Results of Dehairing Process on Alpaca Fibres with a New Dehairing Technology

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Abstract

Many classes of alpaca fibres contain a certain amount of coarse fibres, which are strong and stiff, and cause discomfort to the end users of alpaca fibre products. It is therefore desirable to separate the coarse alpaca fibres from the fine ones, as it is done with llama fiber. With the AM2 new dehairing technology developed in Argentina, various traits of llama and alpaca fiber were performed similar to those in Australia and in cashmere goats In all cases, samples of raw fleeces were used. The possibility of using worsted (combed and intersected) was planned some time ago. This paper reports on trial results on alpaca dehairing using an modulus of AM2 technology dehairing machine. The diameters of alpaca fleece, dehaired alpaca fibres and removed alpaca fibres were analyzed, and the fibre lengths were compared before and after dehairing. In this dehairing assay, the following input fibre was included: Alpaca fibre top: 22.4 µm average fiber diameter; 23.5% CV of fibre diameter; Objectionable fiber w/w: 6.8%; N°/weight: 0.32; Fiber of> 30 µm: 6.6%. Average fiber length (down + guard hair: Baer diagram): 111.8 mm. One dehairing Product/Down (passage VI) was obtained: average fibre diameter 21.9µm; 24% CV of fineness; Objectionable fiber w / w: 2.2%; N°/weight: 0.16; Fiber of > 30 µm: 3.6% Average fiber length (Barbe): 76.6±2.3 mm (reduction: 22%); Hauteur: 72.1±13.2mm (reduction: 10%). Yield at end dehairing was 83.5%. It was concluded that, the dehaired Alpaca product can be processed by the worsted system.

Keywords - *dehairing animal fibre, alpaca top, objectionable fibre.*

I. INTRODUCTION

Many classes of alpaca fibres contain a certain amount of coarse fibres, which are strong and stiff, and cause discomfort to the alpaca fibre product end users. It is therefore desirable to separate the coarse alpaca fibres from the fine ones, as it is done with llama fiber. With the AM2 new dehairing technology developed in Argentina, various tests of llama and alpaca fiber (Frank et al., 2012) were performed as well as in Australia (Wang et al., 2003) and cashmere goats in Australia (McGregor and Butler 2008), with dehairing technology machine describe in Singh (2003) thesis. In all cases, samples of raw fleeces were used. The possibility of using worsted (combed and intersected fibre top) was planned some time ago.

All the dehairing machines available nowadays in the world have different mechanical configurations but they all apply the same principles. The principal actions that happen during dehairing are opening of the scoured fleece into individual fibres, separating of the coarse guard hairs, from the fine down fibres, and then transferring the partially dehaired fibres from one dehairing point to the other. For a dehairing process to be effective all three principal actions need to be as effective as possible. Unfortunately there is no dehairing machine available that will separate all the fine fibres from coarse guard hairs with one pass or run (Singh, 2003).

This paper reports trial results on alpaca dehairing using an AM2 modulus technology dehairing machine. The diameters of alpaca fleece, dehaired alpaca fibres and removed alpaca fibres were analyzed, and the fibre lengths were compared before and after dehairing.

II. MATERIALS AND METHODS

Material of work: top of alpaca fibre combed and folded in intersecting (2,100 k).

- Dissection of a sample of approximately 200 mg by fiber morphological criteria (Frank et al, 2001) and its later weighing, length measurement with caliper (FG), combing and extraction in Comb Sorter (FF) and measurement of diameters in microprojector. It was determined:

A. Frequency of coarse fibers (FG)

FG is expressed in 3 forms:

FG (w/w), FG4 (N°/w) and prickle factor (FG> 30 µm) are calculated from the staple desiccated where the fiber type is determined by morphological criteria.

FG and FG4 from the whole staple (not dissected) where the type of fiber is determined by diameter, its distribution and type of medulla.

From the Wildman model (1954) FG <30µm is estimated from the numerical frequency when the DMF is measured.

B. Total length of fibers expressed as Bear or as Hauteur; % LFT (percent decrease in total length of fiber per run): expresses the degree of fiber breakage. The lengths are obtained in dissected staple.

c) With Mean Fibre Diameters of coarse fibers (DMFG) and Mean Fibre Diameters of fine fibers (DMFF), the Total Weighted Fiber Diameter (DPFT) is obtained.

