

Project: Development of Textile Products from Vetiver Grass Fiber

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Abstract

The researcher was studied the properties of vetiver grass, biomaterial from agriculture for developing textile products from vetiver grass fiber using a chemical process to extract cellulose and remove chlorophyll, resulting in cellulose lengths of between 3 to 10 centimeters monitored by microscope. The long section fibers are in bundles and cross-sections of vetiver fiber in polygon-shaped group. The vetiver fibers are hirsute, shiny, non-sulky and inflexible. The vetiver fiber size is rather large, strong, and tough with a tenacity of 2.11 grams per denier, which is stronger than wool but not as strong as cotton fiber. When the fiber is wet properties are poor flexibility and toughness. To produce good-quality fiber, it must mixed with cotton fiber in a ratio of 50:50 by hand carding, then using a machine until the fibers are aligned and spun into yarn with a spinning wheel, resulting in thread that is large as fancy yarn suitable for a weft. The vetiver is put in a loom weaving in the thread by using a cotton wrap and vetiver fiber weft, using a small textile machine for blue viscose rayon warp and the vetiver thread weft. The result is a new style of vetiver cloth, with the structure of the fabric quite thick with a rough texture like hemp which looks distinctive and outstanding, and which may be used for many products such as women's dresses, place mats of dining table and other uses.

1 Introduction

The researcher works at the Pikun Thong Royal Development Study Centre, is familiar with the agriculture problems facing realizes the value of natural resources, and recognizes the importance of preserving and protecting the environment and reducing pollution. From beginning, the Pikun Thong Royal Development Study Centre was made up of swamp land which could not be used for agriculture. Thus, the Study Centre initiated the idea for this area for learning and experimentation in agriculture and many projects for raising the standard of living for people to become more self-reliant. In particularly, the Agriculture House–Muno Livestock has successfully supported integrated farming and cultivating vetiver grass to improve poor-quality acidic soil and has become a learning center for integrating agriculture or new theories of the Office of the Royal Development Projects Board’s Royal Development Projects by planting vetiver grass around lemon trees at the rims of wells, covering soil with cut vetiver grass, producing and making manure, corral roofs and handicrafts. Moreover, there are numerous ways to create value and other benefits. This study looks at creating value–added products by extracting fibers as raw material in the textile industry for the sustainable development of vetiver grass.

At present natural fibers are insufficient in the Thai textile industry, so we have to find new types of natural fiber because textile products are important Thai exports. Therefore, developing of textile products using vetiver grass is an alternative for both industry and consumer. Thailand produces hand-made textile handicraft products using folk wisdom with some simple tools, using machines in the textile industry for export. Thailand has developed every aspect of the industry manufactures, with following modern fashions. This research is consistent with the Government’s research strategy of sharing knowledge and folk wisdom to add value while preserving local environments that lead to sustainable development in communities.

2 Objectives

1 To produce vetiver grass fibers as a raw material in the textile industry with simple manufacturing processes by using weaving looms and textile machinery so that it can be widely used in the future

2 To find new types of textile industry fibers without damaging the environment

3 To promote an identity for vetiver grass cloth in the textile industry

4 To make worthwhile use of natural resources, increase the value of agricultural waste - especially vetiver grass for textile industrial material – so that vetiver will be in demand and can be traded like general agricultural commodities

3 Research Processing

1 Data survey - Explored cultivation in the Study Centre using a plot for integrated farming called “80 Year King’s Anniversary” to restore degraded soils and improve acidic soil, especially the extension of the Center House Agriculture-Livestock Muno, Bunyan sub district, Tak Bai district, Narathiwat.

2 Extraction of vetiver fiber - Evaluated the properties of vetiver fiber by softening the vetiver leaves by beating (pounding) then used the slim bamboo to scrape the chlorophyll out, leaving only fibers; ferments the leaves in water for chlorophyll decomposition by microorganisms that exist in nature which takes a long time; and boiling the leaves in a solution of sodium hydroxide which is the easiest and most affordable way to extract vetiver fibers.

Fiber extraction process

2.1 Cut vetiver leaves age about 5 to 6 months from the farmers’ Learning Center House Agriculture-Livestock Muno, Bunyan sub district, Tak Bai district, Narathiwat.

