Experience with Lyocell and Lyocell with cotton and polyamide blends

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Introduction

In this paper, I would like to provide a brief summary of our experience as a spinning mill with the new generation of cellulose fibres. The Lenzing Lyocell® fibre.

My intention is to give you a brief report concerning our innovation strategy, which will not be limited to the spinning processes, but which will also contemplate our active participation in the subsequent weaving processes and in the adornment of the fabrics.

I shall also refer to the applications that have been experienced and on the future prospects of this new range of yarns based on the Lenzing Lyocell® fibre.

Hilaturas Llaudet, S.A.

Hilaturas Llaudet, S.A. was founded in the year 1901 by my great grandfather, which means that it is about to celebrate one hundred years of existence. It is a medium-sized family business, which manufactures high quality yarns using the ring spinning system. It is currently managed by a Management Committee belonging to the fourth generation of the Llaudet family. It owns four spinning mills equipped with modern machinery installations and a single plant for package dyeing, all of which are located in the autonomous region of Catalonia, in the northeast of the Iberian peninsular.

My name is Josep Maria Llaudet. I obtained my Textile Engineering Diploma at the Fachhochschule of Reutlingen (Germany). From 1971 I was responsible for the Commercial Department and the Product Applications Department, then in 1997 I took over the management and Presidency of the Board of Directors of Hilaturas Llaudet, S.A.

Our products have always distinguished themselves for their high levels of quality and innovation. All of which is thanks to cutting-edge production technology, strict control over quality plus constant and intensive effort into research and development.

Since 1997, our quality system has been certified in accordance with the ISO 9001 standard, and the majority of our yarns have been analysed for harmful substances in accordance with the Oeko-Tex 100 standard.

The continuous, up-to-date information concerning suitable applications for our products that is provided to our customers, together with an efficient technical “Post Sales Support”, are further examples of our most notable characteristics.

Our yarns are therefore highly appreciated and employed in many EU countries, and in other overseas countries, for the production of soaked fabrics, knitted fabrics, sewing threads and other textile and technical applications. Our export figures currently exceed 70% of the total production, which is approximately six million kilograms per year.

One of the paths that can be taken to guarantee the survival of our textile industry, which has expensive labour costs, should be based on production innovation in order to reach the highest technical, qualitative and fashion levels that are also respectful of the environment.

The offer and the distribution systems have evolved and radically changed over the last few years, and they are going to continue doing so even more in the future. The well-known names and distribution chains are being obliged to constantly innovate their offers. When faced by the current intense competition, differentiation factors are being pursued that are becoming more and more in line with the tastes of an ever-increasingly demanding and knowledgeable consumer. Along these lines, it is necessary for the entire textile production chain to become involved.

There is also an increasing ecological awareness, both in production and in the generation and treatment of waste products and also in consumer goods.

With the globalisation of markets, competition with those countries having cheap labour in the
production of basic products has intensified in an extraordinary fashion. European yarns, being the first link in the textile chain, cannot remain aloof from this reality. In order to be considered as a leading industrial sector, it has to achieve a high level of specialisation and to make a significant contribution to the results of the end product. Here, it is those small- and medium-sized companies, which are highly specialised and flexible, that will have the greatest opportunity.

During my professional life of the last few years, I have been a faithful defender of the need to encourage research and development, not only in the yarn fields, but also in all those processes within the textile chain that contribute to the attainment of quality, highly innovating products that possess solid added value. For this reason, Hilaturas Llaudet, S.A., has taken this opportunity aboard, to the point where it has become a significant part of its philosophy. This fact has lead to the development of qualitative concepts and differentiation factors, such as:

**Quality.** This is understood as being the obtaining yarns with high qualitative parameters that permit high performance in the weaving process, together with an unsurpassable appearance and behaviour in the use of the end product.

**Innovation.** This is understood as being the production of yarns with new physical and aesthetic characteristics, which are in line with the latest fashion trends and contribute further added value to the end product.

**Functionality.** The quality and properties of the selected raw materials should follow criteria of functionality (comfort and easy-care etc) and should also contribute to endow the end product with particular and differentiated aesthetic factors (appearance, hang, feel and colour etc).

