INHALTSVERZEICHNIS

ERÖFFNUNG LYOCELL-SYMPOSIUM

Heinrich Stepniczka, Lenzing AG, Lenzing, Austria

Ein herzliches Willkommen im Namen der Lenzing AG hier in den historischen Gemäuern dieses geschichtsträchtigen Ortes, der durch Jahrhunderte ein Schnittpunkt der Kulturen und Völker war. Im 17. Jahrhundert noch Zentrum der Türkenkriege, ist Stadtschlainig heute Sitz des Österreichischen Studienzentrums für Frieden und Konfliktlösung sowie Europäisches Universitätszentrum für Friedensstudien.

Umso mehr freut es mich, heute – kurz vor der Wende zum nächsten Jahrtausend – wiederum ein internationales Publikum hier versammelt zu wissen – zu einem Thema, das, davon sind wir wohl alle hier überzeugt – auch in die Geschichte der Faserindustrie eingehen wird.

Das enorme Interesse an diesem 1. Lenzing-Symposium hier auf der Burg Schlaining beweist die weltweite Aufmerksamkeit an dieser Neuentwicklung, von der wir heute noch gar nicht abschätzen können, welche Bandbreite an Einsatz- und Verwendungsmöglichkeiten, welches Potential sich in der revolutionären Technologie tatsächlich noch verbirgt – wenngleich wir in unseren Forschungslaboratorien beginnen, eine Ahnung davon zu haben.

Wenn ich so durch die Runde unserer Gäste blicke, dann freut es mich umso mehr, viele bekannte Gesichter zu erkennen, Freunde und Geschäftspartner, die seit Jahren und Jahrzehnten mit der Lenzing-Gruppe engste Beziehungen unterhalten, aber ich sehe auch viele neue Gesichter und Firmenvertreter, von denen ich mir wünsche, sie recht bald und häufig wiedersehen zu dürfen.

Die Lenzing-Gruppe, als deren Vertreter ich Sie hier begrüßen darf, hat nicht nur in den vergangenen 60 Jahren eine beständige Entwicklung vom regionalen Viskosefasererzeuger am Rande eines der schönsten Fremdenverkehrsgebiete, dem Salzkammergut, hin zu einem Global Player mit der Präsenz auf den großen Welt-Textilmärkten erfahren, sondern auch in der Cellulosefaserindustrie bahnbrechende Technologien eingeleitet; besonders hervorhebend möchte ich dabei die internationale Vorreiterrolle im verantwortungsvollen Umgang mit der Natur und dem Schutz der Umwelt.
Wir alle wissen um die Problematik insbesondere der chemischen Industrie in der öffentlichen Meinung, die nur allzuoft – berechtigt oder unberechtigt – zum Sündenbock, aber auch zum Anlaßfall von Kritik in Umweltangelegenheiten wird; die Lenzing AG hat hier Pionierleistungen erbracht und bewiesen, daß die an und für sich umweltbelastende Viskose- und Zellstofftechnologie mit entsprechenden Vorkehrungen wasser- und luftseitig sauber arbeiten kann; das hat viel Geld gekostet, aber auch viel Anerkennung gebracht – Annerkennung, die ich als Vertreter des Fachverbandes der chemischen Industrie Österreichs hier in diesem Rahmen einmal mehr aussprechen darf.
Damit nicht genug hat Lenzing aber weiter geforscht und die NMMO-Technologie zur Produktionsreife im großkommerziellen Maßstab gebracht; mit Lyocell ergänzen wir in der Lenzing-Gruppe die Faserplatte um eine Dimension, die wir heute in ihrer Tragweite – wie bereits erwähnt – noch gar nicht erfassen können; **auf diese Innovation sind nicht nur wir Lenzinger, sondern die gesamte Chemie Österreichs sehr stolz!**

Lenzing ist aber auch bekannt in der gesamten textilen Weiterverarbeitungskette durch ihre profunde Anwendungstechnik und die Serviceleistungen, die wir unseren Kunden bei der Verarbeitung unserer Produkte anbeiten; und ich weiß, wie wichtig diese Unterstützung vor allem bei einem neuen, noch vielfach unbekannten Produkt ist, sodaß wir speziell für Lyocellfasern umfangreichen technischen Support leisten können und werden.

Ich nütze diese Gelegenheit auch für meinen ganz persönlichen Dank an alle Mitarbeiter, die diesen Kongreß hier ermöglicht haben, und wünsche Ihnen allen spannende, informative und diskussionreiche Tage beim 1. Lenzing Lyocell Symposium auf der Burg Schlaining, **das ich hiermit für eröffnet erkläre!**

GRUSSBOTSCHAFT

F. Peter Schinzel, Wirtschaftskammer, Wien, Austria

Verehrte Festgäste, sehr geehrte Damen, sehr geehrte Herren!

Es ist mir eine Ehre, Sie meine Damen und Herren, als Geschäftsführer des Fachverbandes der Textilindustrie Österreichs begrüßen zu dürfen. Ich betone damit die enge Verbundenheit der Textilindustrie mit der Chemiefaserindustrie, die der wichtigste Rohstofflieferant für unsere Branche ist.

Weltweit betrachtet sind die Chemiefasern mit einem Anteil von 54 % vorherrschend. Von den in Österreich verarbeiteten rund 118.000 t Fasern sind nahezu zwei Drittel Chemiefasern, gefolgt von Baumwolle, Flachs und Wolle. Die Chemiefasern werden fast zur Hälfte im technischen Bereich eingesetzt, die zweite Hälfte teilen sich die Heimtextilien und die Bekleidungstextilien. Ohne die Chemiefasern wären die vielfältigen Anwendungsmöglichkeiten, wie zum Beispiel für anspruchsvolle Sportbekleidung, hochmodische Stoffe u.s.w. undenkbar. Auf diesem Gebiet stellt die Entwicklung von Lenzing Lyocell eine besondere Bereicherung dar. In den letzten Jahren fanden die Chemiefasern durch ihre hervorragenden Eigenschaften auch als Autotextilien den gebührenden Stellenwert.
Wir leben in einer Zeit weitreichender Integrationsbewegungen. Es wird in ganz Europa konjunkturell härter aber nicht schlechter. Die politischen und ökonomischen Veränderungen in Europa, Amerika und Asien lassen Produktionsverlagerungen in neuen Dimensionen erscheinen.

Durch die Globalisierung der Wirtschaft hat sich der Wettbewerb auf nahezu allen Märkten drastisch verschärft. Die Textilindustrie ist eine gesunde und vitale Industrie, aber auch eine sehr konjunktursensible, die ein Tief rasch spürt, die aber eine der ersten ist, die aus dem Tief herauskommen.
Der Exportanteil der Textilindustrie verglichen mit anderen Industriezweigen ist einer der höchsten. Mit einem Exportwert von 27,6 Mrd Schilling (+4%) im Jahr 1996 - das entspricht einem Exportanteil von rund 85% gemessen am Produktionswert - muß man schon weit über die Grenzen schauen, um Absatzmärkte zu finden. Die österreichische Textilindustrie lieferte in 140 von insgesamt 193 Länder der Welt. Die Exportoffensive lebt die österreichische Textilindustrie schon seit Jahrzehnten. Was unsere Branche braucht, sind Entbürokratisierung, eine gesunde Eigenkapitalbasis und eine vernünftige Lösung beim Nachtarbeitsgesetz, damit ein sinnvoller Strukturwandel aus eigener Kraft bewirkt werden kann. Um einen ausgewogenen Standortmix zu erreichen, sind in bestimmten Bereichen Produktionsverlagerungen in Niedriglohnländer unerläßlich.

In Brüssel gibt es eine Entwicklung, von der sich die Textilindustrie einiges erwarten kann: EU-Kommissar Bangemann hat im Juni des vergangenen Jahres zu einem Textil-Forum eingeladen, an dem Repräsentanten der Textil- und Bekleidungsverbände sowie der Europäischen Gewerkschaften und Regierungsvertreter teilgenommen haben. Für die nächsten Jahre wurden beträchtliche Arbeitsplatzveriuste prognostiziert, sofern nicht geeignete Maßnahmen getroffen würden. In Arbeitsgruppen wurden die Probleme analysiert und Maßnahmen erarbeitet. Die endgültige Fassung dieser Studie, die bald vorliegen wird, soll für die EU-Kommission in künftigen Jahren als Unterlagen für Entscheidungen im Sinne der Erhaltung und des Ausbaues einer integrierten Textil- und Bekleidungsbranche in Europa herangezogen werden.

Die jetzige Situation verlangt von den österreichischen Textilunternehmern ständige Anpassung. Das ist meines Erachtens nur möglich, wenn alle Mitarbeiter an einem Strang ziehen und die Unternehmenskonzepte auf Flexibilität im wahrsten Sinne des Wortes ausgelegt sind. Allerdings sind auch diese Spielräume in sich begrenzt und ganz ohne Wachstum auf Dauer geht es natürlich nicht. Doch die Zeit arbeitet für die Wirtschaft, denn die Konjunktur beginnt sich zu beleben. Die Textilunternehmen, die sich behauptet haben, sind gestärkt aus der Krise hervorgegangen. Die Hoffnung und das Vertrauen liegen in der nahen Zukunft, die den vollzogenen Anpassungsprozeß wiederum auf Wachstumskurs bringen wird.

Die Grundstrategie für Europa muß für jedes Unternehmen lauten: „Profilierung am Markt mit Produkten, die identifizierbar sind, die sich von Konkurrenzprodukten abheben und differenzieren".

Die österreichische Textilindustrie beschäftigt in 330 Betrieben 22.000 Mitarbeiter und erwirtschaftete 1996 einen Umsatz von 32,5 Mrd. Schilling gegenüber 1995 entspricht dies einem Plus von 0,4 %.

Ich kann Ihnen im Sinne des Vorstehers unserer Branche versichern, daß wir die Herausforderungen des Marktes mit Begeisterung aufnehmen und unser Potential an Know-how, Kreativität und Flexiblität mit aller zur Verfügung stehender Kraft einsetzen werden.

Möge das Interesse an den Fachvorträgen, die Freude an den Gesprächen zwischen Kollegen in dieser schönen Umgebung, die kommenden Tage beherrschen. Das wünsche ich Ihnen von Herzen.

GRUSSBOTSCHAFT

Dieter Graschitz, WIBAG, Eisenstadt, Austria

1994 entschloß sich das Land Burgenland die Kompetenzen im Bereich der Wirtschaft in eine eigene Gesellschaft, nämlich der WIBAG zu konzentrieren. Die Wirtschaftsservice Burgenland AG ist im Alleinbesitz des Landes Burgenland.

Die Aufgabengebiete der WIBAG sind:
- Förderstelle des Landes von der Einreichung bis zur Vergabe
- Unternehmensberatung
- Beteiligungen
- Technologie und Technologietransfer
- EU-Projekte im Rahmen der Ziel-1-Förderung
- Betriebsansiedlung

1991 wurden die ersten Vorentwürfe zur räumlichen Struktur von Heiligenkreuz – St. Gotthard im Hinblick auf eine grenzüberschreitende (Öst.-Bgld.-Ungarn) Entwicklungsplanung diskutiert.

1993 wurden die ersten Grundoptionen für den grenzüberschreitenden Wirtschaftspark abgeschlossen.
Der österreichische (Bgld.) Teil des Business Parks umfaßt ca. 100 ha, der ungarische Teil bis ca. 200 ha.

1995 entschied sich die Fa. Lenzing AG für den Standort Heiligenkreuz. Bedingt durch seine Lage – zwischen einer Flutmulde von 190 m Breite und der Laftnitz entsteht der Business Park eingebettet in einem wahren Naturbereich. Derzeit sind in diesem Park in Ungarn:

	General Motors	1.400 Mitarbeiter
	Dometal	20 Mitarbeiter
	Vossen	100 Mitarbeiter
	Lurotex-Spinnerei	80 Mitarbeiter
in Österreich:		
	Lyocell	120 Mitarbeiter
	Holler	12 Mitarbeiter
	Abwasserverband	
	Jennersdorf	9 Mitarbeiter
	Energie	6 Mitarbeiter
	ISC	17 Mitarbeiter

Mit einer eigenen Energiezentrale wird die Versorgung des Business Parks mit verschiedenen Medien sichergestellt. Sie ist verantwortlich für die kontinuierliche und ausfallssichere Energieversorgung der angesiedelten Firmen mit Strom, Dampf, Kälte, Druckluft, Prozeßwasser und Trinkwasser rund um die Uhr 365 Tage im Jahr.

Wir haben uns im Business Park entschlossen, zwei Cluster zu forcieren, der eine KFZ-Zubehör, der andere die Textilfaser.

Bedingt durch die Positionierung der ungarischen Betriebe und Lyocell, glauben wir an ein Entstehen eines Kompetenzzentrums im Bereich Textil, wobei nicht nur Faserproduzenten, sondern auch Veredler, Färber und Ausrüster implementiert sind. Das wiedererwachte Interesse an nachwachsenden Rohstoffen gibt darüber hinaus die Möglichkeit, im Südburgenland eine Verflechtung zwischen Landwirtschaft und Standortindustrie zu induzieren, den Cluster Textil zu verstärken und gleichzeitig eine regionale Forschungs- und Entwicklungskapazität aufzubauen. Unser Engagement in den nächsten Jahren für den Business Park wird neben der Neuansiedelung von Betrieben und der Erweiterung des Lyocell-Werkes und einer hochtechnologisierten Infrastruktur – auch im Bereich der Telekommunikation (Datahighway) – sich sehr wesentlich auf Forschungs- und Entwicklungsprojekte ausrichten, bedingt durch seine Möglichkeiten und der hohen Förderungen in diesem Bereich.

Wir dürfen Sie daher einladen, sich an der Zukunft eines hoch technologisierten Textilclusters mit dem Textilkompetenzzentrum des Business Parks HK/St. Gotthard näher zu beschäftigen.

THE FUTURE OF THE TEXTILE INDUSTRY IN HIGH-PAY COUNTRIES

Franz Martin Hämmerle, Hämmerle Textilwerke AG, Austria

1. Introduction

This paper is to show some facts and make some observations on why high-pay countries are still reasonable and justifiable locations for the textile industry, despite the globalisation of the trade.

With the exception of the garment industry, there is no industrial branch which in the course of the past years has experienced such far-reaching changes as textile industry. Rapid technological progress, radical changes in respect of the geographic locations of the individual undertakings, new customers and markets, complementary purchases of textiles performed all over the world, and the unpredictability of the development of fashion in combination with strict legal requirements, such as quotas or customs duties, have created a completely new situation in international textile trade. As a consequence of the slow opening of the world markets and the free trade entailed by it - which has been influenced by the MFA, GATT and WTO Agreements - newly industrialising and developing countries are establishing and expanding textile and garment industries. Those countries which can also grow cotton or which already have a synthetic fibre industry are especially favoured.

The past four decades have brought deep changes for the textile and garment industry, especially with reference to locations and structures. Due to the fact that labour costs are very different, in the sixties and seventies the highly manpower intensive garment industry was transferred to low-pay countries. Although the textile industry was extremely capital intensive even then, being an outside supplier to the garment industry it followed it to the low-pay countries. What happened at that time was a typical process of backward integration in the textile chain. This process had begun in the seventies and has been continued in an even more intensive way in the past two decades. Today, textile and garment industry, therefore, is a basic industrial branch that is established in almost all countries in the world. The trade flows of textile products have been dramatically changed by this globalisation.

Textile and garment indstry is one of the oldest industrial branches. Its importance for world economy is emphasised by the fact that its turnovers rank third after those of tourism and the information industry, even before the chemical, automobile and mechanical engineering industries.

2. The World Textile Market

2. 1 Absolute Consumption and Per-Capita Consumption of Textiles*

*Calculated on the basis of fibre consumption and import/export of textiles

In 1992 the global market volume of textiles and garments amounted to 38.1 million tons, which corresponds to a per-capita consumption of 7.7 kg per year. The forecast for the year 2002 expects a growth by 31% to 50 million tons of fibre consumption or 8.5 kg per capita and year (Table 1). The average growth of the world textile market amounted to 2.2% per year between 1980 and 1990 and will increase to 2.8% per year in the period from 1992 to 2002.

There are two reasons for this growth:

- the rise in population and
- the increase of the per-capita consumption.

The aforesaid growth of 11.9 million tons, however, will not be shared out evenly between all countries in the world.
In proportion to the rise in population the consumption of textiles will increase progressively. The major part of the absolute growth of consumption (+ 5.7 million tons) will be experienced in the developing countries due to their above-average rise in population, while the minor part (+ 4.3 million tons) will be caused by industrial countries on account of a further increase of the per-capita consumption. Per-capita consumption, however, will increase the most in Eastern Europe and the successor states of the former Soviet Union, where the starting point was very low after the decay of the Comecon in 1989.

Other sources show similar forecasts. The FAO (UN Food and Agriculture Organisation) and the ICAC (International Cotton Advisory Committee) predict the following fibre consumption:

- *2003: 49.0 million tons*
- *2004: 51.5 million tons*

Although the per-capita consumption in industrialised countries is already five times as high as that in developing countries, the distance will even increase in the near future. Per-capita consumption is highest in the USA with 29.4 kg/year (forecast for 2002: 33.9 kg/year).

While in 1995/96 the cotton harvest amounted to 88.3 million bales (19.2 million tons), a harvest of 100 million bales (21.8 million tons) (+ 13.3%) is predicted for the year 2000. These figures, too, are indicators for a considerable increase in textile consumption.

2.2 Global Textile Capacities

With a share of 57% newly industrialising and developing countries are the dominant factor in today's world textile production. Until 2002 this quota will rise to approximately 60%. However, these figures can only show a quantitative scope but do not imply any statements about the quality and the value of the products concerned.

Table 2 shows the regional distribution of the various production capacities of short staple spinning and weaving mills in 1983 and 1993. The table also shows clearly how the capacities have shifted.

Textile fibre consumption for garment textiles in 1992 and forecast for 2002

	1992			2002			1992 - 2002 Growth in %		
	million tons	population (millions)	kg per capita	million tons	population (millions)	kg per capita	million tons	population (millions)	kg per capita
Industrialised countries	18.4	850	21.6	22.7	900	25.2	23	6	17
Eastern Europe and former Soviet Union	4.0	380	10.5	5.9	410	14.4	48	8	37
Newly industrialising and developing countries	15.7	3,730	4.2	21.4	4,540	4.7	36	22	12
World total	38.1	4,960	7.7	50.0	5,850	8.5	31	18	10

Source: Textile Outlook International

Table 1

Regional distribution of capacities (short staple spinning and weaving mills) in %

	Ring spindles		Rotor spindles		Shuttleless looms		Shuttle looms	
	1983	1993	1983	1993	1983	1993	1983	1993
Western Europe	11	7	11	10	20	12	7	3
Eastern Europe	16	7	66	46	34	32	13	3
Asia / Australia	49	67	12	24	17	35	59	76
North America	13	7	7	15	22	12	8	3
South America	6	7	2	3	4	6	8	9
Africa	5	5	2	2	3	3	5	6
Total	100	100	100	100	100	100	100	100
Number (thousands)	151,735	163,546	5,364	7,675	306.7	683.8	2,569.1	2,045.3

Source: ITMF

Table 2

At present production increases are steepest in China. However, this development will slow down in view of the currently exploding economic growth. In the years to come other Asian countries - in particular on the Indian subcontinent and in South-East Asia - will experience the fastest growth.

between the goods produced and domestic requirements. An index of more than 100 means that the quantities produced exceed the domestic requirements: these are the great textile exporters. Countries with an index of less than 100 are net importers.

Self-sufficiency index of various countries and regions

		1992	1995	2004
Industrialised western countries	USA	77	75	71
	European Union	64	59	49
	Other western European countries	62	60	50
	Japan	73	64	60
	Other industrialised countries	43	44	35
Total		69	65	58
Eastern Europe and former Soviet Union	Eastern Europe	107	110	115
	Former Soviet Union	100	99	100
Total		101	102	104
Newly industrialising and developing countries	China	153	157	165
	Latin America	110	112	110
	South Asia	149	147	156
	East and South-East Asia	186	200	188
	Other countries	107	104	104
Total		143	146	148
World total		104	103	102

Source: Textile Outlook International

Table 3

The industrialised nations will also experience a continuous growth of textile production over the next ten years. However, the annual growth in the EU, the USA and Japan will amount to only 1.3 to 1.4%.

2.3 Textile Trade Flows (Exports and Imports)

Textile trade flows are determined first of all by the self-sufficiency index characterising the individual regions and producer countries (Table 3). This index indicates the relationship

In some industrialised western countries imports amount to more than three quarters of the whole textile market. On the whole, however, even in 2004 the EU member states will still produce approximately 50% of their own demands for textiles. But every further increase in imports will henceforth depend almost exclusively on the market growth and only in part on a freezing of existing industry.

The rise of the world population leads to a long-term increase in the demand for textiles which on account of the increase in the per-capita consumption will be convex in relation to the population rise.

The continuously growing affluence of the newly industrialising and developing countries of Asia and Latin America as well as of the countries of the former Eastern bloc will let the textile exports of these countries grow more slowly or even stagnate in the future. The increasing domestic requirements for textiles will also lead to a greater interest in the domestic markets. Due to a strong increase in purchasing power many of these countries will even turn into importers of high-quality and innovative textiles.

It is true that China exported textiles and garments equivalent to a value of 36 billion US dollars in 1995, but it also imported textiles and garments for 20 billion US dollars. While imports had increased by 28% as compared to 1994, exports had increased by only 8.4%. Today China is therefore already the world's largest textile and garment importer.

In his latest book (Megatrends Asia) the American futurist John Naisbitt states that the Asian economies have so far relied first of all on export business, whereas in the future it will first of all be the consumers' purchasing power and a new middle class to boost economy. By the year 2000 there will be approximately half a billion people in Asia who will belong to a middle class defined according to western criteria. ... In view of the rapid growth in Asia only those undertakings will be able to play an international role in the future which earn at least one third of their yields in Asia.

The globalisation of textile industry will lead to the following "division of labour":

- the new textile superpowers that dispose of their own raw materials and basic commodities - first of all the cotton-growing countries - will produce the commodities,
- while high-pay countries with long traditions in textile industry will produce high-quality fashionable specialities and innovative niche products.

This "division of labour" will in turn produce mutual trade flows of considerable importance.

3. Distorted Competition on the International Textile Market

3.1 Labour Costs

Depending on the product concerned, labour costs in textile industry amount to 20 to 30% of the total costs in a high-pay country but to only 5 to 10% in a developing country. The wage level is therefore a decisive factor for competitiveness.

An annual research by Werner International shows clearly that labour costs in industrialised western countries and Japan are many times higher than those in the developing countries. Austria, for example, ranks ninth among the 60 most important textile-producing countries (Tables 4 and 5, Annex).

3.2 Working Hours

An international comparison of the annual working hours in textile industry shows that the high-pay countries are among those countries with the lowest numbers of working hours (Table 6, Annex). The EU member states rank last in this list (between 1,600 and 2,000 working hours per year).

3.3 Machine Time

One important competitive drawback is machine run time. Since textile industry requires very capital intensive plants and machinery, an optimum capacity utilisation is of decisive importance for the level of competition. While in most Asian "textile superpowers" the machines run for more than 8,000 hours per year, industrialised countries have to face legal provisions on maximum working hours which put strict limits to the maximum machine run time that would be theoretically possible (8,760 hours / year) (Table 7, Annex). Long machine run times mean short processing times, which are absolutely necessary in view of the requirement of quick responses. Especially in textile industry, where the level of employment is almost always subject to strong seasonal fluctuations, it is of vital importance that an undertaking is allowed to commence and continue production whenever this is required by the orders position - if necessary, even on Sundays.

3.4 Non-Tariff Trade Barriers and Competition-Distorting Practices of Newly Industrialising and Developing Countries

In addition to the aforesaid competitive drawbacks there are various protectionist measures which may be taken by newly industrialising and developing countries and distort competition, such as

- social and environmental dumping
  - prohibition of trade unions
  - no social security
  - child labour
  - no environmental protection
- market restrictions
  - high import duties or even bans on import
  - import formalities
- state subsidies
  - export subsidies
  - subsidies for cotton
- evasion of copyrights for design

Regrettably, this list could be continued as one likes. The practices employed differ very much between the individual countries concerned. Whether protectionism in world-wide textile trade will be cut down in the next years, as is stipulated by the WTO Agreement, will yet have to show.

4. Locational Advantages for Textile Industry in High-pay Countries

Despite manifold and sometimes serious disadvantages, high-pay countries do still hold numerous trump cards in the international competition for the best local conditions.

