TEXTILE PROPERTIES OF SANSEVIERA CYLINDRICA

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ABSTRACT

Using descriptive-evaluative research design, this study aimed to spin the Sanseveria cylindrica fiber, to determine the physical properties of blended Sanseveria cylindrica yarn in terms of breaking force, actual blend ratio, yarn number and twist direction, and to evaluate the yarn as to quality for textile materials.

The findings were as follows: The spinnability of the fiber sample blended with polyester yielded yarn count of 21.54 Ne; the physical property test of the polyester/Sansevieria yarns in the twist direction of the yarn was Z twist with 668 twist count per meter (tpm); the yarn properties of the polyester/Sansevieria yarn possessed acceptable properties comparable to polyester/pineapple and polyester/water hyacinth which was successfully used for clothing and apparels.

The researchers concluded that the blended yarn exhibited yarn realization with a minimum ends down; the blended yarn is strong due to higher number of twist per meter; the blended yarn possessed acceptable properties comparable to polyester/pineapple and polyester/water hyacinth which was successfully used for clothing and apparels.

The researchers recommend that other natural fibers be blended with Sanseveria cylindrica; that different degumming treatments be used to give the most satisfactory performance during spinning; that weaving of yarns be undertaken to assess the economic viability of Sansevieria cylindrica for textile material.

INTRODUCTION

The textile and garments sector in the Philippines is a vital part of the country’s economy. The industry expanded rapidly during the 1960’s and 1970’s but has recently experienced a decline. This has been due to mainly to tougher conditions in export market and failure to invest in new manufacturing technology.

Considering its geographical condition, the Philippines is strategically suited for natural fiber production. Development of natural fiber is in consonance with the Republic Act 9242, which prescribes the use of Philippine tropical fabrics for official uniforms of government officials and employees and for other purposes. All fabrics to be used for uniforms and for other purposes shall contain at least five percent-weight of abaca, banana, and pineapple; 15 percent-weight of silk. All of these components should have passed the test and certification of compliance by PTRI-DOST, the certifying agency. Yet, one of the bottlenecks of the textile
industry today is the insufficiency of raw material supply and modern high-tech machinery to upgrade the characteristics of the natural fiber in order to compete with the synthetic fiber. Thus, investigation, production, and development of viable sources of fibers should be developed and sustained.

_Sanseviera cylindrica_ or _Spear Sanseviera_, a native of South Tropical Africa and Natal, is one of the more interesting sansevieras that are grown on the ground. This plant has rigid leaves reaching about five feet in height and about one and one fourth inches in diameter. Like all sanseverias this plant is easy to culture. It is well-suited to the home environment. The Cylindrica nature of the leaf apparently occurs due to a suspension of dorsi-venral symmetry, which procedures a true top and bottom in most leaves. Instead, the ‘precursor tip’ produced during the earliest stages of leaf development (usually small in most species) enlarges without breaking radial symmetry. The flowers are white tinged with pink measuring one and half inch.

Moreover, _Sanseveria cylindrica_ grows easily and tolerates a wide range of conditions with the use of a soil consisting of three parts to one part sand. The plant is very tolerant to drought. It is watered about every other week during the growing season. It can be fertilized once during the growing season. During the winter months it is watered once a month.

Furthermore, _Sanseveria cylindrica_ is propagated by cuttings or by divisions taken at any time. Cuttings should be at least 3 inches long and inserted in moist sand. A rhizome emerges at the cut edge of the leaf. (http://www.plantoftheweek.org/listserv.shtml.)

Based on previous findings that _Sanseveria cylindrica_ fiber could be processed into yarn, the researchers undertook this study to determine further the properties of yarn that could be turned into fabrics that will compete with the existing natural fabrics.

**Conceptual Framework**

This study was based on the initial assessment that _Sanseveria cylindrica_ can be processed into yarn based on the exhibited fibers’ properties of the fibers.

