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The Processing and Use of Indigenous Fibres

Final Report

by

Dr W Oxenham B.Sc., Ph.D., C.Text., A.T.I.

Dr P A Smith B.Sc., Ph.D., C.Text., F.T.I.

University of Leeds Industrial Services Ltd
175 Woodhouse Lane, Leeds LS2 3AR, United Kingdom
Telephone Leeds (0532) 333444 Telex 556473 UNILDS G Fax (0532) 445270

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Department of Textiles Industries

University of Leeds

To: The Chief
Contracts Section
General Services Division
Department of Adminstration
UNIDO
P O Box 300
Vienna
Austria

June 1990

Ref: DP/PHI/87/002

ULIS Ref: CJ2890

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Synopsis

Carding trials have been carried out on a worsted card to process abaca, banana, kenaf, maguey and pineapple fibres. The abaca fibre was badly prepared and could not be processed, but the four other fibres could be carded with some manual assistance. Blends of these fibres with polyester, acrylic and viscose fibres 50:50 processed rather more easily, but still needed some assistance.

Once the material was obtained in the form of carded sliver the operations of gilling and spinning were relatively straight forward. The 110 tex yarns have been spun and tested. In some cases counts of 40 and 60 tex were also spun.

It is recommended that the semi-worsted system could be used, but that the card would have to be modified to suit these fibres.

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Introduction

Although there were clear difference between the five fibres, the general problems of yarn production were almost the same in each case. These were:-

1. The fibres are basically far too long for spinning and have to be broken down into shorter fibres before the spinning stage. The problem was how to do this without leaving any over length fibres, and without making too much very short fibre.

2. The fibres were in the form of a network or as fibre bundles. It was necessary to break the fibres down into as fine a form as possible without reducing the fibre length too much.

3. All the fibres tended to produce a card web of very low strength. It was very difficult to take the web from the card without breakage, but when MMF were added this problem was much easier.

All these problems were found in preparation and carding; in gilling and spinning processing was much more straight forward.

Experimental Work

1. Methods of reducing the fibre length.

   Each of the five fibres were experimented with individually, but all fibres responded in a similar way, so that they can all be dealt with at the same time. The exception to this was abaca, which broke up into very short fibres in every treatment.

   A rag pulling machine was used first using a swift clothed in coarse metallic wire. The longest fibres found after processing were about 250 to 300mm long, which was quite satisfactory, but this process made too much short fibre. In the next trial another swift with pinned clothing which was less severe was used, but again there was too much short fibre. For this reason it was decided not to use this method of processing.

It was found that a fearnought could be used to break the long fibres and this was less severe than the rag pulling machine, because the density of pinning was much lower. It was found that this machine gave less short fibre but there were also more very long fibres which was not very satisfactory.

The final method used was to cut the fibres by hand to 150mm. This process seemed to be technically the most appropriate, and it is suggested that a rotary cutter or mechanical guillotine should be purchased to allow further experiments along these lines.

2. Process to split the fibres to a finer state

It was found to be possible to split the coarser fibres by carding, but the process was a very critical one. If too little working power is applied in carding the fibrillating effect is not significant, whereas if too much working power is used there is a quite good fibrillation, but also a great deal of fibre breakage. Adjustments have to be made very carefully for each fibre. It is not clear to us at the present time whether or not this would become a commercially viable process.

3. Take-off of the card web

In all cases the card webs were so weak that they could not support themselves over the short distance between the fly comb and the calender rollers (700mm). This was due to the low cohesion of the coarse, crimpless fibres. When a blend of MMF and natural fibres was used the cohesion from the finer crimped MMF eased this situation, but in most cases it was necessary to process the fibre on the scribbler section of a woollen card because this had a lattice to carry the web from the fly comb to the calender rollers. It is concluded that it is essential to have some form of apron take-off after the fly comb to carry the web to the calender rollers. Once through the calender rollers the cohesion problem was much less serious due to the pressure exerted by these rollers. However even at the gilling stage the slivers were not strong, and had to be handled with care.