First of all there are factors such as high productivity, low inflation, low interest rates, high-quality infra-structures, reliable staff, high levels of education and training, and socio-political stability which speak well for locations in high-pay countries. These locational trump cards have to be mobilised in order to safeguard jobs.

4.1 Labour Efficiency and Production Plants

Labour efficiency in industrialised countries has increased dramatically in the past years. But the lead over developing countries in respect of efficiency can only compensate for a part of the substantially higher labour costs.

Since labour costs are higher and costs of capital are lower in industrialised countries, there is only one strategic option: investments have to promote automation by employing highly developed technologies. This is the most efficient way to avoid competition in the production of labour-intensive products.

4.2 Staff

One decisive factor for an undertaking's success or failure is its staff. The quality of a given location for a textile undertaking is therefore substantially influenced by the qualification of its personnel and the availability of experts. Well educated staff are a valuable asset that helps even locations in Central Europe to maintain their holds on the world market - despite the fierce competitive pressure and unfavourable conditions of production in respect of the costs to be borne.

4.3 Products

An enterprise that offers products which others can manufacture in a comparable quality and at lower prices, will very soon have to drop out. One of the most important factors for survival in a "high-pay country" therefore has to be product innovation. Undertakings should concentrate on their strengths and their core competence and enhance them. Novelties and niche products - fabrics presenting great fashionable or technical requirements - have to be developed. These products which are manufactured in high-pay countries have to be designed and produced in a way that makes them unique and hardly or not at all possible to be copied by newly industrialising or developing countries.

4.4 Necessary Strategic Orientations

Strategies are the results of logical and conceptive reflection on a future that can be planned. The speed with which things are changing is still increasing dramatically. Due to shorter planning horizons, once developed strategies have to be reconsidered much sooner than they used to.

European textile undertakings which cut down their productive capacities need not give up markets for this reason. Existing and new sales areas may be attended to also by offering goods which have been bought complementarily. Complementary purchases have to be seen as global sourcing nowadays, as a world-wide search for outside supplies at reasonable prices. Creative processes, product development, production and marketing may be performed at different locations in the future. Strategic alliances will thus be an important factor for the future success of an undertaking in a high-pay country.

5. Conclusions

New suppliers from newly industrialising and developing countries have forced the European textile industry to adjust its structures and capacities. In the past 40 years this process has halved the number of jobs in textile industry. Nevertheless textile industry still provides more than 1.3 million jobs in the European Union, in addition to 1 million jobs in garment industry. This diminution is slowing down more and more and will finally come to a standstill since the global demand for textiles will increase strongly.
External influences, such as a generally favourable economy, a boom in a certain branch or the international monetary situation, affect the success or failure of an undertaking only to a very limited degree. What is of decisive importance, however, is the right product.

Fashion is still made in Europe. Therefore, there will also be a core of textile industry in the near future. Textile industry in Eastern Europe and in Asia is not able to meet the requirements for a modern garment industry, neither in respect of the quality produced nor in respect of logistics. The manufacturing of fashionable fabrics makes maximum demands on a producer's technical flexibility (i.e. small lots and short terms of delivery).
Since staple commodities and high-volume articles are produced at rock-bottom prices in newly industrialising and developing countries, traditional textile countries can only turn towards specialities requiring a high level of know-how as well as highly innovative products, which may be marketed world-wide. Even on a medium-term basis such products will certainly be manufactured by traditional European textile undertakings. But it is also necessary to be already present as a supplier to the growing future markets.

The list of the 15 leading textile-exporting countries consists of eight high-pay countries, three newly industrialising countries, and only four developing countries with a low wage level (Table 8, Annex). This list alone shows that textile industry is not in such a bad position as is generally assumed (with reference to garment industry these statistics have to be considered a bit more cautiously since large shares of the goods exported have been imported from low-pay countries in the first place).

In order to guarantee success, the answers to competitive drawbacks have to be defined as follows:

- selective branded articles and niche products,
- creativity and design of fashionable products,
- innovation and technical know-how in respect of high-tech textiles,
- the highest quality and reliability possible,
- flexibility and small batch productions,
- short processing times and quick responses,
- adjustment to the markets,
- customer services,
- optimisation of business processes,
- reasonable investments and process innovations,
- automation,
- cost management and reduction of unit cots.

The wohle industrial sector has to win back its competitiveness in order to be able to safeguard jobs; this will be the callange for the next years. Therefore, employers, employees and the legislator alike will have to promote the following fundamental measures:

- reduction of overall labour cost by reducing non-wage labour costs,
- more flexible working times, i. e. new concepts for a definition of annual working times with better balancing possibilities,
- the possibility to increase machine running times without premium pays,
- prolongation of the working life by raising the age of retirement,
- possible reductions of working hours only without pay compensations

In his principal work on The Origin of Species Charles Darwin stated: "It is neither the strongest nor the most intelligent being that survives but the one that is best able to adjust to changes." Our future strategy and planning must be based on this principle.

A KEY TO SUCCESS IN THE TEXTILE PIPELINE: CORRECT OPENING AND CARDING OF LENZING LYOCELL

Hermann Selker, Trützschler, Germany

1. INTRODUCTION

Lenzing Lyocell - a new fibre or Lenzing Lyocell - an additional viscose fibre variant.

Which of the above statements is more appropriate from the viewpoint of the manufacturer of spinning preparation machines? Without doubt this fibre is innovative, opens up new fields of applications, and provides interesting product possibilities. On the other hand, the spinning mills make the justified request to be able to process this fibre with the existing machinery. This results in problems that have to be defined by the fibre suppliers as well as by the machine manufacturers. Ideally the user, fibre producer, and machine builder work together and have a common goal in mind.

Today I would like to address a specific area of this cooperation: the adjustment of the fibre preparation machines and cards to the fibre. First I would like to briefly deal with the fibre and test techniques, and then describe how we optimized the fibre opening and came to a surprising realization. I will cover carding on a high performance machine in-depth, and the drafting process relatively quick. The last part of my lecture contains the sentence:

„Lenzing Lyocell can be processed without any problems on standard spinning preparation machines."

Following this look-ahead, I now would like to go into the details.

2. THE FIBRE

Literature has taught us that Lyocell fibres possess high strength, have little washing shrinkage, and can absorb much moisture. Fibrillation makes it possible to change the feel and optic, especially in regard to silk-like character. But how does the Lyocell fibre do with sober testing equipment results? We have discovered that Lenzing Lyocell - in contrast to other man-made fibres - can be tested well with the Zellweger AFIS-test equipment.

The nep results correlate well with manual counts, and the length measuring reacts sensitive to process-bound changes in length. The colleagues from Zellweger may forgive me for declaring the cotton testing equipment AFIS suitable for Lyocell as well. Of course I am aware that optimization and adjustments are still necessary and practical. Within the scope of these tests, however, we have assumed the validity of the AFIS results.

The AFIS-results (length value in relation to weight) characterize the tested Lenzing Lyocell fibres (1,3 dtex/40 mm) as follows:

- average fibre length	36,5 mm
- coefficient of variation	19,5 %
- short staple content > 12,5 mm	0,2 %
- UQL	39,9 mm
- Neps	28/g
- average nep size	0,73 mm

The bundle strength lies at approx. 35 cN/tex, and the bundle elongation at approx. 14 to 15%.

During the analyzing process, fibres with different finishes were checked. The following results are in relation to a lot with a ring spin finish from January 1997.

The UQL of approx. 40 mm shows the length of the cut staple; short fibres can hardly be measured. The nep content in the bale - as compared with other man-made fibres - is relatively high in the 40 mm staple area. This is already an indication that special emphasis needs to be given to nep reduction during carding.

3. FIBRE OPENING

The most important principles for fibre opening are:

1. Fibre opening needs to be carried out as gentle as possible.
2. If a high degree of opening is required, the opening must be done gradually.

The desired degree of opening depends on the requirements of subsequent processing, in this case of the cards. When processing man-made fibres it usually holds true that a higher degree of opening results in gentler carding and higher card performance. This is therefore usually the goal.

Regrettably, a high degree of opening has also a negative side: the neps in the tuft increase. On a properly designed card, however, this usually doesn't play a role and has no effect on the amount of neps in the card sliver, respectively in the yarn.

The bale opening was carried out with a manually fed bale opener BO. For the tests 4 types of openers were available (see fig. 1).

Types of openers

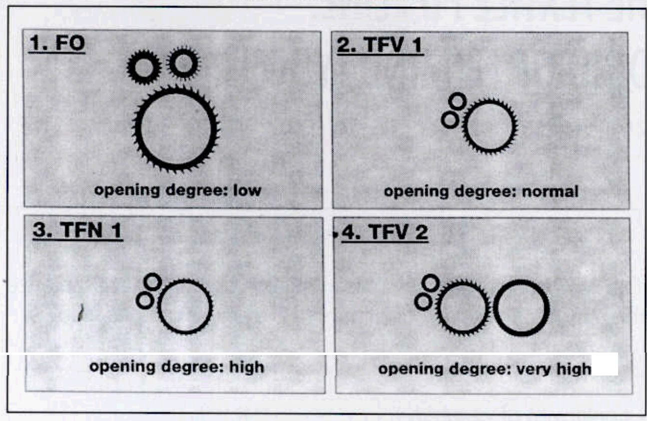


Fig. 1

The opener TUFTOMAT TFV 1 is a standard opener for polyester, polyamid, or polypropylene. The opener TUFTOMAT TFV2 is normally used for viscose and Modal. As expected the selection of the opener has an influence on the degree of opening (see fig. 2).

Influence of the opener on degree of opening

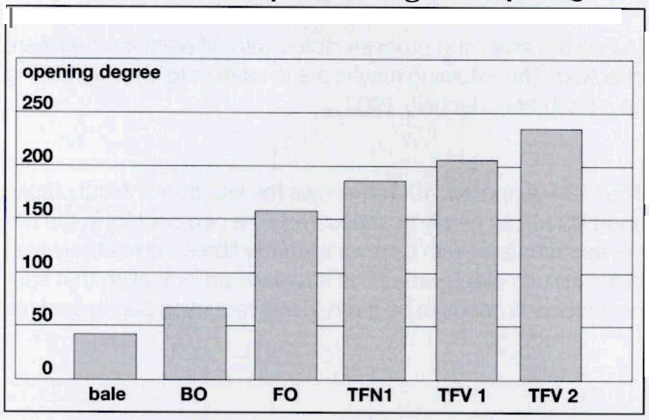


Fig. 2

The highest degree of opening is achieved with the two-roll opener TUFTOMAT TFV2. The nep formation is relatively small after the opener. A slight influence of the opener, however, can be detected (see fig. 3)

Influence of the opener on the neps in the tuft

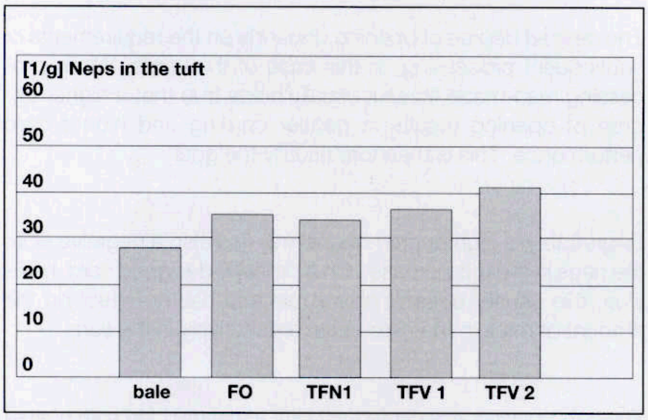


Fig. 3

Not all types of openers have an influence on the fibre length. The results ate within the variation range of the bale values (see fig. 4).

Influence of the opener on the fibre length in the tuft

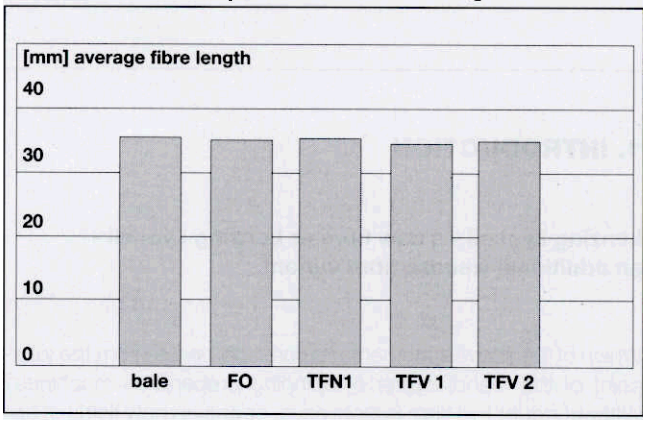


Fig. 4

When making a general evaluation of these detail-results, we normally would prefer the two-roll opener TUFTOMAT TFV 2 because it achieves the highest degree of opening. But it is also known that an isolated observation of the opening test results - without the inclusion of carding - could lead to wrong conclusions. We therefore carded and tested the material from all 4 opening lines. The result was surprising: the best overall outcome was achieved with minimal opening prior to the card. The laboratory values as well as the visual evaluation by experts show the following results (Fig. 5).

AFIS-results card sliver

Opener	FO	TFV 1	TFN 1	TFN 1
average fibre length [mm]	36,1	36,7	36,4	36,4
content of short staples < 12mm [%]	0,3	0,3	0,3	0,4
UQL [mm]	39,8	40,0	40,0	40,0
neps [1/g]	12	26	21	21

Fig. 5

The nep result was the decisive factor for our conclusion. During a second test series with another fibre finish this decision was confirmed.

How come Lenzing-Lyocell requires less opening prior to carding, contrary to our experience with other man-made fibres? I believe there are two deciding factors here:

1. The relatively high nep value in the bale
2. The application of a new high production card with a special pre-opening unit

Naturally, the low degree of opening in the opening line places higher demands on the card. This also corresponds with practical Lyocell experiences. Older cards without pre-opening segments are therefore not suitable for Lyocell-processing, not even for small productions. However, cards of the second generation of high production cards - starting approximately in the early 80s - can process Lyocell with moderate productions well. These cards are equipped with pre-opening segments.

What does an ideal opening line for Lenzing-Lyocell look like? The layout of such a line depends on the production (see fig. 6).

Opening Lines

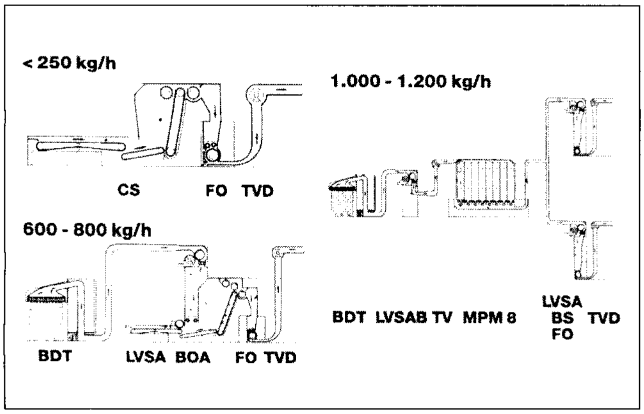


Fig. 6

Fig. 6 shows 3 variants for different production areas. If Lenzing-Lyocell is to be blended with other fibres, no pre-opening prior to the tuft-blending equipment is necessary.

4. CARDING

The problem definition for carding of Lenzing-Lyocell deviates somewhat in comparison with other man-made fibres. Similar to cotton processing, increased emphasis needs to be placed on nep reduction. Today, cards for cotton and man-made fibre differ from each other only in regard to clothing and adjustments. The objective of our tests is to find the optimum for both criteria.

Allow me to address some special features of the trial card in more detail. We have applied a Truetzschler DK 803 high production card. Before going into any specifics of this machine I would like to describe the concept of the card and the problem definition on which this development is based. The carding quality is determined mainly in the area between cylinder and flat, and cylinder and carding segment.

Theoretically we would like to work with highest possible cylinder speed, tightest possible adjustment, and finest possible clothing. However, the fibre to be processed sets technological limits for us. The line between optimal carding and potential fibre damage is very fine. Especially the size of the tufts which are delivered from the taker-in to the cylinder determines these limits. These tufts must first be opened some more on the cylinder of the pre-carding segment area. In order to further open the tufts before they reach the cylinder surface, we developed a new pre-opening unit for the DK 803. Thus the possibility is provided for more effective carding in the cylinder area, i.e. to achieve a higher quality level, higher production rates, and therefore higher economic efficiency. The possibility of improved opening at this card is certainly a reason why Lenzing-Lyocell requires relatively little opening during fibre preparation.

How does this new pre-opening process work on the DK 803? The traditional separation between tuft feeder and card is omitted. The tuft feeder DIRECTFEED is integrated in the card (fig. 7).

DIRECTFEED

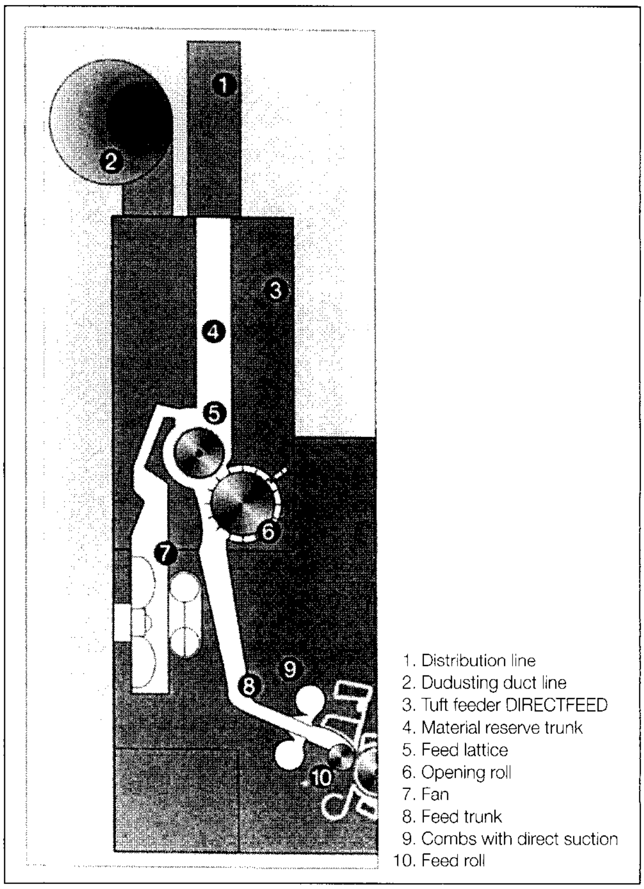


Fig. 7

The web is formed only a few centimeters before the feed roll of the card. This way faulty drafts and malfunctions in the area of traditional web transfer to the card are avoided. Especially materials with high fibre-metal friction, like Lenzing-Lyocell, are sensitive.

The feed area of the DK 803 is named SENSOFEED (fig. 8)

SENSOFEED

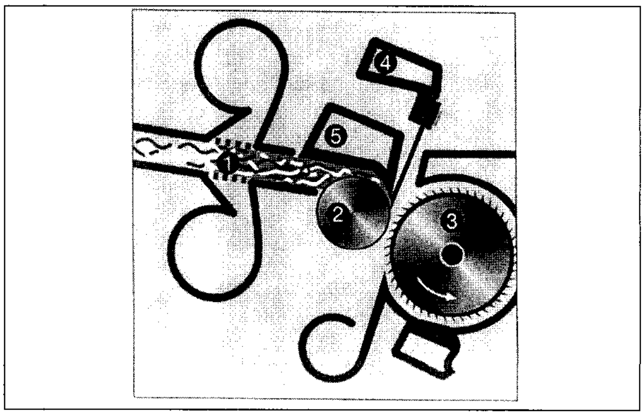


Fig. 8

SENSOFEED is a completely new developed unit. It consists of a feed roll with special surface structure and a feed plate located above it. 10 leaf springs, each 10 cm wide, guide the material to the transfer point between feed roll and taker-in. These spring elements are independent of the feed plate and adjust themselves precisely to the width of the material thickness. This unit results in an extremely gentle material feeding and a very sensitive web scanning. The scanning signal of the 10 leaf springs is integrated and used for short-term levelling.

The WEBFEED is a fibre-protective pre-opening unit (fig. 9).

WEBFEED

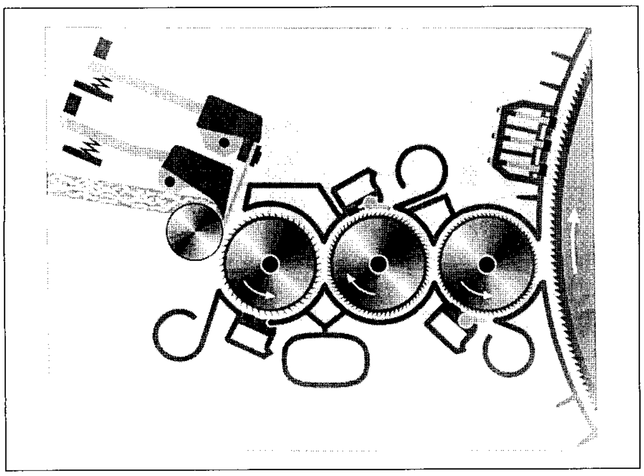


Fig. 9

Three taker-ins open the tufts and form a web. This web is delivered to the cylinder by the third taker-in. For cotton processing, the first taker-in is designed as needle roll. For the Lenzing-Lyocell fibres we have used a clothing roll with 36 points/inch^2, and neutral angles. The two other taker-ins are equipped with finer clothing. To rule out fibre loss the deflector blades of the dirt removal system are closed when processing Lyocell.

Before presenting you with the carding results I would like to mention three basic quality aspects in more detail.

A) Flat adjustment

The adjustment of the flat bars to the cylinder are of utmost importance for the nep result. This adjustment is usually carried out manually. The accuracy of the adjustment depends on the skill of the person. Today there exists the possibility - with the FLATCONTROL FCT system - to objectively measure this adjustment. The difference to manual measurement is shown in the following test (fig. 10):

In a spinning mill we had asked a customer to adjust 10 cotton processing cards, and then carried out the adjustment on the 10 cards with FLATCONTROL FCT. Though the new adjustment did not bring any improvement to the best card, the average nep level is approx. 20% lower. This quality-gain should not be given away, especially in case of material that reacts critically to neps,

More quality constancy through FLATCONTROL FCT

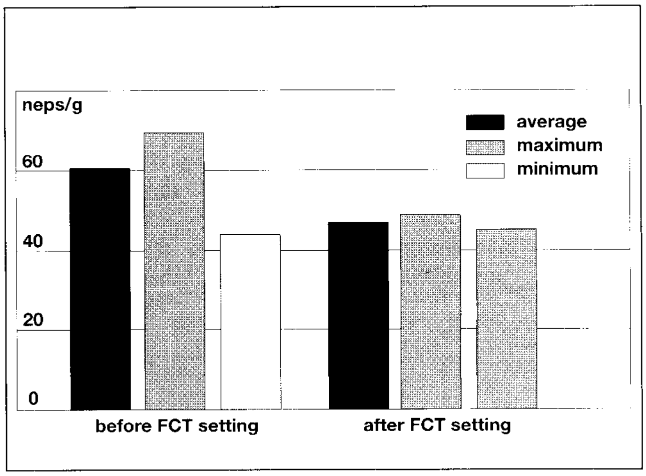


Fig. 10

like Lenzing-Lyocell.

B) On-line nep control

A further tool of quality management is the on-line control of neps at the card. Instead of random testing in the laboratory it is possible to continuously count the neps with the NEPCONTROL NCT (fig. 11).

