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HYBRID FANCY YARN IN OPEN END SPINNING

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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The report of project work submitted by the above students in partial fulfillment for the award of Bachelor of Technology degree in Textile Technology of Anna University were evaluated and confirmed to be report of the above students and then evaluated.

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(INTERNAL EXAMINER) **(EXTERNAL EXAMINER)**

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ABSTRACT

Fancy yarns in ring spinning were very successful in the commercial market and this yarn finds lot of novel application. The method adopted is adjusting the feeding of the rove in the spinning was attempted the successfully. The same concept was tried in open end spinning.

We have developed a mechanical hybrid yarn spinning system that produces different yarn types on a modified open-end rotor spinning frame. In order to improve yarn properties and produce novel yarns, we investigate the effects of combinations with typical hybrid yarns by inserting two filament yarns with varying filament over-feeds. The results are a new rotor spun loop (RSL) yarn made by combining two aspects of typical hybrid yarn production into one process, and an RSL yarn where a filament yarn, fed with a core filament over-feed (CFOF), is located in the center of one yarn and the other filament yarn, fed with the effect filament over-feed (EFOF), makes a loop on the yarn surface

Novel slub yarn are produced by one method. The slub effect required was achieved and in this study this methods were elaborated. The produced slub yarns were as knitted into a fabric.

சாராம்சம்

நூற்பாலைகளில் தயாரிக்கப்படும் கண்ணை கவரும் slub வகை நூல் வகைகள் உலகளவில் வணிகச் சந்தையில் வெற்றிகரமான வரவேற்பை பெற்றுள்ளன. இவ்வகை நூல்வகைகளின் மூலம் தயாரிக்கப்படும் நெசவுத்துணி புதுமையான வகையில் பயன்படுத்தப்படுகிறது. இந்த வகை திரிகளை உள்செலுத்தி தயாரிக்கப்படும் கண்ணை கவரும் நூல் வகைகள் வெற்றிகரமான வரவேற்கை பெற்றுள்ளன.

(O.E) இயந்திரம் மூலம் எங்கள் திட்டம் என்னவெனில், (Rotor) சுழல் வீச்சின் நடுவில் ஒரு சிறு துளையிட்டு அதன்பின் இரண்டு வகை நூல்கள் செலுத்தப்படுகின்றன.

1. உள் அமைப்பு வகை
2. வெளித்தோற்ற சுறுக்கு வகை.

இவ்வாறு இவ்வகையான நூல்களை தயார் செய்தோம்.

பின்பு தடிமனான (Slub) நூல் வகையும் தயார் செய்தோம். இவ்வகை நூல்களை கொண்டு பின்னலாடையில் தயாரித்தோம்.

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INTRODUCTION

INTRODUCTION:-

Fancy yarn is an aesthetic apparel of textile materials is of great importance for the manufacturer on account of the valuable influence it exerts on sales.

Fancy are mainly regarded as a means for ornamenting and enormous range of dress, furnishing and household fabric. Hence the cloth designers especially in the fashion trade where such properties as strength and durability are not the most important considerations hold them in high esteem. Hence for the cloth designers especially in the fashion trade where such properties as strength and durability are not the only requirement.

A great variety of fancy yarns are produced at present has doubled yarns using fancy doublers meant for that purpose however some fancy yarns such as crimp, corkscrew, marl, chenille etc, can be produced in spinning frames themselves by employing different and devices to produce the required effect. It is relatively easy to arrange continuous, intermittent or varying delivery speed of the roving just before it is spun into a yarn and by combining these methods of roving with devices to control other yarns many varieties of fancy yarn can be produced.

Fancy yarns at OE spinning are now relatively finding its commercial value in recent times. The slubs produced are bigger in size and are used in heavy materials. Now this slub yarn can be produced as hybrid yarns using one core yarn and other fancy yarn wound over in the rotor itself. This produced hybrid fancy slub yarns. Yarns that can be used are acrylic, polyester, and lycra.

REVIEW OF LITERATURE

2.REVIEW OF LITERATURE

2.1Effect type of drawn and spun fancy yarn:

Slub yarns produced at the spinning frame are know as spun slubs:-

Spun slubs can be produced by mechanical modification to the spinning frame. So that intermittent acceleration of the roller of the drafting zone causes alternating degrees of draft to be applied. A similar method can be used at the roving stage to produce a slubbed roving from which a slub yarn can be spun using a constant draft.

Various mechanical system have been made which can provide this facility at the spinning frame.

Some examples are given in the following paragraphs to illustrate the principle involved.

A simple method of doing this is to use a draft gear wheel, from which some teeth had been removed. This would provide intermittent stopping of the back rollers to produce a thin place. Normally, nowadays, this method is not used because it provides only limited scope for the effect length-too long a stoppage would cause a spinning end breakage. It also introduces a considerable mechanical shock to the machine parts involved.

A development of this method as given by prince smith & son, is to use a pair of different diameter driving gearwheel. One wheel has teeth missing where the other one did not, and vice versa. A pair of complete driven gear wheel is used to gear up with wheel. So that the drive is provided alternately either via wheels. With such an arrangement, a wider range of yarn is possible; the minimum yarn count is positively controlled, and the mechanical shock is reduced. Different arrangement of tooth distribution on wheel could provide a range of different slub effect.

A more sophisticated method of providing an alternating draft has developed in which a random generator permits the production of slubs that are random in both distribution and in dimensions. The random impulse generator is used to energize the magnetic particle clutch as required. When the clutch is not energized, the drive via gear wheel is connected. So that the back roller shaft rotates at a higher speed, leaving gearwheel and there by reducing the draft to produce the slub.

Slub injection can be used for drawn-and-spun yarns by fitting the necessary control and feed mechanism to the spinning frame; the additional slub material is fed into the drafting zone front roller with the desired slub length and spacing being varied as required over very long repeat length to avoid patterning effects in the subsequent fabric. Flake yarn effect- i.e. elongated slubs can be produced by this method.

2.2 VARIOUS KINDS OF FANCY YARNS:

- Marl yarn
- Spiral or corkscrew yarn
- Gimp yarn
- Diamond yarn
- Eccentric yarn
- Boucle yarn
- Loop yarn
- Snarl yarn
- Mock chenille yarn
- Knop yarn
- Stripe yarn
- Cloud or grandrelle yarn
- Slub yarn
- Nepp and fleck yarn
- Button yarn
- Fasciated yarn
- Tape yarn
- Chainette yarn
- Chenille yarn
- Cover yarn
- Metallic yarn

Manufacturing techniques

- Overview of production processes
- Yarn production systems
- Yarn and fabric trials
- Future developments

2.3 FANCY YARNS PRODUCED ON FOLDING/CABLING MACHINERY

A limited range of fancy yarns can be produced using convention folding/cabling machinery. Details provided by Eric Oxtoby in this connection are summarized and given below.

