of a Prototype of Packaging

The individual packaging was designed, however, the size the of paper was limited. The packaging for holding the tumbler was made following the steps.

- cutting 4 pieces of coconut pulp paper with the size of 11 x 13 cm^2.
- cutting 1 piece of coconut pulp paper with the size of 11 x 11 cm^2.
- sawing the coconut pulp paper (11 x 13 cm^2) completing the box.
- sawing the coconut pulp paper (11 x 11 cm^2) for the bottom of the box.
- sawing 2 paper holders to complete the tumbler packaging.
- using the hot stamp to present the brand or logo (if any).

Results and Discussion

1. Survey of the Readiness of the Community

The coconut residue in Ban Phaeo District is valueless and increases environmental pollution in the area. Ohama, Choomee, Namwong, Wonsawat, Sansiriphan, & Khamphan (2017) were also interested in using coconut residue following the concept of zero waste. The residents in Ban Phaeo District collaborated to reduce pollution and add value to the biomass. Marketing knowledge is important to understand customer behavior when producing goods and services. The problems and requirements of the 102 residents in the community were first surveyed. Residents completed paper questionnaires to evaluate their problems which included a lack of work during the pandemic (Figure 2). The demographic analysis showed that 57% of the respondents were female and more than 50% were married (Figure 3). Most were 26-33 years old, had a bachelor's degree were self-employed. Large family units mirrored Thai traditional living. Monthly household income was 50,000-100,000 THB, with an expenditure of 10,000-30,000 THB depending on the size of the family. We concluded that 44% of the respondents were in debt due to insufficient income, while most relied on a second job to make ends meet.

Figure 2 Respondents Completed Questionnaires Concerning their Problems and Requirements.

Source: Photographed by Authors.

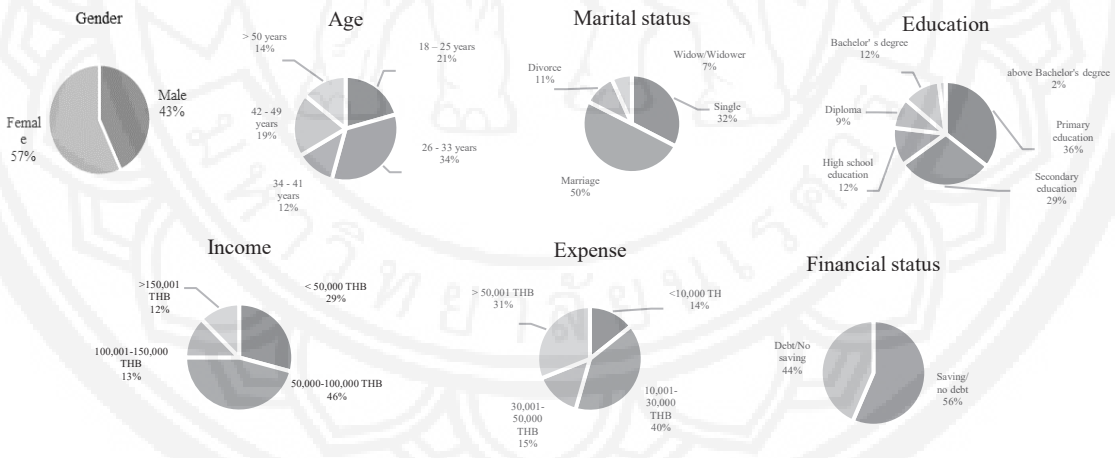

Figure 3 Demographic Information of Respondents Related to Problems and Requirements.

Source: Computed by Authors.

Problems that impacted living standards were evaluated, as shown in Figure 4. The respondents were mainly troubled by health and economic problems during the pandemic. Social distancing, washing hands, wearing a mask in public, and receiving vaccinations were recommended under government policy, while 44% of respondents lacked sufficient income. Almost half were ready to assist in the project to add value to coconut residue through the preparation of coconut pulp paper packaging as a second job or training, as shown in Table 1. Results guided our concept to create a standard product from coconut residue while training the community group.