4. Drop-out of natural fibres during carding

In all the carding experiments there was a very significant loss of the natural fibres during carding due to the fibres dropping off the wire. When carding natural fibres alone this resulted in a very low yield, but when carding a natural/MMF blend it reduced the percentage of natural fibre from 50% down to about 25%. It is concluded that it is essential to have undergrids on the card to prevent this drop out.

Carding experiments on specific fibres

1. After initial experiments on the worsted card in which it was found impossible to take-off the very weak card webs, all experiments were done on the woollen card.

2. Maguey fibre

a) 100% maguey, break, 4 passages of carding, 4 passages of gilling, spinning.

The carding did not make the fibres significantly finer, but the yarn could be spun to 200tex.

b) Break the maguey, blend 85/15 with acrylic fibre, 2 passages of carding, 4 passages of gilling, spin. Yarn was spun to 125 tex, showing the improvement with the synthetic fibre.

c) Break, card, blend 85/15 with acrylic fibre, card, gill, spin. This yarn was also spun to 125 tex but contained more maguey fibre because the blended material was only carded once.

3. Kenaf fibre

a) Rag pull, card, gill, spin.

There was too much fibre breakage in this process.

b) Fearnought, card, gill spin.

Still too much fibre breakage.

c) Fearnought, card with workers raised to reduce carding power, gill, spin.

This was found to give a satisfactory product.

d) As c) but blended 50%/50% with acrylic fibre.

This was very satisfactory and was spun to 110 tex.

e) As d) but blended 75/25 with acrylic fibre.

Again satisfactory and could be spun to 165 tex.

f) As e) but using a fine dtex acrylic fibre (2.5 dtex).

The finer synthetic fibre enabled a yarn of 71 tex to be spun.

4. Abaca fibre

It is thought that this fibre had been damaged in the degumming process because there was excessive fibre breakage. For this reason the fibre was cut instead of broken.

a) Cut, blend 50/50 with acrylic, open, card normally, gill, spin.

This process could be spun to 100 tex, but would not spin to 70 tex. However this was very satisfactory in view of the coarseness of the fibre.

b) As process a) but with the workers raised to reduce carding power. Although this process probably gave rather less fibre breakage there was no significant improvement to the spinning conditions.

c) As process b) but finally taken through a rover and worsted spun.

This method of preparation should allow a finer yarn to be spun, but in this case the yarn was not satisfactory, because it contained too many slubs.

5. <u>Banana fibre</u>

a) Blend 75%/25% acrylic fibre, rag pull, card, gill, spin.

It was found that the acrylic fibre was being broken by the rag pulling process.

b) Cut to 150mm, rag pull with pinned swift, blend 75%/25% acrylic card, gill, spin.

This process was found to be quite satisfactory and was spun to 200 tex.

c) As process b) but blended 50%/50%.

Again satisfactory and was spun to 400 tex, but it is certain that it could be spun finer.

d) As process c) but roved and spun on the worsted ring frame.

A very fine yarn was spun (33 tex), but there were a lot of end breaks.

A more realistic figure would be 50 tex.

e) As process c) but with workers set closer to give more carding power.

The intention of this experiment was to fibrillate the fibres into a finer state, but it was not successful. As pointed out earlier this setting is very critical and in this case simply gave more fibre breakage.

f) 100% banana fibre, breaking, 2 passages with metallic card clothing, 2 passages with flexible clothing, 3 passages of gilling, spin.

This seems to be a good process. The material could be spun easily to 220 tex and probably finer.

6. Pineapple fibre

a) Blend 75%/25% acrylic fibre, open, card, 4 passages of gilling, spin.

This process was very successful and gave 66 tex yarn at high speed (7500 rpm).

b) As process a) but 50/50 blend.

This was found to spin to 59 tex.

c) As process b) but using 3.3 dtex acrylic, then roved and spun on a worsted ring frame to 20 tex.