SPIRAL YARN;

A spiral yarn or corkscrew is a yarn in which one-component spirals around the other component. If equal length of two or more components containing s and z twist respectively are combined with twist, the component to which twist is added will contract in length, while the other will extend and spiral around the outside of the yarn thus formed; this is later referred to as an unbalanced-twist spiral yarn. If equal length of two yarns, one coarser than the other, are folded together, the thicker one will spiral around the other.

DIAMOND YARN

A diamond yarn can be made by folding a thick single yarn with a fine yarn of contrasting color, possibly a continuous filament yarn, using s twist, and then, cabling the produced with a second similar fine yarn using z twist. The end product will then have two fine yarns, with an equal number of turns of opposite twist to each other; spiraling suitable amounts of s and z twist are used.

By introducing different amount of folding twist in each of the threee-fold yarns, different colors of single yarns or groups, different count, or different spirals, a wide range of fancy yarns could be produced.

GIMP YARN;

A gimp yarn can be made by cabling an unbalanced twist spiral yarn as described previously with a single yarn (know as the binder) using twist opposite in direction to the previous spiral folding twist. The resultant yarn consists of a previous spiral folding twist. The resultant yarn consists of a twisted core with projection semi-circular loops.

Cabling two or more unbalance-twist equal and opposite in direction to the folding twist makes a mock chenille yarn. Each of the original spirals usually contains more than two components so that final compound yarn has single components projection around the yarn surface.

The general arrangement in a specialized folding machine, to produce fancy yarn is to provide facilities for feeding two or more yarns at speeds which are independently controlled, including uniform, fluctuating, or intermittent feeds as required; this is represented by rollers 1,2 and3, although more than three sets of rollers can be used.

The yarns may be brought together, perhaps via a yarn guide for twist insertion at a knapping bar which may be stationary or moving, and then passed through a lappet guide before twist insertion and winding can take place, using the ring spindle.

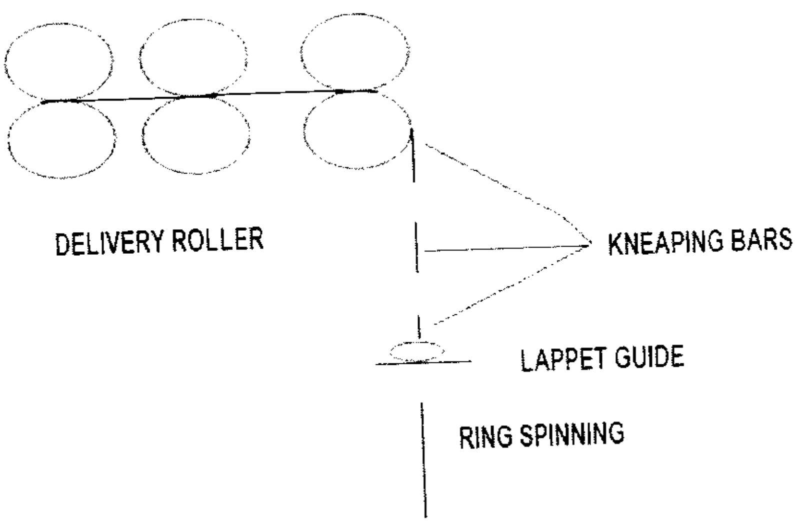


fig 1 Gentral arrangement of fancy yarn

Usually, irregular time intervals can be selected for the mechanisms to actuate the various mechanical or electro-mechanical methods, which have been devised the production of the required variety of fancy yarns. The main groups are described in the following paragraphs, with methods of production where ever appropriate.

CLAUD YARN:

The arrangement of threading for the production of a cloud yarn.\ two different colored components are fed by alternately fast and slow deliveries of rollers 2 and 3 which are 180° out of phase so each thread forms the base while the other forms the cover to obscure the base from view.

KNOP YARN:

Using the threading show in figure can make a knop yarn. Roller 2 feeds foundation thread intermittently, while the knopping thread is given a continuous delivery by roller 3, forming a knop. A knop yarn may be bound by an additional thread added at a cable operating using the opposite twist direction to that of the folding process. This will effectively prevent the knop from accidentally sliding along the yarn during subsequent processing.

By using two additional knopping threads via roller 3, guide 4, and knopping threads bars 6 and 7, a three-colour knop may be produced.

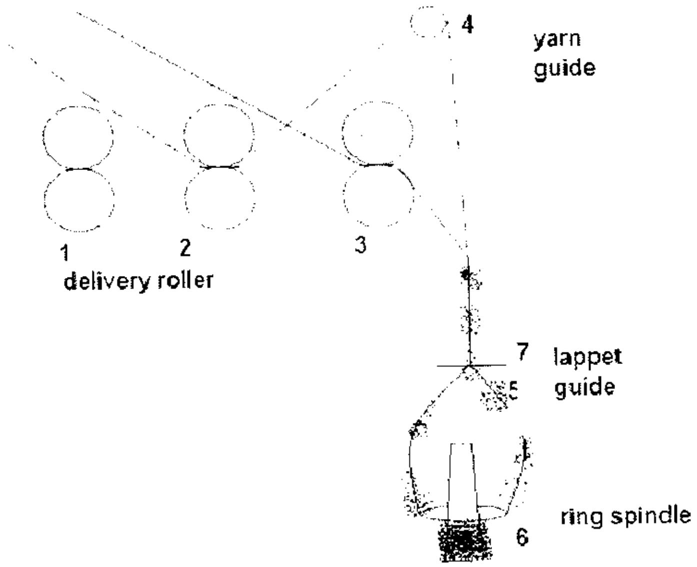


FIG 2 KNOP YARN

If different sets of rollers, running at different speeds, are used for the knopping threads, then the different colors of knops can be of different sizes, and by altering the delivery speed of the knopping threads, the sizes of knops of a given colors may be varied.

Elongated knop can be made by arranging to meet the knopping bars upwards while the foundation thread is stationary.