NEPCONTROL NCT

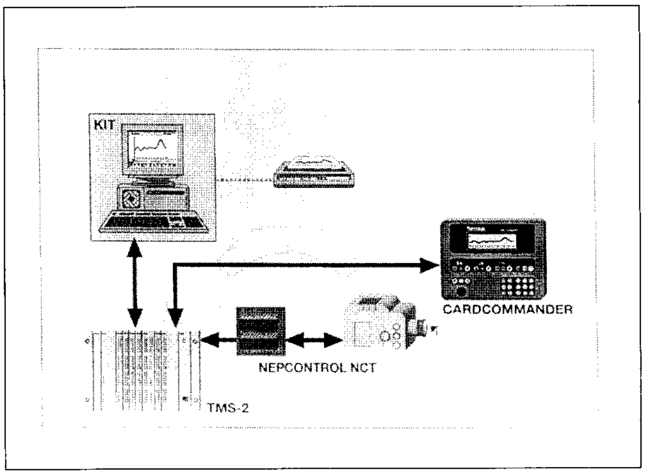


Fig. 11

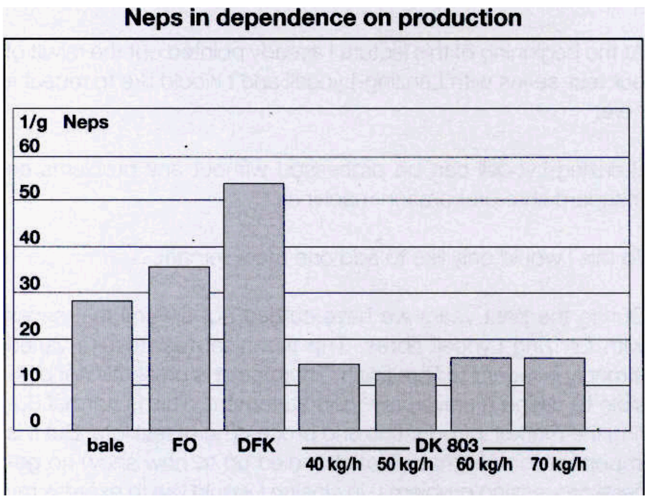
A video camera, oscillating over the whole width, is checking the card web and transfers these values to the TMS 2 computer of the CARDCOMMANDER. The values are shown on the display and, if required, forwarded to the higher ranking SLIVER INFORMATION SYSTEM Truetzschler m-KIT. When chosen limit values are exceeded, m-KIT automatically stops the respective card. Then the multimedial elements of the m-KIT support the machine operator in finding the malfunction. If necessary m-KIT also offers interactive training possibilities, aided by multimedial functions as well.

C) Spectrogram examination

A further instrument to increase quality is the creation and evaluation of spectrograms. During production the card computer generates a spectrogram each hour. It can be shown on the card display. The monitoring of the spectrograms by the m-KIT system

For the carding of Lyocell we applied relatively conventional clothing. The best results were achieved with a cylinder clothing that had 720 points/inch² at a 20 degree angle. As flat a semi-rigid fiat is necessary. We used a 'Graf Primatop PT 43/0'. *Fa* the purpose of nep reduction a small amount of strips should be produced and separated.

For our tests we naturally gave priority to possible production rate and the dependence of quality on production. Let's first look at the neps (fig. 12).



5.12

The nep level following the opener FO is increased to 53 neps/g due to a relatively unfavorable pipeline-layout in the trial installation. The card reduces these neps to approx. 15 g/h. A dependence on production cannot be noticed. The lack of this dependence, which is common on normal cards, is typical for the *card* DK 803, however, it is also a matter of fibre finish.

The average fibre **length** has not changed; it lies approximately between 36 and 36.4 mm fa the 4 card productions. This is exactly according to the bale values. The percentage of short staples for all 4 card productions is exactly 0.3%. This means that there is no fibre damage, not even at 70 kg/h.

The running behavior of Lenzing-Lyocell on the oard was excellent It can be cornpared with the processing of polyester. We could not register an influence on production rate.

5. DRAFTING

The oard slier is furthe processed via 2 draw frame passages. As is common practice today, the breaker was not leveled, and the finisher was leveled. In actual processing, Lenzing-Lyocell is currently drafted at approx. 500 m/min. We have carried out our test with 600 m/min and supplemented it with short laboratory tests of 500 and 700 m/min. We used the high performance draw frame HSR 1000. This draw frame has a 4-over-3 drafting system with pressure bar. Technologically it is a 3-over-3 drafting system with an additional top roll on the delivery cylinder. The top rolls are pneumatically loaded; this can be adjusted individually. The draw frame has a servo-motored direct drive without inserted gears. This guarantees highly dynamic levelling.

Lets first look at the sliver evenness (fig. 13)

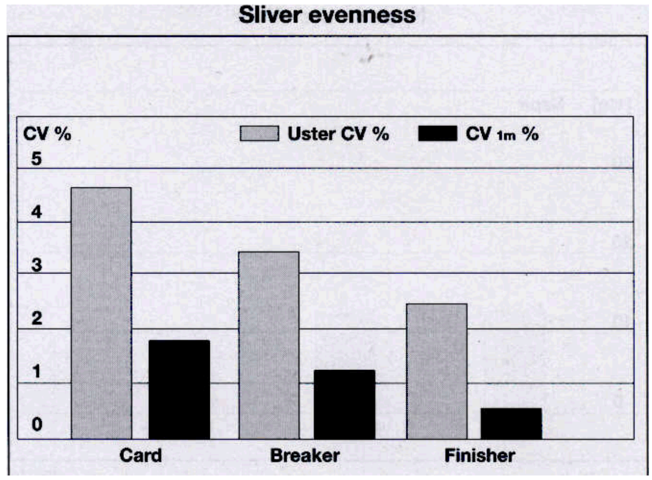
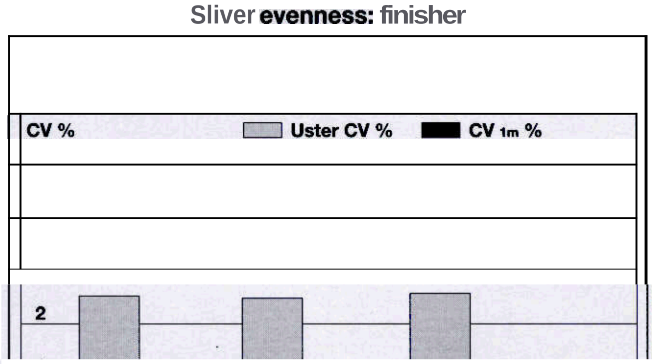


Fig. 13

The sliver evenness at the card - as compared to polyester or viscose - is relatively bad. During previous tests with Lenzing-Lyocell we had noticed that this value depends vety much on the finish. I am sure that this still has potential for optimization. The Card slier value of approx. 4,7 CV% improves over two draw frame passages to approx. 2,5 CV%. The value of 1 m *cui* length - whii is of such importance for yarn fineness variation - improves even from 1,85 to 0,5 CV%. Thus yarns of exceptionally low yarn fineness variations are to be expected.

A significant influence of delivery speeds between 500 and 700 m/min could not be noticed (fig. 14).

Sliver evenness: finisher



Before giving a recommendation in regard to a practical draw frame delivery speed further field trials are necessary. Especially the influence of draw frame delivery speeds on further processing needs to be checked.

The amount of neps is hardly influenced by the draw frame (fig. 15)

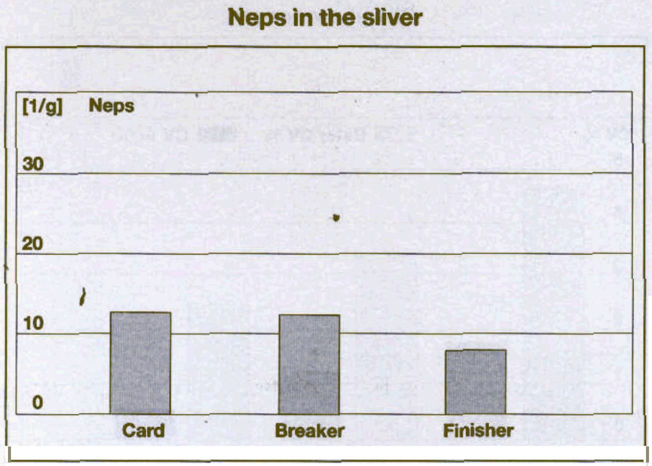


Fig. 15

The low value of the finisher sliver is not caused by an actual reduction of the neps by the draw frame, rather it is typical for AFIS test results of high-parallel slivers (fig. 16).

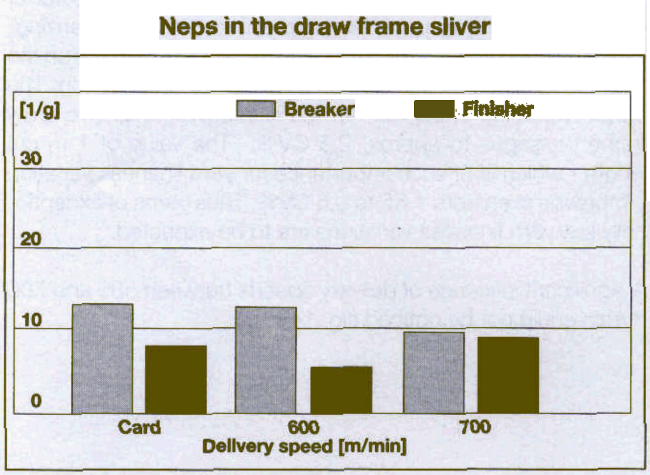


Fig. 16

Also in regard to neps there seems to be no dependence on the delivery speed. The running behavior of the draw frame shows no specific characteristics which are influenced by the fibre. At most there is a slight winding tendency of the top roller during restart following an extended standstill. This has been counteracted by an automatic relief of the top rolls during standstill, a feature intended for the HSR 1000.

6. SUMMARY

At the beginning of this lecture I already pointed *out* the result of our test-series with Lenzing-Lyocell and I would like to repeat it here:

„Lenzing-Lyocell can he processed without any problems on standard fibre preparation machines."

To this I would only like to add one more remark:

During the past years we have carried out several test-series with Lenzing-Lyocell fibres. The technical test results varied strongly in regard to fibre finish. Therefore it is presently not possible to define a universally valid statement. This is normal during the market introduction and processing of test lots. But it is important to note that all lots handled up to now show no general processing problems. In closing I would like to express my sincere thanks to Truetzschler's technological team. Without the thorough and conscientious work of this team - under the supervision of Mr. Guenter Koenig - this lecture would not have been possible.

Literature:

1) Practical experiences with the new card DK 803
Dr. Eng. Stefan Schlichter
11. Reutlinger Spinning-Colloquium May 1997

PROCESSING OF LYOCELL FROM FIBRE TO END USE

Jurg Bischofberger, Rieter AG, Switzerland

Around Lyocell lots of ideas concerning innovation, fashion and also environmental arguments exist. These topics are regarded as important in the whole process. All these points ere also arguments in spinning. There is less energy required per kg of yam produced in comparison to cotton. The quantity of raw material for the same production is less than in the case of cotton. Processing of Lyocell in spinning does not require special efforts, if the fibre and the machines are optimised. Looking to the future shows a big potential for further growth.

1. FROM FIBRE TO END USE

1.2 *Customer needs*

Around the Lyocell fibre there are a lot of customers' arguments which are not technically oriented. It is very interesting to also look at these arguments in spinning. The Lyocell fibre starts as natural raw material and in marketing, environmental questions are playing an important roie. The customer wants to feel comfortable, in clothes made out of Lyocell fibres.

Lyoceli brings up different ideas:

Customer* Needs *concerning Lyocell

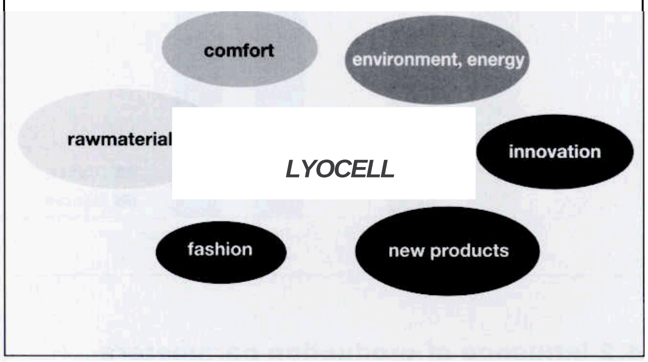


Fig. 1

Lyoceil covers a big expectation for *new* products, new markets, an overall look at the arguments. The customer wants to know the possibilities of a new fibre in the whde process. to be sure about energy and environmental impact. An ecological balance sheet has been worked out for the Lyoceli fibre production already, including material and energy consumption. The industry also needs to follow fashion trends faster with a new fibre and, very important, to e m some more money on a new fibre.

2. REQUIREMENTS OF THE TEXTILE PROCESS

2.1. *Product development, soft hand, silky surface, fashionable clothes*

A very interesting feature of the Lyocell f i r e lies in the possibility to make a fibnllisation process after weaving or knitting In spinning a „normal" yarn can be produced. m e softening of the surface is effected closer to the customer, i.e. in a later process step. Fashion can be followed faster

2.2. Energy requirement

Due to research of the fibre manufacturers processes which cause much less damage to the environment have been found to produce cellulosic fibres. We have to answer the question, whether there is also an energy savincr potential in short staple spinning. Which conditions have to be fulfilled first to meet these requirements?

2.3. *Comparison* with *alternative fibres*

There are comparisons of Lyocell fibres with cotton regarding properties and process technology.

Interesting points are not only the energy consumption for the production of cotton and Lyocell but also the conditions in all the subsequent processes on the basis of actual industrial production.

3. SPINNERS' POINT OF VIEW

3.1. *Processing Lyocell in short staple spinning*

As e general remark one can say that there are no major problems in spinning, if fibres and machines are optimised

3.2. *Spinning process*

Biowroom and carding is effected according to the following steps:

Blowroom

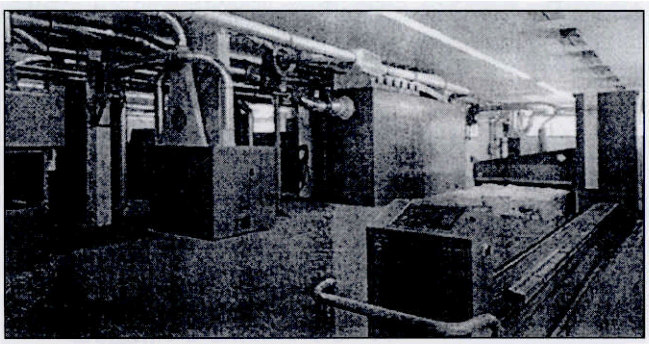


Fig. 2

Cards C 50

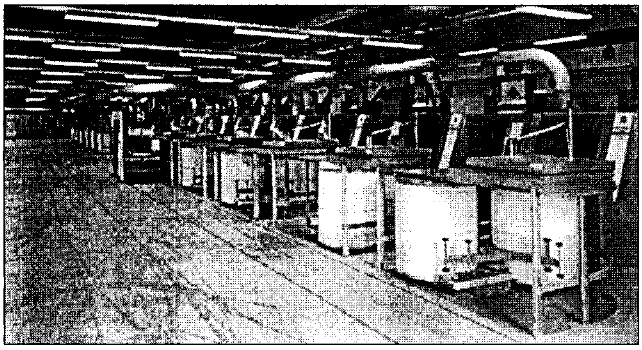


Fig. 3

After opening the flocks, the fibres have to be mixed and fed to the cards. According to quality requirements, production on carding goes over 50 kg/h. In rotor as well in ringspinning high productivity can be achieved with good running condition. In preparation high speed autolevelling draw frames are used.

Draw frame RSB D 30

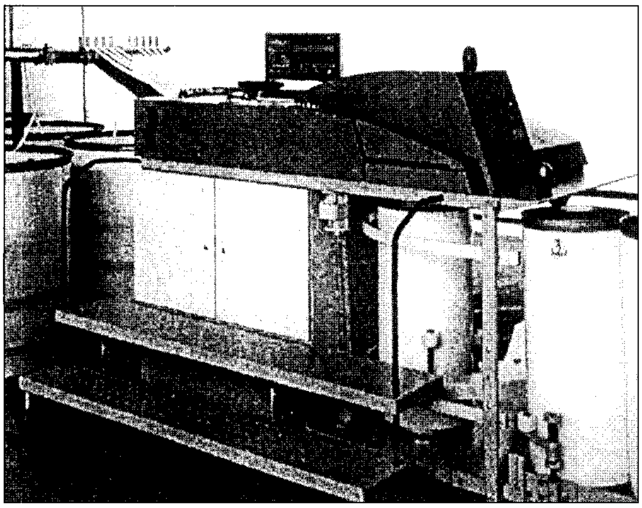


Fig. 4

Ring spinning machine G 30

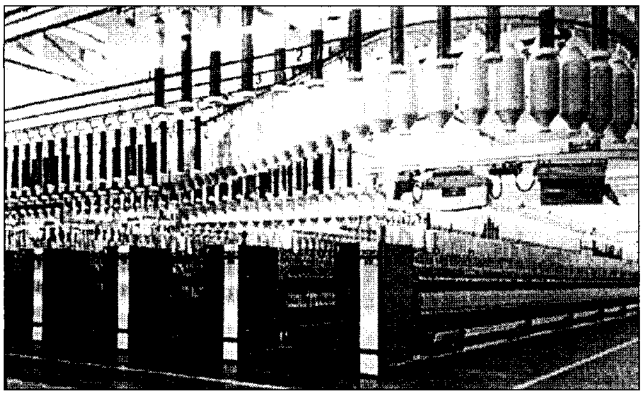


Fig. 5

4. MANUFACTURING COSTS AND ENERGY REQUIREMENT IN SPINNING

4.1. Comparison of Lyocell with cotton

We distinguish three different topics, first the shorter process in spinning. This means a reduction in the number of machines needed. Secondly productivity and thirdly, the yield of the raw material.

A comparison of a process for ringspun yarn Ne 30/Nm 50 with Lyocell and cotton shows a much shorter line for Lyocell.

Ring spinning line for Lyocell and cotton

	Cotton	Lyocell
Opening	UNIfloc	UNIfloc
Cleaning	UNIclean	
Blending	UNImix	UNImix
Cleaning	UNIflex	
Carding	Card C 50	Card C 50
Drawing	RSB D 30	RSB D 30
Combing	UNIlap	
	Comber	
	Drawframe	
Spinning	Flyer	Flyer
	Ringspinn G 30	Ringspinn G 30

Fig. 6

If the fibres are processed at the same speeds, which is required, the manufacturing costs are 24 % lower with Lyocell compared to cotton, calculated on central European cost factors. The difference in the energy costs is 16 % in favour of Lyocell.

Manufacturing costs and energy consumption for Lyocell and cotton

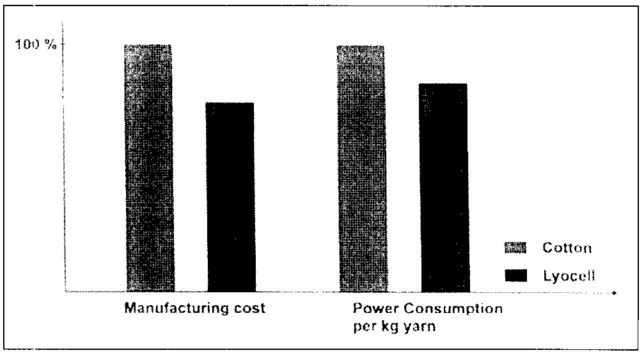


Fig. 7

4.2 Influence of production parameters

The influence of production parameters can be shown by the carding example. The energy consumption per kg of fibres is shown in Fig 8. With an increase of 20 kg/h production the energy costs can be reduced by about 30 % in the relevant production level. Therefore, it is a reasonable expectation that the Lyocell fibre should be processed at similar production rates as cotton.

Energy savings at higher production rates

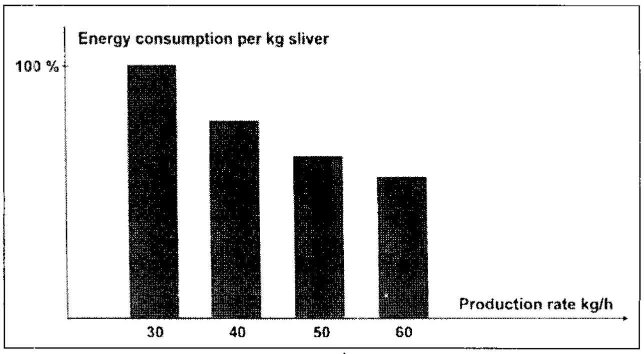


Fig. 8

4.3. Exploitation of raw material

Cotton needs to be cleaned carefully because of trash and foreign matter contamination, specially to spin high quality fine yarns. To produce one kg yarn of the count Ne 30/Nm 50 over 25 % more fibres would have to be used than with a Lyocell fibre.

Raw material input for Lyocell and cotton

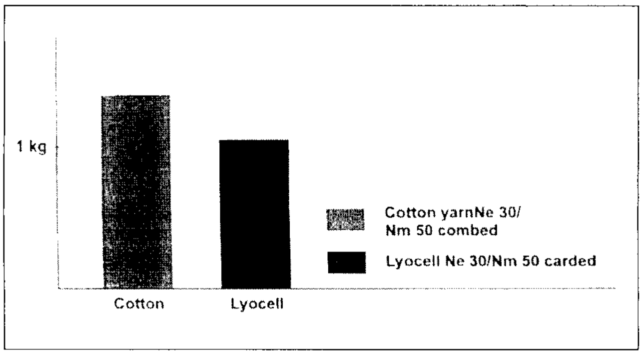


Fig. 9

4.3. Spinning on rotor and ring spinning machines

On rotor spinning quite high speeds can be achieved.

Rotor spinning of Lyocell

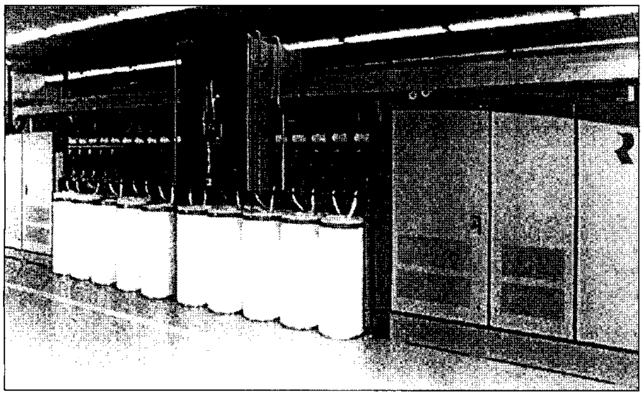


Fig. 10

The spinner expects to run the same speeds with Lyocell as he is accustomed to in the case of normal viscose fibres or cotton. This means for finer yarns and a rotor diameter of 30 - 32 mm speeds around 125 000 and twist coefficients of ct, 1 1 5 - 120 can be used also in ringspinning. There should not be too big a difference compared to normal viscose, if so ringspinning or fibre properties have to be adjusted.

4.4. Comparison with microfibres

To produce a fabric surface with soft hand there is also the possibility to use microfibres. Especially in carding this can reduce the production rate.

Carding of Lyocell and microfibres

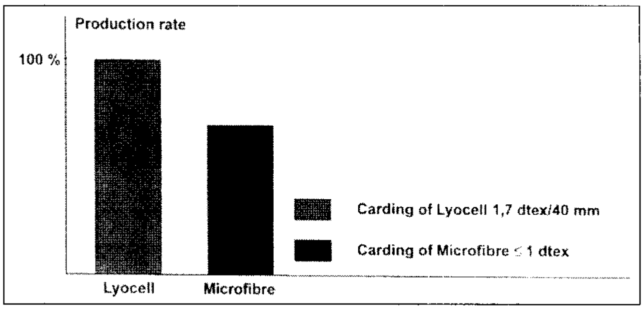


Fig. 11

The „small difference", as to whether the fibre is originally spun as microfibre or the fibre can be fibrillated makes a big difference to spinning. For carding a coarser fibre is the preferred one, for spinning, the fine fibre allows to produce finer yarns with better running conditions due to higher spinning limit, i.e. Minimum number of fibres in the cross section.

Lenzing Lyocell 1.3 dtex, bright

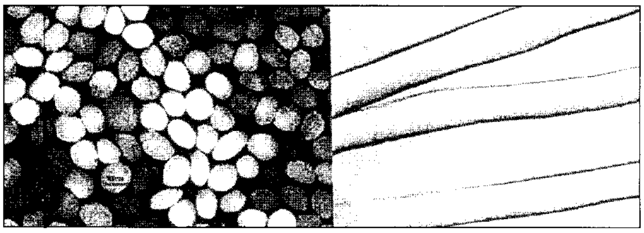


Fig. 12

Fibrils of the Lyocell-Fibres

Fig. 13

Fibrils of the Lyocell-Fibres

Fig. 14

5. THE INNOVATION LYOCELL

Lyocell offers new opportunities, there is room for innovative fibres and new products. Especially interesting is the use in blends.