Spinning is an operation that converts fibers into yarns, which could either be in pure form or in blend with other textile fibers, natural or synthetic. Processes ability of fiber into yarns will validate further the textile value of the fiber and will measure the effectiveness of the pretreatment conditions of the fibers.

The concept of the study with the Input-Process-Output (IPO) model is illustrated in the paradigm below.
Statement of Objectives

The main concern of this study was to determine the physical properties of Sanseveria Cylindrica yarn for textile materials. Specifically, this study aimed:
1. To spin the Sanseveria cylindrica fiber;
2. To determine the physical properties of blended Sanseveria Cylindrica yarn in terms of:
   a. breaking force
   b. actual blend ratio
   c. yarn number
   d. twist direction;
3. To evaluate the yarn as to quality for textile materials.

RELATED LITERATURE

Sanseveria cylindrica or Spear Sanseveria, a native of South Tropical Africa and natal, is one of the more interesting sanseverias that we grow the ground, rigid leaves reach about 5 feet in height and are about one and one fourth inches in diameter. Like all sanseverias they are easy to culture and well suited to the home environment. The Cylindrica nature of the leaf apparently occurs due to a suspension of dorsi-ventral symmetry, which procedures a true top and bottom in most leaves. Instead, the ‘precursor tip’ produced during the earliest stages of leaf development (usually small in most species) enlarges without breaking radial symmetry.
The flowers are white tinged with pink measuring one and half inch. *Sanseveria cylindrica* is propagated by cuttings or by divisions taken at any time. Cuttings should be at least 3 inches long and inserted in moist sand. A rhizome emerges at the cut edge of the leaf. (http://www.plantoftheweek.Org.listserv.shtml.)

Yarn is a long continuous length of interlocked fibers, suitable for use in the production of textiles, sewing, crocheting, knitting, weaving, embroidery and rope making. Thread is a type of yarn intended for sewing by hand or machine. Modern manufactured sewing threads may be finished with wax or other lubricants to withstand the stress involved in sewing. Embroidery threads are yarns specifically designed for hand or machine embroidery (http://en.wikipedia.org/wiki/Yarn)

Physical properties are the inherent strength and behavior of yarn under applied force, which determine the mechanical service ability or usefulness in commerce. For some products, like cordage and handicrafts, they alone determine the suitability of as fiber for such uses. For other products, such as pulp, paper and textile, physical, together with chemical properties of fibers/yarns, is a factor in the evaluation of the suitability of a fiber/yarn for a particular use.

Hence, while fiber length and fiber fineness are the two most important factors in the production of yarn on ring spinning machines, in rotor spinning it is the fiber tenacity and elongation of fibers which are predominantly important for successful spinning. In the rotor spinning method, fiber length plays a secondary role (Schenek, 1993).

In the processing of hemp as a natural product, from a straw-like, agricultural product to high value raw material for modern industrial sectors, development of processing technology is required which facilities a design of the fibers, corresponding to processing possibilities (cotton spinning), and the desired end product (yarn). The requirement is that the profile of hemp fibers should strongly resemble that of cotton to avoid any extensive modifications of cotton machines (Nebel 1994).

Moreover, in the study of Hagad (2003), spinnable form of Dracaena sp. Fibers were already successfully converted into textile material, specifically for suiting, thus giving an indication that yarn displaying similar properties can also be converted into similar material. In the preparatory process (after carding and drawing), there is a recordable wastage of about 13% to 17%, which is slightly above the acceptable norm of 11% to 15%. This could be possibly attributed to the fiber drops during carding. The actual blend ratios of the resulting yarn from PE/Dracaena sp.blend were lower by 16% to 20% from the targeted theoretical blends.

Furthermore, the spin ability of the treated fiber was determined as a further measure of the effectiveness of the pretreatment method employed on the fiber. The spinning performance exhibited by the treated Dracaena sp.fiber in blend with polyester fibers at different blend ratios gave an indication of the extent of the fiber’s spin ability to yarn as well as its most –likely end use. The produced yarns are relatively coarse thus limiting the end-use of the fiber.