2.2 Cut vetiver leaves to 5 to 10 centimeters of 250 grams

2.3 Boil vetiver leaves in a solution of sodium hydroxide concentration of 15 gram per liter of water at 100^oC for approximately 60 minutes, filter and clean vetiver fiber with water

2.4 Soften vetiver fiber at room temperature for 20 minutes, squeeze out the water and air which can yield 2 to 3 grams with 3 to 10 centimeters. Use 100x microscope monitoring long sections (the tubular cell line as well as a bunch) and cross section (polygonal cells that coalesce into groups) are similar to pineapple and hemp fiber with tenacity of 2.11 force grams per denier, standard for natural fibers

3 Fiber carding - carded vetiver grass fibers by hand two times so that the fibers did not stick together cotton and vetiver weighing 1000 grams are mixed in the ratio of 50:50 and the vetiver grass fibers were carded by machine three times, with the machine rolling with spikes to produce parallel vetiver fiber lab sheets.

4 Thread spinning - Spun lap sheets with an ancient craft spinning wheel, always used for spinning natural fibers such as wool, silk, cotton, and polyester fibers the Thai weaving community, Nong Sakae, Tambon Kao Chai Thong, Nakhon Sawan, producing fancy yarn measuring 140.58 tex (1265.22 denier).

5 Weaving

5.1 Hand looms use traditional folk wisdom that has been handed down since ancient times by the Thai weaving community at Nong Sakae, Tambon Kao Chai Thong, Nakhon Sawan, using cotton warp 6 heddles and a vetiver grass thread as weft to made *lukkaew* style which can produce fabrics 29 inches wide and 8 yards long

5.2 Weaving with Iwama Loom machines is used mainly in the small textile industry and used for teaching in classroom lessons of Professor Manoon Chitchaichum, Vice Dean for General Affairs in the faculty of the Textile Industry of Rajamangala University of Technology Krungthep to produce yarn fibers Viscose Rayon Dyed in blue, 2 heddles as warp and use vetiver grass as weft. Woven fabric

face is 40 inches wide and 7 yards long. During weaving the yarn is easily torn due to a bobbin threads becoming knotted, and unsmoothed.

6 Analyses

6.1 Vetiver fabric test cloth weight is weighed using ISO 3801:1977, a laboratory temperature for 24 hours, cut to a diameter of 11.3 centimeters for three sample pieces of each weighed one by one: if made from hand loom an average weight of 266.9 g/m^2 , if made from textile machinery an average weight of 192.0 g/m^2 . The vetiver fabric is quite heavy and the vetiver fabric made by hand loom is thicker cloth with bigger thread than made by textile machinery because made cloth by hand loom has more gaps.

6.2 Testing of yarn in the fabric using ISO 7311:1984, a laboratory temperature for 24 hours, cut to 5 x 5 centimeters for three sample pieces and laid on pick glass frame 1x1 inch, made by hand loom can count woven cloth with warp 45 lines/inch weft 35 lines/inch if made by textile machinery has a warp 93 lines/inch and a weft 23 lines/inch. The results show that the warp yarn is smaller but greater quantity than warp and that warp yarn is more threaded than weft yarn so with a smaller quantity of yarn the surface was thicker and coarser.

6.3 Testing the tensile strength of the fabric win ISO 13937-1:2000, a laboratory temperature for 24 hours, cut line parallel to the warp size 5x30 centimeters for 10 pieces, and cut the fabric, parallel to the weft size 5x30 centimeters for 10 pieces. We can obtain the results of the tensile strength of vetiver cloth made by hand loom of 471.8 Newton, but made by textile industrial machinery give us 382.28 Newton, which shows that the fabric made by hand loom is stronger than made by textile industry machinery.

6.4 Testing the tearing strength of the fabric with ISO 13934-2:1999, a laboratory temperature for 24 hours, cut thread up parallel to the transverse diameter of 50 millimeters, length 200 millimeters wide at the middle, cut slits 100 millimeters for

5 pieces, results in a tearing strength of vetiver cloth made by hand loom of 46.1 Newton, but that made by textile industrial machinery of 50.64 Newton, which shows that the fabric made by hand loom is more flexible and durable than that made by textile industry machine.