It is an interesting question to ask about the future development of Lyocell consumption. Facing a relatively *easy* process in spinning and the potential in products and fashion, we assume a considerable growth in the future

Use of the Uniblend A 80 lor blends with Lyocell

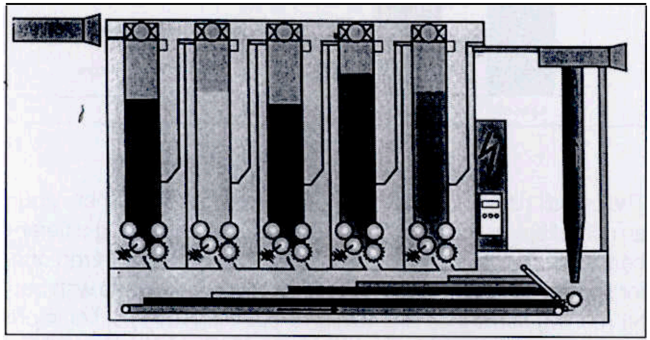


Fig. 15

Fibre consumption in the future

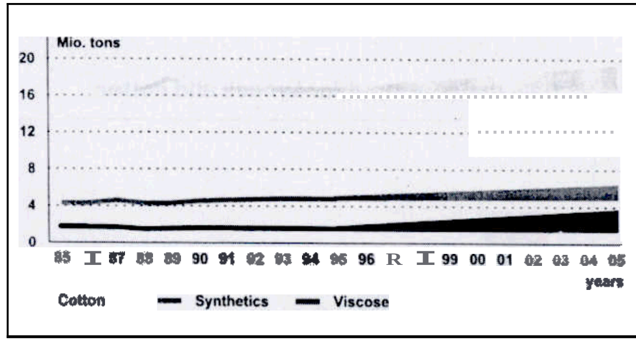


Fig. 1

EXPERIENCE OF PROCESSING THE RAW MATERIAL "LYOCELL BY LENZING" WITH REGARD TO THE PRODUCTION OF AUTOCORO YARNS

Bernfried Rosery, Schlafhorst AG, Germany

1. Discussion

"At the end is the beginning": the situation which arises when a product is launched on the market could be summarised thus in a sentence, as development usually only commences when a product is completed.

We are not referring here to development work by the manufacturer, but development in adjacent sectors. Several questions need to be answered and these answers corroborated and supported by trials or the results thereof.

"Quality improvements by "Fibre to Fabric Engineering"

In the light of the greater demands made on yarn grades, Schlafhorst is therefore concentrating its efforts in the context of "Fibre to Fabric Engineering" on co-ordinating the textile technological processes so that the product desired by the, end customer is generated by interaction of the individual manufacturing stages.

To attain the set objectives, the processing characteristics of a certain raw material in downstream processes and the final appearance of the textile end product have to be taken into consideration as well as the costs and the potential of the raw material when drawing up the requirements for a yarn. An ongoing exchange of experience and close collaboration with the manufacturers of synthetic fibres are indispensable for this. Schlafhorst has been cultivating close links of this kind for many years.

The future-oriented developments of "Fibre to Fabric Engineering" are of critical importance for Autocoro yarn in particular, Knowledge of the required criieria is leading to a steady expansion of the application range for rotor yarns. However, it may likewise signify a further improvement in the rotor yarns in hitherto established applications.

The high level of acceptance of Autocoro yarns in weaving and knitting applications is attributable not only to the economic advantages of rotor spinning. Improved yarn parameters, good package quality, the outstanding properties of the yarns in downstream processing and the low level of defects in the loomstate fabric are coming increasingly to the fore. Nevertheless, the final look of the garment after finishing and making up is also an important criterion for assessing the yarn.

2. Rotor spinning technology

Since being launched onto the market in 1978, more than 2 million Autocoro spindles have been supplied world-wide. These produce approximately 1,000 tonnes of yarn per hour round the clock in the count range from 12 tex to 145 tex (Nm 7 to Nm 85, Ne 4 to Ne 50) at a low rate of energy consumption, a high level of efficiency and to the complete satisfaction of the users. No wonder, then, that customers all over the world praise the extreme reliability and durability of these efficient machines. This is just one reason why Schlafhorst leads the global market in automatic rotor spinning machines with the Autocoro (Fig. 1).

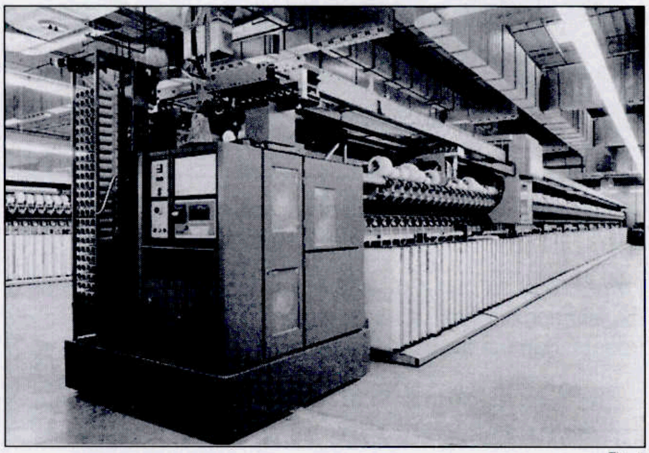


Fig. 1

All the Materials of short-staple spinning, such as cotton, polyester, viscose and polyacrylic, are spun in pure form and in blends on the Autocoro, as well as linen and regenerated fibres. The Autocoro produces the optimum yarn quality for every application area thanks simply to the flexible and targeted deployment of spinning components.

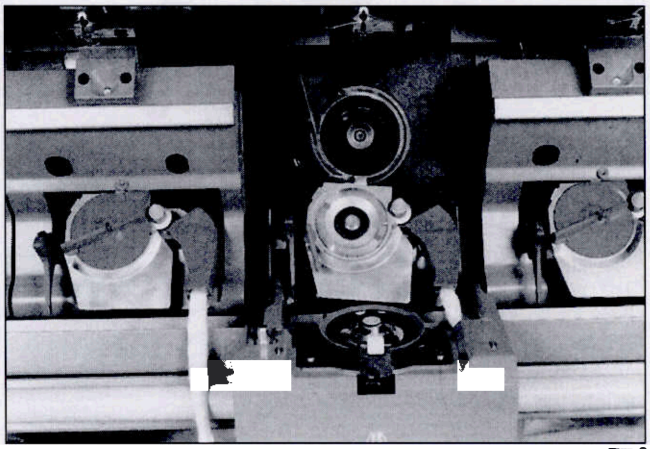


Fig. 2

The series of trials with the Lenzing Lyocell fibre which is documented in the following was carried out on an Autocoro 288 with the new SE 10 spinbox Generation (Fig. 2). This spinbox is the result of continuous development and is based on Schlafhorst's extensive experience of the preceding SE 7, SE 8 and SE 9 models. Completely novel ideas have been integrated into this proven spinbox concept with the outcome that the SE 10 embodies an innovative solution for the economically efficient production of high quality yarns up to 10 tex (Nm 100).

Using the spinning components which are available for the Autocoro (rotors, opening rollers, navels, (Fig. 3)), a broad spectrum of desired yarn attributes can be co-ordinated specifically to the textile end product.

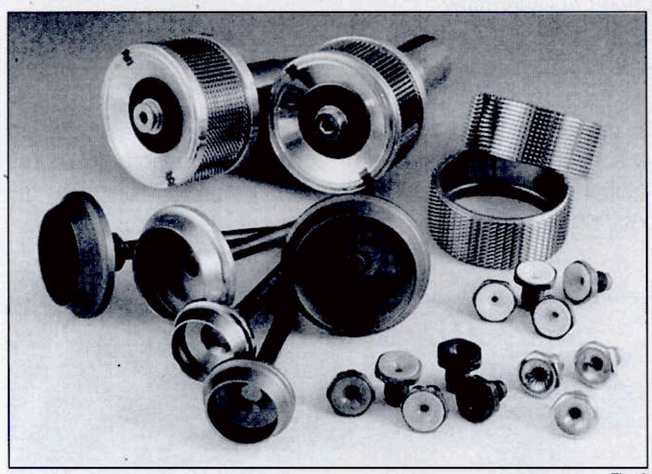


Fig. 3

A brief explanation of rotor spinning technology now follows.

I would like to begin by explaining the spinbox, as general explanations of the rotor spinning process already feature frequently in the available literature.

Prinziple of roter spinning

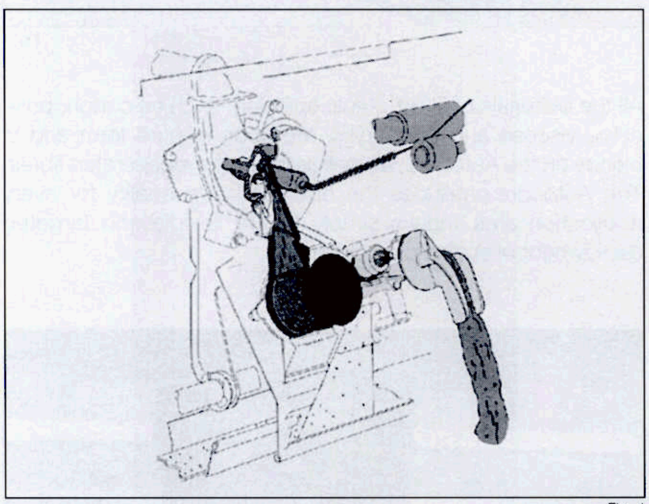


Fig. 4

It makes sense if we follow the fibre flow in the illustration (Fig. 4). The rotor spinning process belongs to the group of open-end spinning processes (OE spinning processes). The basis of all OE spinning processes is the opening-up of the fibre feed into single fibres, which are made to twist by various media, due to which the rotating thread binds the fibres taken up into the "open end".

As can be seen from the Illustration, the sliver is guided continuously into the spinbox through a feed cylinder.

Careful singling of the fibres calls for technological know-how and precision, for exampie to achieve a uniform feed, gentle opening and efficient clearing of the fibre material in the opening roller housing of the spinbox.

Opening rollers (Fig. 5) with highly precise, solid clothing rings ensure that the fibres are singled with care, even in the case of critical Materials.

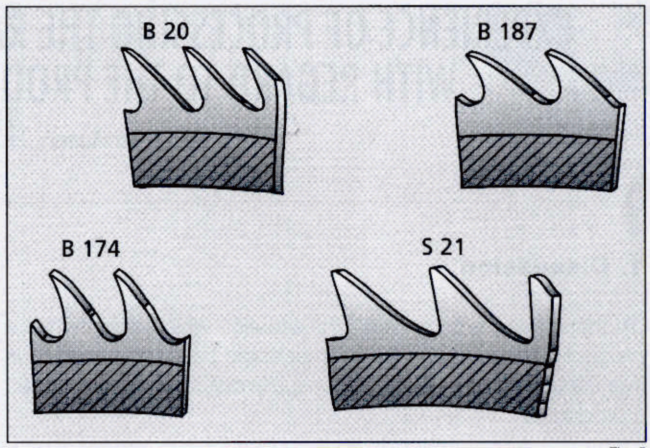


Fig. 5

At the same time, the neps and trash particles present in the feed slivers are removed due to centrifugal force by the trash separation unit. The particles removed are collected in a trash chamber at the end of the machine.

The sliver, which has been opened up into individual fibres, is transported to the fibre guide channel. The negative pressure prevailing in the guide channel detaches the fibres from the opening roller. These are accelerated by the tapering feed channel and oriented length-wise. The fibres arrive straightened at the rotor wall, where they are oriented and drawn once more owing to the fast-running rotor. The fibres are pressed by the high centrifugal force onto the rotor wall, from where they slide slowly into the rotor groove (Fig. 6).

The character and attributes of an Autocoro yarn are influenced decisively by the geometry of the rotor groove amongst other things. A voluminous or compact yarn can be produced depending on ihe groove radius. Yarn tenacity is also considerably influenced by the groove shape or angle. The choice of a navel with the appropriate number of notches determines whether a yarn is smooth or hairy.

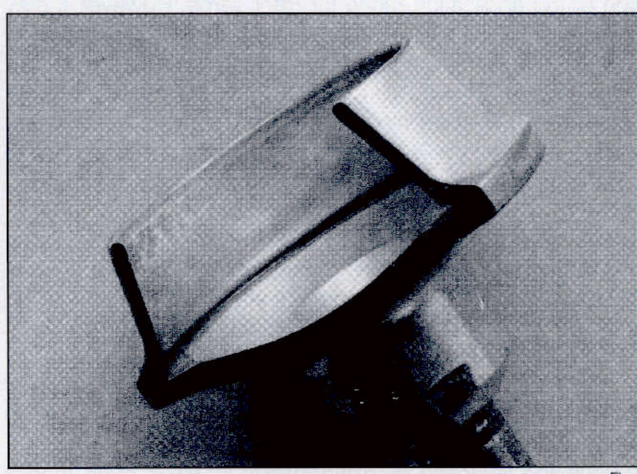


Fig. 6

During production of yarns for knitting applications, direct waxing takes place on the Autocoro spinning machine. For reasons of time I will close my discourse on the OE spinning process here and come to the core topic of my lecture.

3. Processing of Lenzing Lyocell fibres

Two bales of differently finished Lyocell fibres were prepared at Trützschler for the study.

The bales were designated A 31 and A 32 to distinguish between the types of finishing.

The objektive of our series of trials was to spin the differently finished Lenzing Lyocell fibres taking the following criteria into consideration:
- change of twist factor
- determination of spinning trial limits
- influence of finishing

• Reducing the yarn twist (αm-min)

The yarn twist is one of the most important, if not the most important influencing variable in the production of a yarn.

The yarn twist determines
- yarn character
- production
- spinning machine efficiency

Production behaviour – efficiency

In our series of trials, we placed the emphasis on efficiency and took the end break rate as the decisive criterion. When using a new fibre, in this case the Lenzing Lyocell fibre, 200 yarn breaks per 1000 rotor hours was adopted as the yardstick.

If the number of yarn breaks increased on incremental reduction of the yarn twist by a certain amount (> 200 yarn breaks/1000 rotor hours), the twist series was continued with the next largest rotor at a suitably adjusted rotor speed.

In the overall series of trials for yarn twist variation, yarn of a count of Nm 60 was spun.

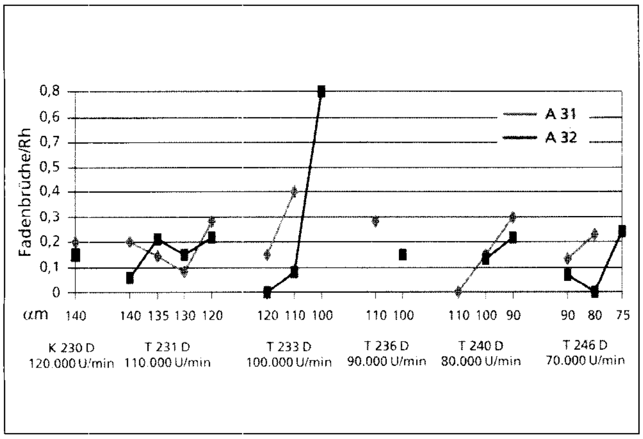


Fig. 7

Depending on which garment group the yarn is to be used in, the user can select the appropriate twist factor with reference to the diagram (Fig. 7). It can be assumed from this that the lower the twist coefficient, the more open the yarn or the softer the feel of the final garment.

Result: The fibres with finish A 32 permitted the greatest reduction in the twist factor when the rotor T 246 D was used. **The value αm 80 was achieved.**

The drastic reduction in yarn twist made it possible to compensate fully for the loss of productivity caused by the low rotor speed.

Example:
K 230 D, 120,000 rpm, αm 140 => 111 m/min
T 246 D, 70,000 rpm, αm 80 => 113 m/min

Yarn quality

As already mentioned earlier, the twist factor also influences the character of the yarn. It is thus of particular interest to see how the Lenzing Lyocell fibre behaves with regard to yarn quality data.
Since each user attaches importance to different decision criteria, we have graphically depicted each yarn quality parameter, such as yarn tenacity, elongation and evenness, and the imperfections individually in our series of trials with the Lenzing Lyocell fibre.

• Yarn tenacity

At all settings tenacity was above 18 cN/tex. As can be seen from Fig. 8, maximum yarn tenacity was achieved at a twist factor of αm 100 using a rotor of a diameter of 40 mm at a rotor speed of 80,000 rpm.

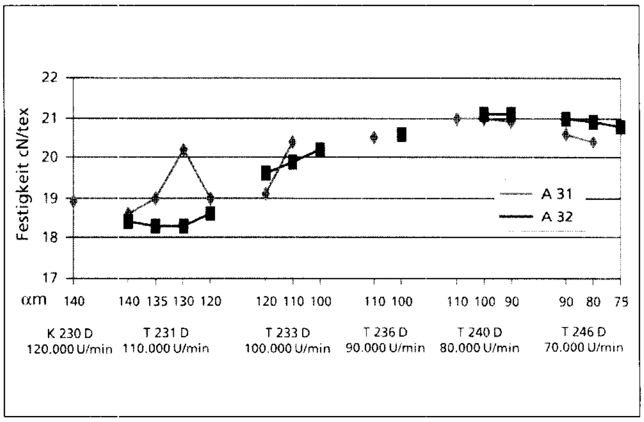


Fig. 8

While it is not yet possible to detect any perceptible influence of the finishes in this diagram, it will be possible to discern marked differences in the following illustrations. However, so as not to ignore the influence of the yarn twist factor, we will look at the two finishes in greater detail later.

Yarn elongation

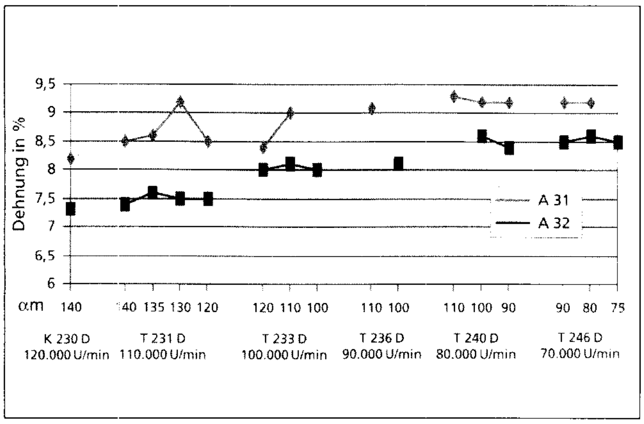


Fig. 9

Yarn elongation varies as a function of rotor speed and rotor size and is less dependent on the twist factor (Fig. 9).

• **Evenness**

CV % Uster Tester III

Here, too, variation of the twist factors tends to play a subordinate role (Fig. 10).

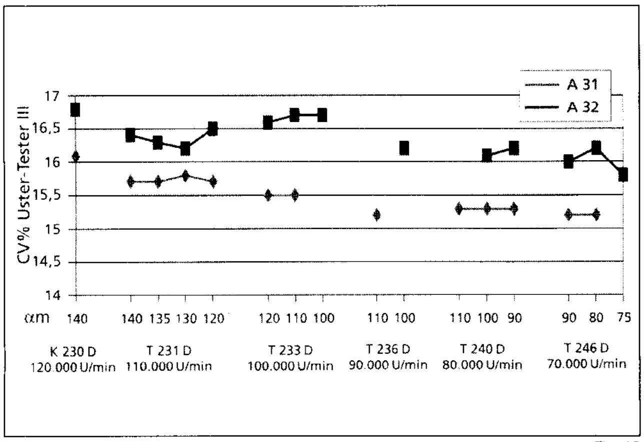


Fig. 10

It is not possible to recognize any marked relation between the twist factor and imperfections or any influence on them when looking at the thick and thin places detected. The number of neps ascertained is within acceptable bounds thanks to good clearing by the opening roller (Fig. 11).

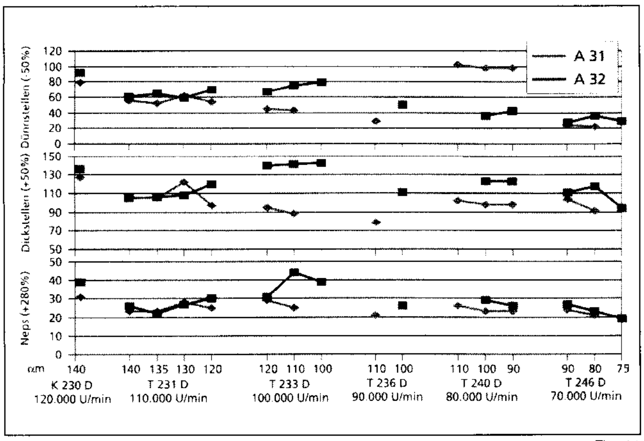


Fig. 11

• **Influence of finishing**

The diagrams shown earlier highlight the strong influence of the types of finish. The differences are less marked in the production characteristics, where the yarn breaks are addressed, but have more influence instead on yarn quality attributes. In this case the fibre manufacturer has to make his own judgement and will be certain to change some ingredients in the "secret recipe kitchen".

In the Schlafhorst textile laboratory "Texlab", testing of the stick/slip length was performed on the slivers with a different finish. This test is performed using the Statimat M testing device manufactured by Textechno H. Stein on a sliver which is clamped between two clamps and made to slide apart by downward movement of the lowest clamp.

The stick/slip test, which reflects fibre/fibre adhesion, yielded clear results. The stick/slip length of the sliver with the A 31 finish came to 52 m sticking length. This should be classed as a higher value for rotor spinning, as the normal value lies between 30 and 40 metres. The sticking length of the sliver with the A 32 finish was around 100 metres and thus a value is obtained which is markedly too high.

It is obvious that a high fibre/fibre adhesion renders opening-up of the sliver to give individual fibres more difficult, thus exerting a considerable influence on yarn quality. As described at the beginning of my paper, the drawframe sliver should be opened into individual fibres by the opening roller. This process is made more difficult by a high level of sliver adhesion. If the unopened packets of fibres enter the spinning process, yarn evenness is impaired by disturbing thick places or neps. In the worst case, the fibre packets do not detach themselves from the clothing of the opening rollern resulting in yarn breaks or the formation of thin places in the yarn and the first signs of fibre laps on the opening roller.

• **Finest yarn count**

When establishing the spinning trial limit, attention must be paid to the number of fibres in the yarn cross-section as well as fibre-specific characteristic data such as flexural strength, fibre length, friction coefficients etc.

The spinning limit can be calculated roughly by turning the equation

nF = texyarn/tex fibre : to give : tex - yarn = nF x tex fibre

If it is assumed that on average 100 fibres are required in the yarn cross-section for the rotor spinning process (exceptions confirm the rule), then in terms of pure calculation a yarn count of 13 tex (Nm 76.9) would be possible.

As a criterion for establishing the possible yarn count, the maximum of 200 yarn breaks / 1000 rotor hours should not be exceeded in these trials either.

As the series of trials showed, the maximum possible setting was reached in spinning a yarn count of 14.2 tex (Nm 70) with approx. 110 fibres in the yarn cross-section.

A further reduction in the number of fibres in the cross-section for a yarn count of 12.5 tex (Nm 80) resulted in increased yarn break rates, which are unacceptable for the industrial manufacturing process.

• **Article groups**

Autocoro yarns produced from the Lenzing Lyocell fibre open up new possibilities for the textile industry. The series of trials documented earlier clearly demonstrates that this fibre can be of interest to every user. High tenacity values and differing yarn characters open up a multitude of application options for yarns made from Lenzing Lyocell fibres. We too will be including yarns made of Lenzing Lyocell fibres in our projects in the context of Fibre to Fabric Engineering.

5. Summary and prospects

Allow me to incorporate the theme of this first international Lyocell symposium, "Experience Lyocell", into my closing comments. We have already accumulated **experience** of this new generation of Lenzing fibres, as Schlafhorst has already accompanied them on a large part of their evolutionary path through spinning trials. Owing to the individual optimization steps implemented by ourselves and Lenzing during this period, it can now be said that Lenzing Lyocell fibres can be processed without any problems on Schlafhorst's Autocoro rotor spinning machine.

This fibre is a **great experience** in every respect. Garments which were inconceivabie a few years ago can now be developed using yarns spun from these fibres.

It is now the turn of the textile industry to become acquainted with these fibres and accept them, for it is the fashion leaders who set the tone. In general it can be said that a powerful potential exists. It is worth concentrating efforts on the technical and technological development of this Lenzing Lyocell fibre; Schlafhorst will certainly be contributing to this.

We wish Lenzing Lyocell GmbH every success for the introduction and the future of their fibre Lyocell by Lenzing.

I would like to conclude by quoting a heading in the Programme for todays event: "Welcome to the future".

LYOCELL, ALSO A CHALLENGE FOR THE MACHINE MANUFACTURER!

Peter Schomakers, Thies GmbH, Germany

1. Introduction

Presently a new cellulosic fibre finds considerable attention in the textile processing industry. Under the generic name lyocell this product is expected to have tremendous chances in the market. Anyhow, in this framework I will not further explain the advantages resp. positive properties of this fibre compared to cellulosic manmade fibres and also cotton or wool, but I will talk about the mechanical processing of lyocell.