In the study of Marin, et al. (2011), water hyacinth (*Eichhornia crassipes*) as a potential source of fiber for yarn manufacture. Results showed that the yarn from the combined woolenization-degumming treatment exhibited fewer and higher yarn realization with acceptable technical properties.
In the study of Agacaoili (2001), anabo fiber reveals its possibilities for use as raw materials for textile, pulp and paper making. The physical property that was tested indicated its potential for textile use. The fiber is capable for yarn manufacturer, pulp and paper making of its acceptable inherent properties.

The above mentioned studies and literature are related to the present study on potential fiber for yarn manufacture. They were used in the conceptualization and also in the interpretation of the results of this study.

METHODOLOGY

This study used descriptive evaluative research design. This study involved the extraction of fibers from the leaves of sanseviera cylindrica plant and spinned the fibers into yarn and further assessed the textile properties of fiber for yarn manufacture.

The tested fibers were subjected to fiber pretreatment to convert the fiber into spinnable form through combined chemical and mechanical treatment.

The treated fiber samples were also blended with polyester which gave an indication of the fibers spin ability into yarns.

The researchers gathered 316 Sanseviera cylindrica stalks at Php18 per stalk (Total = Php5,688.00) from Talogtog, San Juan, La Union. The extraction of the fibers was done at the Philippine Textile Research Institute (PTRI), Bicutan, Taguig, Metro Manila, using the electric decorticating machine. The spinnability test, the pre-treatment of the fibers, the physical property test, and the evaluation of the yarn were also conducted at PTRI in October 2012. The results were retrieved in December 2012.

Table 1 shows the tools and equipment used in extracting, spinning, and testing the physical properties of the yarn. The tools were provided by the researchers and the equipment were from the PTRI.

Table 1. List of Tools and Equipment

<table>
<thead>
<tr>
<th>A. Tools</th>
<th>Function(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knife</td>
<td>Used to cut the stalks</td>
</tr>
<tr>
<td>2. Gloves</td>
<td>Used to protect the hands during harvesting</td>
</tr>
<tr>
<td>3. Flask</td>
<td>Used to dissolve the sanseviera yarns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Equipment</th>
<th>Function(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Decorticating Machine</td>
<td>Used to extract Sanseviera cylindrica stalks</td>
</tr>
<tr>
<td>2. Miniature Cotton</td>
<td>Used to test the spinability of the Spinning fibers</td>
</tr>
<tr>
<td>3. Mini-carding Machine</td>
<td>Used to produce slivers.</td>
</tr>
<tr>
<td>4. Spinlab Stelometer</td>
<td>Used to test the breaking strength of the yarn</td>
</tr>
<tr>
<td>5. Twist Counter</td>
<td>Used to determine the number of turns of the yarn</td>
</tr>
<tr>
<td>6. Wrap Reel Apparatus</td>
<td>Used to determine the yarn count</td>
</tr>
</tbody>
</table>
PROCEDURE
This study underwent four phases:

Phase 1: Raw fibers were extracted from sanseviera cylindrica stalks with the use of electric decorticating machine. The sanseviera cylindrica stalks were harvested during maturity. The stalks were cut at the base of the plant using a knife. About three hundred sixteen (316) pieces of Sanseviera cylindrica stalks were harvested (47 kilograms). After harvesting the sanseviera stalks were brought to PTRI for fiber extraction using the electric decorticating machine. After extraction the fibers were washed immediately with clean water, and then dried under sun until completely dried. The fibers will cleaned thoroughly and air-dry for one day. The weight of the dried fibers will be taken.

Phase 2: This involved the evaluation of the fiber properties such as tensile strength, fineness/denier, fiber pretreatment and residual gum content.

Phase 3: Spinnability testing. The fibers were spun into yarn and these were then tested and evaluated using the Standard Method of the PTRI.

Spinning of the Sanseveria stalks was done at the Philippine Textile Research Institute. The actual fiber blend ratio was tested using the AATCC Test Method 20A-1989: Seventy percent Sulfuric Acid. The Uster Tensorapid 3 (CRE) was used to measure the elongation of the yarn following the ASTM D 2256-97. The Wrap Reel Apparatus was used to determine the yarn count.