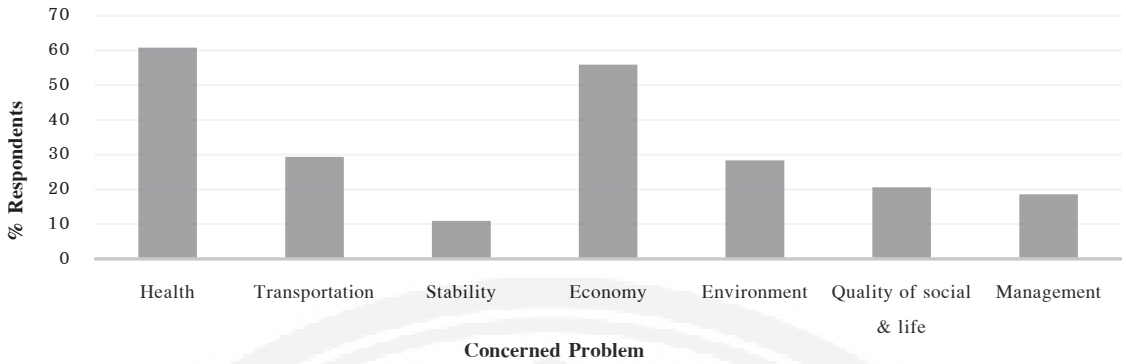

Figure 4 Problems Highlighted by Respondents.

Source: Computed by Authors.

Table 1 Opinions of Residents Towards Work Activity During the Pandemic

Factors	Mean ($\bar{x}$)	SD
1. can increase and provide a stable/permanent income	4.32	0.32
2. can be further developed in the business	4.36	0.34
3. can invest in personnel with a low rate	4.34	0.37
4. employ a raw material or matter in their home/community	4.25	0.35
5. be suitable or consistent with the community environment	4.21	0.35
6. provide products to meet the requirements of the market /customer or have regular customers	4.43	0.31
7. can be done in the local community	4.14	0.36
8. do not destroy the ecosystem or environment of the community	4.29	0.38
9. do not go against the traditions or beliefs of the community	4.35	0.35
10. can participate within the family	4.30	0.38
11. can be done at home	4.34	0.36
12. do not require much knowledge/experience	4.23	0.39
13. do not perform complicated steps	4.20	0.39
14. do not consume much time or affect major occupation	4.26	0.37
15. are supported by private or government agencies	4.13	0.40
16. have an investment fund source with a low-interest loan	4.10	0.41
17. collaboration with the educational institute or education personnel to train the members of the community	4.24	0.39
Score ($\bar{x}$ ± SD)	**4.26 ± 0.36**	

According to the requirements of the respondents, results showed agreed opinions ($\bar{x}$ = 4.26) to get a second job or training due to problems of debt. A job could provide products to meet the requirements of the market with regular customers (maximum score = 4.43). The business could be further developed ($\bar{x}$ = 4.36), while an investment fund with a low-interest loan was minimal needed ($\bar{x}$ = 4.10). In addition, a job could be sustainable and products made from local raw materials were emphasized by the requirements of the customer and consistent with traditional culture. Skill and knowledge were also more important than investment, especially for business start-ups. When the job was sustainable, income would increase while investment could be neglected. To conclude, we decided that a second job did not disturb their normal life or traditional culture. We used local raw materials to add to the coconut residue.

2. Evaluation of Customer Attitudes on Eco-packaging Using Coconut Residue

Evaluation of the attitudes of customers using an online questionnaire was important for market competition due to the outbreak of the COVID-19 pandemic. The sampling focused on generations Y and Z who were mainly university students and graduated students in Bangkok. Younger generations have increasing recognition of the impact of packaging on the environment. From 159 samples, 77.1% were female (Figure 5), 51.65% were 31-40 years old, and 91.1% were single. Attitudes towards packaging were surveyed using the three factors of design, preparation process, and pattern criteria, as presented in Table 2, with a focus on the differences in each factor. The packaging design was investigated using the 3Rs (reduce, reuse and recycle), while the preparation process focused on the safety of individuals and the environment, according to the concept of eco-packaging. The packaging pattern was designed for utility and duration.