2. Wet finishing of lyocell

What does this fibre mean for the textile machine manufacturer, what has especially to be considered regarding the design and construction of finishing machinery for the wet finishing?

Concerning the fabric textiles, next to multi colour articles and denim, the major part is raw fabric material that is in this first stage of finishing still containing a more or less big quantity of sizing agent. Next to the mainly conventional desizing of the fabric in open width one can also imagine the desizing process in rope form on a discontinuous dyeing machine. This not at least, if the fibrillation tendency of the lyocell fibre with its advantages for various fashion effects can already be used in the stage of wet finishing process.

This is the decisive point for the optimum processing of the lyocell fibre. What will my end product look like, which demands shall the end product „textile" meet. This is also the decisive question when the right machine shall be chosen for the different treatment stages. Table 1 shall show you the different possibilities by the processing of woven fabric.

Mögliche Wege der Lyocellfaser in der Stückveredelung

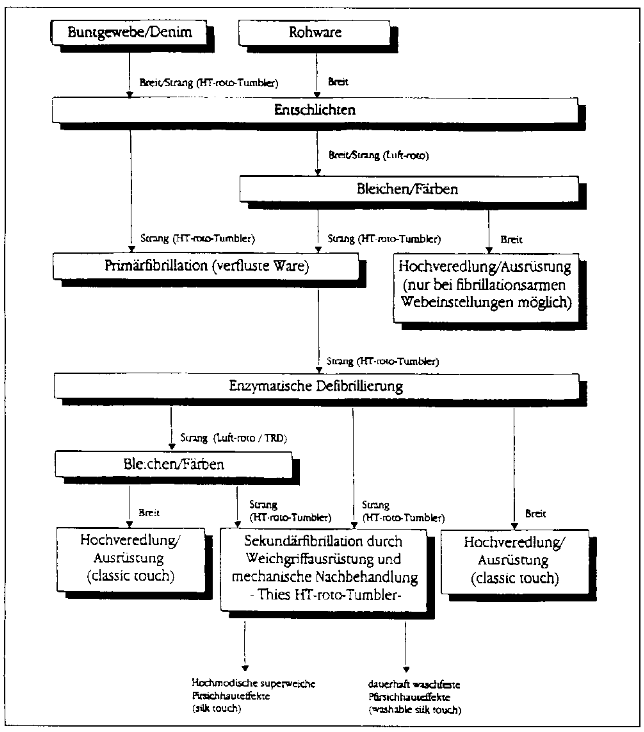


Table 1

3. Discontinuous rope processing

Let us now concentrate on the discontinuous rope processing.

As already mentioned afore, the tendency of the lyocell fibre to fibrillate is decisively when choosing the right machine for the discontinuous wet processing. What matters here is if the fabric requires high fibrillation or if the fibrillation achieved by the wet processing shall be quite low.

High fibrillation is obtained by high fabric speed with strong mechanical stress applied to the fabric, with simultaneous proper folding whereas in no case uncontrolled marking or even damages may happen.

4. ROTO-STREAM

This could only be achieved by additional air intake resp. air transport in the dyeing machine hence by modification of the roto-stream a suitable and well proven system could be used. Not at least by use of the Vario nozzle the machine's varied possibility of use could be kept up.

The smooth fabric transport at very high fabric speed is supported by the not driven, rotating fabric drum.

However, it also evidenced that the advantages of such tensionless transport of the evenly displaced fabric in the fabric drum mean constructive disadvantages especially for high weight fabrics made from lyocell fibres.

So the position of the winch and the position of the air nozzle resp. the Vario nozzle for the processing liquor is limited by the rotating drum. (Fig. 1)

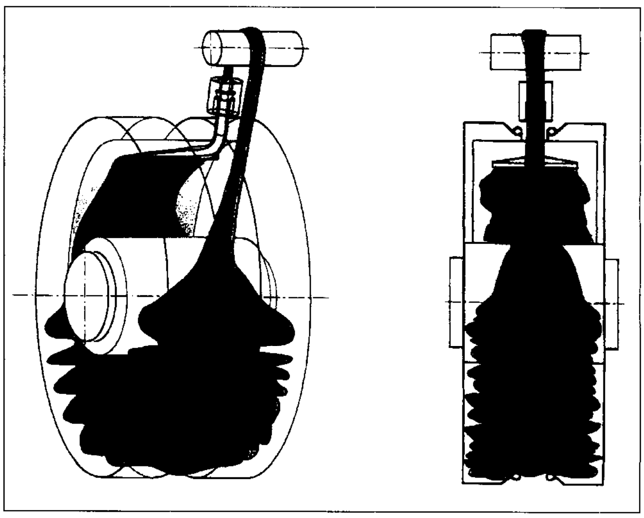


Fig. 1

That meant for the machine manufacturer to constructively adjust the fabric drum to the conditions required. (Fig. 2) Clearly visible is the new position of the winch to the penetration pipe, the arrangement of the blower and the optimised liquor guidance under consideration of liquor ratio as low as possible.

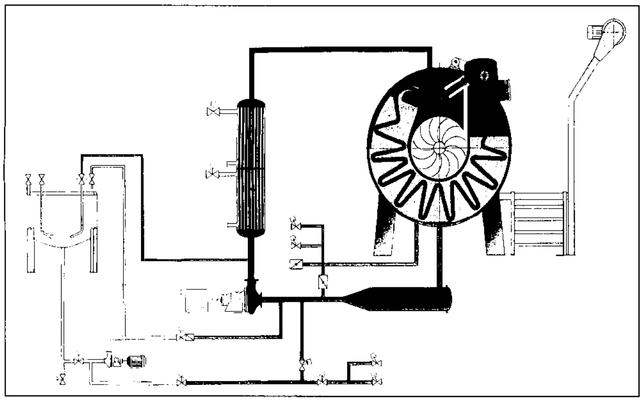


Fig. 2

The machine is equipped with a plaiter. The chamber capacity for lyocell is approx. 100 - 150 kg, depending on the fabric weight and form, at a liquor ratio of 1 : 4 to 1 : 6.

5. SOFT TRD

Impotant for the right choice of a machine is which properties the finished fabric shall have. In this context let me also draw your attention to the use of a partially floated machine corresponding to the so-called overflow system like our type „soft-TRD" for the mere dyeing of lyocell fabric.
This is partially also true for the processing of woven fabric the fibres of which do not swell so much. The material behaves more supple so that here also standard soft-jet machines like the „eco-soft" as well as the overflow type „soft-TRD" can be applied. (Fig. 3)

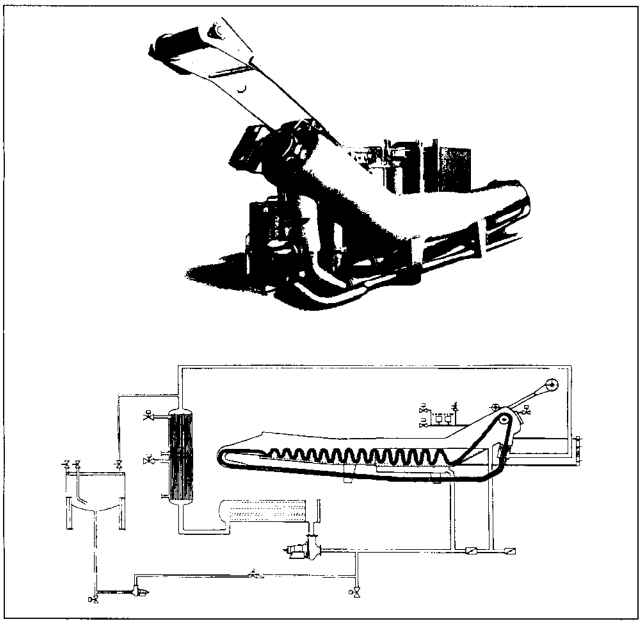


Fig. 3

6. Fashion factors

Next to the wet processing of lyocell on suitable discontinuous dyeing machines, also later processes require certain conditions due to the fibre's character. Depending on the different chemical and mechanical processes you can achieve an even fabric „classic touch" or a pre-fibrillated/de-fibrillated fabric the surface of which resp. handle and drape can still be modified. Required and desired is the „peach-skin effect", a chemically modified „sand wash" effect, the „used look" and not at least different variations of touch.

This is achieved by a chemical soft touch finishing, but in the majority by the secondary fibrillation, i.e. a mechanical after-treatment on a suitable tumbler.

7. ROTO-TUMBLER

Next to the conventional drum tumblers we have here also a discontinuous system in which the fabric can be tumbled mechanically via air, both as rope and in open width. The capacity of such a machine is approx. 120 to 150 kg, and a fabric speed of 200 m/min max. can be achieved using this unpressurized system.

The roto-Tumbler can maintain 1000 m/min fabric speed for lyocell fabrics. The machine operates at 140° C and a pressure of 3,5 bar. (Fig. 4)

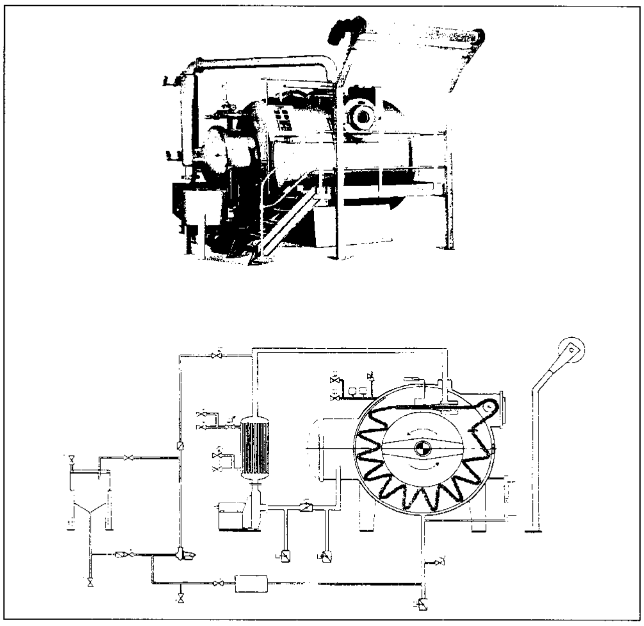


Fig. 4

With increasing system pressure the air density was increased accordingly, i.e. in this system the air density is three times as high as in atmospheric systems, which causes an intensive tumbling effect at low energy consumption.
The Roto-Tumbler also allows to steam and wet the fabric before starting the tumbling process. Furthermore, there is the additional option to carry out the wet processes required for the lyocell fibre such as fibrillation and defibrillation as well as the softening processes by an integrated liquor cycle.

DIE HOCHVEREDLUNG, GRIFFGEBUNG UND FUNKTIONELLE AUSRÜSTUNG VON LYOCELL

E. Agster, Pfersee Chemie, Germany

Nicht nur zur Verhinderung der weiteren Fibrillierung während der Haushaltswäsche, sondem auch um die Gebrauchstüchtigkeit zu erhöhen, ist die Hochveredlung von Lyocell von großer Wichtigkeit.
Im Vergleich zu anderen reg. Cellutosefasem, wie z.B. Modal oder Viskose, benötigt Lyocell deutlich niedrigere Einsatzmengen an Vemetzer um dieselben bzw. zum Teil auch bessere technologischen Werte zu erzielen.

Erste Versuche mit sog. funktionellen Ausrüstungen insbesondere Fleck- und Flammschutz, haben auch auf Lyocell vielversprechende Resultate gezeigt.

1. Allgemeines

Die hervorragenden Eigenschaften der Lyocellfaser im Hinblick auf die Festigkeiten,insbesondere die Naßfestigkeit,den herausragenden Warengriff,den seidenartigen Glanz sowie die starke Neigung zum Fibrillieren sind ja hinreichend bekannt.Insbesondere die Fibrillierneigung bietet einem eine Vielzahl von Möglichkeiten um die Textiloberfläche zu modifizieren.
Durch die Ablösung von Fibrillen entlang der Faseroberfläche durch mechanische Beanspruchung während der Naßbehandlung erhält man Effekte wie Peach Skin,Sand-Wash oder Used-Look.

2. Hochveredlung von Lyocell

Die Ausrüstung von Lyocell mit Cellulosevernetzern hat verschiedene Gründe.Zum einen will man die Fibrillierung unter Kontrolle bringen, d.h. man will verhindern,daß bei einer späteren Haushaltswäsche es immer wieder zu einer unkontrollierten Nachfibrillierung kommt.
Zum anderen will man,wie bei allen cellulosischen Fasern,die Pflegeleichtigkeit wie z.B.

die Trockenknitterwinkel
die Naßknitterwinkel
das Monsantobild
sowie die Waschkrumpfung

verbessern.

Durch gezielten Einsatz von Weichgriffmitteln bzw. Silikonemulsionen in der Vernetzerflotte kann man den Warengriff entsprechend modifizieren.
Neben allen Vorteilen die die Hochveredlung für Lyocell bietet,ist eine gewisse Verschlechterung der Faserfestigkeiten unvermeidbar.

2.1. Veredlungsvarianten

Neben der klassischen Hochveredlung wie sie in Variante Ia und Ib (Abb.1) zu sehen ist, besteht auch die Möglichkeit,Lyocell gegen die Anschmutzung mit ölhaltigen sowie wässrigen Substanzen zu schützen (Variante IIa) oder auch die Auswaschbarkeit von fetthaltigen Substanzen zu verbessern (Variante IIb), ohne die Atmungsaktivität der Ware zu beeinflußen.

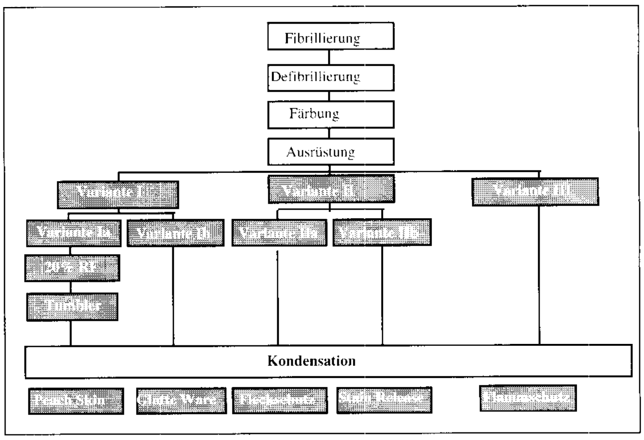


Abb. 1

Auch die waschbeständige Flammschutzausrüstung von cellulosischen Artikeln ist eine Ausrüstungsart,die in den letzten Jahren stark zugenommen hat und deren Einsatz auch auf Lyocell denkbar ist.

Variante Ia und Ib basieren auf derselben Grundrezeptur. Der Unterschied liegt nur im Verfahren. Bei Variante Ia wird nach dem Aufbringen der Ausrüstungsflotte die Ware auf eine Restfeuchte von ca.20% getrocknet,anschließend auf einem Tumbler (z.B.Airo 1000 von Biancalani ;Then Airflow oder Thiess Roto Tumbler) behandelt was zu der sog.Sekundärfibrillierung führt.Daran anschließend wird durch eine Kondensation des Cellulosevernetzers der erzielte Fibrillierungseffekt permanent gemacht und gleichzeitig eine weitere Fibrillierung gestoppt.

Durch direktes Trocknen und Kondensieren nach dem Foulardieren (Variante Ib) erhält man den klassischen Hochveredlungseffekt mit glatter Warenoberfläche.

2.2 Produkteauswahl

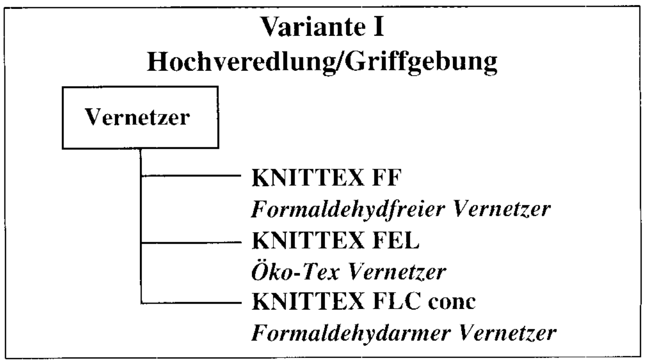


Abb. 2

Als Vernetzer kommen je nach Anforderung verschiedene Reaktantvernetzer zum Einsatz. Produkte vom Typ Dimethyldihydroxyethylenharnstoff sind frei von Formaldehyd und werden in der Regel nur für ganz bestimmte Artikel gewünscht oder gar gesetztlich vorgeschrieben. Vollveretherte DM(DH)2EU-Vernetzer werden eingesetzt, wenn der ausgerüstete Artikel die Anforderungen des Öko-Tex Standards 100 erfüllen soll.
In allen anderen Fällen genügen normalerweise formaldehydarme Produkte.

Silikonfreie Weichgriffmittel

	Fettsäure amid	Fettsäure ester	Poly ethylen	Paraffin
Griff	sehr gut	mäßig	gut	gut
Vernähbarkeit	gut	gut	sehr gut	exzellent
Abrieb	sehr gut	mäßig	exzellent	gut
Hydrophilie	gering	sehr gut	gering	hydrophob
Sublimation	sehr gering	gering	sehr gering	hoch
Permanenz	gut	mäßig	sehr gut	sehr gut
Naßanschmutzung	gering	sehr gering	gering	mäßig

Abb. 3

Wie in der Hochveredlung allgemein üblich, werden neben Vernetzer und Katalysator auch noch griffverbessernde eingesetzt. Die Möglichkeiten reichen hier von den preislich sowie effektmäßig Silikonemulsionen über Polyethylene bis hin zu den Standardweichgriffmitteln auf Basis von Fettsäurekondensationsprodukten oder hydrophilen Fettsäureestern.

Bei den Silikonemulsionen hat man inzwischen schon fast die Qual der Wahl zwischen Makro, Mikro oder Semimikroemulsionen mit Amino- bzw Amidogruppen in den Seitenketten oder reaktiven Hydroxy-Endgruppen,die eine Vernetzung ermöglichen.
Hervorragende Ergebnisse bzgl. Weichheit und Oberflächenglätte haben wir auf Lyocell mit einer klassischen, vernetzbaren, aminofunktionellen Makroemulsion erzielt.

Wer einem weniger silikonartigen Griff den Vorzug gibt, sollte auf die feinteiligen Mikroemulsionen zurückgreifen,welche einen anderen, mehr innerlich weichen und nicht so oberflächenglatten Griff sowie eine deutlich höhere Stabilität gegenüber Scherbeanspruchungen aufweisen.

Bei den silikonfreien Weichgriffmittein ist die Produktevielfalt noch wesentlich größer.Unsere Versuche auf Lyocell wurden zum einen mit Fettsäurekondensationsprodukten, zum anderen mit Fettsäureestern mit deutlicher besserer Hydrophilie, durchgeführt. Sek.Polyethylenemulsionen werden meist in Kombination mit Silikonelastomeren eingesetzt, um die Eimendorf-Abscheuerung zu verbessern.

Für die Grundrezeptur für die Varianten 1a und 1b hat man also die Auswahl aus einer Vielzahl verschiedenartiger Produkte mit unterschiedlichem Preisniveau und ebenso unterschiedlichem Effektniveau.

Nachfolgende mechanisch-technologische Untersuchungen wurden mit Ware gemacht,die wie folgt ausgerüstet war.

Variante I
Hochveredlung/Griffgebung

Sil.emulsionen
- **MEGASOFT FMG** *Aminofunkt.Mikroemulsion*
- **ULTRATEX FSX** *Aminofunkt.Makroemulsion*

Abb. 4

Variante I
Hochveredlung/Griffgebung

Standardrezeptur

KNITTEX FEL	40 g/l
KNITTEX KAT.MO	12 g/l
Essigsäure 60%	1 ml/l
ULTRATEX FSX	20 g/l
TURPEX ACN	20 g/l

Abb. 5

2.3. Effekte

Trocken und Naßknitterwinkel

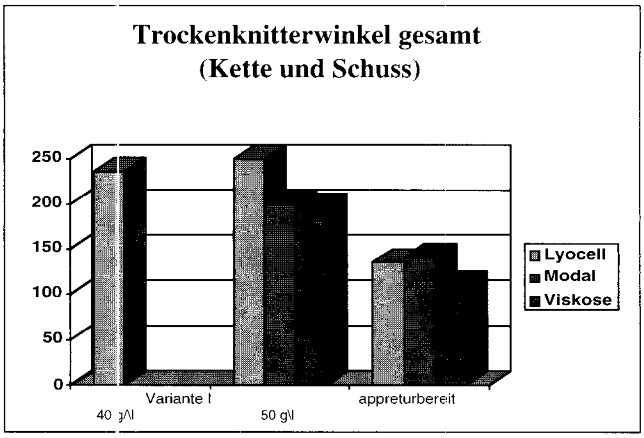


Abb. 7

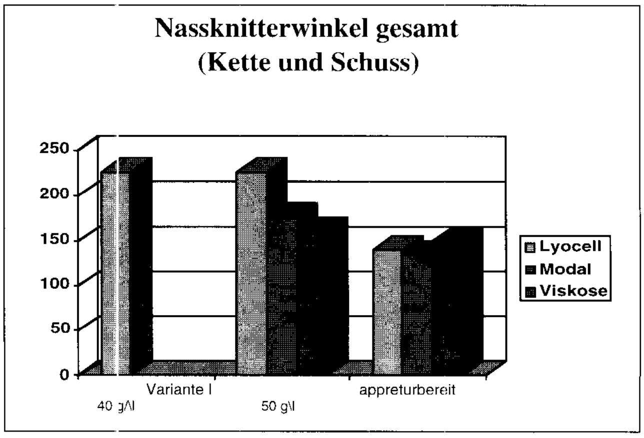


Abb. 8

Durch den Einsatz von 40 g/1 Vernetzer erzielt man eine hervorragende Steigerung der Trocken- und Naßknitterwinkel.
Eine weitere Erhöhung der Vernetzermenge bewirkt eine nur minimale Steigerung der Knitterwinkel aber einen deutlichen Abfall der Festigkeiten im speziellen der Scheuerfestigkeit.
Betrachtet man hierzu das Effektniveau von Modal bzw. Viskose, so wird deutlich daß bei der niedrigen Einsatzmenge auf diesen Fasern effektmäßig kaum etwas zu erreichen ist.

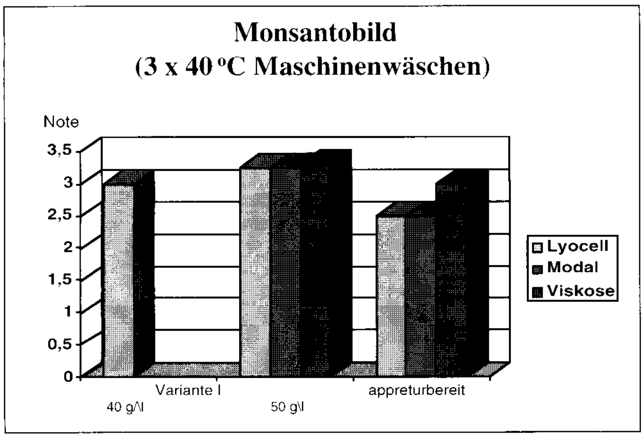


Abb. 9

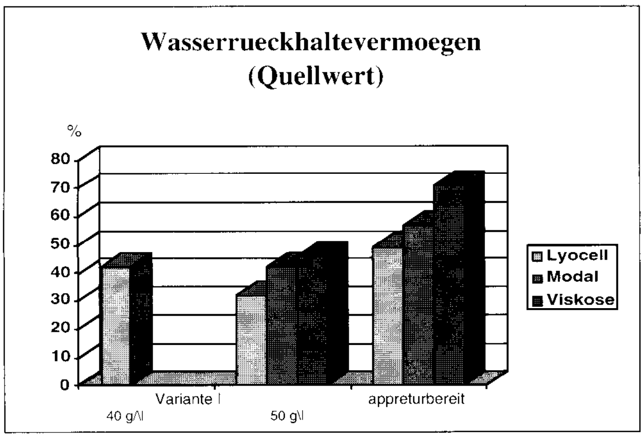


Abb. 10

Im Monsantobild, ein wichtiges Beurteilungskriterium für das Easy-Care bzw. Wash & Wear Verhalten von Textilien, erzielt man eine Steigerung um 1/2 Note der ohnehin bereits im appreturbereiten Zustand schon relativ guten Ware.
Selbst wenn bei der höheren Einsatzmenge von 50 g/l eine Steigerung um 1 Note möglich wäre, raten wir aus bekannten Gründen nicht dazu.

