International Journal of Education, Modern Management, Applied Science & Social Science (IJEMMASSS)
ISSN : 2581-9925, Impact Factor: 6.882, Volume 04, No. 04(II), October - December, 2022, pp. 137-142

UPGRADATION IN PHYSICAL PROPERTIES OF THE YARN DEVELOPED BY THE FUSION OF ORGANIC COTTON & SILK WASTE FIBER

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ABSTRACT

Natural fibers are obtained from plants, animals, minerals and other geological processes. The aim of the study was to develop the yarn with environmental benefit as well as having cost effective material. In the present study two natural fibers have been taken regarding environmental perspective. organic cotton and silk waste have been blended and developed the yarn with different ratios as 67% silk waste + 33% organic cotton, 33% silk waste + 67% organic cotton, 50% silk waste + 50% organic cotton, 100% silk waste and 100% organic cotton. The fiber was blended to achieve better quality of the fabric with the effective cost management. The yarn was prepared following the process blowing, carding, drawing, roving, and spinning. The yarns were assessed on the basis of yarn count, tenacity, unevenness, thin and thick places and hairiness properties. Study reflects that the yarn with the ratio of 67% silk waste and 33% organic cotton found best result following other ratios of the yarn. The yarn made from blended fiber will be of inexpensive having good properties and environmental welfare as well.

Keywords: *Blending, Fusion, Organic Cotton, Silk Waste Fibre.*

Introduction

Natural fibers are fibers that are produced by plants, animals, and geological processes. Natural fibers have good sweat absorbents characteristics and it is found in variety of textures. Cellulosic fibers are decomposed by aerobic bacteria and fungi. Wool and silk are also subject to microbial decomposition by bacteria and molds. A textile is a flexible material consisting of a network of natural or synthetic fibers. Yarn is developed by spinning of raw fibers of wool, flax, cotton, hemp or other materials. Textiles are prepared by different methods such as weaving, knitting, crocheting, knotting, felting or braiding.

Blending of fibers is usually made with different fibers having dissimilarity in their properties, with a view to achieving certain characters of the yarn or its processing performances. Fiber blending can achieve quality products that cannot be realized using one fiber type alone, blending can also reduced the cost of the product by substituting a less expensive fiber for a more costly one.

According to Nandi, K.A., et.al (2015) Blending of jute and ramie fibre which bears superior fibre qualities compared to jute can produce high quality blended fabrics with improved aesthetic properties like texture, feel, resiliency, drapability and durability which add values for consumers' adoration.

According to Rajalakshmi,M., et.al, (March 2018) They found in their paper that when the ratio of micro polyester had been increased in micropolyester: cotton blended yarn, the properties of prepared yarn as their evenness, imperfections and mechanical properties such as strength, elongation had a significant influence. It was also observed that quality of 65:35 micropolyester/ cotton blend ratio showed better improvement than the 100% cotton yarn in which a small proportion of micro polyester in there.

As quoted by Kalita, B., et.al. in their paper, "properties of Ramie and its Blends (2013) Ramie is the strongest fibre of all natural bast fibres in the world. The fibre materials were capable of producing excellent blended fabrics and it worked as a substitute for cotton. Ramie blended with different types of silk showed good results, but 50:50 blends showed the best result. Blending of ramie with different silk with different blend proportions offers excellent scope for producing a variety of materials for different uses.

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As quoted by saika, s., in her paper "a study on Blending of regenerated Bamboo with silk (2016)" that blending of different fibres can achieve quality products. Now the demand for fabric is not only related with style &durability but it required hygienic and many other properties also. In her paper she found that all the blend proportion of bamboo & silk showed better result which is required for clothing materials.

In the study organic cotton and silk waste fibers will be blended together to develop environment friendly product or fabric. Organic cotton is grown using methods and materials that have a low impact on the environment. Organic cotton is generally defined as the product that is grown organically in subtropical countries such as Turkey, China, &parts of the USA from non- genetically modified plants, and without the use of any synthetic agricultural chemicals such as fertilizers or pesticides Organic cotton can be found in everything from clothing, footwear and home furnishings (towels, bathrobes, sheats, blanket, bedding), children's products (clothing, toys, diapers), personal care items (sanitary products, make-up removal pads, cotton puffs and ear swabs) and even stationery and note cards.

Silk is a natural protein fiber, some forms of which can be woven in to textiles. The protein fiber of silk is composed mainly of fibroin and is produced by certain insects larvae to form cocoons. The best known silk is obtained from the cocoons of the larvae of the mulberry silkworm Bombyx mori reared in captivity (sericulture). Silk has a smooth, soft texture that is not slippery, unlike many synthetic fibers. One example of the durable nature of silk over other fabrics is demonstrated by the recovery in 1840 of silk garments from a wreck of 1782. The most durable article found has been silk.