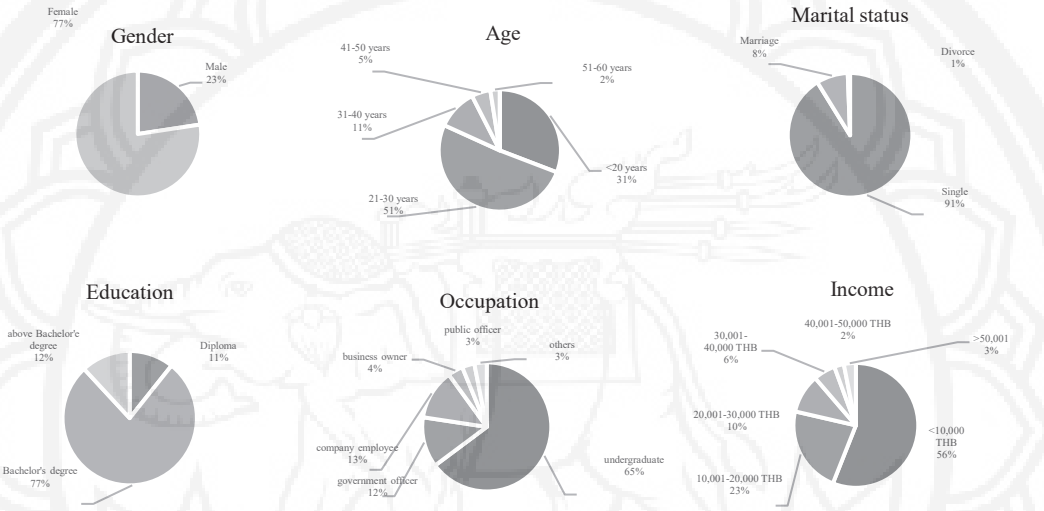

Figure 5 Respondents Demographics.

Source: Computed by Authors.

Table 2 Customer Attitudes Towards Eco-packaging (n = 159)

Factor	Mean ($\bar{x}$)	SD	Interpret
1. Customer attitudes toward the design of a packaging			
- easy to decompose	4.48	0.39	Agree
- environmentally friendly	4.52	0.40	Strongly Agree
- reduce pollution	4.51	0.40	Strongly Agree
- do not reduce resources	4.36	0.37	Agree
- can be recycled	4.47	0.39	Agree
A score of customer attitudes toward the design of a packaging	**4.47 ± 0.39**		**Agree on Design**
2. Customer attitudes toward the preparation of a packaging			
- materials are not influenced by the environment	4.34	0.36	Agree
- consume a small number of chemicals	4.43	0.38	Agree
- produced from local materials	4.28	0.35	Agree
- consume a small amount of water that is treated before draining	4.41	0.38	Agree
- efficient energy consumption	4.35	0.36	Agree
- waste products can be recycled	4.28	0.35	Agree
A score of customer attitudes toward the preparation of a packaging	**4.31 ± 0.35**		**Agree on Preparation**

Table 2 (Cont.)

Factor	Mean ($\bar{x}$)	SD	Interpret
3. Customer attitudes toward the pattern of a packaging			
– can hold heavy material	4.06	0.31	Agree
– requires no colored ink	4.26	0.35	Agree
– lasts a long time to reduce replacement	4.30	0.35	Agree
– can be used for other functions	4.39	0.37	Agree
A score of customer attitudes toward the pattern of a packaging	**4.25 ± 0.34**		**Agree on Pattern**

Results showed that customers preferred design over other attitudes (4.47 ± 0.39), with packaging made from natural raw materials also attractive due to being environmentally friendly and reducing waste in the community. Packaging design that was environmentally friendly and reduced pollution was strongly agreed upon and customers recognized and gave precedence to environmental awareness. Thus, packaging from coconut residue met customer requirements. The preparation process consumed small amounts of chemicals that were not toxic. The packaging was designed with the ability to hold heavy material. Customers placed more importance on package function than dimensions. We concluded that customers recognized the importance of eco-packaging. The market opportunities were interesting and challenging, especially products for generation Y. The reduced use of chemicals in the process was a preferable option.

3. Preparation of Coconut Pulp Paper

The Kala Ake-Ban Krachom Thong group had previous experience in the production of utensils and decorations made from coconut under the brand name *Kala Ake* but did not achieve market success. They were interested in creating a new product by adding value to coconut residue as packaging material. We used technical knowledge to create the packaging from coconut residue. They had some experience in making paper from plants and this activity upgraded the skills of the group. Quality coconut pulp paper as a new product was produced under optimal conditions.

Figure 6 A Meeting between the Authors and Members of the "Kala Ake-Ban Krachom Thong".

Source: Photographed by Authors.

We initiated work on coconut paper preparation on a laboratory scale by transferring marketing and scientific knowledge. The members of the Kala Ake-Ban Krachom Thong group decided to work on sampling and preparation of the coconut residue. Pulping of coconut with sodium hydroxide produced rigid cellulose fibrils that were then mixed with natural additives consisting of corn starch as the adhesive agent and CMC as the formation aid. The preparation process consumed a minimal amount of chemicals and utilized natural substances. Under these conditions, we produced coconut pulp paper, as shown in Figure 7a-e. The paper was brown and looked like a natural product. This eco-friendly paper could be used as Kraft paper. The community also prepared coconut paper following the same procedure in a laboratory (Figure 7f). The quality of preparation and properties of the

paper samples followed the National Standard. The group also made paper under the same conditions, as shown in Figure 8.