LOOP YARN:

Delivering two-foundation thread at a constant speed, and delivering the looping thread at a fast speed make a loop. The looping thread is made from long rigid fibers, which also may be lustrous, such as mohair or luster wool roving, or an untwisted thick continuous filament yarn. The thick thread forms loops, which become the two foundation thread.

SNARL YARN:

A snarl is made in the same way as a loop yarn except that a twist-lively yarn is used to form projecting snarls instead of loops, the twist of the snarl yarn is usually in the same direction as the folding twist; a binder is usually added at a subsequent cabling process twist.

SPIRAL YARN:

A spiral yarn can be made using the threading show in figure, with the yarn having constant, but different, delivery speeds; the slower yarn will provide the base around which the faster yarn will spiral. A more pronounced spiral can be obtained by using a base yarn with twist for the spiraling compontent. By using a varying roller speed a fluctuating spiral can be produced.

STRIPE YARN:

A stripe yarn can be made with an altering fast/slow delivery of the stripping threads on to the constant slow delivery of the foundation thread. Part of the appears to be a normal folded yarn but the stripe obscures the foundation thread intermittently. Using a moving knopping bar also can make this type of yarn; a point may be reached at which it is difficult to distinguish between an elongated knop and a stripe.

SLUB YARNS BY PLUCKED SLUB METHOD;

Slup yarn can be produced by the plucked slub method. Two foundation threads are fed through roller to meet a twist less roving, which is fed by the intermittent action of roller. The roller act as an intermittent drafting zone and so produce tufts of roving which become twist between the foundation threads, in general plucked slubs give a neater and cleaner appearance than spun slubs.

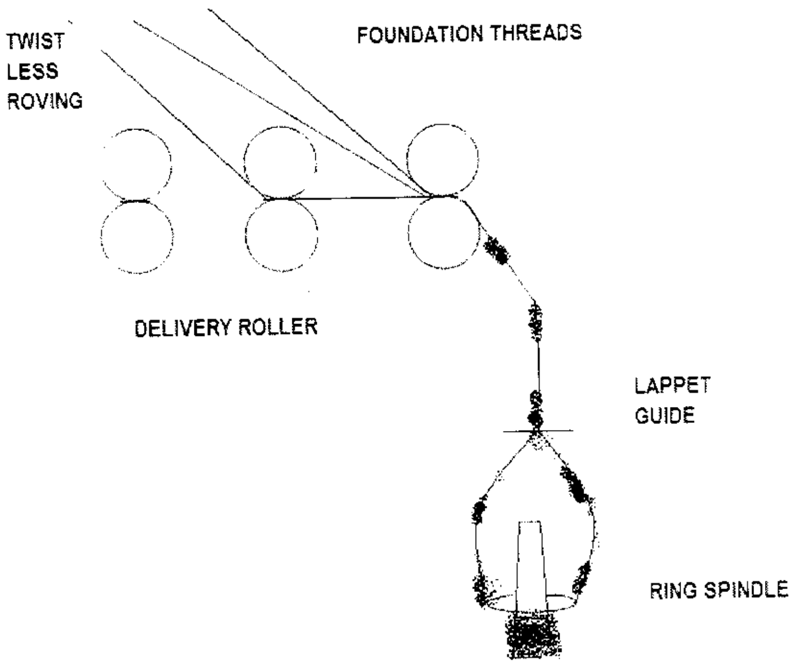


FIG 3 PRODUCTION OF PLUCKED SLUB YARN

FANCY YARNS:

Fancy yarns is an essential reference to a wide range of industrial textile technologists including spinners, knitters and weavers, fabric and garment manufacturers, students of textile technology and design and curators and conservationists of historical textile collections.

2.4 THREE TECHNIQUES OF YARN SPINNING

Cotton, wool, and man-made staple products are converted to yarn by a process called spinning. Upholstery fabric yarns are spun by three basic methods:

- Wrap Spinning
- Ring Spinning
- Open End Spinning

Wrap Spinning

In wrap spinning, a bundle of parallel fibers is wrapped in a spiraling fashion with other fibers. A bundle may contain 150-200 individual fibers along its length, yet not be thicker than a paper clip. Yarns spun by other methods are similar in size. Warp spinning is suitable for making strong, dense yarns.

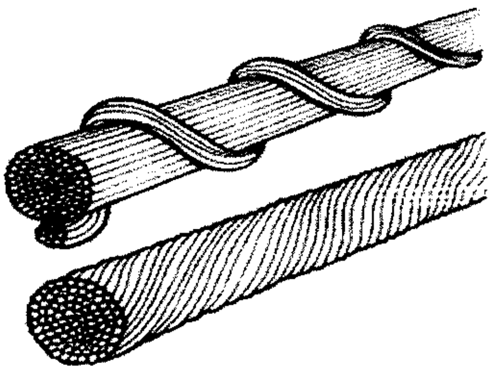
RING SPINNING

In ring spinning a parallel bundle of fibers is tightly twisted for cohesion and strength. No wrapper fiber is needed.

OPEN END SPINNING

With open end spinning the yarn has individual fibers that are not arranged as uniformly as in wrap or ring spun yarns. Most of the fibers are generally parallel, but with lots of crisscrossing, while some fiber irregularly wraps around the main bundle.

WRAP SPINNING& RING SPINNNING



OE SPINNING

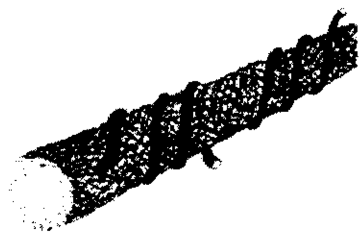


FIG : 4

2.5 Principle of Open End Spinning:

In Open End spinning the manufacturing of yarn is done by a brush like open end of yarn which keeps on grasping fibres and fibres are binded by twist given by rotor.

Blow Room

Card

↓

Draw Frame

↓

Rotor

Comparision of Ring Frame v/s Rotor Yarn

TABLE 1

Properties	Ring Spun	Open end
Tenacity	High	Low
Elongation	High	Marginally low
Unevenness	High	High
Neps	Very high	Low
Hairiness	High	Low
Neps (+200) for ring spun and (+280) for open end yarn		

Average Stress-Strain Curves for Cotton Yarns

Rotor Spinning:

The production of worsted or woolen yarn differs from cotton in that the raw loose fibre is first scoured, washed, dried and blended. Carding and condensing for woolens and carding, gilling, combing (Noble or French), gilling again, blending and drawing for worsteds. The result is what is called a white wool top. The top is then drawn and spun into yarn. Woolen yarns are made up of fairly short fibres, loosely spun with little twist. Worsted yarns however, are made up of longer fibres with a higher twist. Woolen yarns have a fuzzy appearance whilst worsted yarns are smooth.

