The Development of Home Textile Product from Hibiscus tiliaceus Fiber

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Abstract: The research aims at the developing and applying Hibiscus tiliaceus fiber for home textile. The study, development and experiment focused on production/ process and properties of fiber, yarn, and fabric. From the experiment, it was found that fiber was removed from the trunk and then water rating could be used successfully for separating fiber from sheath of Hibiscus tiliaceus. The microscopically longitudinal studies showed roughness and flat surface. Fiber width, yarn number and strength of fiber were 0.3 millimeter, 651.9 Denier and 10.93 Newton, respectively. There are three conditions for fiber treatments viz. without treatment, scouring and bleaching treatments. The results showed that yarn number of Hibiscus tiliaceus fiber without treatment was 7,005 Denier. For the scouring and bleaching treatment, the yarn number was 8,343 and 6,061 Denier, respectively. The yarn was spined as "Z" twist and number of twists were 6, 7 and 5 twists per inch. The tensile strength were 134.60, 102.14 and 88.28 Newton. The fabric made from 62 threads per inch of cotton yarn for warp direction and Hibiscus tiliaceus yarn for weft direction shown the tensile strength values of 1695.14, 1435.14 and 1312.23 Newton were found for fabric made from weft yarn of Hibiscus tiliaceus fiber without treatment, scouring and bleaching treatments, respectively. The fabric made from Hibiscus tiliaceus fiber and applied for home textile shown good physical properties and also beautiful of home textile products thus might be superior for textile uses. It is therefore conclusive that the Hibiscus tiliaceus fiber from the research can be developed and commercialized for the home textile.

Keyword: Home textile, Hibiscus tiliaceus, Natural fiber, Natural yarn, Natural products

1. Introduction

Nowadays, it has been widely perceived that there is fierce competition between Thai textile industry and textile industries from other countries such as China, Vietnam and India. The most crucial aspect that facilitates Thai industry to compete with others is to develop researches on new innovation of textile products. Further, these researches must have a capacity to be developed in order to create new textile products. Based on a concept of sustainable development, Thai textile industry is required to change its structure to be in a direction of innovation-driven economy by paying a crucial attention to a development of creative products. Further, this direction of innovation driven economy encompasses many important tasks, such as to create a high quality product, to create market segmentation, to innovate a product that fits to the market demand (consumers' demand), and to add value to a product by integrating local wisdom into the product.

In the present time, many kinds of textile and fibers are brought to be decorative elements in Thai households. By focusing on the development and a way to add value to the textile products in the market, results from this study should be able to bring new insights on current situation of the market and to develop products that fit to demand of the market. As a result, these insights are expected to make the Thai textile industry competing with markets from other countries as well.

A research on the development of home textile product from hibiscus tiliaceus fiber was initiated from an observation of current situation of home textile in Thailand. Generally, the tiliaceus has become one of Thai economic plants since 1968 by stating tiliaceus (Hibiscussabdariffa and Corchoruscapusularis) as the exported plant. After World War II, price of corchoruscapusu-

laris was his due to a problem in production's process. Therefore, many countries had tried to invent fibers from other types of plant to substitute the fiber of corchoruscapusularis. Fiber from hibiscus sabdariffa has invented to substitute the usage of corchoruscapusularis' fiber. While the hibicussabdariffa are planted the most in India, Brazil, Bangladesh and Pakistan, its textile production is normally done in Manchuria, South Korea, China, Taiwan, Philippines, Vietnam and Thailand. The hibiscus sabdariffa was originated in tropical area of African continent, however it was later spread through the United States. Not only the hibiscus sabdariffa is well grown in the tropical area, it is also able to grow in the cold area. For Thailand, there is not clear evidence of when the hibiscus sabdariffa was brought to grow in the country. At the beginning, it was called Chinese hibiscus sabdariffa. Thus, it can be assumed that it must be imported from China or Taiwan. Later, it was named as Thai hibiscus sabdariffa instead. In 1950, there was a widespread of hibiscus sabdariffa planting in the Northeastern Thailand. As a result, a sack weaving factory was founded in AmphoeSikhio, NakhonRatchasima province, in 1953. Due to demands of the market, the industry has expanded ever since.