**Versatility.** To conceive new yarn qualities that permit their use in a wide range of applications.

**Competitiveness.** This is understood as being the just relationship of “value for money” which allows the manufacture of high quality, innovating articles, which are, at the same time, competitive.

European yarns are therefore faced with the need to develop products that are clearly innovative and distinguishable. The production of quality raw materials, whether used 100% or mixed with natural and/or man-made fibres that provide both technical and aesthetic improvements to the end product, with the consequent added value. This is the case of yarn obtained from the new generation Lyocell cellulose fibre, where the products require specific research and development into applications and later adornment. This is a true challenge to both technology and innovation.

The Lyocell fibre represents a significant contribution to the textile industry, not only from the ecological point of view, but also thanks to its properties and characteristics, together with its formidable potential for innovation. Through the employment of specific finishes, it is possible to obtain fabrics and garments with numerous interesting variations in appearance and feel. The immense development possibilities open up pathways to truly revolutionary textiles.

The Lyocell fibre is being put forward as the most promising innovation in the man-made fibre sector for almost half a century. Since it is manufactured to be respectful of the environment, the Lyocell fibre is completely biodegradable, its production is ecological and it meets most of the requirements of the contemporary textile industry.

Because of its high absorption capacity and moisture transfer rate, the Lyocell fibre, whether used pure or mixed with other natural or man-made fibres, complies with the consumers’ demands for comfort.

Because of its inherent dry and wet strength properties, the Lyocell fibre is located at a high level in terms of “easy-care” properties and moreover, it will not shrink.

The Lyocell fibre possesses a series of unique advantages:

- **It provides the end product with excellent properties.** The advantages of a cellulose fibre, usage physiology, both dry and wet strength, durability, volume and extreme softness, thanks to its permanent chemical curl, controlled fibrillation, and it can also be machine washed.

- **It is a raw material that is attractive to the textile production line.** It allows high levels of productivity in both spinning and weaving, dura-
bility in wet conditions and cost-effectiveness in dyeing and finishing.

- **It is ideal for innovation and creativity.** New possibilities in both appearance and feel, thanks to the controlled fibrillation.
- **Respectful of the environment.** Obtained through a process that is respectful of the environment, sustainable and biodegradable material.

**Hilaturas Llaudet and Lyocell fibre**

The enormous expectations that have been created around this new generation of cellulose fibre around 1993, awakened our interest in the possibility of including it in our production programme in the near future. The encouraging results that were then obtained in the “denim” sector also made a significant contribution to this.

We complied as much information as was possible concerning the available experience from both Europe and Japan. Except for a few specific applications, we found ourselves facing an embryonic and somewhat disappointing situation because of the presence of significant problems. We learned that the technology and processes for dyeing and finishing on the fabric weave was still in an experimental stage. Actual experience was still scarce and there were serious problems in obtaining an acceptable product quality.

As from this point in time, we decided that our own R + D Department would carry out, right from the very beginning, a thorough investigation and experimentation in to the applications, in which all the textile line processes, in other words, weaving and, above all, preparation, dyeing and the finishing of the fabrics should be contemplated.

As a first step, and in order to establish the state of the new dyeing and finishing techniques, contact was established with the main machinery manufacturers and with most of the chemical product manufacturers, together with a series of well-known prestigious finishing firms.

The work that has been carried out during these last few years has provided us with deep knowledge as to the application possibilities for this new product.

Today, thanks also to the Lenzing Marketing Department and to the efficient collaboration with a series of firms belonging to the textile sector, I am now able to confirm the growing interest and demand for yarns manufactured with Lyocell fibre.