Typically about 40 to 60% of the original raw wool is made up of wool grease, suint (water soluble wool wax), excess water and dirt, which is removed on scouring and drying. Oil is then added prior to carding to reduce later breakages. A further 1 to 4% waste consists of burr which is removed at the carding stage (alternatively it can be removed by carbonising which is an acid treatment process).

Twist is inserted into the yarn at the spinning stage. If the direction of the twist is to the left, looking up the thread, it is called S-twist. If to the right it is Z-twist. When yarn is made of one strand of twisted fibres it is known as a singles yarn, and when two or three singles are twisted together it is a twofold or threefold yarn. When folded yarns are twisted together the result is a cabled yarn. There are also a range of what are called 'fancy yarns' which are obtained by variations in how yarns arc twisted together. These include slub, loop and gimp yarns.

2.6 YARN PROPERTIES

Yarn Evenness

We used the same lot of cotton fibers for all the spinning methods, which was a great advantage when comparing the evenness results for all yarns. We found no significant evenness differences in the three kinds of yarns, except for a higher frequency of thick places and neps in the MVS yarn. The hairiness length (1 mm) for the MVS yarn was similar to the OERS yarn and lower than the RS yarn. For the hairiness length (3 mm), MVS yarn hairiness is much lower than the other two kinds of yarns. The reason for this low hairiness of MVS yarn is the thin layer of wrapper fibers, which prevents fibers from protruding from the main yarn body and forming wild fiber loops along the yarn axis.

Yarn Bulkiness

Mohamed et al. reported that OERS yarn is bulkier than the equivalent RS yarn [5]. While the data in Table IV show a diameter of OERS yarn that is similar to that of RS yarn, we can judge that the OERS yarn is bulkier than the RS yarn at the same yarn linear density, according to the report of Mohamed et al. Overall, MVS yarn is the bulkiest of the three kinds of yarns, as judged by the yarn diameter values in Table IV. This is caused by the existence of loose wrapper fibers formed by swirling air around the spindle under no tension and also by the creation of loops of wild fibers.

Yarn Tenacity

The yarn tenacity value of RS yarn is higher than that of OERS and MVS yarns (see in Table V). The reason for the lower tensile values in the GERS yarn structure is the lack of fiber parallelization, which causes a non-uniform load distribution. With regard to MVS yarns, the twisted fiber core of RS yarn as opposed to the nontwisted core of the MVS yarn creates a stronger bond between the fibers. While these fundamental structural effects cause the higher tenacity value of RS yarn compared with MVS yarn, it is important to note that there is no optimal selection of twist factor for this MVS yarn production from the viewpoint of tenacity.

YARN MECHANICAL PROPERTIES

Compression Properties

From a and b compare the compression energy (WC) and compression resilience (RC%), at the maximum pressure of 100 gf/cm^sup 2^, of the three yarn types. MVS yarn had the highest compression energy value (WC) of these three kinds of yarn, which can be partly explained by its bulkiness. Another factor for the higher WC may be the higher resistance to compression pressure found in MVS yarn (see Figure 4c), particularly in the displacement range from 0.02 to 0.055 cm. This higher resistance may be caused by the higher resistance of the wrapper fibers of MVS, because the circumference of a yarn must increase when the yarn's cross section is deformed from round to flat.

Bending Properties

From a and b illustrate the bending rigidity and bending hysteresis differences of the three yarn types. The bending rigidity of MVS yarn is higher than OBRS and RS yarns. The reason for this is the helical coil spring structure of the RS and OERS yarns, which confers a narrower bending moment to the structure. In MVS yarn, the core fibers straighten each other and can be assumed to be a straight rod. It is natural that more force will be required to bend a straight rod than a coil spring of the same outer length.

DEFINITION

On open-end machine: Subject matter wherein the piecing up is effected in a twister of the type wherein a strand is rotated about its axis while the free-end or "tail" is in contact with, or in proximity to, a source of supply of loose fiberlike material.

2.7 Process and device for open-end spinning

During the production of a yarn, and independently of fiber feeding into the spinning element, the air circling together with the opener roller during spinning is removed from the area of the housing which does not convey fibers by an auxiliary air stream which is so strong that it removes fibers and fiber fragments that have become detached from the opener roller and are circling with the opener roller. The auxiliary air stream removed from the housing is introduced into the spinning rotor in such manner that the fibers which are conveyed with it are deposited on the fiber collection surface. To remove the auxiliary air stream, an auxiliary channel is provided which is connected to the source of negative pressure independently of the fiber feeding channel and at the same time may let out into the spinning element.

claim:

1. A process for open-end spinning in which a fiber sliver is conveyed by means of a feeding device to an opener roller located in a housing to be opened into individual fibers, the individual fibers being conveyed by an airstream through a fiber channel to a fiber collection surface of a spinning element to be spun into yarn, said process comprising drawing an auxiliary airstream independent from the airstream through the fiber channel from the opener roller housing at a point past the location of the fiber channel opening in the opener roller housing in the direction of rotation of the opener roller, and with said auxiliary airstream and independent of fiber feeding through the fiber channel removing fibers and fiber fragments that were not drawn off through the fiber channel so that these fibers and fiber fragments do not adversely interfere with the spinning process.

2. The process as in claim 1, further comprising introducing the auxiliary airstream into the spinning element so that the fibers conveyed by the auxiliary airstream are deposited on the fiber collection surface.

3. The process as in claim 2, further comprising depositing the auxiliary airstream fibers on the fiber collection surface in the same direction as the fiber channel deposits fibers on the fiber collection surface.

4. An open-end spinning device, comprising:

a spinning element for spinning individual fibers into yarn,

an opener roller preferably carried in an opener roller housing for opening a fiber sliver into individual fibers, said opener roller housing generally surrounding said opener roller;
a feeding device for feeding a fiber sliver to said opener roller;
a fiber feeding channel with an inlet opening in a peripheral wall of said opener roller housing and an outlet directed toward said spinning element, said fiber feeding channel extending from said opener roller housing to said spinning element and connected to a negative pressure source for conveying fibers from said opener roller to said spinning element; and
an auxiliary fiber channel having an inlet opening located in said peripheral wall of said opener roller housing between said fiber feeding channel inlet opening and the location where said feeding device feeds a fiber sliver to said opener roller, said auxiliary fiber channel configured in communication with a negative pressure source independently from said fiber feeding channel such that said auxiliary fiber channel is not in communication with its respective negative pressure source through said fiber feeding channel, said auxiliary fiber channel disposed so as to remove fibers and fiber fragments from said opener roller that were not drawn off by said fiber feeding channel so that said fibers and fiber fragments will not adversely interfere with the spinning process

5. The device as in claim 4, wherein said auxiliary fiber channel comprises an outlet directed to let out into the spinning element.

