CHAPTER (6)

CONCLUSIONS

1) For the yarn count the interaction between the yarn count and the polyester percentage has a negative effect on yarn count i.e. the yarn tends to be finer when the interaction decrease.
2) The count coefficient of variation increase with the increase of yarn count in case of 75%,80% and 85% yarn waste while it decrease with the 90% yarn waste. The higher increase rate is obtained at 75% yarn waste and it decrease with the increase of the percentage of waste. the coefficient of yarn variation decreases with the increase of yarn count. The rate of decrease is higher with the higher percentage of knitted waste.
3) The yarn evenness of the coarser count is lower than the finer yarn and the value is highly related to count, this agrees with the literatures. Also the 95% hard waste has lower evenness values for coarse counts, but this is reversed after Nm 15 for both type of hard waste. In the same time of increase in yarn evenness is directly proportion with the percentage of hard waste in both cases. This contradicts with the result of yarn coefficient of variation for the knitted waste.
4) All the factors under study had a straight line effect on the elongation coefficient of variation only the percentage yarn waste has an interactive relation with the yarn count. The maximum range of the elongation coefficient of variation between counts is higher in case of knitted waste compared with the yarn waste.
5) The clips percentage and yarn waste percentage both have a high positive effect on the yarn RKM; yarns from yarn waste have nearly twice value of RKM than yarns from knitted wastes. At 95% yarn waste the yarn RKM at 10/1 equal 15 more than the value of 5% uster statistics 2001, 100% cotton, open end which gives 14.8 RKM.
6) The clips ratio leads to high C.V % RKM than yarn waste ratio.
7) When the percentage of clips is raising the neps value is raising too. The finer counts have a higher number of neps than the coarse counts with the increase of the yarn waste percentage.
8) Only the yarn count and the yarn waste percentage have the main effect on the yarn thick places and both have a positive effect on it is value, this may be due to exist of unopened fibers and very short fibers content.
9) Both of polyester percentage and clips percentage only have the effect on the elongation, and have a positive affect, but the polyester percentage has the higher effect, this may be due to the nature of the man-made fibers which have a high elasticity and the clips consist, which have open structure , low twist and no plied yarns .
10) Only the clips percentage and the yarn waste percentage have the affect on the c.vb and positive effect, and this may be due to very short fibers, unopened fibers and the high different in fiber length.
11) The range of pure fiber in different soft wastes was found to cover the range from 23.9 mm to 27'. 5 mm for low cotton grade, and 26.5 mm to 30.2 mm for higher cotton grade depending on the waste type. This range is said to be relatively high if compared to raw fibers, so it is believed that the cotton soft wastes are suitable for reprocessing
12) It is recommended that the reclamation of hard wastes "clips" is applied to knitted fabric, for the knitted fabrics in general, allows a higher degree of opening than woven fabrics due to the soft twist and the open structure of the knitted fabrics.

13) The waste during reclamation of clips is 24%. This waste resulting from the opening process is unreturnable due to the high content of threads and unopened clips.
14) Samples obtained after every beater of the opening line of clips are extremely hard to be tested, since they consisted mainly of threads. And unopened teared pieces of clips.
15) Further processing concerning the trial of reprocessing clips only involved the open-end process, because the colored material reduced the dyeing process; thus reduced cost. Also, the unopened bits of yarns, and the expected unevenness of the carded sliver resulted in a fancy-like structure to the open-end coarse yarn, being adequate to the upholstery industry, which requires coloured, fancy and coarse yarns.
16) The fact that material is found to be difficult to be processed ended up in an optional solution that is blending with some other material of longer fiber length to act as a carrying material. The carrying material may be of pneumatic cotton, acrylic or polyester.
17) Production of a material suitable for open-end as well as for cotton wool is confirmed.
18) To produce 1 k.g. of open-end yarn out of raw cotton, the raw material will cost 17.9 L.E./k.g.And to produce 1 k.g of open-end yarn out of reclaimed cotton, the raw material will cost 8 L.E.for 6/1 Ne.