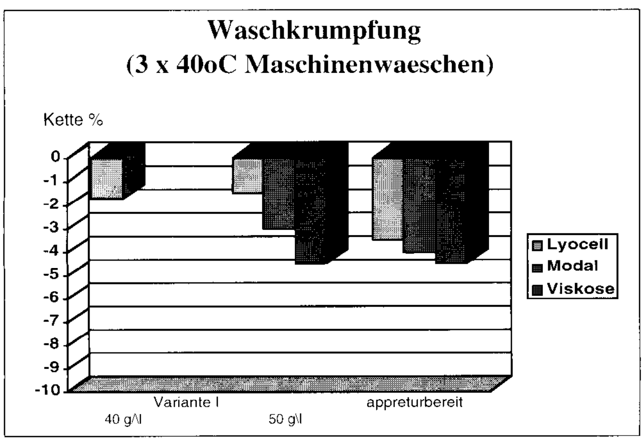


Abb. 11

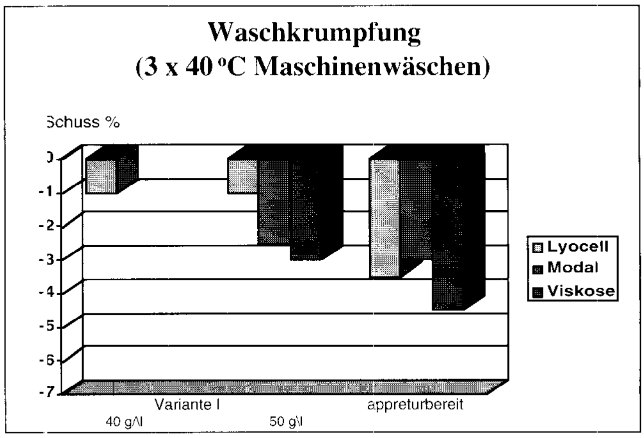


Abb. 12

Die bereits im appreturbereiten Zusand geringe Waschkrumpfung kann sowohl in Kett- als auch in Schußrichtung durch die Hochveredlung noch weiter verbessert werden. Die Werte von Modal bzw. Viskose liegen hier deutlich schlechter.

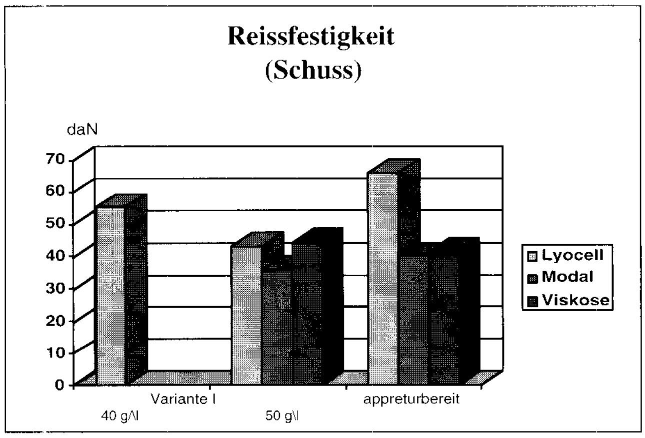


Abb. 13

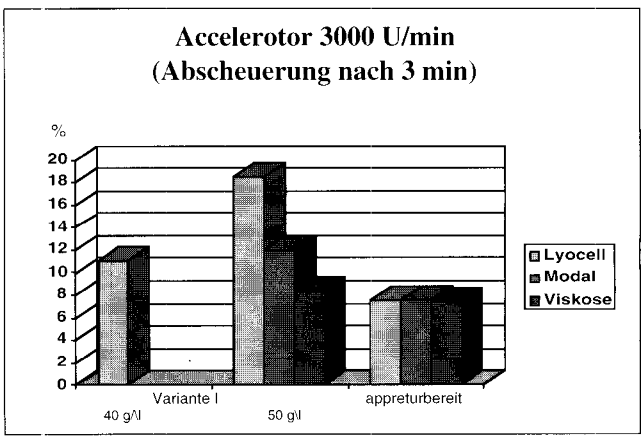


Abb. 14

Festigkeiten - ein Problem?

Schaut man sich den Reißfestigkeitsabfall in Schußrichtung bei einer Einsatzmenge von 40 g/l Vernetzer an,so bewegt sich dieser mit ca. 23% in einem durchaus akzeptablen Rahmen. Auch bei der Scheuerfestigkeit haben wir mit einem Gewichtsverlust ca. 11% im Vergleich zu 7,5% der appreturbereiten Ware einen Wert,welcher im üblichen Bereich liegt.

Das Wasserrückhaltevermögen,oft auch fälschlicherweise als Quellwert bezeichnet,liegt bei Lyocell niedriger als bei Viscose oder Modal, was, neben geringeren latenten Spannungen bedingt durch die schwächere Verstreckung bei der Herstellung von Lyocell mit ein Grund für den verhältnismäßig geringen Waschkrumpf ist.

Der Formaldehydwert mit weniger als 20 ppm gemessen nach der Japan Methode spricht für sich.

3. Funktionelle Ausrüstungsvarianten

3.1. Öl- und Wasserabweisung

Hat man noch vor einigen Jahren Fluorpolymere fast nur auf Sport- und Freizeitbekleidung gefunden,so hat sich der Einsatzbereich inzwischen um eine vielfaches erweitert und reicht von Heimtextilien wie Möbelbezugsstoffen,Vorhangstoffen oder Tischdecken über Techn.Textilien wie z.B. Planen oder Markisen bis hin zu spez. Einsatzgebieten wie z.B. Schutzbekleidung für die verschiedensten Bereiche.

Woran liegt dieser immense Erfolg der FC Ausrüstung?
An dem Spruch: „Was für Bratpfannen gut ist, ist auch gut für Bekleidung" scheint doch etwas Wahres zu sein.

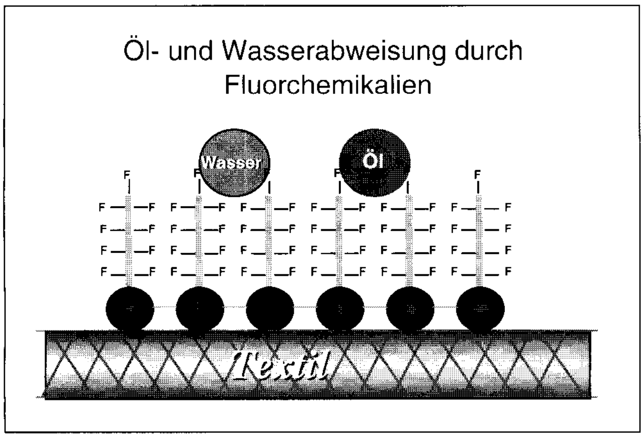


Abb. 15

Schaut man sich das schematisierte Funktionsprinzip an, so ist relativ leicht zu erkennen worin das Geheimnis liegt.

Durch die langen und dicht beeinander stehenden Fluorkohlenstoffketten wird die Oberflächenenergie der Warenoberfläche herabgesetzt was zu einer abweisenden Wirkung sowohl gegenüber wässrigen als auch ölhaltigen Substanzen führt.

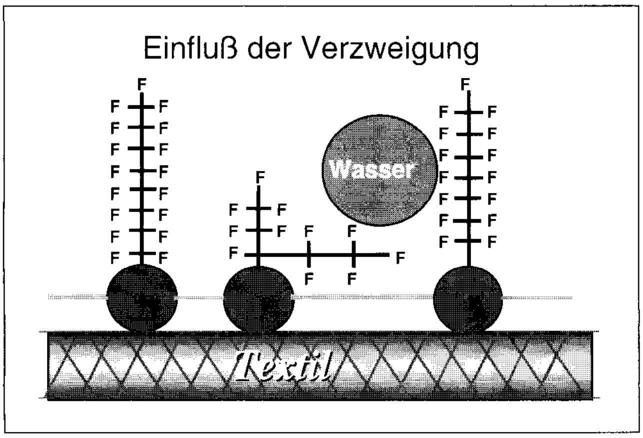


Abb. 16

Für die Qualität der Öl- und Wasserabweisung stehen in erster Linie die Kettenlänge und der Kettenabstand wohingegen das Prepolymer sowie die Verankerung der Fluorketten in demselben für die gute Wachbeständigkeit stehen. Eine Verzweigung der Ketten würde unweigerlich zu einem niedrigeren Effektniveau führen.

Variante I
Hochveredlung/Griffgebung

Standardrezeptur

KNITTEX FEL	40 g/l
KNITTEX KAT.MO	12 g/l
Essigsäure 60%	1 ml/l
ULTRATEX FSX	20 g/l
TURPEX ACN	20 g/l

Abb. 17

Bei unseren Versuchen auf Lyocell haben wir uns aus einer Vielzahl zur Verfügung stehender Produkte auf 3 Grundtypen beschränkt.
OLEOPHOBOL C für ein höchstmögliches Effektniveau auf cellulosischen Fasern.
OLEOPHOBOL CM für gute Effekte in Verbindung mit einem weichen Warengriff.
OLEOPHOBOL SRN neu. Hierbei handelt es sich um ein sog. „Stain Release Produkt", ein Produkt welches die Auswaschbarkeit von Flecken verbessert.

3.1.1 Effekte

Bei Einsatz von 50 g/l OLEOPHOBOL C erzielt man sowohl im Original als auch nach 5 Wäschen bei 40° C bzw. einer chemischen Reinigung eine Ölabweisung der Note 5. Die unbehandelte Ware zeigt natürlich keinerlei öl- bzw. wasserabweisende Wirkung. Hinsichtlich der reinen Wasserabweisung hat man im Original ebenfalls den maximalen Spraywert von 100 der allerdings nach Wäschen geringfügig zurückgeht. Dieser Wert kann durch Zusatz eines sog. Extenders allerdings noch gesteigert werden.

Variante IIa
Fleckschutzausrüstung

OLEOPHOBOL C	50 g/l oder
OLEOPHOBOL CM	50 g/l
Essigsäure 60%	1 ml/l
KNITTEX FEL	60 g/l
KNITTEX KAT.MO	18 g/l

Abb. 18

Für die leichte Fleckauswaschbarkeit sieht die Rezeptur etwas anders aus. Neben einem speziell modifizierten FC Produkt wird ein Produkt zur Verbesserung der Hydrophilie (ULTRAPHIL HSD) eingesetzt.

Bei der Prüfung des Stain Release Effektes werden auf die Ware unter anderem Paraffinöl, DMO, Ketchup, Kaffee und noch weitere fetthaltige Substanzen aufgebracht und deren Auswaschbarkeit beurteilt.

3. 2. Dauerhafter Flammschutz

Variante III

Funktionelle Ausrüstung

Flammschutzmitteln

PYROVATEX CP new

Abb. 19

Als letzte Ausrüstungsvariante von Lyocell möchte ich kurz die Ausrüstung mit dauerhaften Flammschutzprodukten anschneiden.

Als Einsatzgebiete könnte man sich z.B. den Artikel Kindernachtbekleidung als interessanten Markt vorstellen.

Durch den Einsatz spezieller Produkte wird die Lyocellfaser bereits unterhalb ihrer Zersetzungstemperatur karbonisiert und dadurch der Brennvorgang sowie die Bildung entzündbarer Gase unterbunden.

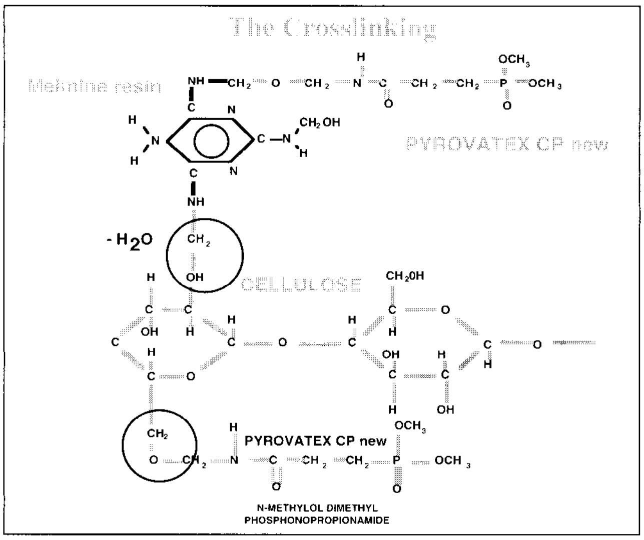


Abb. 20

Für dieses spezielle Gebiet haben wir ein Produkt in unserer Gamme, welches ausschließlich für den Einsatz auf cellulosischen Fasern konzipiert ist.

Für die Dauerhaftigkeit gegenüber zahllosen Wäschen ist die Fixierung des Produktes auf der Faser ausserordentlich wichtig. Die Vernetzung erfolgt an 2 Seiten des Cellulosemoleküls. Zum einen direkt mit der CH2OH Gruppe, zum anderen unter Zuhilfenahme eines Melaminvernetzers an der OH-Gruppe unter Wasserabspaltung.

Beide Vernetzungen sind für die hohe Dauerhaftigkeit des Effektes notwendig.

PYROVATEX CP neu bedarf keiner speziellen Applikationstechnik und ist mit vielen in der Ausrüstung üblichen Produkten wie z.B. Weichgriffmitteln, Silikonemulsionen, opt. Aufhellern oder Fluorchemikalien einbadig applizierbar.

Auch bei der Ausrüstung mit Flammschutzprodukten ist durch die Vernetzung mit einem Abfall der Scheuerfestigkeit zu rechnen

Flame retardant finish for children night-wear fabric:Lyocell

recipe: 420 g/l PYROVATEX CP new
40 g/l LYOFIX MLF new
40 g/l ULTRATEX FSA
25 g/l phosphoric acid 80%
1 g/l TINOVETIN JU

Abb. 21

Diese Ausrüstung wurde geprüft nach
DIN EN 532
DIN 54336
und zeigte in beiden Fällen auch nach 10 und 20 Wäschen bei Kochtemperatur hervorragende Flammschutzeffekte.
Die Formldehydwerte erfüllten den Öko-Tex Standard.

Diese Ausrüstungsvorschläge erheben keinesfalls den Anspruch auf Vollständigkeit sondern sind einfach als Denkanstöße zu verstehen. Es steht außer Frage daß die Ausrüstung- bzw. Anwendungsmöglichkeiten der Lyocellfaser noch lange nicht ausgeschöpft sind sondern erst am Anfang stehen.

ENZYMATIC DEFIBRILLATION OF LYOCELL - THE KEY PROCESS TO ACHIEVE NEW, CREATIVE HANDLE AND SURFACE EFFECTS

R. Breier, Textilchemie Dr. Petry GmbH, D-Reutlingen, Germany

Lyocell is becoming increasingly important in the textile finishing. The number of dye houses involved in the finishing of this new fibre is constantly growing. The reasons for this story of success originate from the unique properties profile of Lyocell.

As a fibrillating fibre Lyocell is pratically ideal for producing fashionable fabric surface effects.

To the finisher, however, controlling this fibrillation tendency often involves problems. Controlled fibrillation and enzymatic defibrillation are the key processes in the wet finishing of Lyocell and therefore utmost care must be taken.

The following survey of the current state of the art of enzymatic defibrillation processes is intended to show possible ways of exploiting the opportunities presented by this new fibre type.

1. FIBRILLATION

Lyocell as such would not cause any problems whatsoever during the finishing process. In principle, all washing, bleaching and dyeing processes which are used on cellulosic fibres can also be applied on Lyocell. If there wasn't the characteristic of fibrillation.

Polymer fibre interactions

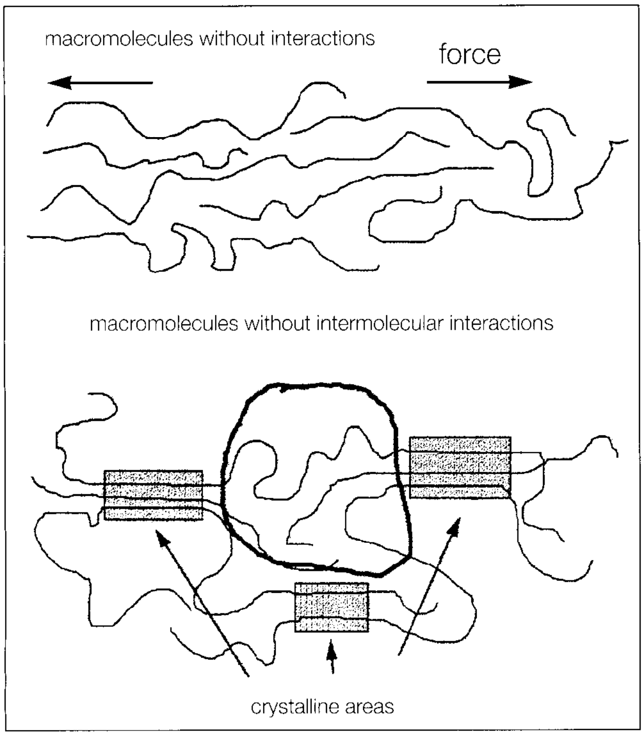


Fig. 1

Differences in the production processes of various man-made cellulosics cause a different morphological construction of the fibre resulting thereof.

Depending on the particular process, a certain ratio of crystalline and amorphous areas in the fibre structure are obtained. The crystallinity in longitudinal fibre direction of normal viscose ranges between 60 – 70 %, whereas the new Lyocell fibre shows a degree of crystallinity of up to 90 %.

The higher the share of crystalline areas in longitudinal fibre direction the higher the strength but also the brittleness and thus the tendency to fibrillation.

Fibrillierung

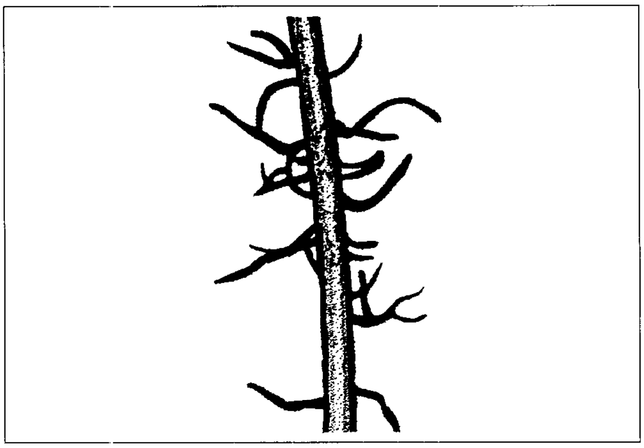


Fig. 2

Fibrillation means the splitting of individual fibrils along the fibre surface during the wet finishing process caused by fibre swelling and mechanical stress.

The fibre-specific degree of fibrillation as well as its control and manipulation by controlled mechanical action during dyeing and finishing is the key to obtain a great variety of handle/surface effects.

The variation possibilities cover the complete elimination of fibril formations, which allows for the production of classical fabrics up to the application of further treatments, such as enzyme and/or tumbler treatments, resulting in super-soft, voluminous peach-skin effects.

In water Lyocell shows a strong fibre swelling and thus a high wet rigidity. In combination with mechanical action a partial breaking off of fibril ropes from the fibre surface results. With regard to this fibrillation one must distinguish between long-staple, uneven primary or macro fibrillation and short, even secondary or micro fibrillation.

When wet-finishing Lyocell piece goods a rough primary fibrillation occurs very quickly, giving the fabric a completely spliced and fluffy look. The working out of this primary fibrillation is of utmost importance for the finishing routing of Lyocell. A not sufficiently prefibrillated fabric may lead to complaints after wet-treatments, such as for example even household washings.

High fibrillation degrees allow for the quick achievement of interesting handle/optical effects. On the other hand, however, they mean a difficult control of the dyeing and finishing processes. This especially applies for the rope finishing and the garment wash where fixation of creases in the rigid condition sometimes cause considerable problems.

The higher the fibrillation degree the greater the danger of a local over-fibrillation, i. e. the occurrence of loop and chafe marks.

Figure 3 shows the fibre specific degrees of fibrillation of the most important man-made cellulosics compared to cotton.

Fibrillierungsgrade

	faserspezifischer Fibrillierungsgrad
Baumwoile	2
Cupro	2 – 3
Viskose	1
Modal	1
Polynosic	3
Lyoceil	4 – 6
* Lenzing Lyocell	≈ 4
* Tencel	– 4 – 5
* New Cell	– 6

1 = minimale Fibrillierung 6 = maximale Fibrillierung

Fig. 3

The table shows that due to its high fibrillation tendency the new Lyocell fibre offers a wide range of variation possibilities which allows to achieve creative surface effects on piece goods.

Beside the fibre specific fibrillation degree there are further parameters which influence the fibrillation tendency of a piece good.

Conditions which increase the fibrillation:

- **low yarn twist, open fabric structure**
- **high temperature**
- **alkaline pH value**
- **high mechanical stress**

Conditions which lower the fibrillation:

- **high yarn twist, tight setting of the weave**
- **low temperature**
- **low mechanical *stress***
- **application of crease avoiding or lubricating systems**
- **singeing**
- **enzymatic treatment with highly specific cellulase combinations**
- **resin finishing with reactive crosslinking systems avoids formation of fibrillation completely and durably**

Fig. 4

Thus when it comes to wet finishing there actually is only one possibility to eliminate a forming of fibrillation completely and durably - the immediate treatment with reactive crosslinking systems.

These crosslinking systems can either be build up on the basis of classical resin finishing chemicals or - deviated from the chemical structure of reactive dyestuffs - on the basis of polyfunctional reactive systems.

On the other hand the usage of such cellulosic crosslinking systems reduces the variation possibilities of the handle/optic effects considerably.

Since this is undesirable especially when it comes to the production of fashionable surface effects it is necessary to take into account the particularity of the fibrillation during the wet finishing process.

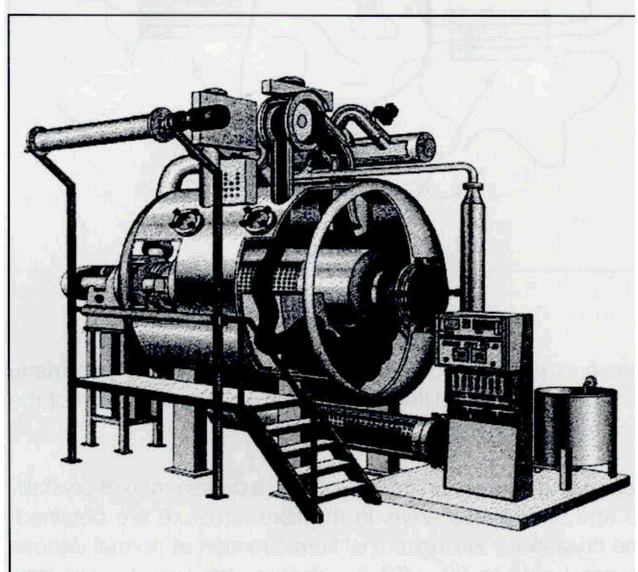
Controlled mechanic, that means the harmonisation between fabric setting, application of auxiliaries, type of machine and finishing routing to achieve the intended finishing target are the main preconditions for good and reproducible results.

The most interesting effects but also the greatest difficulties result from the rope finishing of Lyocell. Therefore we want to have a closer look at this finishing line.

As far as machinery is concerned, the new aerodynamical systems have definitely proven advantageous in rope finishing. The gentle fabric transport allows for an even fibrillation and thus a good reproducibility of the effects.

The most popular and according to our experiences so far best suitable machine is the Then-Aimow AFS.

Strangenveredlungsmaschinen



Fg. 5

The machines listed below have also proven very successful:

Thies	**- Luft-Roto**
ICBT	**- Alizee**
Kranth	**- Aero Dye**
Scholl	**- Soft Glider**
Henriksen	**- Air Jet**
Atyc	**- Airtint** and
Hisaka	**- Airjet**

This list does not claim for completeness but only shows the actual state of experience.