6. The device as in claim 5, wherein said auxiliary fiber channel tapers in the direction of said spinning element.

7. The device as in claim 6, wherein said auxiliary fiber channel is tapered essentially within said opener roller housing.

8. The device as in claim 5, wherein the cross-section area of said fiber feeding channel outlet is from one to four times that of said auxiliary fiber channel.

9. The device as in claim 5, wherein said spinning element includes a conical inner surface and defining a collection groove therein, said auxiliary channel outlet configured

with a tangential directional component in the rotational direction of said spinning element.

10. The device as in claim 9, wherein said fiber feeding channel and said auxiliary fiber channel let out in a common slit, said slit extending parallel to the plane of said spinning element collection groove and directed to deposit fibers onto said spinning element conical inner surface.

11. The device as in claim 10, wherein said fiber feeding channel and said auxiliary fiber channel lead out both into said common slit from the side away from said plane of said spinning rotor collection groove.

12. The device as in claim 5, wherein said fiber feeding channel outlet lets out into said spinning element before said auxiliary fiber channel in the direction of rotation of said spinning element.

13. The device as in claim 12, wherein said fiber feeding channel outlet forms an angle of at least less than 90 degrees with a horizontal plane through said spinning element.

14. The device as in claim 4, wherein said auxiliary fiber channel inlet is configured with a tangential directional component in the direction of rotation of the opener roller.

15. The device as in claim 4, wherein said fiber feeding channel and said auxiliary fiber channel are in communication with a common said negative pressure source.

16. The device as in claim 15, wherein said fiber feeding channel and said auxiliary fiber channel are in communication with said same negative pressure source through said spinning element.

17. An open-end spinning device, comprising:

a spinning element for spinning individual fibers into yarn, an opener roller operably carried in an opener roller housing for opening a fiber sliver into individual fibers, said opener roller housing generally surrounding said opener roller;

a feeding device for feeding a fiber sliver to said opener roller;

a fiber feeding channel with an inlet opening in a peripheral wall of said opener roller housing and an outlet directed toward said spinning element, said fiber feeding channel extending from said opener roller housing to said spinning element and connected to a negative pressure source for conveying fibers from said opener roller to said spinning element;

an auxiliary fiber channel having an inlet opening located in said peripheral wall of said opener roller housing between said fiber feeding channel inlet opening and the location where said feeding device feeds a fiber sliver to said opener roller, said auxiliary fiber channel connected to a negative pressure source independently from said fiber feeding channel, said auxiliary fiber channel disposed so as to remove fibers and fiber fragments from said opener roller that were not drawn off by said fiber feeding channel so that said fibers and fiber fragments will not adversely interfere with the spinning process; and
an auxiliary negative pressure source connected with an auxiliary suction channel in communication with the interior of said opener roller housing through a switchable valve, said auxiliary fiber channel also in continuous communication with the interior of said opener roller housing through said valve, said valve switchable between a first position wherein during piecing said auxiliary suction channel draws a suction on the interior of said opener roller housing and a second position wherein said auxiliary suction channel is blocked from drawing a suction on the interior of said opener roller housing.

18. The device as in claim 17, wherein said valve comprises a turning body defining intersecting channels, one of said channels connecting said auxiliary suction channel to said opener roller housing in said first position, and the other of said channels connecting only said auxiliary fiber channel to said opener roller housing in said second position.

2.8 Structure and Properties of MVS Yarns in Comparison with Ring Yarns and Open-End Rotor Spun Yarns

The structure and properties of Murata vortex spun yarns are investigated and compared with ring and open-end rotor spun yarns. Cotton yarns are spun from the same lot of Australian raw cotton fibers using the Murata vortex, ring, and open-end rotor spinning methods. Yarn structures are observed with an optical microscope equipped with a digital camera. Based on the digitized photographs, fiber arrangements are classified as wild, wrapper-wild, wrapper, belly-band, and core. Yarn diameter, yarn helix angle, wrapper fiber pitch, wrapper fiber crest, wrapper fiber length for a one-turn twist, and wrapper fiber helix angle to the yarn axis are examined, and yarn parameters such as tenacity, evenness, and hairiness are evaluated. The mechanical properties of dry relaxed yarns are measured with Kawabata Evaluation System instruments. Attempts are made to relate yarn structure differences to differences in the yarn formation mechanism for the three spinning methods. The differences in measured yarn properties such as evenness, hairiness, bulkiness, tenacity, compression properties, and bending properties can be explained by the observed differences in the yarn structure.

There are three major spinning methods for cottonring spinning (RS), open-end rotor spinning (OERS), and Murata vortex spinning (MVS). Ring spinning is a continuous spinning system in which twist is inserted into a yarn by a circulating traveller. The yarn twist insertion action and winding action take place simultaneously by means of a rotating spindle. Even though ring spinning has a low production rate, the ring spun yarn structure is generally accepted as the fundamental or basic structure in spun yarn technology. In open-end rotor spinning, fiber bundles from the sliver feed stock are separated into individual fibers with an opening roller and an air stream. The separated fibers are re-collected in the rotor groove and converted into a continuous strand of yarn by a passage through the doffing tube [9]. Many open-end spinning methods have been invented, but none have been more successful than open-end rotor spinning. Production speeds up to 200 m/min can be achieved, although the method is generally only applicable for yarn counts up to 20 tex in 100% cotton spinning. Recently, Murata vortex spinning (MVS), based on the air jet spinning technology by the Murata Machinery Company in Japan, has been commercialized. With the MVS system, it becomes possible to use a wider fiber length range for 100% cotton yarn, allowing spinning of a wider yarn size production range. In the MVS system, drafted fibers are introduced into a spindle orifice by an air vortex. While entering and passing through the orifice, fibers that are twisted by the swirling air are also introduced into the outer side of the orifice [4]. One of the great advantages of MVS is that it can deliver yarn at up to 400 m/min.