Phase 4: Yarn physical properties test and evaluation. The test and evaluation of the yarn were conducted at the PTRI testing laboratory using relevant international standards.

- Yarn Number. Yarn number was evaluated using the skein method wherein a pre-set length of yarn were wound on a reel as skein and weighted. The yarn number was calculated from the mass obtained and the length of the skein as specified per ASTM D 1907-2001.

- Breaking Strength. The specimen was placed in the clamp of tensile testing machine, stretched or loased until broken and the breaking strength was observed per ASTM D 2256-2002.

- Actual Blend Ratio. Cut samples of polyester/sanseviera yarns were put in a flask containing 70 percent sulfuric acid and agitated in a mechanical shaker for 30 minutes. The acid solution dissolved the cellulose (sanseviera) leaving the polyester still intact. The fibers were then washed and oven-dried. Percent loss was cellulose content of the yarn. (AATCC 20A-2007)

- Twist. Twist is the number of turns about a yarn’s axis observed length. A 25 mm yarn length was clamped on the twist counter instrument. The twists were counted as the yarns were untwisted by rotating one end of the specimen. The number of turns required to completely remove the twists were counted and reported as twists per meter (ASTM D 1423-2002).
RESULTS AND DISCUSSION

Spinnability Testing

Spinning is an operation that converts fibers into yarns, which could either be in pure form or in-blended with other textile fibers, natural or synthetic. Spinnability of fibers into yarn will further enhanced the textile value of the fiber.

This study determined three important physical of fiber before it could be used to reach its highest potential: yarn count, breaking force, and twist direction.

Table 2 reflects the data pertinent to the physical properties of *Sansevieria cylindrica* yarn. The *Sansevieria cylindrica* was blended with polyester fiber with 85 percent polyester and 15 percent *Sansevieria cylindrica* fiber.

Further, the sansevieria/polyester yarn with a yarn realization of 82.89 percent showed satisfactory performance in terms of spinning. This means that this was acceptable within the range of 82.89-83.46 percent using the Philippine Textile Research Institute (PTRI) standard on testing of natural fibers.

This finding runs parallel to the study of De Leon, et al. (2012) on water hyacinth using the treatment employed, the combined woolenization-degumming treatment yielded the most desirable fiber quality for spinning. The yarn exhibited higher natural fiber composition and higher yarn realization compared to the other treatments.

In addition, in the study of Hagad (2003), the spinning performance exhibited by the treated *Dracaena sp.* fiber in blend with polyester fibers at different blend ratios gave an indication of the extent of the fiber’s spinnability to yarn as well as its most–likely end use. The produced yarns are relatively coarse thus limiting the end-use of the fiber.

Furthermore, the *Sansevieria cylindrica* yielded yarn count of 21.54 Ne, This finding, an indication that the fiber is within the medium yarn category, having finer strands. Hence, it can be spun into finer count yarn. This was based on the ISO that the higher the number of the yarn count, the finer the yarn size. Yarn counts up to 20 are called coarse yarn; 20 to 60 medium yarn and above 60 are fine yarns (Fibers to Yarn, 1975). Hence, based on the standards made by the Philippine Textile Research Institute, the produced yarn is relatively coarse thus limiting the
end-use. The yarn, although coarse in terms of yarn quality, can be spun into textile materials (Samay Bulletin 2006).

It can also be gleaned from the Table that the twist direction of the yarn was Z twist with 668 twist count per meter (tpm). This means that the yarn was fine based on the ISO standard. The finding implies the Sanseviera cylindrical yarn was fine. The breaking force of the yarn exhibited 16.2. This finding means that the breaking force simplified and improved the technical preparation of the weaving process. While the actual blend ratio (fiber composition) was (85/15) nearest to the targeted 89/20 blend was achieved. Also, as the twist increased, the strength of the yarn also increases (Fiber to Fabric, 2005).