2.1 Material and Method

The main material for this research is 200 kilograms Hibiscus tiliaceus plants, taken from Takrob, AmphoeChaiya, SuratThani province. The plant age is 3-4 months old. Its diameter is around 5-7 centimeters and its length is between 3-10 centimeters.

2.2 Methodology

2.2.1 Process of hibiscus tiliaceus fiber production

Procedures of hibiscus tiliaceus fiber production are clarified as followings:

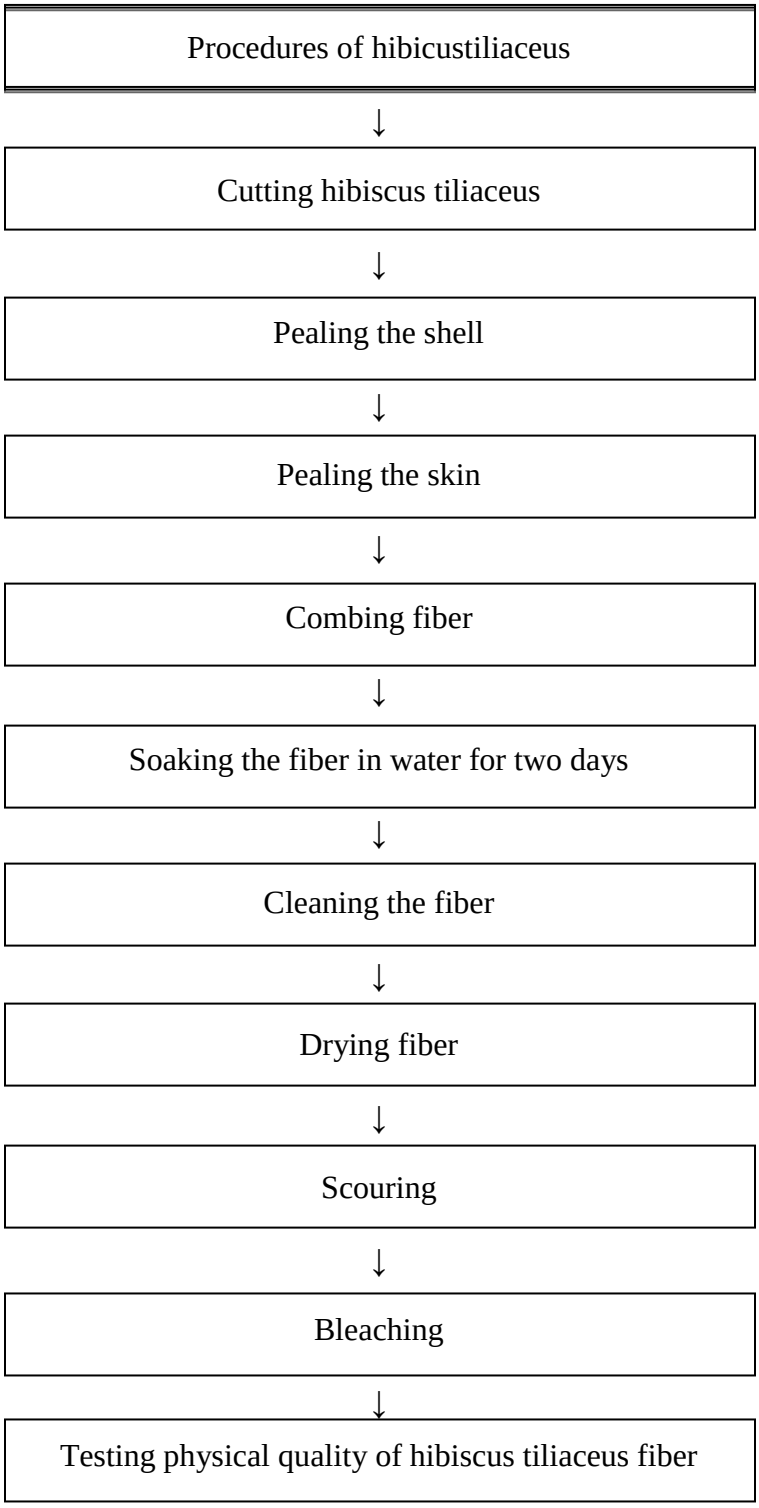


Figure 1: The hibiscus tiliaceus fiber's production

2.2.2 Process of yarn production

In order to produce warp face, this research has adopted hand yarn spinning (Thai local knowledge) by comparing three types of fibers, which are hibiscus tiliaceus fiber, hibiscus tiliaceusfiber-scouring, and