As far as **auxiliaries are concerned** the application of crease avoiding agents or lubrication systems in the rope treatment as well as in the garment wash have proven to be indispensable

Faltenverhüter

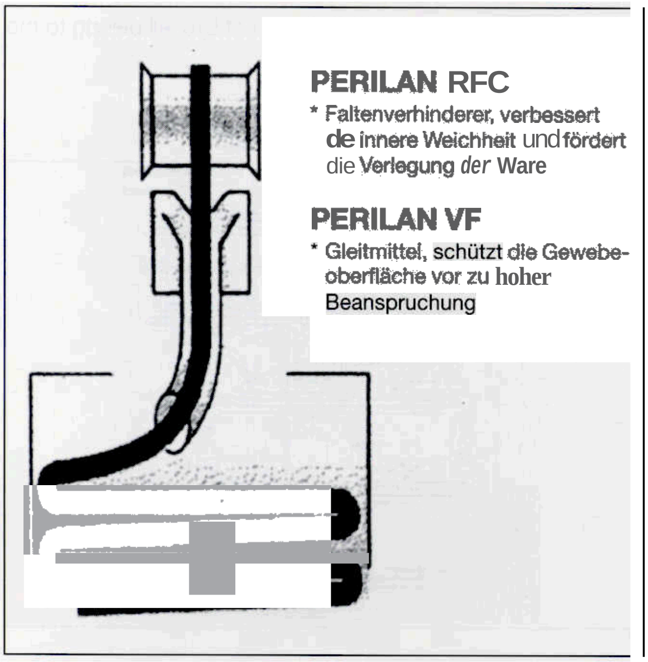


Fig.

Thereby, a combination of a crease avoiding agent and a lubricant shows a distinctly better efficiency than each individual product on its own. The reason being that in such a system the crease avoiding agent improves the inner softness of the fabric, i. e. it has a counteractive effect on the wet rigidity and the lubricant protects the fabric surface from too high mechanical stress. A combined application of crease avoiding agent and lubricant reduces and equalises the mechanical stress on the fabric, causing a counteraction to overfibrillation. PERILAN VF and PERILAN RFC are highly-effective products which have proven successful during the finishing of fibrillating fibres.

As far as the fabric itself is concerned the rope finishing reaches its utmost limits with medium-weight, closely woven fabrics (approx. 200 g/lfm) since the high wet ngidity creates creasing mark problems which cannot be solved Knitted fabrics represent a special case. Due to their open structure a particularly pronounced fibrillation is the result. Despite this fact them are finishing processes which have proven successful for knitted fabrics also. The explanation of these, however, would be beyond the scope of this lecture.

2. ENZYMATIC DEFIBRILLATION

The removal of the pnmary fibrillation forming during washing, bleaching and dyeing processes necessitates a treatment with special cellulase enzymes.

2.1 Enzymes

Enyzmes are substances which fundamentally differ from the textile auxiliaries which are employed normally. Due to the fact that even so-called enzyme experts often use demonstration forms for enzymes which in no way correspond with the realty the ideas as far as the construction and the mode of action of enzymes are concerned often are rather misleading and obscure.

Figure 7 shows two of such .models", showing enzymes as greedy animals

Enzymes do not look *that* way

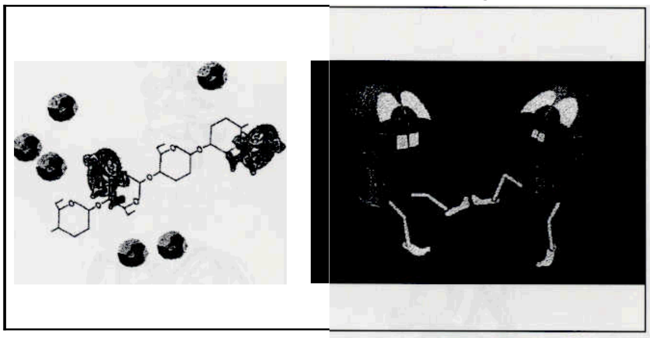


Fig. 7

Falsely, enzymes often are demonstrated as a kind of creatures, Similar to bactenals or microbes.

Enzymes, however, are no greedy animals. No, enzymes are inanimated. natural products of metabolisms of creatures, mostly of bactenas.

Enzymes are highly molecular proteins having a complexe build-up with pnmary, *secondary*, tertiary and quartemary structure

The foundation of all proteins and thus of the enzymes are the a-amino acids.

a-amino **acids have** *the* following general **chemical structure:**

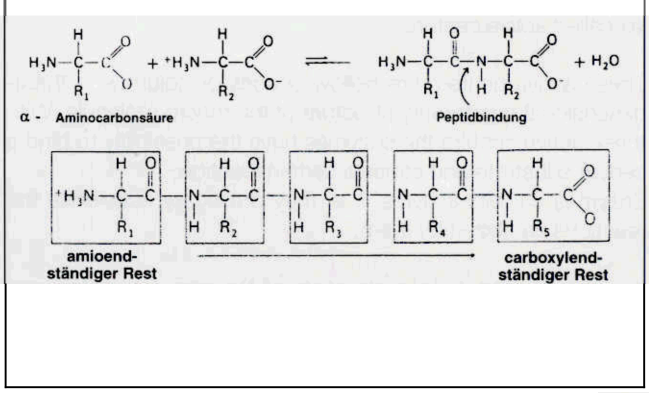


Fig. 8

An amino group and a carboxylate group are bound in direct neighbourhood with a carbon atom.

Such amino acids can have a mutual chemical reaction, thus forming peptides. Thereby, the carbon acid group of one amino acid reacts with the aminogroup of the other amino acid *etc.*

The peptides forming during this reaction have at both ends the same reactive groups as the a-amino acid. If more and more amino acids react to a polypeptide, then a macro molecule forms.

The sequence of the various amino acids (they differ in the rest R) now form the primary structure of such a macro molecule.

Enzyme – Proteine mit komplexer Molekülstruktur

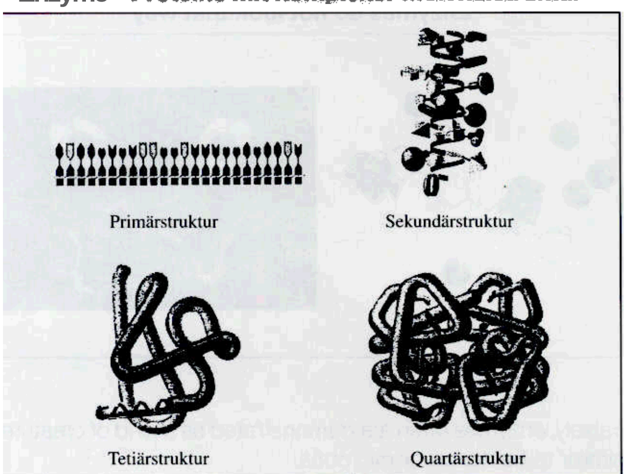


Fig. 9

Due to intermoleculary forces these long molecules, however, are not available as linear chains but they form complex spacial structures up to the quarternary structure.

This picture shows the enormous complexity of such a molecule. This is what enzymes look iike.

Admittedly, this form of presentation is not as spectactular as the greedy animals which we have seen before but this meets with reality.

Due to the special complex quaternary structure enzymes have so-called active centers.

These active centers are hollow spaces or columns in three-dimensional quarternary structure of the macro molecule. With these active centers the enzymes have the possibility to bind a certain substrate and cause a certain reaction.
Enzymes are biocatalytes, i. e. they drastically accelerate the reactions catalyzed by them.

If substrate and spacial structure of the enzyme match and furthermore the active centers can catalyse the desired reaction, then - and only then - the enzyme can *effect*

Therefore one also speaks of the key-lock principle.

Schlüssel-Schloß-Prinzip

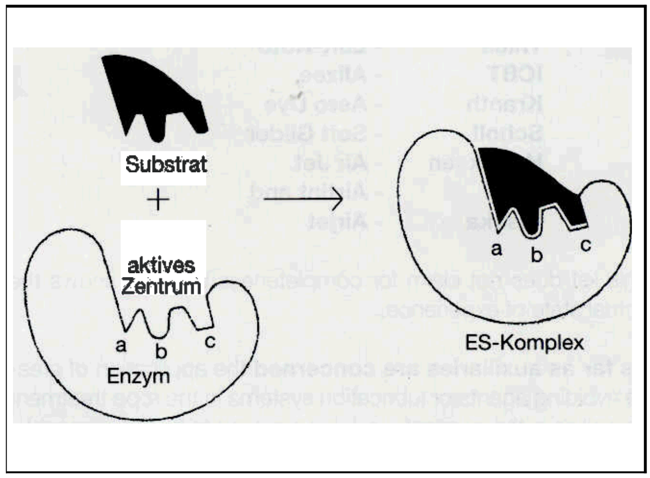


Fig 10

The enzymes used for the defibrillation of Lyocell belong to the species of cellulases.

Degradation of cellulose

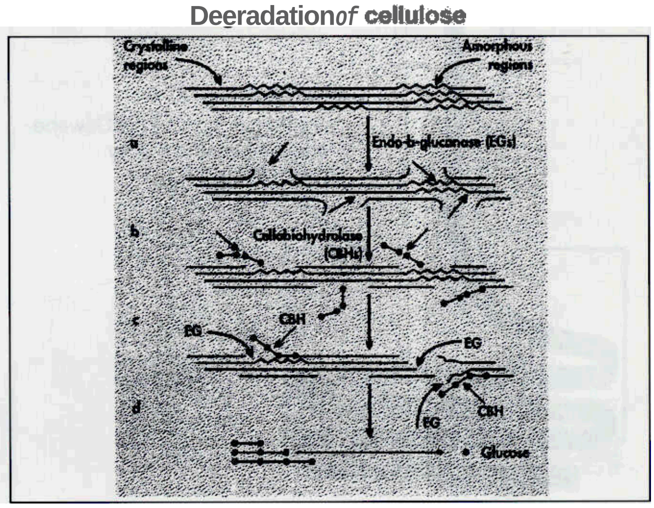


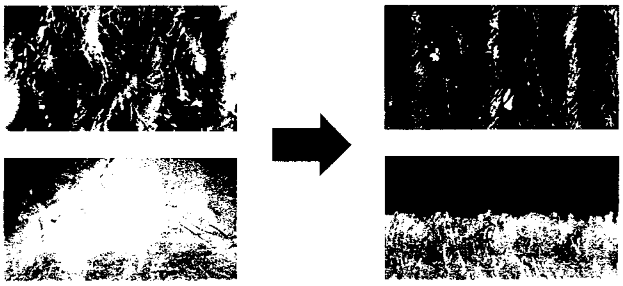
Fig. 11

Cellulases are enzymes which catalyse the hydrolytic degradation of the cellulose and accelerate this reaction enormously. The degradation mechanism is complicated. To degrade long cellulose chains down to the monomere, the glucose, many intermediate steps are necessary.

Due to the large molecular construction of the cellulases the accessibility of the enzymes to the inside of the fibre is iimited. Therefore the effect of cellulases mainly takes place on the textile surface. For this reason cellulase enzymes are perfectly suitable for the defibrillation of Lyoceli.

2.2 The defibrillation effect

In combination with a controlled mechanic a complete and lasting defibrillation of the fibre may be obtained by means of an enzymatic treatment. After an optimal enzymatic process an originally linted fabric shows an absolutely clear surface structure. Apart from the usage of suitable aggregates (rope/aerodynamic systems) the most important factor to obtain this result is the application of enzyme complexes especially adapted for the application on the Lyocelifibre.



fibrillierte Oberflächenstruktur von Lyocell-Maschenware vor dem Defibrillierungsprozess

klare Oberflächenstruktur von Lyocell-Maschenware nach dem Defibrillierungsprozess (60 min., 4 g/l PERIZYM 2000)

Fig. 12

Due to the particular morphological build-up of the Lyocell fibre conventional cellulase products normally do not show a sufficient effect. Therefore, to obtain an optimal and lasting defibrillation highly specific enzyme complexes must be employed.

2.3 Fibre blends

For fashionable reasons but also for price reasons Lyocell is often blended with other fibres.

When it comes to an enzymatic defibrillation of fibre blends, in particular with cotton or linen, it becomes more difficult. The high specific enzyme activity necessary for an effective treatment of Lyocell very quickjly leads to an overproportional degradation on the accompanying fibre and thus to losses in tesile strength which cannot be tolerated.

Folgen einer enzymatischen Überbehandlung von Leinen

Leinen unbehandelt | **nach 30 min. mit 2 g/l PERIZYM CLS**

nach 45 min. mit 2 g/l PERIZYM CLS | **nach 60 min. mit 2 g/l PERIZYM CLS**

Fig. 13

Figure 15 shows how narrow the gap between an optimal effect and a total damage of the fibre is, for example with linen.

The picture on the upper left side shows the REM microscope picture of an untreated linen fibre. The irregular surface can be seen very clearly.

The picture on the upper right side shows the same fibre after a 30 min. treatment with 2 g/l cellulose. The fibre has been optimally smoothened, irregularities have been removed.

After 45 min (picture below left side) the fibres already show cracks and depressions - distinct signs of fibre damage.

After 60 min of treatment (picture below right side) one can see deep cracks and breaks - total damage.

It is not my intention to frighten you from enzyme processes but to show you that enzymatic processes must be carried out very carefully.

Linen is by far the most sensitive fibre when it comes to an enzymatic treatment with cellulases.

With fibre blends of Lyocell with such sensitive cellulosic fibres therefore it s of utmost importance to use an enzymatic product which meets the special requirements of the accompanying fibre. Controlled fibrillation and enzymatic defibrillation are the key processes in the wet finishing of Lyocell and threfore utmost care must be taken.

When choosing suitable enzymes and the appropriate treatment routings the finisher therefore should seek the advise of an experienced producer of auxiliaries.

Already since the very beginning of the commercial finishing of Lyocell Textilchemie Dr. Petry is engaged in the developmentt of tailor-made problem solutions.

Lyozym-Verfahren

Hochspezifische Enzyme zur Defibrillierung von Lyocellfasern und deren Mischungen

PERIZYM LYO	• speziell auf Lyocell abgestimmte Cellulasenkombination • hohe Wirksamkeit • nachhaltige Defibrillierung • sehr guter Weichgriff
PERIZYM LYCM	• speziell auf Lyocell/Cellulose- und Lyocell/Leinen-Mischungen abgestimmte Cellulasekombination • hoher Nutzeffekt auf Lyocell bei bestmöglicher Schonung von nativen Cellulosefasern • nachhaltige Defibrillierung • guter Weichgriff
PERIZYM 2000	• neueste Entwicklung im Enzymsektor • sehr hoher Nutzeffekt bei bestmöglicher Schonung von nativen Cellulosefasern • sehr guter Weichgriff

Fig. 14

The Petry-Lyozym-Process stands as generic term for a number of enzymatic processes proven in pratice and their accompanying cellulase products.

Beside the choice of the appropriate enzyme the strict observation of the prescribed process parameters (pH value, temperature) as well as the adjustment of the threatment time in accordance with the individual fabric are basic conditions for good and reproducible results.

Finally, the appropriate process for the enzymization must be worked out for each individual fabric in order to obtain an optimal compromise between a lasting defibrillation and the loss in tensile strength.

3. CREATION OF HANDLE/OPTIC DISSONANCES

After the enzymatic removal of the rough primary fibrillation a sebsequent treatment on a rope tumbler can be effected in order to obtain a peach-skin touch, silk look and soft handle. The high running speed and the strong mechanic of these machines offer ideal conditions to obtain and further develop a secondary fibrillation on a fabric after having been defibrillated enzymatically.

Sekundarfibrillierung

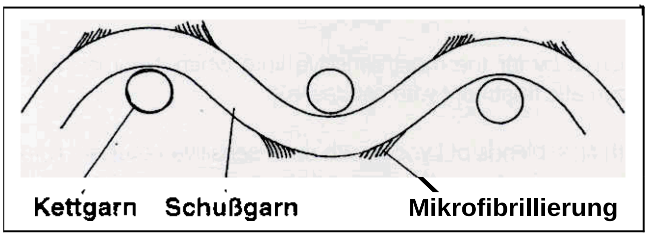


Fig 15

This creates a very fine fibrillic pile at the raised areas of the textile surface which looks very much like a perfectly emerized polyester micro fibre fabric. In addition to that the soft handle and the volume of the fabric are distinctly improved. When using the appropriate silicone softeners, super soft, voluminous peach-skin effects can be obtained with this procedure.

The most popular and actual most effective machine is the Airo 1000 of Biancalani.

Strangtumbler

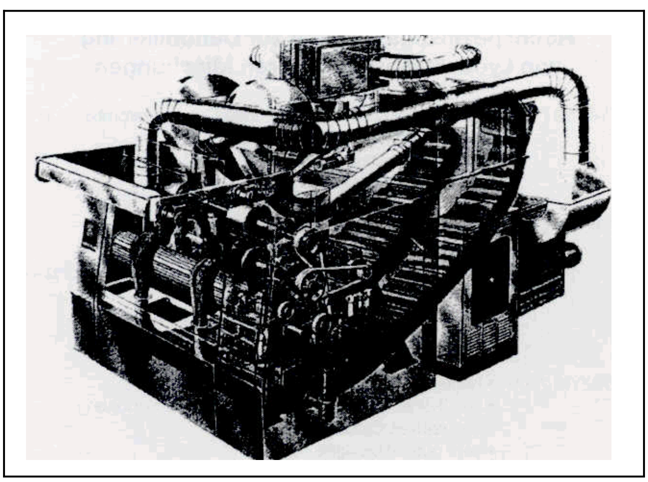


Fig. 16

Further suitable machines are

Thies - Roto-Tumbler
ICBT - Zephyr

as well as the rope dyeing machines equipped with tumbler modul

Krantz - Aero-Dye
Then - Airflow AFS and
ATYC - Airtint.

This list does not claim for completeness but shows the actual state of expenences.

4. FINISHING EXAMPLE

This picture exemplarily shows the finishing routing (reactive dyeing) of a Lyocell woven fabric in the rope treatment.

Veredlungsroute (Krantz-Beispiel)

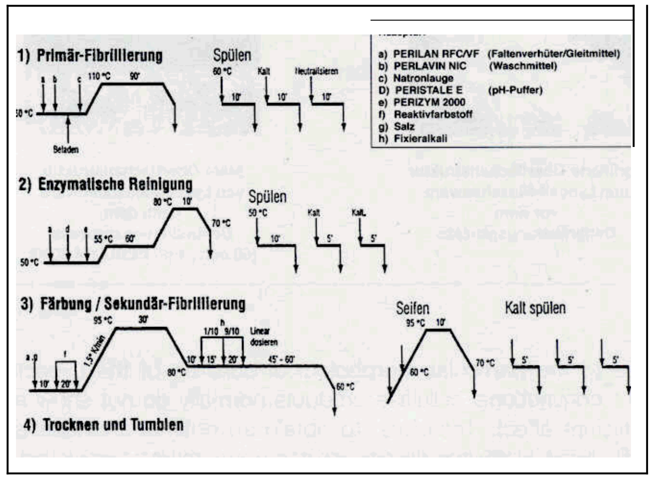


Fig. 17

To prepare the fabric accordingly it should in any case be open-width desized. *An* additional singeing in many cases leads to an improved finishing behaviour in the rope since projecting fibre hairs which would lead to an extreme fibrillation are removed right from the beginning. By adding alkaline in order to reinforce the fibre swelling the fabric must be prefibrillated followed by the enzymatic removal of this rough fibrillation split off due to swelling and mechanical action.

As a side effect of the continuously reacting mechanic a depending on the fabric quality more or less pronounced secondary fibrillation results after the subsequent dyeing process. This micro fibrillation can be further intensified by a subsequent treatment on the tumbler before the final finishing of the fabric. To achieve a definite stop of the fibrillation a slight resin finishing might be necessary in some cases.

The described method car only be an example. The experience has shown that depending on the kind of fabric and the finishing effect one wants to obtain, the optimal finishing routing can vary very much and therefore needs to be planned very carefully.

5. FINAL REMARK

At the end of my lecture I would like to summarize it in brief

The Lyocell fibre is an attractive raw material for new, creative textile developments.

The technological properties are of utmost interest for the whole textile chain. Even if the fibrillation during the finishing process sometimes still presents difficulties it, on the other hand, offers completely new variation possibilities as far as the creation of handle and surface is concerned.

Especially in the starting period, a new fibre with new properties necessitates an appropriate qualification especially with respect to the finishing. At first sight each new development means a financial risk but each risk, however, also offers a chance.

With fibrillating fibres like Lyocell exclusive and fashionable effects can be obtained. From the mastery of the finishing of such fibres a remarkable benefit can be taken.

Thanks to the cooperation between fibre manufacturers, machinery industry, textile auxiliary producers and dye houses many questions concerning the finishing of Lyocell meanwhile could be answered already. But there are still some more to be answered. It is worthwhile to mutually seek for solutions in order to take advantage of the chance „Lyocell“ for the textile industry.

Literature:

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THE DYEING OF LYOCELL FIBRES

Uwe Mrotzeck, DyStar Textilfarben GmbH, Germany

Lyocell is the generic name for a new regenerated cellulose fibre which is increasingly making inroads on the market. For Dystar, the world's largest producer of textile dyestuffs, the dyeing of Lyocell fabrics is an established part of the company's marketing and development activities.

Unlike many other new developments, where market success is basically based on the substitution of conventional products, Lyocell fibres have created a new and growing market as a result of their specific fibre properties. According to our own practical experience, Lyocell is now processed all over the world but is mainly focused in Europe.

The Lyocell dyeing process is part of a multistep process in which the coloration and visual and handle effects created on the fabric surface can be varied in a host of different ways, thanks to the deliberate use of dyestuffs, auxiliary agents, chemicals, machines and process engineering.

In the talk, the dyeing properties of Lyocell fibres will be discussed taking Levafix® and Remazol® reactive dyestuffs as an example. General recommendations can be deduced in this way for the selection of dyes and process as well as for process control.

Dyehouses today rarely still ask „how does one dye Lyocell fibres" since the optimisation of Lyocell finishing processes has become the theme of central importance.

FROM BLANCHING TO THE"USED"-LOOK, FROM FINISHING ERRORS TO A SUCCESSFUL PRODUCT

Lutz Schmidt, LUCT-Beratung Textilverede ung, Switzerland

1. SUMMARY

The author will name the methods best known today for changing the surface of textiles. He will describe how finishing errors, which the textile world has been aware of for a long time, and certain properties associated with Lyocell spun fibres have developed to become „items of fashion".
No process engineering details will be named in this talk, they can, however, be sent on to interested parties.

2. INTRODUCTION

I am quite sure that you are familiar with the terms given in the title:

The „used" look and blanching

However, I will still provide you with a definition.

The „used" look:

A light, grey-greenish, silky glossy layer, in the original sense on copper or copper alloyed yarns. The thickness and composition of the layer allow us to draw some conclusion about the age of bronze figures.

The „used" look = „old/a refined appearance".

Blanching:

A brushed up surface
a rub mark = a damaged surface

For textile finishers I would like to make the reference to the „blanching" finishing phase clear by providing you with two quotations.
„Mastering the finishing of fibres with a tendency to fibrillate offers a number of opportunities to enhance the value added" (R. Breier)
„Masterly work of the most complex nature on the smallest possible scale in nanometers. Following the example of Mother Nature, finely fibrillating fibres are purposefiilly attacked and the surface is slit but not destroyed. The human eye can discern this finishing process merely by the grey surface aspect, by the „used" look. To the touch, the feeling is that of a fine fibre down, a pleasant warm and nice feeling" (L. Schmidt)
These quotations state the most important points. Finishers have one more indication of the difficulties to be expected by the finisher when performing blanching on piece goods if they take a look at my grey hair.
I don't want to bore you with recipes involving endo and exo cellulases but I would like to tell you something about the blanching of textiles on piece goods, to tell you the story, as I see it, and deal with the most essential points of process engineering.

3. HISTORY

At the beginnig, the idea was much the same as with any other new technical development. An entrepreneur was found to put this idea into practise, with the courage to take risks and invest a considerable sum of money.
The binding force to solve the manifold and difficult technical and quality problems, a team of co-workers, began to form. The team learned how to apply the „used look" on piece goods step-by-step with unbelievable patience. Today this team is still learning and can still come across surprises. In the final analysis, however, the team has created a fashionable, up-to-date product with a high value added.

In my role as captain of this team, I have contributed to this, the finishers are Messrs. OTTEN in Hohenems.

Back to the idea of „learning from mistakes, and making the best of mistakes".
The blanching process or these rub marks are a trauma I acquired in my youth. I was an apprentice at Messrs. Opladen in Schusterinsel, the European company for silk, cupro, viscose, wool, PES/PA, which now no longer exists like lots of other companies in this field. The man in charge of dyeing, Fünfschilling, was the master of 30 winches, 50 star-dyeing machines, jigs, padders and lots of co-workers. He was dreaded and hated, but at the same time respected as a specialist in his field. „One mistake when dyeing silk twill on the winch " bankruptcy was inevitable, the blanched places were already evident in the fabric and Fünfschilling was giving hell.
At that time, Bemberg Record was dyed, printed and finished apart from silk. Cuprammonium silk - named silk for normal citizens at that time - displayed the same kind of bad habits as silk: a pronounced susceptibility to mechanical stress, i.e. rub marks were also created. Today, this sensitivity is known to the finisher as „fibrillation". The cellulose fibres are divided according to their tendency to fibrillate as follows:

Viscose	spun fibre	does not fibrillate
Modal	spun fibre	can be fibrillated with raising auxiliary agents
Polynosic fibres	spun fibre	can be fibrillated with raising auxiliary agents
Cuprammonium silk		can be fibrillated
Lyocell	spun fibre	ean be fibrillated

The trauma of my youth, blanching, stayed with me until 1984/1985: In the Far East I saw garment washing on items of clothing made of silk on a business trip with my boss at that time. This defined the goal: we are going to do that on piece goods. But with what kind of fibres?