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7. Recycling of Textile Waste Using DREF 3 Friction Process. (Engineered cotton fibre selection in the era of fibre-to-yarn engineering) Dr.Yehia Elmogahzy

Appendix # 1

Recycling Equipment: ITMA Review (12)

Pre-treatment

We should mention here special spraying units for applying process-assisting and/or use-related textile auxiliary agents (Ommi Spa, Prato/Italy). '

Use of blending chambers

These material stores of various dimensions are usually located between the process of chopping into small pieces (cutting equipment and/or coarse breaker) and the actual fibre reclaiming line. In this respect, they have a positive effect on the material batch, making possible the trouble-free material throughput.

Cutting machines

The guillotine-type cutting machines of Ateliers Pierret Sprl., Corbion, Belgium in conjunction with the automatic Robot loading system, is reliable in processing of up to 5000 kg/hr of textile waste at a 600 mm working width.

The Laroche S.A. Cours la Ville (France), starcut rotary cutting machine attains a maximum output of 6000 kg/hr. Through the use of rotary cutters with up to four knives, shorter cut lengths can be produced, and material throughput increased with no significant loss of capacity. The machines offered by Italian engineers confirm this development trend (Rolando, Biella and Italiana Rigenerazione, Prato). Alternative possibilities for pre-cutting, especially for the fields of used textiles and old carpets, are offered by coarse breaking machines as a robust fibre reclaiming machine version (Laroche, Italiana Rigenerazione).

Breaking machines

Technologically inflexible chain drives are• replaced by individual motor drives (Rolando). New developments are generally designed with frequency controlled drives (Bonino Cording Machines SAS, Sandigliano Biella/Italy, Margasa S.L., and Barcelona/Spain). Margasa is extending its product range by the MCM model. This machine is produced in working widths of 1.4 and 2 m, and offers the possibility of break gap adjustment from the outside, plus a particle-eliminating unit designed for extracting foreign .bodies.

Laroche has replaced its junior series by the new First model with 1 and 1.5 m working width (600 mm drum diameter), while the Cadette model series is now offered with a 1 m working width. The new development presented by Rolando as a twin breaker embodies an interesting form of material control. Two successive opening operations are combined with the use of only a single drum. This compact process reveals its advantages in the preparation of production waste from nonwoven sector.

Complete plants

There is a tendency in fibre reclaiming machinery production to supply from under one roof. For the preparation of carpet waste, and for solving the associated technical and technological problems, Italiana Rigenarazione has developed equipment technology with preliminary breaker, specially produced feed units and intensive material cleaning. In the USA, a plant with a processing capacity of: up to 4000 kg/hr of carpet waste has been built as a complete system with attached random web formation. The production of directly spinnable reclaimed fibres with a particularly high degree of material opening is made possible by a plant concept from the Spanish manufacturer Margasa. In conjunction with the breaking process, AF fine openers (250.kg/hr) specially developed to that end ensure the complete opening of yarn residues still contained in the material.

Trend to wider machines

Wide width fibre reclaiming equipment requires special measures for ensuring continuous material flow, particularly for material transfer between reclamation units. In addition to bilaterally exhausted perforated cages, two alternatives are observed. Italiana Rigenerazione solves the problem by installing a condenser and a feed chute in each unit. With the aid of air and material acceleration produced by the breaking drum, and with no perforated cage or condenser, the vibrating chute feed principle, used by Bonino within the newly designed SF 2000 line, is applied. Generally positive effects of this homogenizing material feeding system lie in preventing individual machine component overloading due to material variations, and optimum energy consumption with no absolute peak values. Reclaimed material can be taken away to the bale press after each breaking unit

Further processing

The random web-former perfected by Laroche now operates in accordance with an improved process, providing for fabric weights up to 3000 gm/m^{A}2. As an exhibition innovation, Dr. Ernst Fehrer AG, Linz (Austria) presented the Dref 2000 friction spinning machine for economic yarn production from reclaimed fibres in the 40 to 2000 Tex range.