hibiscus tiliaceus-bleaching. Further, the research applied CRD experimental scheme in order to study its character and its quality afterwards. Later, the research also tested its quality based on ASTM testing. The procedures are clarified as followings:

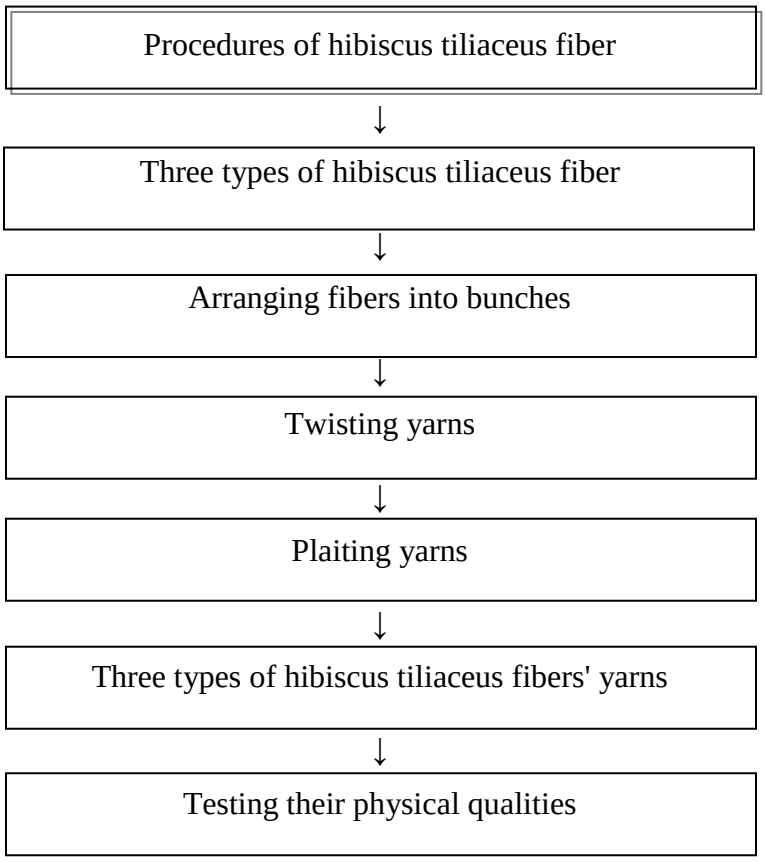


Figure 2: The hibiscus tiliaceus yarn's production

2.2.3 The study of their characters and qualities is operated based on three aspects, which are (1) testing their strength, (2) testing size of the yarns, and (3) counting strands of yarns. Details can be found in the following paragraphs.

1. The test of their strength follows the standard test of ASTM D 2256-02 Standard Test Method for Tensile Properties of Yarn by the Single-strand Method.