Larger scale production work

All the work described above was done on very small samples on an experimental basis to find the best conditions for the larger scale samples.

Maguey fibre

a) 100% form

The fibre was cut to 150mm, opened, carded, gilled three times and then spun at 5000 rpm to 110 tex on a Mackie semi-worsted spinner. When processed on a slightly larger scale new problems became evident. The sliver was too weak to pull out of the cans and also tended to break between the front roller and the coiler for the same reason. In the long term these problems could be solved by having springs in the coiler cans, having an assisted creel immediately over the tops of the cans and possibly by using a fibre finish to increase the cohesion. There were also static problems, which could also probably be removed using an anti-static finish.

In view of these problems only a small sample was spun, sufficient to test the yarn properties and to retain a small amount for future reference.

b) 50% blend with Polyester

The fibre was cut to 150mm, blended with polyester then processed as above except that the spindle speed was reduced to 3000 rpm. This fibre blend was processed with no difficulty in gilling, but there was a lot of fly in spinning and winding.

The same blend was also spun to finer counts by making 800 tex rovings from the 3 ktex sliver and then spinning on a worsted ring frame to 60 tex and 40 tex. There was no particular difficulty in spinning these counts.

c) 50% blend with acrylic fibre

This fibre blend was processed in just the same way as above. There was no problem in gilling, but problems with fly in both spinning and winding. 110 tex was spun with 2.45 turns/cm at 3000 rpm. No attempt was made to spin finer counts in this case, but this blend would probably have performed very like the polyester blend.

d) 50% blend with Viloft

It should be made clear that the trade name Viloft is used by Courtaulds both for their hollow fibre and for normal viscose with a soft finish. This fibre was normal viscose not hollow fibre. This blend was processed as before and could be carded and gilled without difficulty but could not be spun due to excessive end breaks.

<u>Kenaf fibre</u>

a) 100% form

After preparing in the normal way the fibre was carded without difficulty. In gilling it could be passed into and through the drafting unit without problems, but the slivers broke continually between the front rollers and the coiler, so that no bulk sample could be made.

b) 50% blend with polyester

This blend was prepared and carded in the usual way without any problems. The gilling also ran with no problems and the sliver was spun to 110 tex at 3000 rpm but there was a lot of fly. This blend was also spun to finer counts by making 800 tex roving, which was spun to 60 tex and 40 tex without any additional problems.

c) 50% blend with acrylic fibre

This blend was prepared as normal. It carded and gilled without problem and was spun to 110 tex without any trouble except that there was a lot of fly. No attempt was made to spin this blend to finer counts.

d) 50% Kenaf with viscose

This blend was prepared in the normal way; it carded and gilled without problems. It was spun to 110 tex at 3000 rpm and ran very well except for some fly in spinning and winding.

Abaca fibre

a) 100% form

As mentioned earlier it was very difficult to card this fibre at all, so that we were never able to judge its performance in gilling and spinning.

b) Abaca in blends with polyester, acrylic and viscose.

Although all the other natural fibres processed quite well in blends with the MMF, all the blends of MMF with abaca were very difficult to card and it was impossible to card a long enough length to pass onto the gilling stage. No yarn samples could be produced.

Banana fibre

a) 100% form

The fibre was prepared and carded in the usual way. The gilling process was no problem, but there were many ends down when spinning 110 tex at 5000 rpm. Only a small quantity of yarn could be spun.

b) 50% banana with polyester

Preparation, carding and gilling were no problem. The 3ktex sliver could be spun to 110 tex at 3000 rpm easily, but there was a lot of fly in spinning. An attempt was made to spin this blend to finer counts but this was not successful.

c) 50% banana with acrylic

The material performed in exactly the same way as the polyester blend above. No attempt was made to spin finer counts.

d) 50% banana with viscose

This blend processed without any serious problems in carding and gilling, but there were many end breaks at the start of the spinning package.