Appendix # 2

Recycling of Textile Waste Using the DREF 2 Friction Spinning Process (13)

The DREF 2 machine has now been on the global market as a serial machine for the past 20 years. This spinning technology for the coarse yarn sector in the Nm 0.25-10 yarn count range has shown the textile industry a wealth of new and interesting production possibilities, above all in the recycling sector - (Fig. 5) shows the friction and spinning principle. In the meantime, over 3000 DREF 2 spinning heads are in industrial operation, manufacturing some 280,000 t of yarn annually. Of this figure, around 216,000 t come from the recycling sector and are employed for production of blankets, cleaning cloths and mops, filler yarns for woven carpets, cables, ropes, leisure footwear and working gloves, etc.

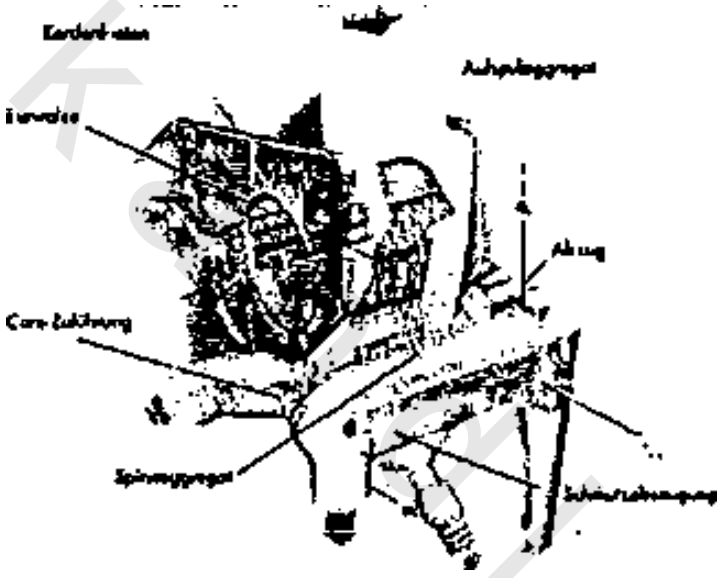


Fig.7 Dref 2 function scheme

Raw material range: all types of synthetic fibres such as PES, PAN, PA, viscose, etc. and their related blends in the following dtex and staple range: 1.7-17 dtex and 10-120 mm (exception: PP and PA fibres in the 10-60 mm and 1.7-6.7 dtex segment) PP and PA fibres with a coarser titre and longer staple can be used in blends, but in smaller percentages (up to approx. 30 %). Also all types of waste fibres such as cotton, wool and other wastes, regenerated and substandard fibres and textile waste (tailoring waste, selvedge waste, yarn and filament waste, etc) . Every type of natural fibre such as flax, linen and jute in blends (homo- or heterogeneous deeding) with cotton and synthetic fibres and 100% wool and wool blends. Animal hair, including goat and horsehair in blends with other fibres. All types of flame retardant fibres, aramid, preox, glass blends and other special fibres. Diverse filaments (multi-, mono-, high strength and textured filaments), metal wires, glass filaments and rovings, threads, substandard filaments, etc. can all be used as cores for DREF 2 yarns.

Special DREF 2 yarn products

Blanket sector: The machine produces blanket yarns for hometex, hotel, hospital, camping and military sectors, as well as, covers made entirely from waste material, substandard, and for high-quality acrylic blankets from virgin fibres. A large percentage of the waste fibres from carded and combed yarn spinning, as well as some from cotton spinning mills, can be utilized for respinning, particularly for his blanket sector.