2. The test of yarns' size adopts the standard test of ASTM D 1059-01 Standard Test Method for Yarn Number Based Short-Length Specimens

3. Counting strands of yarns adopts the standard test of ASTM D 1423-02 Standard Test Method for Twisting in Yarn by Direct-Counting

2.2.4 Process of fabric production

Process of fabric production made from the hibiscus tiliaceus fiber is as followings

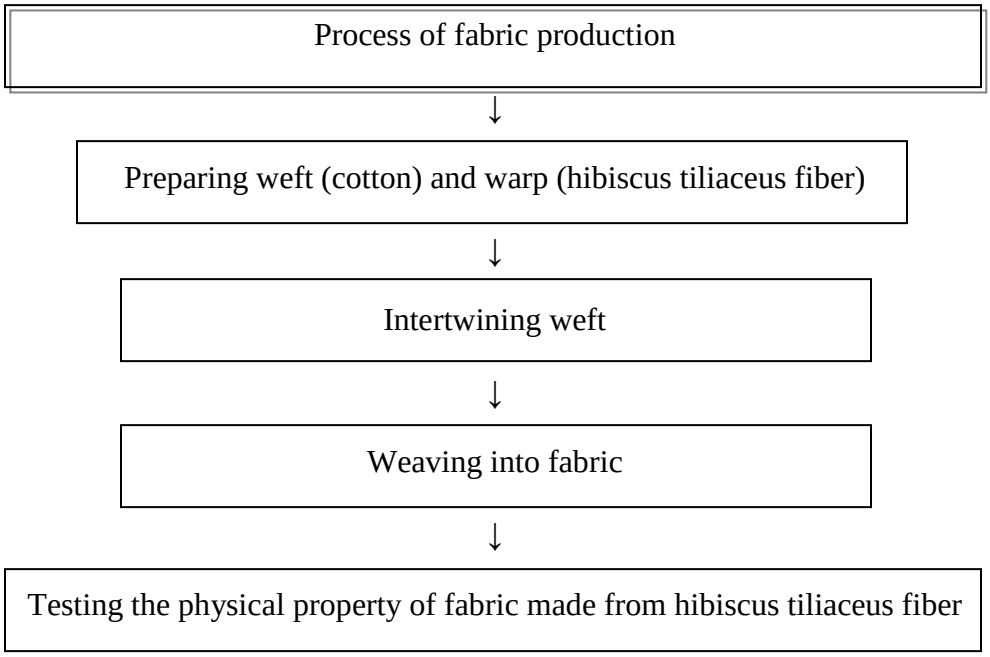


Figure 3: Process of fabric production

2.2.5 The study of characters and properties of fabric made from hibiscus tiliaceus fiber

1. A study of yarn density in hibiscus tiliaceus textile is pursued by applying the standard test of ASTM D 3887-1996 Standard specification for tolerances knitted fabric, Fabric Science.

2. A test of its strength and elongation of the textile fabric adopts the standard test of ASTM D 5034-1996 Breaking Strength and Elongation of Textile fabrics.

3. Results and Discussion

3.1 Botanical character of hibiscus tiliaceus

Figure 4: Hibiscus tiliaceus

Hibiscus tiliaceus has various beneficial aspects. For example, its leaf can be used for medicine to cure wound and chronic wound. The leaf can also be laxative medicine. Its flower can be boiled with milk to cure ear symptoms. Its shell (skin) has a quality to induce vomiting. Its mucilage from the shell is helpful for curing alimentary canal symptom. Its root has a property to cure a cold. Further, it can be use as laxative and urinary medicines. Additionally, its fibers gained from the shell can be used to make robe and paper.

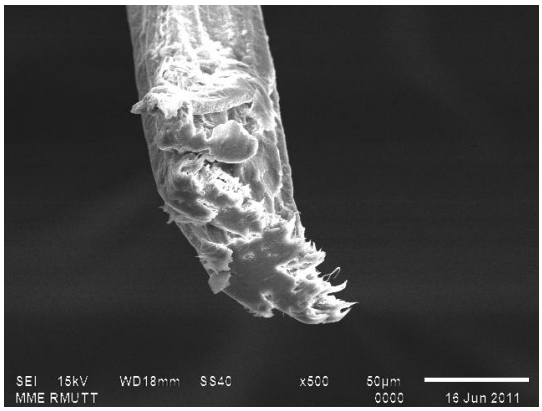
Figure 5: A flower of hibiscus tiliaceus

Figure 6: Leafs of hibiscus tiliaceus

3.2 Physical property of the fiber of hibiscus tiliaceus

Based on a result of hibiscus tiliaceus fiber spreading, its character appears to be a flat long fiber. Its size is 0.3 millimeter. The color is brown. Its cross-section and longitudinal view are demon-

strated in figure 7 and figure 8.