In addition, the breaking force of the yarn is 16.2 therefore; the twisting process is employed to produce twisted yarns which can be used to produce fabrics for various applications. The breaking properties of twisted yarn depend on the strength of the component yarns, the number of strands, the twisting amount, the friction forces between the yarns, as well as on the twisting method used. This finding means the breaking force simplify and improve the technical preparation of the weaving process.

Table 3 presents the properties of Polyester/Sanseviera cylindrica yarn is presented for comparison. Sanseviera cylindrica exhibited (16.2) breaking force, and yarn number (15.1), which is comparable to polyester/pineapple and polyester/water hyacinth that was studied by the Philippine Textile Research Institute, to the fiber composition (85/15) nearest to the targeted 89/20 blend was achieved. The twist, however, is slightly higher compared to polyester/pineapple and polyester/water hyacinth.

The results of the yarn property testing of blended yarn possessed acceptable properties comparable to polyester/pineapple and polyester/water hyacinth which was successfully used for clothing and apparels.

Table 3. Physical Properties of Polyester/Sanseviera cylindrica yarn and some PTRI Developed Yarn

<table>
<thead>
<tr>
<th>Yarn</th>
<th>Ends-down per spindle-hr</th>
<th>Yarn realization (%)</th>
<th>Yarn number (Ne)</th>
<th>Breaking force (N)</th>
<th>Twist count (tpm)</th>
<th>Fiber composition % (poly/nat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester/Sanseviera cylindrica</td>
<td>1*</td>
<td>82.89*</td>
<td>21.54*</td>
<td>16.2</td>
<td>IZ 668</td>
<td>85/15</td>
</tr>
<tr>
<td>Polyester/Water hyacinth</td>
<td>2**</td>
<td>90.6**</td>
<td>10.31**</td>
<td>13.25**</td>
<td>IZ 509**</td>
<td>83/17</td>
</tr>
<tr>
<td>Polyester/Pineapple</td>
<td>4**</td>
<td>85.5**</td>
<td>11.86**</td>
<td>13.9**</td>
<td>IZ 443**</td>
<td>80.3/19.7**</td>
</tr>
</tbody>
</table>


**SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

The main concern of this study was to determine the physical properties of Sanseveria cylindrica yarn for textile materials. Specifically, this study aimed:
1. To spin the Sanseveria cylindrica fiber;
2. To determine the physical properties of blended Sanseveria cylindrica yarn in terms of:
   a. breaking force
   b. actual blend ratio
   c. yarn number
   d. twist direction;
3. To evaluate the yarn as to quality for textile materials.

This study used descriptive evaluative research design. This study involved the extraction of fibers from the leaves of sanseviera cylindrica plant and spinned the fibers into yarn and further assessed the textile properties of fiber for yarn manufacture. The tested fibers were subjected to fiber pretreatment to convert the fiber into spinnable form through combined chemical and mechanical treatment. The treated fiber samples were also blended with polyester which gave an indication of the fibers spin ability into yarns.

The salient findings of the study were:
1. The spinnability of the fiber sample blended with polyester yielded yarn count of 21.54 Ne.
2. The physical property test of the polyester/Sanseviera yarns in the twist direction of the yarn was Z twist with 668 twist count per meter (tpm).
3. The yarn properties of the polyester/Sanseviera yarn possessed acceptable properties comparable to polyester/pineapple and polyester/water hyacinth which was successfully used for clothing and apparels.

Based on the findings, the following conclusions are drawn:
1. The blended yarn exhibited yarn realization with a minimum ends down.
2. The blended yarn is strong due to higher number of twist per meter.
3. The blended yarn possessed acceptable properties comparable to polyester/pineapple and polyester/water hyacinth which was successfully used for clothing and apparels.

Based on the conclusions, the following are recommended:
1. Other natural fibers may be blended with Sanseviera cylindrica.
2. Different degumming treatments may be used to give the most satisfactory performance during spinning.
3. Weaving of yarns may be undertaken to assess the economic viability of *Sansevieria cylindrica* for textile material.

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