4 Utilization

Handicrafts and industrial products made from vetiver fabric are of good quality with a thick structure, fair in strength with a surface texture the same as hemp fabric with unique characteristics suitable for special design for unique and exotic products for this research:

1 A blouse, an A–shape skirt with *lookkaew* brocade. Because the vetiver grass cloth surface is rough. The wearer may feel irritation so the tailoring is extruded with fabric glue and a secondary lining layer to prevent irritation.

2 A tablecloth of 36 x 50 inches and placemats. Because the fabric has quite thick threads and an exotic texture - especially made by hand loom - extrusion with fabric glue and sewn with fabric trimmed in gold and flowers with acrylic paint give the products greater value.

3. Framed wall photo decorations; to embroider or oil color paint onto a vetiver grass fabric, fitted in wooden frame as valuable wall decoration products.

5 Development

1 Testing various properties of vetiver fabric for choosing appropriate applications

2 Studying production fabric processes and industry trends or handicrafts for assessing value

3 Testing various properties of vetiver fabric for home textile products and fabric insulation applications

4. Finding trade channels for developing vetiver grass fabric products and increasing community income

5 Studying special properties and added features of vetiver grass fabric for other applications such as chemical fire protection

6 Summary

This study found that vetiver grass, agriculture waste, can be used as raw material in the textile industry like the renewable natural fibers such as hemp and pineapple fiber, but with greater value. The most suitable method is to boil vetiver leaves in a solution of sodium hydroxide concentration of 15 grams per liter of water at 100°C for 60 minutes. The results showed that the sodium hydroxide solution, timing, and temperature affect fiber quality. Concentrations greater than 15 g/L of sodium hydroxide solution made fibers decompose; concentrations less than 15 g/L sodium hydroxide solution remove chlorophyll. If boiling takes less than 60 minutes the chlorophyll cannot be removed; if it takes more than 60 minutes, the fibers will rot. The process of extracting fibers should be controlled carefully to get best and toughest fibers. Fiber properties can be adjusted by a chemical substance or mixing with other fibers. The alternative is to use another weaving method such as woven fiber or satin makes the fabric look even sleeker. Weaving and scratching fabric will make it softer, making vetiver fiber fabric 100% by a hand loom can result in large, inflexible threads with no kink which must be mixed with 50% for increased properties suitable for weaving folk or women weaving traditional cloth. Supan Buri and Nakhon Sawan are facing a shortage of natural fibers and have to buy at high prices and cannot control fiber quality.

The vetiver fiber fabric is one of their options which they can weave by themselves and has own unique identifier design and looks the same as hemp but the process of tailoring the extruder with fabric glue and a lining layer to prevent skin

irritation makes it comfortable to wear. It is expected that vetiver grass may be used in the near future.

Table 1: Vetiver added value

Vetiver	Quantity (kg)	Amount (THB)	User
manure	5	50	Agriculture
roofing	5	100	Agriculture
basket product	1	300	All occupational groups.
vetiver grass yarn	1	600	Weaving Handicraft Group
vetiver cloth	1	1,200	Designers.
clothes	1	2,400	All occupational groups