Pineapple fibre

a) 100% pineapple

In the pure form the fibre could be carded and gilled without any serious trouble. Spinning to 110 tex was possible but there were excessive end breaks so that it was not possible to spin a large sample of yarn.

b) 50% pineapple with polyester

This blend carded and gilled without any problems. 110 tex yarn was spun at 3000 rpm without any trouble. It is worth recording that there was much less fly than with other fibres, though still a lot in comparison with the normal apparel fibres. This blend was also roved to 800 tex and spun to 60 tex and 40 tex without any other problems.

c) 50% pineapple with acrylic fibre

Again this blend carded and gilled well. It also spun to 110 tex without trouble, giving less fly and performing even better than the polyester blend.

d) 50% pineapple with viscose

The viscose blend performed well in carding and gilling. It spun readily to 110 tex count, but in this case there was rather more fly.

Summary

A summary of these "production" runs is given in the table below, from which it is easy to see that Abaca was a difficult fibre and all the fibres were easier to spin when blended than in 100% form.

Summary of the "Production" runs

	100% form 110 tex	50% Polyester 110 tex	50% Polyester 60 tex	50% Polyester 40 tex	50% Acrylic 110 tex	50% Viscose 110 tex
Maguey	PSS	LS	SS	SS	LS	PSS
Kenaf	PSS	LS	SS	SS	LS	LS
Abaca	PX	PX	/	/	PX	PX
Banana	PSS	LS	PX	PX	LS	PLS
Pineapple	PSS	LS	SS	SS	LS	LS

Key
- SS small sample made
- LS larger sample made
- P some problems but yarn could still be spun
- PX serious problems and spinning virtually impossible

After production all the yarns were tested for regularity, strength and elongation. These results have been sent to the Philippines Textile Research Institute direct and have not been included in this report. All the yarn samples have been wound, packed and air freighted direct to PTRI.

Conclusions and Recommendations

1. It is our opinion that the semi-worsted system is a satisfactory way of processing abaca, kenaf, maguey, banana and pineapple fibres. We believe that it is particularly good for blends with MMF and for finer counts. However we are not in a position to compare the semi-worsted system with the flax system, which should certainly be very seriously considered.

2. All the fibres require some preparation to break them up prior to semi-worsted carding. In our experience the best way of doing this

is by guillotine (rotary or linear) because this produces less short fibre than breaking the fibres in opening or carding. We therefore recommend that a guillotine is necessary if the semi-worsted system is used.

3. All the fibres (with the exception of abaca) processed well on the semi-worsted card but there was a lot of dropping and a lot of difficulty in feeding the card web to the coiler. We recommend that a man-made fibre (MMF) type semi-worsted card (without morel section) with full undergrids and removable top covers is suitable for processing the five fibres. It is essential that an apron take-off of the type now used on cotton cards must be provided to assist the card web between the fly comb and the coiler. (The design made by Crosrol Ltd seems ideal to us). We are not familiar with any semi-worsted cards with apron assisted take-off, but it is quite easy to verify this. It would be preferable to buy an existing machine rather than a modification. A flax card could also be considered. (At one time flax machinery with little modification was used as a form of semi-worsted system).

4. The pin density on the card depends on whether the card is used only for carding or is also to be used to fibrillate the fibres. It also depends on how much blends with finer MMF will be processed. We suggest that this should be discussed with the machine makers and that we will be happy to take part.

5. We recommend that an intersector gill box capable of processing slivers down to 3 ktex would be suitable. The pinning of the fallers should be decided as in paragraph 4. It is essential that a low assisted creel should be available to prevent sliver breakage at the back of the gill box and also that the cans should be fitted with springs.

6. We recommend a standard double apron semi-worsted ring frame with collapsed balloon spindles. It would be best to have a short machine with two or three spindle sizes and two or three ring sizes so that different counts can be spun.

7. We recommend the above system for counts down to 80-90 tex. For counts finer than this we recommend a rubbing rover. If small enough rings can be obtained the same spinner may be satisfactory. If not then a worsted double apron ring frame would also be needed.

P A SMITH

CJ2890/MB/July 1990