**Lenzing Lyocell fibre yarns**

*Why have we chosen Lenzing Lyocell® fibre?*

- Because we consider that Lyocell is a cellulose fibre with a future.
- Because of the guarantee that we are offered by a fibre producer such as Lenzing, which is backed up by our long and intense relationship that covers more than thirty years.
- Because of the proven quality and extremely interesting properties and characteristics of the Lenzing Lyocell® fibre, which significantly surpasses all other cellulose fibre known today.
- Because it is a fibre with a natural origin that provides a high degree of comfort and its feel is extremely pleasant to the skin.
- Because its production process is highly respectful of the environment.
- Because it is a biodegradable fibre with Oeko-Tex certification.
- Because it provides a wide range of application possibilities.
- Because it allows various, highly innovative finishes to be obtained.
- Because it can be finished in piece (across the width and the weave) and the finished garment.
- Because it can be mixed with other natural and man-made fibres, emphasising their properties.
- Because it represents a true challenge to both technology and innovation.

The yarns that employ Lenzing Lyocell® fibre and which currently form part of our manufacturing programme are as follows:

**LYOCELL:** 100% CLY, Lenzing Lyocell® 1.3 dtx 38 mm bright

**LYOCOT 67/33:** 67% CLY, Lenzing Lyocell® 1.3 dtx 38 mm bright
33% CO, Cotton 1” 1/8 super-combed

**CLYPA 75/25:** 75% CLY, Lenzing Lyocell® 1.3 dtx 38 mm bright
25% PA, Polyamide 6.6 DuPont Nylon, 2.2 dtx 40 mm semi-dull

**100% LYOCELL**
Our company was one of the first Lenzing customers to experiment with the Lenzing Lyocell® fibre when this was still being produced at a pilot plant installed at Lenzing. After several years of prior investigation, as from September 1997 we began the industrial production of yarn employing 100% Lenzing Lyocell® 1.3 dtex 38 mm bright.

The specifications for the yarn that was employed are as follows:
- Fineness: 1.3 dtex
- Length: 38 mm
- Appearance: bright
- Section: oval
- Twist: permanent chemical
- Strength (acon.): > 40 cN/tex
- Stretching: > 14%
- Wet strength (85%): (85%)

These yarns were designed for creativity and comfort. The yarns that are manufactured with natural origin Lenzing Lyocell® fibres harmonise with our bodies. The appearance of fabrics that are manufactured with LYOCELL yarns is, by sight and touch, one of the finest natural fibres. Garments that are produced with LYOCELL yarn are extremely pleasant to the skin, allow active transpiration, do not produce allergy and provide good absorption of body moisture. They are easy to take care of and may be machine washed without any problems.

The range of counts is as follows:
- Nm 1/34, Nm 1/34 voile, Nm 1/40, Nm 1/50, Nm 1/70, Nm 1/70 crêpe S+Z, natural, white and coloured (package-dyeing). These yarns are also supplied in two- or three-plies twists.

The R & D work also included experimentation with the specific machinery for dyeing and finishing and the most suitable chemical products, together with the preparation, dyeing and finishing processes for:
- Yarns
  - In package-dyeing
  - Soaked fabrics
    - Across the width
    - Across the weave
  - Knitted fabrics
    - Across the weave
- Garment
  - In made-up garment: Soaked fabrics

Knitted fabrics: Fully fashioned (rectilinear knitting machines and cotton machines)

Hosiery

Sewing threads

Soaked fabrics. Successful investigation has been carried out, on both dyeing and finishing across the width (Pad batch), and dyeing and finishing across the weave (airjet and airtumbler).

The R + D that was carried out into soaked fabrics (spinning, weaving, preparation, dyeing and finishing), were included in the Brite-Euram VIRTEx programme in Task 2.3 of the Quality Chain, in which Mas Molas, S.A. (fabric manufacturer), Fibracolor, S.A. (fabric preparation, dyeing and finishing) collaborated, together with the textile technological institutes ITV-Denkendorf and Intexter.

Knitted fabrics. This is perhaps the area in which we have concentrated most of our efforts. The lack of available information as to the preparation, dyeing and finishing of knitted fabrics encouraged us to deeply examine this subject. Today, after carrying out research and experimentation with various specific finishing machines, we are able to state that the process now offers full guarantees of quality.

One of the machines that was most successfully employed in the knitted fabric finishing process was the Alliance Zephyr Air-tumbler. This machine carries out the fibrillation process of the dyed material in a water medium, the enzymatic defibrillation process and, if required the dry tumble and final drying treatment.