Jute and cotton waste blends for cable and carpet fillers and summer sandal yarns:

Due to the prevailing technical limitations, up till now, mills of cotton/jute blends or jute/PP regenerated fibre blends in the 85/15 % or 90/10 % ratios were employed in conventional spinning. Using DREF 2, these blends can be easily adjusted and spun with 50/50 % or 60/40%, providing a sizeable reduction in the material price of the blend.

The following advantages derive from the processing of secondary fibres on DREF 2:

Cheap filaments can be used as a yarn core, which allows increased production speeds and spinning without yarn breaks and a more voluminous yarn. ***S*** Through targeted sliver feeding (e.g. waste fibre in the core, substandard or virgin fibres in the sheath), the yarn can be given a good visual appearance. Direct weaving, doubling or braiding of 8 kg bobbins (no rewinding required). No clogging-up or spinning disturbances due to extremely dusty material, as a dust suction device is integrated into the spinning process.

Cotton waste and cotton waste blends with PA filament for transport and conveyor belts:

In a spinning mill in Poland , which has been in operation for about 10 years , 1000 t of yarn with an average yarn count of NM 4.5 are spun annually from textile waste in 3-shift operation . Weaving and knitting mill waste from production and finishing is used as a raw material, along with yarn and fibre waste from the spinning mill and fabric production. In total, the plant consists of four DREF 2 spinning machines, each with 24 spinning heads. Initially, production involved yarns for the blanket- , deco- , and denim- and cleaning cloth sectors. However, for several years, the producer has been using 50% of spinning capacity for the manufacture of yarns NM 3.5/4 - NM 4.2/4 with 1880 dtex PA and 1100 dtex PES filaments. The yarns are woven into the -fabric in warp and weft on special weaving machines in one or more layers and then coated .The value added in this sector is naturally very high , as recycling has been combined with the manufacture of very high-tenacity technical core yarns and the subsequent production of special fabrics with enhanced dimensional stability.

Non-asbestos products, for clutch and brake linings:

For several years, there has been a trend towards the processing of regenerated FR fibres in blends with other special fibres into technical yarns using DREF 2 friction spinning. In most cases, a glass filament is employed in combination with a metal wire as a

core , which are then sheathed with aramid or glass blends . The market is accepting products from recycled FR.

Gloves made of synthetic, regenerated fibres and cotton waste:

Some DREF 2 customers produce PES and PAN regenerated fibre yarns in the NM 5-10 yarn count range for knitted working gloves. The advantage of DREF 2 yarns derives from the high strength of the yarn, which results from the use of a low-cost yarn core, and subsequent higher abrasion resistance and a longer service life. For applications where a certain protection against cuts is required, metal wire is employed as a core instead of the synthetic filament.

DREF fancy yarns for the deco- and hometex sectors:

Yarn residues or threads cannot only be used as a yarn core, but also for the creation of a specific DREF mele effect. As in the case of fancy slivers, e.g. nep slivers; it suffices to let this material run on the left side of the feed unit with the remaining fibre slivers (sheath effect) . The opened fibres from a more or less clearly visible mele effect on the surface of the yarn in accordance with the colour and the amount fed in. Yarns, which are unsuited to the production of a mix effect due to their colour, or cannot be used as core threads as a result of quantity shortage, are utilized for the formation of the yarn core by feeding in an opened condition. Applications are knitted yarns for pullovers, socks, furniture and cushion covers, low-price denim and curtains.

الملخص

نظرا لاهمية عمليات الاسترجاع و التدوير للعوادم و المخلفات لارتباطه الوثيق بإضافة قيمة مضافة للمنتجات، و أيضا لقلة الخامات (الطبيعية-صناعية)، مع التزايدالمطرد لعدد السكان و تضخم حجم المخلفات و العوادم لكثرة الانتاج و التصنيع و كمية الاستهلاك، مما دفع الباحثون و العلماء فى المضى فى هذا الاتجاه بزيادة البحوث فى مجالات تقليل العوادم و أفضل استخدام للمنتج ،و استرجاع المخلفات و العوادم ،و تحسين الظروف البيئية .