The data are presented as summary tables and graphs depicting the dynamic process of dehairing for the different variables evaluated. In the graphics a smoothing adjustment (Loess) was added and mean comparison between runs was performed by non-parametric analysis of variance (Kruskal-Wallis).

In the first table a summary of the general results obtained with the 6th pass or run is presented and the desired values are added for a wool top of 22 µm to be spun by the worsted system according to Alexander (1995).

III. RESULTS & DISCUSSION

TABLE I
Variables summary of the last 6th run of the test with the complete top :

Variables	Result data	Desirable data
Bear (B):	76.6 ± 12.3 mm	75 mm
Hauteur (H):	72.1 ± 18.4 mm	68 mm
LAC (B):	60.6 ± 18.4 mm	(not available), but B can be used.
LAC (H):	57.4 ± 13.4 mm	(not available), but H can be used
Coefficient of length variation	20,88%;	desirable: maximum 48%.
Fibers <25 mm:	0.0%	maximum 10%
Fibers <40 mm:	0.0%	maximum 25%
Length of fibers from the shortest 5%:	60 mm	minimum 20 mm.
Length of fibers from the shorter 50%:	70 mm	minimum: 54 mm
Overall mean diameter	21.92 µm	
Yields to the dehairing of the 6th run:	83,54%	minimum: 70%
Percentage of objectionable fibers of the 6th run:	2,2%	maximum: 3.2%
Proportion of objectionable fibers of the 6 th run:	0,16 n/mg	maximum: 0.23
Prickling factor of the 6 th run:	3.6%	not available

Source of desirable fibre variable level from Alexander (1995).

In this dehairing assay, the input included was: Alpaca tape top 22.4 microns average of diameter; 23.5% CV of fibre diameter; Objectionable fiber w/w: 6.8%; Nº/weight: 0.32; Fiber of> 30 µm: 6.6%. Average fiber length (down + guard hair: Baer diagram): 111.8 mm.

One dehairing Product/Down (VI) was obtained: average fineness 21.9µm; 24% CV of fineness. A small reduction in fiber diameter (0.5%), but a larger reduction in diameter variation (20%). In Australian alpaca dehairing assay a reduction of 6% in Medium fibre lot, also in Strong, but a smaller 4% of reduction in Extra Strong fibre lot were obtained in fibre diameter (re-estimated from Wang et al., 2003). But in the case of variation of fibre diameter, the Australian authors obtain a reduction of 8,6% in Medium, similar in Strong but small reduction (4,2%) in Extra Strong fibre lot. In a dehairing assay of Dromedary camel fibre, a fibre diameter reduction of 19,2% was obtained, and by our self assay with raw alpaca fibre a non significant reduction was obtained; however, a significant reduction of 7.2% in Llama fibre was obtained (Frank et al., 2009).

In objectionable fiber w/w of 2.2% in VI runs (-55.5%; Nº/weight: 0.16 (-50%) ; Fiber of > 30 µm: 3.6% (a reduction of 60%) was obtained (see Figure 1). In Australia, with raw Alpaca fiber, only a 38.5% reduction of fibers of> 30 microns was obtained, in the Medium batch. In the case of Strong lot, a 24% of fibre >30 µm, and a 5.8% reduction in Extra Strong lot (Wang et al., 2003) were obtained.

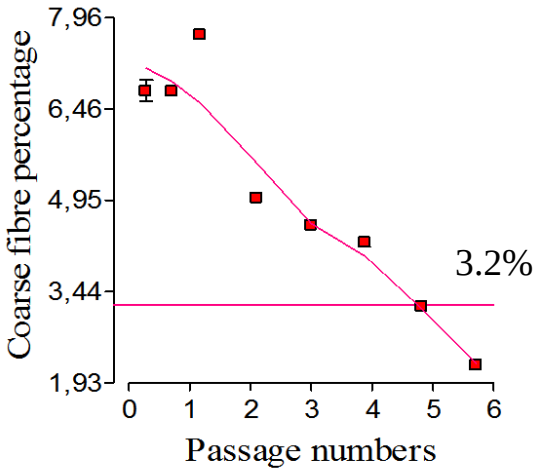

Figure 1: Reduction of coarse fibre percentage by passage numbers with horizontal line depicted minimal coarse fibre detected by panelist (3.2%).

The minimum frequencies of objectionable fibers needed to produce prickle effect in Llama fiber knit fabrics reach 3.2%. For the same fiber weave fabrics are 1.6% (Frank et al., 2013).