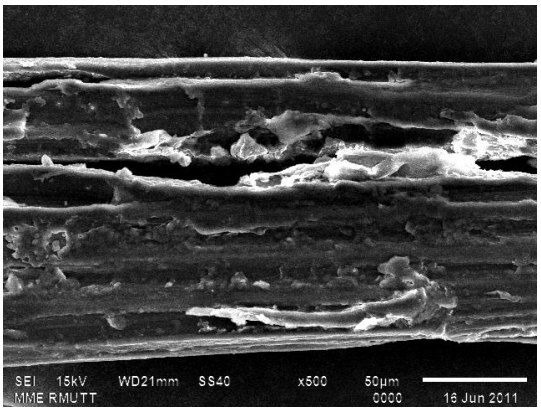


Figure 7: Cross-section of hibiscus tiliaceus

Figure 8: longitudinal view of hibiscus tiliaceus with X500 magnification

Physical properties of hibiscus tiliaceus fiber

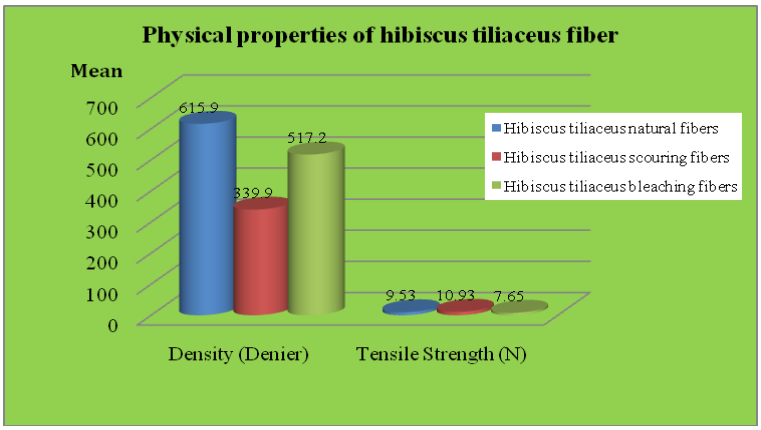


Figure 9: Physical properties of hibiscus tiliaceus fiber

The figure 9 demonstrates that hibiscus tiliaceus fiber after scouring process has a physical properties in terms of its fiber's strength the most. An average mean of its strength is 10.93 newton. The fiber's size is 339.9 denier. The hibiscus tiliaceus fiber comes the second with its strength 9.53 newton. Its size is 6.15.9 denier. For the hibiscus tiliaceus after bleaching, its strength is 7.65 newton and its size is 5.17.2 denier.

3.3 Local enterprise and spinning yarn made from hibiscus tiliaceus fiber

After the process of spreading fiber, the hibiscus tiliaceus fiber is spun by hand following the local knowledge of PrachinBuri province. There are three steps regarding this process. That is - (1) arranging fiber into bunches, (2) twisting fiber into threads, and (3) plaiting threads. Results are clarified as followings:

Figure 10: Material gained from hibiscus tiliaceus fiber

Figure 11: Twisting fiber into yarns

Figure 12: Hibiscus tiliaceus yarns

3.4 Physical properties of Hibiscus tiliaceus yarns

The yarns are tested to observe its physical properties. Results are demonstrated in the following paragraphs.