Although the number of MVS frames operating in mills is still much lower than the number of RS and OERS frames, MVS installations are growing rapidly. This is ostensibly because of high production rates compared with RS and OERS, but also because MVS yarns have characteristics that the yarn marketplace is beginning to appreciate. However, there has been no research in which the structure and yarn properties of MVS are systematically compared with RS and OERS. Thus, our objectives in this investigation are to conduct a comprehensive study of the structure of MVS yarns based on their formation mechanism, and to analyze the properties of MVS yarns based on their structure by comparing them with RS and OERS yarns spun from the same cotton.

2.9 SAMPLE PREPARATION AND SPECIFICATION

Yarn Preparation

The same lot of Australian cotton fibers arranged by CSIRO, Australia, was used to produce 100% cotton yarn on the RS, OERS, and MVS systems. The fiber properties of the cotton used to produce the yarns are shown in Table I [3]. For all yarns, raw cotton fibers were opened, cleaned, carded, and subjected to two drawing passages. OERS yarns were spun directly from second passage sliver, while for RS yarns, the second passage sliver was converted to roving before spinning. For MVS yarns, the second passage sliver was subjected to a third drawing before spinning. A 21.87 tex (Ne

27/1) RS yarn was spun on a Rieter G30 ring frame located at the International Fiber Center in Melbourne, Australia; a 19.68 tex (Ne 30/1) OERS yarn was spun on a Schafhorst Autocoro SE11 at an affiliate of CSIRO; and a 19.68 tex (Ne 30/1) MVS yarn was spun on an MVS 851 at the Murata Machinery Company in Kyoto. Data describing the process settings and conditions for cotton spinning are listed in Table II. While it would have been ideal to produce the same yarn count for all spinning methods in order to make comparisons clearer, due to the unavoidable circumstances, the RS yarn was produced at 21.87 tex. However, all yarns were spun with a suitable twist factor for knitted fabrics. In addition, a 19.68 tex MVS yarn with tracer fibers was produced at the same MVS frame. Dyed fibers were inserted into the drafted fiber ribbon as tracers before the nozzle.

Testing Methods for Yarn Specifications

Yarns spun on each spinning system were examined using the following instruments: (a) the Textechno Statimat for determining yarn count and tenacity, (b) the Uster evenness tester for measuring yarn evenness, (c) the Zweigle D 302 twist tester for measuring yarn turns/ meter (T/M), and (d) the fiber index tester for measuring yarn hairiness. Four randomly selected cheeses from each yarn were used for these tests, and all tests were conducted in a standard atmosphere of 21 ± 1°C and 65 ± 2% relative humidity [1].

2.10 MICROSCOPIC OBSERVATION OF YARN STRUCTURE

Classification Scheme of Fiber Arrangement in the Yarn Structure

A Nikon SMZ 1500 microscope with a DXM 1200 digital camera was used to investigate the side visual assessment of the yarn structures. The fiber arrangements of the RS, OERS, and MVS yarns, including the MVS yarn with the tracer fibers, were carefully observed using this set-up. Chasmawala et al. reported a classification scheme of fiber arrangement for air-jet spun yarns [2]. We adopted their classification method and modified it for this study for the RS, OERS, and MVS yarns we investigated. The envisaged schematic diagram of fiber arrangement nomenclature in the yarn structure is presented in Figure 1. Descriptions of each classification depicted in Figure 1 follow.

1. Core fibers: Straight or inclined fibers that constitute a major proportion of the yarn are called core fibers. The orientation of the core fibers directly affects the stress-strain behavior of the single yarn.

2. Wild fibers: Fibers that randomly protrude from the main body of the yarn in various directions are named wild fibers. Loops forming along the yarn axis are also classified as wild fibers. Wild fibers do not directly affect the stress-strain behavior of yarn, and their existence makes the yarn hairy.

3. Wrapper fibers: Fibers wrapped around core fibers in the same direction or with some degree of inclination with respect to the yarn central axis are classified as wrapper fibers. The helix angle of wrapper fibers in the MVS yarn structure is regarded in the same way as the yarn helix angle of RS and OERS yarns because the core fibers of MVS yarns are considered to have zero twist.

4. Wrapper-wild fibers: Fibers wrapped around core fibers in a direction different from wrapper fibers, with some degree of inclination with respect to the yarn central axis and with a scattered appearance, are classified as wrapper-wild fibers. There is no common angle for wrapper-wild fibers because of their disordered appearance.

5. Belly-band fibers: Fibers wrapping the main yarn body composed of either core fibers or core and wrapper fibers in the upright position with respect to the yarn central axis are called belly-band fibers.

Method of Observation and Analysis

Roughly 100 digitized pictures were taken continuously for each kind of yarn. Every fiber that had a starting and ending point associated with the main yarn body was counted by visually assessing the respective digitized pictures. In order to make assessments easier, the order of the fiber counting procedure was wild fibers, belly-band fibers, wrapper fibers, wrapper-wild fibers, and core fibers. Fiber arrangements in the yarn structure for all yarn types were classified on an 850 μm yarn length in each digitized picture.

From the enhanced digitized picture, yarn helix angle, yarn diameter, wrapper fiber pitch (P), wrapper fiber crest width (C), wrapper fiber length for one-turn twist (L), and wrapper fiber helix angle were measured using the image analysis functions in the Image-Pro Plus Version 4.5 software. Note again that the yarn helix angles for RS and OERS yarns were measured on each core fiber inclination to the yarn axis, while the wrapper fibers' inclinations were measured for MVS yarn.

In order to estimate the number of thin layer wrapper fibers in MVS yarns, a yarn was untwisted with the hand twister until reaching zero twist for wrapper fibers. Digitized pictures were taken to classify and count the untwisted wrapper fibers under zero twist conditions.

2.11 MEASURING YARN MECHANICAL PROPERTIES

Sample Preparation

Yarns from each spinning method were prepared in a single-layer parallel yarn set as per reference 6 in order to test yarn compression and bending properties. To test compression properties, a 2 × 2 cm square hole was cut out of the center of a 10 × 10 cm thin paper frame. Yarns were laid side by side from one side of the edge to the other and both sides were firmly held at the same tension with double adhesive tape. Yarn density was maintained at 20 yarn ends/cm across the whole sample set. For the bending properties test, a 1 × 10 cm rectangular hole was cut out of the center of a 10 × 10 cm thin paper frame. Yarns were laid side by side across the paper frame and both sides were firmly held at the same tension with double adhesive tape while maintaining a yarn density of 22 yarn ends/cm. Sample sets were then kept at a standard atmosphere of 20 ± 1°C and 65 ± 2% relative humidity for several days to allow the yarns to relax.