Knitted garments. Other applications that were successfully investigated were the dyeing and finishing of knitted garments that were manufactured from knitted fabrics, together with garments that were produced with rectilinear knitting machines and cotton machines.

Socks. The application of Lyocell fibre yarns was also developed for the manufacture of socks.

Sewing threads. Sewing threads manufactured using Lyocell fibre makes an interesting alternative to 100% cotton sewing threads. The characteristics and extraordinary properties of the
Lyocell fibre permit the manufacture of sewing threads that provide extraordinary performance and behaviour in the production of all types of garments.

100% Lyocell sewing threads are also the most suitable for the production of soaked and knitted fabrics that have been manufactured from Lyocell yarn or mixtures that are to be later dyed and finished as garments.

**LYOCOT 67/33.** Around the middle of 1999, after two years of industrially producing yarns manufactured with 100% Lenzing Lyocell® fibre, it was considered a suitable time to increase the range with a fine mixture of Lyocell fibre with combed cotton in proportions of 67/33.

This is when we became aware of the combined action of the Lyocell fibre and cotton. The composition and properties of LYOCOT 67/33 yarn allow the production of soaked and knitted fabrics that possess characteristics, appearance and feel that had been previously unknown. Garments that are produced with LYOCOT 67/33 yarn are extraordinarily pleasant to the skin, allow active transpiration, do not produce allergy and provide good absorption of body moisture. They are easy to take care of and may be machine washed without any problems.

**Range of counts:**
Nm 1/40, Nm 1/50, Nm 1/70, in natural, white and colours (package-dyeing).

These yarns are also supplied in two- or three-plies twists.

The same type of Lyocell fibre is used for this mixture (1.3 dtex 38 mm bright) and cotton fibre, 1” 1/8 combed at 18%.

A more cotton-style of feel and appearance was sought, but at the same time maintaining the Lyocell fibre properties and characteristics. This product is therefore, recommended for sportswear, with a wider range of possible end use than in the case of yarn produced from 100% Lyocell (unisex garments).

The applications of the LYOCOT 67/33 quality are basically the same as those for the LYOCELL 100% quality, except for sewing threads.

The processes that are followed for the preparation, dyeing and finishing of the fabrics and garments are basically the same as those employed for articles made from 100% Lyocell.

**CLYPA 75/25.** These are yarns that are produced from a fine mixture of 75% Lenzing Lyocell® fibres and 25% of Polyamide 6.6 fibres. The composition and properties of CLYPA 75/25 yarn allow the production of soaked and knitted fabrics that possess very important characteristics, appearance and feel.

Through the dyeing of the Polyamid 6.6 fibres and the reserve, bleaching or dyeing of the Lyocell fibres, interesting denim are obtained, together with combined colours and two-tone effects.

The CLYPA 75/25 yarns are also very suitable for mixing with elastane (Lycra®) fibres. The characteristics of the dyeing of the polyamide fibres do not deteriorate the remarkable stretching and return strength properties of the elastane fibres.

Garments that are produced with CLYPA 75/25 yarn are extraordinarily beautiful, pleasant to the skin, allow active transpiration, do not produce allergy and provide good absorption of body moisture. They are easy to take care of and may be machine washed without any problems.

**Range of counts:**
Nm 1/40, Nm 1/50, Nm 1/70, in natural and colours (package-dyeing). These yarns are also supplied in two- or three-plies twists.

The applications of the CLYPA 75/25 quality are basically the same as those for the LYOCELL 100% quality, except for sewing threads.

The processes that are followed for the preparation, dyeing and finishing of the fabrics and garments are basically the same as those employed for articles made from 100% Lyocell.

**Conclusions**

It is quite obvious that we now possess yarn qualities that possess extraordinary possibilities that were unthinkable just a few short years ago. They are products that provide significant improvements to the production processes and which greatly contribute to innovation and to the improvement of the performance of the finished product. It is also true that fear and reticence involved in the consumption of this type of products have been overcome thanks to the gradual sway in favour caused by the fabric adornment processes. In spite of all this, we are only at the beginning.