Simultaneously the Australian authors obtain an increase of the degree of curvature in the dehaired fiber. This is logical because the objectionable fibers

are straight and rigid, while the down fibers (which prevail in the dehairing) are crimpier.

An average fiber length (down: Baer diagram): 83.0 mm (reduction: 6.9 - 21.2%) (see Figures 2 and 3). Yield at end dehairing was 83.5%. Percentage reduction of fiber length in three different types of fibers, in previous works, Alpaca threw for a reduction of 70% of the fiber length . This drastic reduction explains the strong fiber breakage caused by the dehairing (Frank et al. 2009). In Australian alpaca fibre Wang et al, (2007) obtained a reduction of 20% in Medium lot fibre, 18% for Strong and 6.5% for Extra Strong alpaca lot.

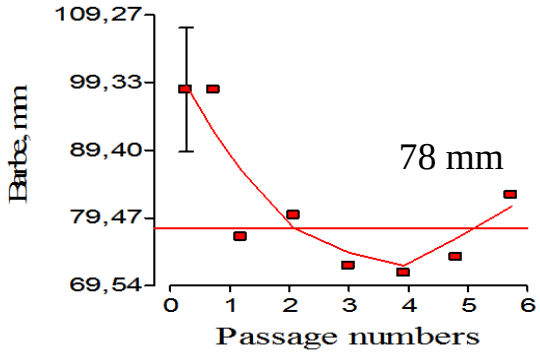

Figure 2: Reduction of fibre length (expressed as Barbe) by passage numbers with horizontal line depicted minimal desirable Barbe length for worsted process (78 mm).

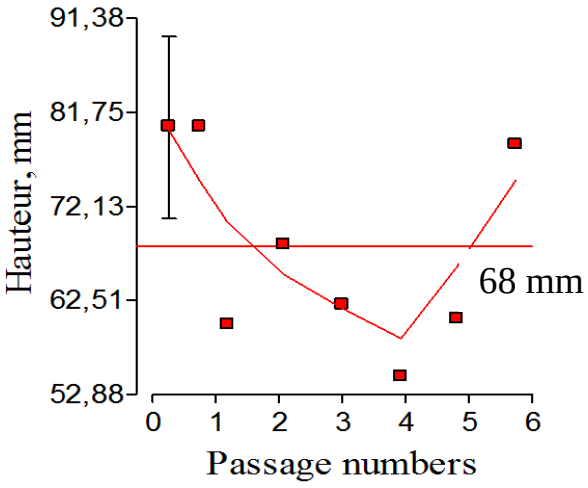

Figure 3: Reduction of fibre length (expressed as Hauteur) by passage numbers with horizontal line depicted minimal desirable Hauteur length for worsted process (68 mm).

The dehairing process also shortens the dehaired fibre length considerably in Australian dehairing assay with Alpaca raw fibre (Wang et al, 2003).

A considerable discussion exists on the extent to which the length of the dehaired fiber is expressed. In principle two measures are used: barbe (weight-weighted length) and hauteur (length weighted by fiber cross-section). The assumptions on which both measures are based are considerably violated in the case of dehaired fiber. However, either way the measure, the product can be processed by the worsted system (combing) (Alexander, 1995).

IV. CONCLUSIONS

The result of dehairing Alpaca fiber assay, pre-processed at top level (carding, gilling and combing) is successful.

Objectionable reducing coarse fibers can reach the minimum required not to cause prickle possible effect at six runs.

Despite the length reduction by fiber breakage, it is still possible to process the final product by the worsted system.

However, the economic evaluation of the process is still under way and the feasibility of improving the price of Alpaca fiber by dehairing is subject to this assessment.

REFERENCES

[1] Alexander, D., 1995. Factors important in fabrics production. Wool Tech. and Sheep Breed. 43(4): 323 – 327.

[2] Frank, E.N., Hich, M.V.H., Adot, O., 2012. Determination of dehairing, carding, combing and spinning difference from lama types of fleeces. International Journal of Applied Science and Technology 2, 61-70

[3] McGregor, B.A., Butler, K.L., 2008. The effects of cashmere attributes on the efficiency of dehairing and dehaired cashmere length. Tex. Res. J. 78, 486-496.

[4] Wang, X., Wang, L., Liu, X., 2003. The quality and processing performance of alpaca fibres. Australian Government, Rural Industries Research and Development Corporation, pp. 101-103.