Testing Method

The Kawabata Evaluation System compression tester (KES FB-3) measured the compression energy and compression resilience of yarns. The compression load for each sample was applied at a constant rate of 0.04 cm/second up to the maximum pressure of 100 gf/cm^sup 2^ [8]. The Kawabata Evaluation System bending tester (KES FB-2) was used to measure the bending properties of the yarns

YARN STRUCTURE

Microscopic Observation

The digitized longitudinal views of RS yarn (a), OERS yarn (b), MVS yarn (c), MVS yarn with tracer fibers (d), and untwisted MVS yarn (e).

The classification data of fiber arrangements in the yarn structure by microscopic observation. Only fibers located at the outer surface layer of the yarn are represented in these data. Fiber arrangements in OERS yarns are difficult to identify in this regard because of their non-uniform appearance in comparison with RS and MVS yarns. Ring spun yarn has a uniform fiber core, while MVS yarn has periodic wrapper fibers. Neither of these characteristics appears in the OERS yarn structure.

We have found that RS yarn contains the highest proportion of normally oriented core fibers, while MVS yarn possesses the lowest proportion. In RS yarn, the core fibers are completely embedded in the yarn in a helical position, with the diameter varying as the fibers move from the inner part to the outer part and back within the yarn. No wrapper fibers appear in this yarn structure, and belly-band fibers are rare in RS yarn. On the other hand, MVS yarn has the highest proportion of wrapper fibers of the three yarn types. Noticeable also in the MVS yarn is the periodicity of wrapper fibers along the yarn length. In fact the wrapper fiber packing behavior and alignment were the most noticeable features of MVS yarns. The conclusion here is that MVS yarns are mainly composed of wrapper fibers that encircle the core fibers. The absence of twist in the core fibers of MVS yarn must also be regarded as significant. Most wild fibers in MVS yarn protrude from the wrapper fibers rather than the core because the core is encircled by the wrapper fibers. Fibers in a loop formation along the yarn axis are categorized as wild fibers in the MVS yarn structure. All designated fiber types are found in MVS yarn, although the occurrence of belly-band fibers is very low. The number of belly-band fibers is highest in OERS yarn, followed by RS yarn. Belly-band fibers are created in OERS yarns when a fiber under high air pressure at the rotor surface is not able to blend with the twisted fiber strand and winds itself onto the yarn axis as it exits through the navel. Based on our visual analysis of RS, OERS, and MVS yarns.

Ribbon wrapping area/yarn surface area

Using this ratio, note that more than half of the surface area of the MVS yarn is covered and packed by a layer of wrapper fibers.

Yarn Structure in Terms of the Yarn Formation Mechanism

A comparison of the coefficient of variation (CV%) of the yarn helix angle in Table IV reveals that RS and MVS yarns possess higher core fiber parallelization than OERS yarn. This seems to be caused by the action of roller drafting prior to the twist insertion process for both RS and MVS yarns, although one should remember that wrapper fiber parallelization in MVS yarns is closer to the core fiber parallelization of RS yarns. In the MVS yarn structure, core fibers are considered to have zero twist, which differs from RS and OERS yarn structures. From microscopic observation of the MVS yarn structure, it is also clear that the core fiber strand is enveloped by a thin layer of wrapper fibers with good parallelization. The wrapper crest of MVS yarns appears periodically along the yarn central axis, and the packing behavior of wrapper fibers will prevent the mutual movement of fibers along the yarn axis.

Observations of tracer fibers in the MVS yarn structure indicate that some core fibers become wrapper fibers (see Figure 2d). In this case, one end of a fiber in the front part toward the spinning direction is classified as a core fiber and the other end in the rear part becomes a wrapper fiber in MVS yarn. The transformation can be explained by the twist insertion mechanism of the MVS method. No twist insertion is introduced into core fibers during the yarn formation process of MVS yarn, but when the front parts of these fibers are transported inside the nozzle by the orifice, the rear parts of some fibers situated at the outer position of the yarn cross section are spread out from the main fiber stream and twisted by means of the swirling air current at the entrance of the spindle. These are the fibers that are twisted into the sheath of the thin layer of wrapper fibers [4]. Thus, trailing ends of a proportion of core fibers become wrapper fibers.

Estimating the Percentage of Core Fibers Transformed in to Wrapper Fibers in MVS Yarn

Its shows core fibers that are twisted due to the effect of the untwisting action. We separated the untwisted wrapper fibers from the twisted core fibers and counted them. Using the data in Table IV, we then estimated the proportion of core fibers transformed into wrapper fibers. With this approach, we found that 11 % of core fibers are transformed into wrapper fibers due to the twist insertion mechanism of MVS yarn. Figure 3 illustrates the arrangement of wrapper fibers and core fibers found in the MVS yarn structure.

SLUB YARN DEVICES:

1) **RING SPINNING** effect yarn devices:
ground slub, multi count and mulit twist-effect.

2) **OPEN_END** effect yarn devices:
ground slub and multi twist-effect

EXPERIMENTAL STUDY

3)EXPERIMENTAL STUDY:-

3.1 MACHINE PARTICULARS AND PROCESS PARAMETERS;-

The study was conducted at m/s **SRI ANGALAPARAMESWARI TEXTILE MILLS PRIVATE LTD.** The machine particulars and process parameter are given below:

FLOW CHART

Blow room (trutzchler DK- 803)

↓

Carding (trutzchler DK -803)

↓

Drawing (padmatex -720)

↓

Open end spinning (LR – M1/2)

↓

Cone winding (vijay 3 1/3)

MACHINE DETAILS:-

OPEN END SPINNING:-

Make	**: LR m1/2**
No. of rotor/Machine	**: 168**
Rotor speed	**: 35000rpm**
Opening roller speed	**: 7500rpm**
Count delivered	**: 6`s**
TPI/TM	**: 14.6/6**

3.2 TYPES OF MODIFICATION:

1) feed tube fitted with rotor.
2) Feed roller groove modification.