Figure 7 Preparation Steps to Make Coconut Pulp Paper on a Laboratory Scale.

Source: Experimented by Authors.

Figure 8 Preparation Steps for Coconut Pulp Paper as a Community Enterprise.

Source: Made by the Community.

4. Characterization of Coconut Pulp Paper According to TIS. No. 170

The Thai Industrial Standard (TIS) is the national standard for products in Thailand, established under the Thai Industrial Standard Institute (TISI) following the policy of the Ministry of Industry, Thailand. The TISI is the body that controls standards for entrepreneurs, manufacturers, or SMEs for the growth of industry, trade, and the economy (Thai Industrial Standard Institute, 2016). Thai standards are developed to ensure consumer protection, while an industrial promotion is competitive in world markets, safeguards environment protection, and preserves natural resources. TIS. No. 170, presented with ISBN. No. 978-974-292-281-8 is the national standard for Kraft paper that is used for various packaging including cement, food, chemicals, consumer goods, flour bags, envelopes, and gift wrapping (Thai Industrial Standard Institute, 2016). The producer must satisfy TIS. No. 170 when making packaging paper. Thus, if a community enterprise wishes to make coconut pulp paper for eco-packaging, the product must be certified for reliability and satisfy TIS No. 170. Coconut pulp papers prepared by community enterprises are characterized by parameters according to TIS. No. 170 at the Department of Science Service (DSS), Ministry of Higher Education Science Research and Innovation which provides a service for standard testing in Thailand. The results of the coconut pulp paper characterization are shown in Table 3.

Table 3 Coconut Pulp Paper Test Results for Parameters of TIS. No. 170

Parameter	Results	Kraft Paper as a Board-type	Test Method
Grammage, g/m^2	353	125 to 335 (±5)	ISO 536: 2021
Bursting Strength, kPa	506	388 to 905	ISO 2759: 2014

5. Packaging Prototype

The quality of coconut pulp paper under selected conditions of grammage and bursting strength was equivalent to Kraft paper as a board type. The physical features of coconut pulp paper were rigid and a little sticky

due to its strengths. Therefore, it was better designed as packaging for holding weighty material. Packaging should be durable but easy to decompose. The concept of individual packaging for the tumbler is shown in Figure 9. A product such as a bag, box, or plant pot would be an example of a new product for the group with multiple functions rather than one purpose. The product design is now in process and the distribution channels will be increased. Eco-packaging is considered more valuable by the consumer but the price is also an essential factor impacting purchasing decisions (Anh, 2017). Consumers are not willing to pay more for green packaging and product pricing must be correlated with low consumer budgets. The lack of information is another barrier to adopting sustainable behavior (Orzan, Cruceru, Bălăceanu, & Chivu, 2018). Imparting information on bio-packaging will help to change this behavior and recognize the need to safeguard the environment.

Figure 9 Prototype of Individual Packaging for a Tumbler.

Source: Made by the Community.

Conclusion

Universities have functions to serve and encourage people in communities to adopt sustainable development of the economy and society. This study was a driving force to promote the recent increase in the role of higher education through the integration of knowledge (business and science) and local wisdom, to effectively solve local issues. Health and economic issues were the main problems of respondents in Ban Phaeo District as a result of the COVID-19 pandemic. Developing their skill and promoting jobs were assisted during the crisis.

The respondents positively received training to make products from coconut residue during the crisis ($\bar{x}$ = 4.26). They were able to work without disturbing their lifestyles or traditional culture. The work could provide products to meet the requirements of the market and could be further developed. For consumer attitudes toward packaging from coconut residue, we found high recognition, especially from customers in generation Y. The sample mostly preferred the design of the packaging ($\bar{x}$ = 4.47). Expectations of customers for packaging included using natural raw materials, few chemicals, and multiple packaging functions. Coconut pulp for packaging used alkaline conditions with natural additives such as corn starch and CMC. The Kala Ake-Ban Krachom Thong group collaborated in the preparation of coconut pulp paper, from sample collection through to the final packaging product. TIS. No. 170 was used to characterize the coconut pulp paper that was equivalent to board-type Kraft paper. The physical features of coconut pulp paper were rigid due to its strength. This work was fabricated the packaging prototype for the tumbler. Further development of packaging as a new product made by the community enterprise under the brand name *Kala Ake* is planned.

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