7 References

- ความเป็นไปได้ในการแยกเส้นใยจากกากหมากนวล. (ออนไลน์). เข้าถึงได้จากเว็บไซต์ http://web.en.rmutt.ac.th/te/index.php?option=com_content&task=view&id=34&Itemid=28, สิงหาคม 2545
- ความรู้และเทคโนโลยีสิ่งทอ : เอ็มเทค. (ออนไลน์). เข้าถึงได้จากเว็บไซต์ http://www2.mtec.or.th/th/research/textile/textile_sci.html, 25 สิงหาคม 2557
- เครื่องทอผ้าอัตโนมัติ Teaching-glossary. (ออนไลน์). เข้าถึงได้จากเว็บไซต์ http://www.neutron.rmutphysics.com/teaching-glossary/index.php?option=com_content&ta, 4 พฤษภาคม 2557
- เครื่องนุ่งห่มไทย. (ออนไลน์). เข้าถึงได้จากเว็บไซต์ http://www.thaifita.com.thaifita/Portals01/file/ascn_yarnth.doc, 27 มีนาคม 2556
- ชาญชัย สิริเกษมเลิศ, ดร. นวัตกรรมเส้นใยรักษ์โลก : เส้นใยบัวหลวง (Lotus fibers). (ออนไลน์) เข้าถึงจากเว็บไซต์ <http://www.ttistextiledigest.com/articles/technology/item/3860-lotus-fibers.html>, 14 พฤศจิกายน 2556
- ฝ่ายวิชาการ สำนักงานพัฒนาที่ดินเขต 3 จังหวัดนครราชสีมา. “หญ้าแฝก กำแพงชีวิต” (ออนไลน์). เข้าถึงได้จาก www.doae.go.th/library/html/detail/grass2.htm, 20 ก.ย.2556.
- วิเคราะห์ทดสอบสิ่งทอ. (ออนไลน์). เข้าถึงได้จากเว็บไซต์ <http://www.thaitextile.org/lab/content.php?id=ARC0121005162032&lang=th>, 25 สิงหาคม 2557
- Textile Digest. (ออนไลน์). เข้าถึงได้จาก <http://www.ttistextiledigest.com/articles/new-products/item/3214AD.html>, 8 กุมภาพันธ์ 2554

8 Illustration



Figure 1 cut grass was 5 to 6 months.



Figure 2 cut vetiver grass 5 to 10 centimeters



Figure 3 Sodium Hydroxide (NaOH)



Figure 4 chemical weighing

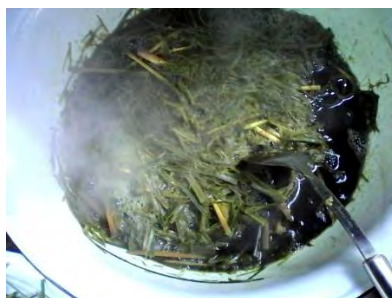


Figure 5 boiled vetiver grass in a solution of sodium hydroxide



Figure 6 filtrate and rinse until clean



Figure 7 air dry



Figure 8 carding vetiver fiber by hand



Figure 9 microscope monitoring



Figure 10 long section

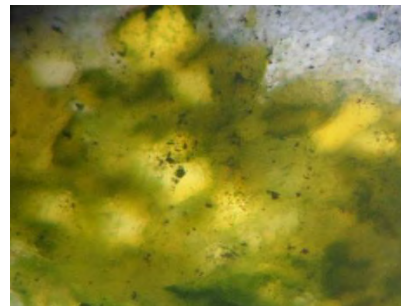


Figure 11 Cross section



Figure 12 mixing cotton and vetiver fibers of 50:50 ratio



Figure 13 carding by machine



Figure 14 Spinning with spinning wheel



Figure 15 vetiver grass yarn



Figure 16 Weaving Loom



Figure 17 Vetiver fabric made by weaving loom



Figure 18 *Lookkaew* fabric



Figure 19 Iwama Loom machine

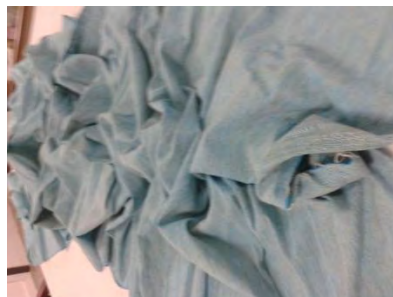


Figure 20 Textile Industry Machine

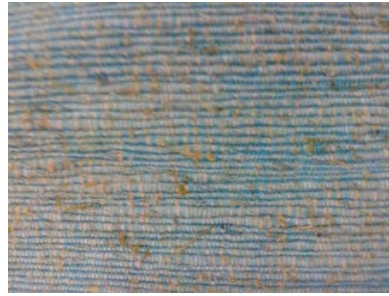


Figure 21 woven fabrics of cotton



Figure 22 designing



Figure 23 painting



Figure 24 vetiver fabric placemats



Figure 25 designing a dress



Figure 26 decorative wall frames



Figure 27 counting yarn



Figure 28 strength testing of fabric per length unit



Figure 29 hemp fabric



Figure 30 vetiver grass cloth