Table 1: Physical properties of hibiscus tiliaceus yarns

Hibiscus tiliaceus yarns	Yarn Twist	Yarn Numbers (Denier)	Tensile strength (Newton)
Hibiscus tiliaceus natural yarns	6/Z	7,005	134.60
Hibiscus tiliaceus scouring yarns	7/Z	8,343	102.14
Hibiscus tiliaceus bleaching yarns	5/Z	6,061	83.28

The table 1 reveals that size of the hibiscus tiliaceus threads after scouring is larger than the hibiscus tiliaceus natural threads and the hibiscus tiliaceus bleaching threads (8,343 denier, 7,005 denier, and 6,061 denier). Regarding the study of strand, results indicate that the natural threads has 6/Z strands per 1 inch. For the hibiscus tiliaceus threads after scouring, it has 7 strands per 1 inch. The hibiscus tiliaceus threads after bleaching, it has 5 strands per 1 inch. A direction of its strand is Z-turn. The strength of hibiscus tiliaceus natural threads is higher than the scouring and bleaching thread (134.60, 102.14 and 83.28 newton).

3.5 textile weaving made from the hibiscus tiliaceus fiber in industrial level

The weaving of textile is proceeded by rapier weaving machine with a plain weave structure. This process involves three steps. The first step is to prepare weft (cotton), which starts with an intertwining the weft into thread cone and putting thread into each heddle. In each comb, thread needs to be folded with a cone from another side. Later, threads need to be spun into a cartridge in order to make warp. The second step regards a preparation of warp (hibiscus tiliaceus thread). The threads need to be spun into a cartridge. The third step involves a weaving stage. This stage starts pressing a separation of heddles. In this process, the weft from the first section is separated, in which it creates a whole. The cartridge needs to go through this whole. The first section of heddle need to be switched out. Later, the stage involves a lifting of the second section of heddle. In this stage, the warp needs to go back through this whole again. In order to make a textile, one needs to follow the aforementioned steps. Results from the study are discussed as followings.

Figure 13: Intertwining the weft

Figure 14: Weaving fabric made from the Hibiscus tiliaceus fiber

3.6 Physical condition of the hibiscus tiliaceus fabric

Table 2: Physical properties of the hibiscus tiliaceus fabric

The hibiscus tiliaceus fabric	Thickness (millimeter)	Numbers of threads in fabric (inch)	Strength of fabric (newton)
The hibiscus tiliaceus natural fabric	2.94	45	1,695.14
The hibiscus tiliaceus scouring fabric	2.65	49	1,435.14
The hibiscus tiliaceus bleaching fabric	2.38	52	1,312.23

The table 2 reveals that the hibiscus tiliaceus natural fabric has the most thickness level with its mean 2.94 millimeters. The hibiscus tiliaceus scouring fabric comes the second with its mean 2.65 millimeters. For the hibiscus tiliaceus bleaching fabric, it has the least thickness level with its mean 2.38 millimeters. In the aspect of numbers of yarns, the data indicates that the bleaching fabric has the most yarns with its mean 52 yarns per 1 inch. The scouring fabric gains the second position with its mean 49 yarns per 1 inch. Among the three, the natural fabric has the least with its mean 45 yarns per 1 inch. Regarding the weft, the three fabrics have equal numbers of yarn, which are 62 threads per 1 inch. The strength of hibiscus tiliaceus fabric, the result points that the natural fabrice has the strength than the scouring and bleaching fabrics (1,695.14 newton, 1,435.14 newton and 1,312.23 newton).

3.7 The Development of hibiscus tiliaceus fabric into commercial product

After the textile production, the hibiscus tiliaceus fabrics were brought to make home product, which is a set of living room products. The set composes of sofa, carpet, curtain and lamp. In order to compete with other products in line in the market, the textile products are developed and designed to improve a quality. Further, the design is based on a long term use.

Fabric 15: Living room products made from the hibiscus tiliaceus fabric

4. Conclusion

The result from home textile product development by using the hibiscus tiliaceus fiber is presented in a form of living room products, which are a sofa, a carpet, a curtain and a lamp. The design is set to deliver sophisticated outcome, which can be used in a long term. Further, the research also create career and income for groups of farmer in the southern part of Thailand. The result from this research also reflects well collaboration among academics, researchers, local enterprises and textile industrial enterprise, who are willing to develop and improve quality of products that can compete other products in line from both national and international market.

5. Acknowledgement

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