3.2.1 COMBINATION EFFECTS OF OPEN-END ROTOR SPUN HYBRID YARNS.

We have developed a mechanical hybrid yarn spinning system that produces different yarn types on a modified open-end rotor spinning frame. In order to improve yarn properties and produce novel yarns, we investigate the effects of combinations with typical hybrid yarns by inserting two filament yarns with varying filament over-feeds. The results are a new rotor spun loop (RSL) yarn made by combining two aspects of typical hybrid yarn production into one process, and an RSL yarn where a filament yarn, fed with a core filament over-feed (CFOF), is located in the center of one yarn and the other filament yarn, fed with the effect filament over-feed (EFOF), makes a loop on the yarn surface. The stable conditions of RSL yarn production are within a range of EFOF [greater than over equal to] 4 (m/min) and -6.0 [less than over equal to] CFOF [less than over equal to] -4.0 (m/min).

EXPERIMENT:-

We used a cotton sliver (2.4cm mean fiber length and 3.7 g/m sliver size) as the staple fiber and two colored polyester yarn (each yarn 16.7 tex. 150 denier/36 filaments) as the continuous filaments fed into the rotor. The hybrid yarn size was about 95 tex and the fiber composition of cotton/polyester was about 63/73%

HYBRID FANCY OPEN END SPINNING

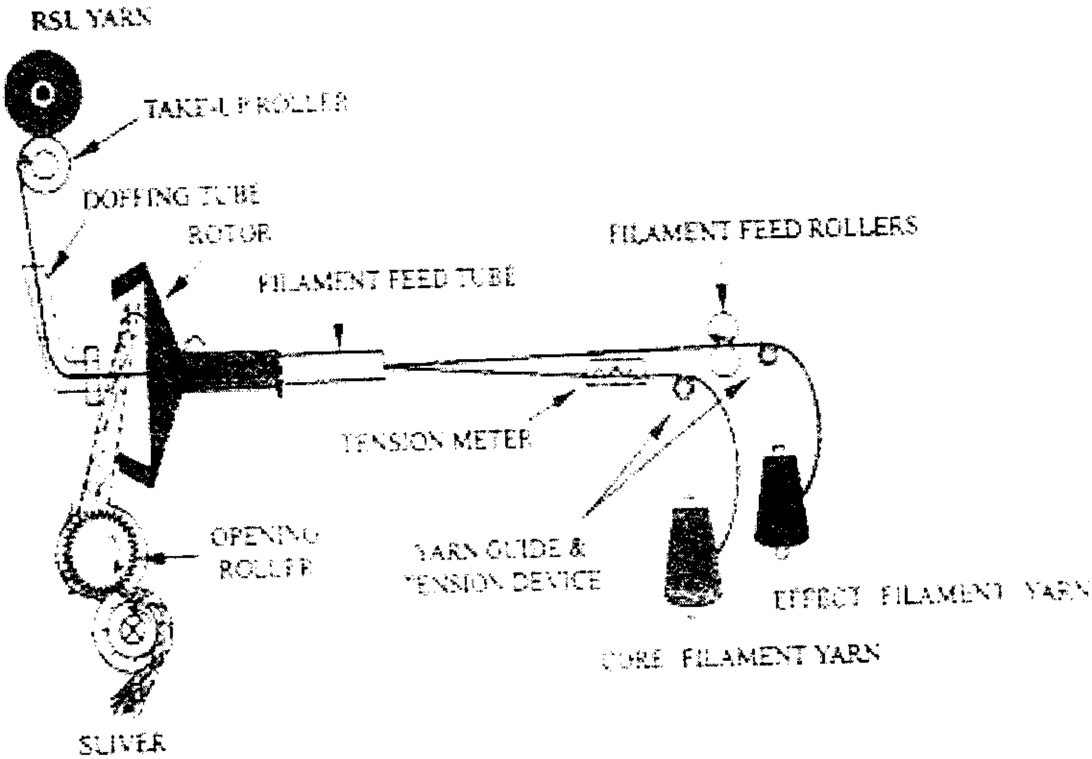


fig 5

Figure is a schematic diagram of the experimental rotor spinning frame. Core-and-effect filament yarns were fed from supply bobbin by means of suitable guides and a tensioning device. They passed straight and doffing tube before being taken up by the take-up roller. Table I lists the spinning parameters for the hybrid yarns.

PARAMETERS	UNITS
ROTOR A) DIAMETER B) SPEED	 64mm 35000rpm
Opening roller speed	7500rpm
Take-up speed	48 m/min
Effect filament feed speed	48-68 m/min
Core filament feed speed	40-48 m/min
Machine twist	14-16 tpi
Draft	64

From this process we come to know that yarn formation is not proper. so we have chosen the other method.

3.2.2 SLUB YARN

1)In this methods we have modified the feed roller grooves.

2)The alternate grooves of the feed roller were modified to produce the slub effect.slub is formed periodically.

3)The distance between slubs is 24 cms

4) Diameter of the slubs is ~ 1mm.(normal yarn diameter is ~ 0.4 mm)

TEST RESULT

4) TESTING RESULT

4.1 FIBER TEST (HVI)

2.5% SPAN LENGTH	24.85
RANGE (MIN & MAX LEN. OF 2.5% SL)	23.92-25.80
50% SPAN LENGTH	11.61
UNIFORMITY RATIO	46.72
STRENGTH (g/tex)	18.10
MICRONAIRE	3.30
LINT	98.22
TRASH	1.20
INVISIBLE LOSS	0.58

4.2 YARN TEST RESULT

Avg Slub dia	1mm
Yarn dia	0.4 mm
Slub distance	~ 24 cm
U%	16.4%
TPI	23.36
TM	5.00

4.3 KNITTED FABRIC RESULT

SINGLE JERSEY (GSM=200)

Loop length (MM)	3.2 mm
Stiffness (kg/cm^2) Course Wales	 2.55 2.04
Drape co-efficient (%)	45.91
Air permeability ($cm^2/s/cm^3$)	43.04
Crease recovery Course Wales	 95 95
Abrasion resistance (%)	98.87%

CONCLUSION

5. CONCLUSION

The study attempted based on:

1) To produce slub yarn in open end spinning which in not available commercially.

2) To produce fancy effect yarn.

3) To create a method adoptable to industry.

Out of this methods adopted here the result are visualized and photographic display are shown.

METHOD 1:

FEED TUBE FITTED WITH ROTOR.

METHOD 2:

FEED ROLLER GROOVE MODIFICATION

SCOPE OF STUDY

6. SCOPE OF STUDY

This method can be practically implemented and bulk yarn can be produced which is urgent requirement in the market.

The feeding system can be automated with slub attachment and slub effect can be produced as desired. I.e. **slub frequency, slub length, slub size** as pre market requirement.

The study was an eye opener to the open end spinning industry to produced **fancy effect.**

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APPENDIX

8. APPENDIX