Materials and Methods

The research work was based on experimental Research Method. Experimental research is any research conducted with a scientific approach where a set of variables are being measured as the subject of experiment. The objective of the present research work was to prepare a yarn by the blending of different fibers and to analyze the mechanical and physical characteristics of the yarn. Two fibers silk waste and organic cotton were taken for the present study.

Materials

Silk waste was procured from Silk Trader, Mahalaxmi Traders, Bangalore and the other fiber was organic cotton, which was assembled from Chandra Mauli Fiber, Vijaywada, Andhrapradesh, India. The properties of the fibers were assessed in the lab.

Methods

- **Blending of Organic Cotton and Silk Waste Fibers**

At the initial stage fibers were blended by hand. After hand blending fiber lubricant was sprayed over the hand blended fiber and leave them for 24 hours so that electrical charges in the fiber would not be create. After 24 hours hand blended fibers were passed through the blow room machine. Air was blowing in the machine. With the help of air, fibers were mixed with each other equally. The equally blended fibers come out of the machine in the form of lap that was rolled on the iron rod as shown in the picture.

Blending (Lap Formation)

- **Development of Yarn**
  - **Carding:** Developed lap was passed through the carding machine. After carding of the blended fibers, the fibers mixed equally and became more uniform and straight and came out as a thick sliver as shown in the picture.

Carding (Thick Sliver)

  - **Drawing:** The thick silver was then passed through the drawing machine. In drawing machine silver passed through the two processes first was breaker and second was finisher. First silvers were through breaker process in which thick silvers became thin silver and become more uniform and after that thin silver were passing through finisher process. By this process thin silver became more uniform and thinner and very little twist was given to them in this process. In drawing frame there were total 8 dumbles to make the silver more uniform. In this experiment 6 dumbles were used for making the silvers more uniform.

Drawing Process

  - **Roving or Speed Frame:** The silver came from draw frame subsequently gone through roving machine or speed frame machine (brand name of machine). In this process silvers were drawn by using drafting and twisting. Drafting is a process of stretching and twisting the silver. After roving process silver become thin. It was look like a thick yarn.

Roving Process

- **Spinning or Ring Frame:** Roving silvers were then undergone through spinning set up (ring frame machine- brand name). During that process again drafting process had been done and silvers were run through in process and produced the final yarn.

Spinning Process

- **Physical Analysis of the Developed Yarn:** Physical testing of the prepared yarn had been tested and analyzed their physical characteristics and also tried to forward that all the present properties were able to develop the unique fabric.
- **Methods of Characterization of Fiber and Yarn Properties:** Yarn Count (Ne), Tanacity (IS 1670-1991) and uniformity of all five types of developed yarns were measured in Lea Strength tester-KMI and Uster Tensorapid-4 Swizerland UTM-350; SDL, UK for comparative study. For Yarn Count total 80 rounds has been taken in one sample and total 3 samples have been taken for evaluation. For tanacity evaluation average 20 readings have been taken. Uster U%, CVM%, CVb% and imperfection (ISO 16549:2004) in the yarn like thin and thick places, neps and hairiness index (ASTM D 5647:2007) of the yarn has been analyzed. For observation UT-S SA 400 zellweger Uster, Switzerland machine was used. All the properties of the 5 developed yarns have been tested for providing comfort to the ultimate consumer.

Result and Discussion

Table 1: Yarn Count of Developed Yarn (IS 1671-1991)

S. No.	Blending Ratios of the Fibre	Yarn Count (Ne)
1	67% (O.C.)+33% (S.W.)	16.29s
2	33% (O.C.)+ 67% (S.W.)	15.53s
3	50% (O.C.)+50% (S.W.)	15.59s
4	100% (S.W.)	15.79s
5	100% (O.C.)	15.70s

O.C. = Organic Cotton, S.W.= Silk Waste

From the above table it was observed that the yarn count of all five samples were about to similar. The maximum yarn count was 16.29 which was found in 67% (O. C.)+33% (S.W.), 100% (S.W.) had 15.79 yarn count and 100% (O.C.) had 15.70 yarn count whereas 50% (O.C.) + 50% (S.W.) and 33% (O.C) + 67% (S.W.) had the least yarn count that is 15.59 and 15.53. The more yarn count the more coarser yarn is developed. Hence to prepare the fine yarn it was trying to develop yarn with minimum yarn count.

Table 2: Tenacity of the Yarn (IS 1670-1991)

S. No.	Blending Ratios of the Fibre	Tenacity/RKM (gm/tex)
1	67% (O.C.)+33% (S.W.)	10.38
2	33% (O.C.)+ 67% (S.W.)	12.68
3	50% (O.C.)+ 50% (S.W.)	11.96
4	100% (S.W.)	13.49
5	100% (O.C.)	7.93

O.C. = Organic Cotton, S.W. = Silk Waste

It was observed in the table that the tenacity of the yarn ratio (33% O.C. + 67% S.W.) had high tenacity 12.68 followed by 11.96 and 10.38 tenacity found in (50% O.C. + 50% S.W. and 67% O.C. + 33% S.W.) ratio of yarn. 100% (O.C.) had the least tenacity 7.93.