وفى الوقت الحالى يتم إعادة تدوير عوادم صناعة الغزل و النسيج الصلبة سواء عوادم الخيوط القطنية (الاسطبة) ، أو عوادم أقمشة التريكو (الكلبس) وذلك بتشغيلها على ماكينات غزل الطرف المفتوح مع إضافة نسبة من الالياف الصناعية مثل البوليستر أو الاكريلك تتراوح من 10% إلى 30% وتكون نسبة العوادم على ذلك من 70% إلى 90% و ذلك حسب متطلبات العميل و مواصفات الخيوط المطلوبة.

ونظرا إلى النقص الشديد فى القطن الخام و أيضا لقلة المساحة المزروعة و الكوارث الطبيعية و أيضا نظرا لإرتفاع سعره، فإستبعاده وتقليل العوادم من الشعيرات يصبح ضرورة ملحة ليمكن المنافسة فى السوق .

الهدف من البحث هو الحصول على خلطة يتم فيها إستبعاد شعيرات القطن الخام تماما و الوصول إلى مواصفات خيوط موجودة بالسوق، إن لم تكن أفضل ، و ذلك بإستخدام أسلوب خاص للتعامل مع هذه العوادم الصلبة فى مراحل التفتيح والخلط والكرد ، والخلطة الرئيسية تتكون من عوادم أقمشة التريكو (الكلبس) أو عوادم خيوط القطن (الاسطبة) مع الالياف الصناعية ، ويتم عملها بضبط العوامل المؤثرة على درجة تفتيح عوادم الخيوط وعوادم أقمشة التريكو.

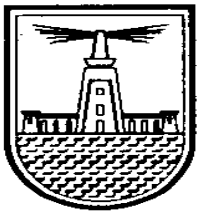
و تم فى هذا البحث عمل دراسة مرجعية لانواع العوادم المستخرجة من مراحل عمليات الغزل و النسيج المختلفة و خواصها الطبيعية.

و تم عمل دراسة مرجعية لاهم متغيرات ماكينة تفتيح العوادم (ماكينة التنسيل) و الشعيرات الناتجة للوصول إلى أفضل تفتيح .

وتم تصميم خمسة خلطات من ثلاث أنواع مختلفة من شعيرات الناتجة من تفتيح عوادم أقمشة التريكو (الكلبس) و عوادم خيوط القطن (الاسطبة) مع شعيرات البوليستر، للحصول على مكونات خلطة تؤدى إلى خواص خيوط تحقق متطلبات العميل .

وتم دراسة تكلفة المنتج مع الأخذ فى الإعتبار تكاليف الخامات و تكلفة أسلوب التشغيل .

وبذلك يتضح أن فائدة الرسالة هى محاولة الوصول إلى المنهجية المستخدمة لاعادة تشغيل عوادم أقمشة التريكو (الكلبس) و عوادم خيوط القطن (الاسطبة) و ذلك بدون إستخدام شعيرات القطن الخام ،والحصول على خيوط غزل طرف مفتوح بجودة مقبولة و سعر تنافسى، و إيجاد بديل آخر للقطن لبخام فى هذه النوعية من الخيوط ، و تحسين الظروف البيئية من خلال إعادة إستخدام لهذه العوادم لتحقيق أعلى ربحية.



التوصل لإحسن ظروف تشغيل لإنتاج خيوط غزل الطرف المفتوح

من عوادم أقمشة التريكو و عوادم خيوط القطن

رسالة علمية

مقدمة الى الدرسات العليا بكلية الهندسة – جامعه الاسكندرية

استيفاء للدراسات المقررة للحصول على درجة

الماجستير

فى

هندسة الغزل والنسيج

مقدمة من

محمد أنور الوطنى أحمد سباق.

2014