Table 3: Unevenness (U%) 0f the Yarn

S. No.	Blending Ratios of the Fibre	Uster U %
1	67% (O.C.)+ 33% (S.W.)	20.85
2	33% (O.C.)+ 67% (S.W.)	17.42
3	50% (O.C.)+ 50% (S.W.)	20.12
4	100% (S.W.)	14.73
5	100% (O.C.)	25.13

O.C. = Organic Cotton, S.W. = Silk Waste, U%= unevenness

It was noticed from the table that the yarn ratio (100% O.C. and 67% O.C. + 33% S.W.) had the maximum unevenness 25.13 and 20.85 whereas (50% O.C. + 50% S.W.) yarn had 20.12 unevenness and (33% O.C. + 67% S.W. and 100% S.W.) ratio of yarn had minimum unevenness which was 17.42 and 14.73.

Table 4: Imperfections in the Yarn

S. No.	Blending Ratios of the Fibre	Imperfection/ Km as Thin Places (-50%)	Imperfections/ Km as Thick Places (+50%)
1	67% (O.C.)+ 33% (S.W.)	1057.0	1124.0
2	33% (O.C.)+ 67% (S.W.)	283.3	625.0
3	50% (O.C.)+ 50% (S.W.)	851.0	1201.0
4	100% (S.W.)	60.8	362.5
5	100% (O.C.)	2721.0	2294.0

O.C. = Organic Cotton, S.W. = Silk Waste

From the above table it was recorded that the yarn prepared from (100% O.C.) and the ratio of (67%O.C. + 33%S.W.) had the maximum imperfection as thin places was (-2721 and -1057) and thick places was (+2294) followed by (+1201.0) thick places found in (50% O.C. + 50% S.W.) ratio of yarn and it had few thin places as (-851.0) whereas the yarn composite from (67% O.C. +33% S.W.) had (+1124.0) thick places. From the analysis it was also observed that the yarn developed from (100% S.W. & 67% S.W. +33% O.C.) had minimum thin and thick places as (-60.0 & -283.3) and (+362.5 & + 625.0).

Table 5: Hairiness of the Yarn

S. No.	Blending Ratios of the Fibre	Hairiness Index (H)
1	67% (O.C.)+ 33% (S.W.)	7.06
2	33% (O.C.)+ 67% (S.W.)	6.78
3	50% (O.C.)+ 50% (S.W.)	7.07
4	100% (S.W.)	6.65
5	100% (O.C.)	6.89

O.C. = Organic Cotton, S.W. = Silk Waste, H= Hairiness Index

It was noticed from the table that (50% O.C.+50% S.W.) had highest hairiness index 7.07 followed by 7.06 hairiness found in (67% O.C.+33% S.W.) and (100% O.C.) had 6.89 hairiness index whereas the fabric made from (33%O.C.+67%S.W. and 100% S.W.) had minimum hairiness index (6.78 and 6.65).

Conclusion

In the present paper two natural fibers (Silk waste & Organic cotton) have been blended with different ratios under the controlled fiber processing set-up. Total three ratios of blended yarns have been developed (50/50% O.C.+S.W., 67/33% O.C.+ S.W., 33/67% O.C.+S.W.) 100% O.C. yarn and 100% silk waste yarn have also been developed. All the blended yarns were compared with each other in terms of physical properties such as single yarn strength or tenacity, yarn count of the blended yarns was tested and imperfections like thin and thick places, hairiness index and unevenness of the blended yarns were also analyzed. It was found that count of all the blended yarns were about too similar with each other but notable improvement have been observed in single yarn strength (RKM) as (12.68 & 11.96) of the yarn ratio of 67/33% S.W./O.C. and 50/50% S.W./O.C. As silk shows satisfactory properties it displays better result in all the related characteristics and the blended yarns of the following ratios (67/33% S.W./O.C. and 50/50% S.W./O.C.) revealed significant improvement in the properties respectively. Unevenness of the yarn of following ratios (100% S.W. and 67%S.W.+33%O.C.) were found minimum of the same blended ratio yarns were also showed the better improvement as compared to other blended yarns. Elongation rate was also found good in 67/33% S.W. /O.C., 50/50% S.W./O/C. blended yarns whereas TPI of all the blended yarns were observed little less than 100% O.C. & 100% S.W. 100% silk fabrics are

very high in price so it is generally found that it was out of reach for common customers and there is lack of some properties in organic cotton because it is the staple fiber. Under this study it was trying to blend both the fibers to cope-up with the draw- back of both the fibers. In the study it has been clearly indicated that the blended yarns of ratio 67/33% & 50/50% S. W./O.C. were good in maximum properties which were analyzed. These yarns can be used to make a fabric which may attain the required characteristics for high value textile applications and also this type of fabric proved very fruitful for the environment point of view as well.

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