- With silk
- With cuprammonium silk
- With Lyocell fibres
- And later, of course, with interesting blends

From this personal experience one can recognise the following:

- An error, a trauma acquired in youth, blanching, can become a successful product given the right idea.
- A bad habit of Lyocell spun fibres, the propensity to fibrillate which results from the fibre structure, became an interesting opportunity for qualified finishers thanks to the „used look" idea

4. PROCESS ENGINEERING

The method of changing textile surfaces, of scratching them, without destroying them, is well known:

Dry or wet at open width	raising
	emerizing
	brushing with mineral brushes
wet in rope form	„used look" finishing

1. The methods raising, emeriziniz and brushing will not be dealt with. I would only like to mention that these methods are suitable for heavy and medium-weight woven and knitted fabrics, which are frequently produced with a one sided effect. With respect to grey fabric of a poor quality, for example with knots, thick places, there is a danger when emerizing throughout that holes appear. There are several brushing techniques which offer more opportunities than raising and emerizing.

2. The „used look" finishing method is suitable for all weight classes. There is no danger of emerizing through the fabric with regard to irregularities since the fundamental medium, i.e. water, 4'is in liquid form" so it can move and escape. What are the dangers when producing the „used look" in the dyebath and in rope form ? These reside solely in the question of:

   the transportation of the rope
   the displacement of the rope and
   the opening of the rope form.

All textile finishers are familiar with the problem of dyeing in rope form. At the ITMA one is confronted with a wide number of miraculous machines. There is always a new assortment of storage basins and dies, sometimes short, sometimes round and sometimes long, and only the initiated know what is going on. One solution to the problem is offered in the form of „air-supported web control" in complex constructions. Is this really „a comprehensive solution" to these problems? Do all items of clothing and all weight categories really run on machines by Then, Thies, ICBT and Scholl without any problems? My colleagues from the machine construction department have done some excellent work in this field. Despite all this technical sophistication, certain irregularities and structures on the surface of the fabric are part of the character of „fabrics with a used look". One has to live with this. They come with this family of clothing. Or put in simple terms: each machine has its own trademark, there is no universal machine.

Now, briefly, I would like to outline the most important steps in the process when producing the „used look" on Lyocell spun fibres.

1. Precleansing should be free of contamination, there should be no remains of preparing and sizing agents. This can be carried out at open width or in rope form. Normally the „open width" method is given preference.

2. The primary fibrils are produced in rope form, on aerodynamic machines, in a hot alkaline bath.

3. Removal of the unattractive primary fibrils using suitable enzymes, so-called cellulases, also known as defibrillation. This process step is performed on the same dyeing machine as primary fibrillation.

4. Opening the rope form and drying.

5. Finishing with man-made resins and suitable additives.

6. The production of secondary fibrillation in so-called tumblers, damp to dry, with a high mechanical stress. This treatment can be carried out in either rope or open width form whereby the effects are not absolutely comparable. However, the open width tumbler, e.g. Santex - Santa Soft, offers considerable advantages with regard to handling.

- Work from cloth batch to cloth batch, no interruption in the batches

- No creases in the rope, no machine for opening the rope form.

5. MACHINES

I do not want to advertise and am giving you the following without making any valued judgement:

Wet finishing	Then. Thies, ICBT
Tumbler rope:	Biancalani Airflow, MAT Combi-Soft, Flainox Then, Thies, ICBT as a single-unit machine for wet and tumbler treatments
Tumbler open width:	Santex Santa-Soft

I remain at your disposal for any details you may require. Thank you for your attention.

EXPERIENCES IN DYEING OF FIBRE BLENDS OF LYOCELL AND WOOL

Karola Schäfer, Deutsches Wollforschungsinstitut an der RWTH Aachen e.V., Germany

Experiences in dyeing of lyocell and lyocell/wool are reported. Lyocell can be dyed with direct dyes in short times and at low temperatures (RT, 60, 80° C) with high levelness, in deep shades and with sufficient wet fastness properties. However, a complete penetration of direct dyes across the whole fibre cross section of lyocell fibres can only be achieved after dyeing of lyocell at temperatures of T ≥ 80° C and in times of t ≥ 30 min.
Furthermore, reactive dyes (Cibacron type) can be used to dye lyocell successfully.

Blends of lyocell and wool fibres can be dyed with direct dyes and acid, 2 : 1 metal complex or reactive dyestuffs satisfactory regarding levelness, depth of shade, tone-in-tone effects and wet fastness properties without impairment of the fibre quality. Lyocell/wool blends were dyed optimally in 35 min at 95° C using a one-bath procedure.

Fibre blends of lyocell and wool can be dyed also with reactive dyestuffs in different procedures (one-bath, two-step, multiple bath process). On the one hand, the blend component wool is sensitive to alkali, the cellulosic component, however, tends to a stronger extent to fibrillation in alkaline medium, thus, the dosage of the alkali required for fixation of the reactive dyestuff to the cellulosic fibre and on the other hand for removing excess unreacted reactive dyestuff has to be performed thoroughly. Lyocell can be dyed yet at pH-values around the neutral point (pH 5.5 to 8.5) intensely by reactive dyestuffs so that the danger of alterations of the wool component of the blend by alkali is reduced.

1. INTRODUCTION

Fibre blends of lyocell and wool are interesting new textile materials which can be used for the production of fashionable effect yarns with pleasant handle and lustre as well as for light summer, sports and leisure wear. The special properties of lyocell as high tear strength, low specific weight, soft handle, silky lustre, high wet stability and high moisture absorbency render lyocell into an interesting blend component for wool [1, 2]. Lyocell can be dyed using the usual cellulose dyestuffs [3, 4]. The dyeing of homogeneous blends of wool and cellulose fibres necessitates high demands on the dyeing procedure. Especially, dyeing of tone-in-tone or specific differential-dyeing-effects of wool in blend with cellulosic fibres are difficult to achieve in one-step processes. During dyeing of the cellulose fibre component, a staining and an alkali damage of the wool component of the blend can occur as cellulosic fibres are dyed in alkaline medium [5, 6]. Dyeing of blends of wool and lyocell is complicated, furthermore, by the strong tendency of lyocell to swelling in wet processing [7].

Experiences in dyeing of fibre blends of lyocell and wool by using different dyeing procedures and dyestuff systems are reported. Beside a coloristic evaluation of the dyed blends, the effects of the dyeing on the fibre properties of both components of the blend are analysed.

2. EXPERIMENTAL

2.1 Materials

2.1.1 Textiles:

Lenzing-Lyocell flock (18,24 µm, 3,3 dtex, 90 mm staple length); wool top (20 µm), lyocell(CLY)/wool roving yarn (80/20), lyocell/wool roving yarn (70/30), lyocell/wool roving yarn (40/60); lyocell/wool fabric, twill (50/50), lyocell/wool fabric, plain-weave (50/50), lyocell/wool fabric, Oxford weave (50/50), lyocell/wool fabric, crepe (50/50).

Pretreatments:
Wool top was extracted with methylene chloride (4 h). Lyocell flock was washed with an aqueous solution of Uniperol O (BASF) (0.1 ml/l; liquor ratio = 1:30) for 10 min at 40° C. Afterwards, a rinsing step with water was performed for 20 min. The lyocell/wool roving yarns were used without further pretreatment.

2.1.2 Dyestuffs:

Direct dyes:
Sirius Supra Blue SBRR1 - C.I. Direct Blue 71 (Dystar, Leverkusen); Sirius Supra Yellow KGRL (Dystar); Sirius Supra Red F4BL - C.I. Direct Red 212 (Dystar).

Solophenyl Blue FGLE (Ciba-Geigy, Basel); Solophenyl Flavine 7GFE (Ciba-Geigy); Solophenyl Yellow GLE (Ciba-Geigy); Solophenyl Red 4GE (Ciba-Geigy).

Acid dyestuffs:
Supranol Blue RLW - C.I. Acid Blue 204 (Dystar); Supranol Yellow 4GL - C.I. Acid Yellow 260 (Dystar); Supranol Navy R - C.I. Acid Blue 113, C.I. 26360 (Dystar); Supranol Red BL - C.I. Acid Red 260 (Dystar); Supranol Red 3BW - C.I. Acid Red 274 (Dystar).

2:1 Metal complex dyes:
Lanaset Yellow 4G - (Ciba-Geigy); Lanaset Red G (Ciba-Geigy).

Reactive dyestuffs:

Cibacron Blue F-R - C.I. Reactive Blue 182 (Ciba-Geigy); Cibacron Yellow F4G - C.I. Reactive Yellow 143 (Ciba-Geigy); Cibacron Red FB - C.I. Reactive Red 184 (Ciba-Geigy),
Lanaset Blue 2R - (Ciba-Geigy); Lanasol Blue 3G - C.I. Reactive Blue 69 (Ciba-Geigy); Lanasol Yellow 4G - C.I. Reactive Yellow 39 (Ciba-Geigy); Lanasol Red G - C.I. Reactive Red 83 (Ciba-Geigy).

2.2 Dyeing of lyocell and lyocell/wool blends

The dyeing experiments were performed by bath exhaustion procedures in the laboratory dyeing machines Ahiba Turbocolor (type MPC 600), Ahiba Texomat (Ahiba, Birsfelden, Switzerland) or Zeltex Colorstar CS2 (Mathis, Niederhasli, Switzerland). After the dyeing, the materials were rinsed in each case for 10 min with warm (50-60° C) and for 20 min with cold water.

The mentioned dyestuff concentrations (in percentage by weight) refer in all cases to the fibre component for which they are applied usually (e.g., 1 % Sirius dyestuff in a dyeing test of CLY/wool blend means 1 % of dye relating to the weight of the lyocell component).

2.2.1 Dyeing of lyocell

Dyeing with direct dyes:
Lyocell was dyed in each case in a liquor ratio (LR) of 1:30 in a liquor composing of 5 g/l Na_2SO_4 calc., pH 6.5 (acetic acid) at different temperatures and in varying times.

Temperatures:	RT, 60, 80, 90, 95, 98 or 104° C
Times:	1, 2, 5, 7, 10, 20, 30, 35, 40, 50, 60, 70 or 90 min
Resist agent:	0.2 g/l Mesitol HWS fl. (anionic, arylsulfonate; Bayer)
Washing off:	in some cases washing off with Levogen BF (Bayer) (2 %ig, pH 6-6.5; RT, 20 min) was performed.

Dyeing with reactive dyestuffs (Cibacron type):
Lyocell was dyed with Cibacron dyes from an aqueous liquor composing of 45 g/l Na_2SO_4 calc., 1 g/l Lyoprint RG (Ciba-Geigy) (LR = 1:30) at 50° C in 50 min. The pH-value of the liquor was adjusted with Na_2CO_3 in most cases to 8.5. Furthermore, the pH-value was varied or kept constant over the dyeing time in the range of 5.5 to 10.5 by dosage of 0.1 N Na_2CO_3 . In some cases, addition of 2 % Mesitol HWS was used as resist agent.

2.2.2 Dyeing of lyocell/wool blends

Dyeing with direct dyes and acid dyes:
Lyocell/wool blends were dyed with direct dyes and acid dyes as described above for the dyeing of lyocell with direct dyes.

Dyeing with direct dyes (Solophenyl type) and Lanaset dyestuffs:
Lyocell/wool blends were dyed with Solophenyl and Lanaset dyestuffs in a one-bath procedure from a liquor (LR = 1:30) composing of 5 g/l Na_2SO_4 calc., 0.17 g/l Albegal SET (Ciba-Geigy), pH 6.5 at 95 or 98° C, 60 min. In some cases, 2 % Mesitol HWS was added to the liquor.

Dyeing with reactive dyes:
Lyocell/wool blends were dyed with Cibacron-F- and Lanasol dyestuffs in different procedures.

One-bath dyeing procedure:
As liquor (LR = 1:30), 5 g/l Na_2SO_4 calc., 0.25 g/l Albegal B (Ciba-Geigy), 0.2 g/l Mesitol HWS, pH in most cases adjusted to 8.5, in water was used. The dyeing was performed at 50° C in 50 min.

Two-bath/two-step procedure:
In the first step, the lyocell component of the blend was dyed with Cibacron-F dyestuffs at 50° C in 50 min. As liquor (LR = 1:30), an aqueous solution of 45 g/l Na_2SO_4 calc., 1 g/l Lyoprint RG, 2 % Mesitol HWS, pH in most cases adjusted to 8.5, was used.
In the second step, the wool component of the blend was dyed with Lanasol dyes at 95° C in 1 h. The liquor (LR = 1:30) was composed of 1 g/l $(NH_4)_2SO_4$, 2.5 g/l Na_2SO_4 calc., 0.25 g/l Albegal B, pH 6.5.

Washing off after the 1st step:
First experiments to remove excess Cibacron dyestuff from the fibre blend were performed by ammoniacal aftertreatment, by soda treatment or by treatment with NaOH in each case for 20 min at 50° C.

Multistep procedure:
1. Step: Initiation of primary fibrillation: oxidative rapid bleaching [LR = 1:30; 12.5 ml/l hydrogen peroxide; 4 g/l Prestogen W (BASF, Ludwigshafen), 1 g/l Laventin LNB (BASF), pH 5-5.5; 60 min at 60° C];
2. Step: Dyeing of the wool component: with Lanasol dyes at 95° C, 1 h (liquor: cf. above);
3. Step: Enzyme catalysed defibrilliation; (LR = 1:30; 2 g/l Perizym 2000 (Textilchemie Dr. Petry, Reutlingen), pH 4.5-5.5; 55° C, 45 min, afterwards, enzyme inactivation at 85° C in 10 min;
4. Step: Dyeing of the lyocell component with Cibacron dyes at 50° C in 50 min (liquor: cf. above).

Analogous multistep dyeing experiments were also performed with direct dyes in combination with acid or metal complex dyes.

2.3 Analysis

2.3.1 Dyebath exhaustion

Dyebath exhaustion of dyestuffs during dyeing was analysed by photometry.

2.3.2 Colorimetry

Colorimetry was performed with the help of a Datacolor 3890 colorimeter (Datacolor, Marl) using the illuminant D65 and the 10° observer. Colour values are calculated according to the CIE-LAB-system with reference to illuminant D65. In each case, five measurements were performed.

2.3.3 Light microscopy and photometer microscopy

Light and photometer microscopic studies of fibres and fibre cross sections were done with the help of a scanning photometer microscope MPM 800 (Zeiss, Jena). Fibres and fibre cross sections which were obtained after embedding in an acrylate resin (Historesin(, Leica, Bensheim) at RT using a rotational microtome Supercut 2050 (Leica) in thicknesses of 20 µm were embedded in an immersion oil (nD = 1,515).

2.3.4 Fastness testing

2.3.4.1 Washing fastness

The determination of washing fastness was performed according to the IWS test method 193 (April 1976) at 50° C. The evaluation of washing fastness was done by colorimetry according to ISO 105-A02/A03.

2.3.4.2 Fastness to perspiration

Fastness to perspiration was analysed in alkaline solution according to DIN 54020 (Nov. 1983). The evaluation of colour changes was done according to ISO 105-A02/A03.

2.3.4.3 Wet abrasion resistance testing

Wet abrasion resistance testing was performed with the help of a crockmeter according to DIN 54021 (Aug. 1984).

2.3.5 Alkali solubility (AS)

Alkali solubilities of wool were determined according to IWTO-4-60 (E) (1966).

2.3.6 Urea bisulfite solubility (UBS)

Urea bisulfite solubility determination was performed according to IWTO-11-62 (D) (1966).

2.3.7 Amino acid analysis

The amino acid composition of wool was determined after total acid hydrolysis (5.7 N HCl, 110° C, 24 h) according to the procedure of Spackman et al. [8].

3. RESULTS AND DISCUSSION

3.1 Experiences in dyeing of pure lyocell

Direct and reactive dyestuffs were used for dyeing of lyocell. Already in short dyeing times, an intense colouration of lyocell was achieved by direct dyes at 95° C (Fig. 1). Lyocell could be dyed even at low temperatures (60° C) by direct dyes (Fig. 2). Lyocell has obviously a high absorptive capacity for direct dyes. A bath exhaustion of more than 90 % was obtained even after dyeing of lyocell flock with Sirius Blue SBRR1 for one minute at 60, 80 or 95° C (Fig. 1-3). After 30 min of dyeing time for all studied direct dyes a nearly complete bath exhaustion was obtained (Fig. 3). Short-term dyeing and dyeing at low temperatures can be used to dye lyocell.

The distribution of dyestuffs in the lyocell fibre dyed at low temperatures or in short times were analysed as well as its wet fastness properties.

A ring-dyeing was detected by light microscopy in lyocell fibres which were dyed for 35 min with direct dyes at low temperatures (60-80° C). Short-term dyed lyocell fibres showed a concentration of direct dyestuffs also in the outer parts of the fibres. In lyocell fibres which were dyed for 35 min at temperatures above 90° C, a complete distribution of the dyestuff across the whole fibre cross section was achieved.

Lyocell fibres which were dyed at 95° C with direct dyes were completely dyed over the whole cross section after a period of 20-30 min.

Lyocell flock dyed at 95° C for different times with Sirius Supra Blue SBRR1 (1 %).

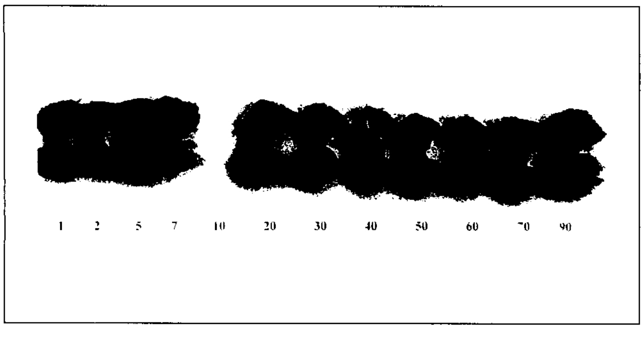

Fig.1

Bath exhaustion of Sirius Supra Blue SBRR1 (1 %) during dyeing of lyocell flock at 60, 80 or 95° C.

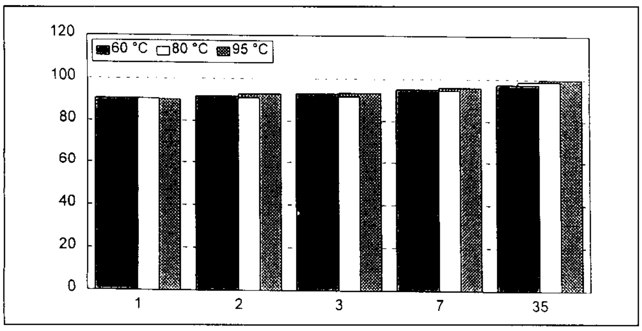

Fig.2

Bath exhaustion curve of Sirius Supra Red F4BL (1 %) during dyeing of lyocell flock at 95° C in dependence on time.

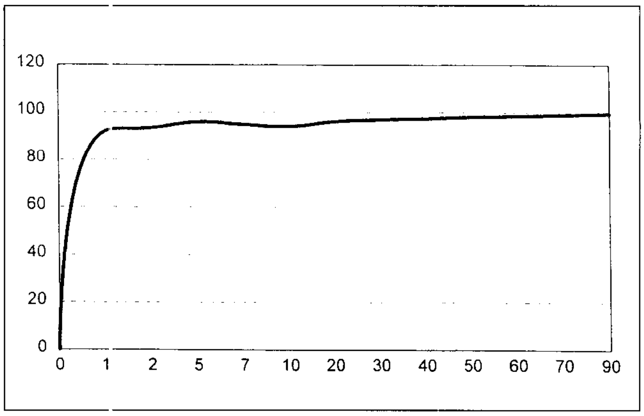

Fig.3

Ring-dyed textile fibres have often lower wet fastness properties than materials with a dye-stuff distribution across the whole fibre cross section [9-11]. In this study, similar fastness properties were found for lyocell fibres which were dyed with direct dyes at low temperatures (here: 60 or 80° C, 35 min) or at 95° C in short times compared to materials dyed at higher temperatures or in longer times (30 or 60 min at 95° C) (Table 1, 2).

Beside direct dyes, reactive dyestuffs (Cibacron type) were used for dyeing of lyocell also (Fig. 12, 13).

Washing fastness of lyocell flock dyed with Sirius Supra Blue SBRR1 (1 %) (according to IWS TM 193, 1976) - evaluation according to ISO 105-A02/A03.

Dyeing conditions	Colour changes	Staining of wool	Staining of cotton
60° C, 35 min	4-5	5	1-2
80° C, 35 min	5	4-5	1
95° C, 10 min	5	4-5/5	1-2
95° C, 30 min	5	4-5/5	1-2/2
95° C, 35 min	5	4-5	1
95° C, 60 min	5	5	1-2

Table 1

Fastness to perspiration of lyocell flock dyed with Sirius Supra Blue SBRR1 (1 %) (according to DIN 54020) - evaluation according to ISO 105-A02/A03.

Dyeing conditions	Colour changes	Staining of wool	Staining of cotton
60° C, 35 min	4-5	4-5	2-3
80° C, 35 min	4-5	3	1
95° C, 10 min	4	4-5	3
95° C, 30 min	3-4/4	4-5	3-4
95° C, 35 min	4-5	3	1
95° C, 60 min	3-4	4-5	3-4

Table 2

3.2 Experiences in dyeing of lyocell/wool blends

At first, lyocell flock and wool top were dyed together in a laboratory dyeing machine in order to study the process of dyeing of fibre blends of lyocell and wool. Furthermore, lyocell/wool roving yarns and lyocell/wool fabrics were used.

A slightly lower dye-bath exhaustion was found during dyeing of lyocell/wool with the direct dye Sirius Supra Blue SBRR1 at 95° C compared to reference dyeings of pure lyocell. This was most pronounced in short-term dyeing experiments. These results are a surprise as the direct dyestuff stains also the wool component. However, studies of the bath exhaustion of Sirius Supra Blue SBRR1 during dyeing of lyocell/wool and of pure lyocell in dependence on the temperature reveal a more intense adsorption of the dye on the blend compared to pure lyocell (Fig. 4). This should be due to a stronger uptake of direct dyes by the wool component of the blend at low temperatures. The comparison of the colour values of lyocell which was dyed in blend with wool at similar conditions as pure lyocell showed that it was dyed in a deeper shade than pure lyocell (Table 3). This is most pronounced in a deeper depth of shade (DL) in case of lyocell dyed with Sirius Supra Blue or Sirius Supra Red, whereas, this finds its expression more in the yellow shade (Db) in case of yellow coloured lyocell (Table 3). The presence of wool fibres promotes obviously the sorption of direct dyes onto lyocell. Direct dyes are taken up by wool also so that these results are a surprise. Direct dyestuffs applied at 95° C in 35 min are located only in the outer parts of the wool fibres.

Bath exhaustion of Sirius Supra Blue SBRR1 (1 %) during dyeing of lyocell and lyocell/wool for 35 min at different temperatures (liquor: without Mesitol HWS added).

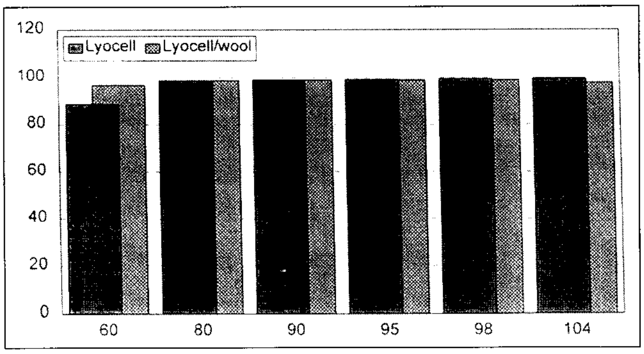

Fig. 4

Trichromatic dyeing of lyocell flock/wool top with (1 % in each case) Sirius Supra Blue SBRR1, Sirius Supra Yellow HGRL and Sirius Supra Red F4BL at 95° C in 35 min, with/without Mesitol HWS added.

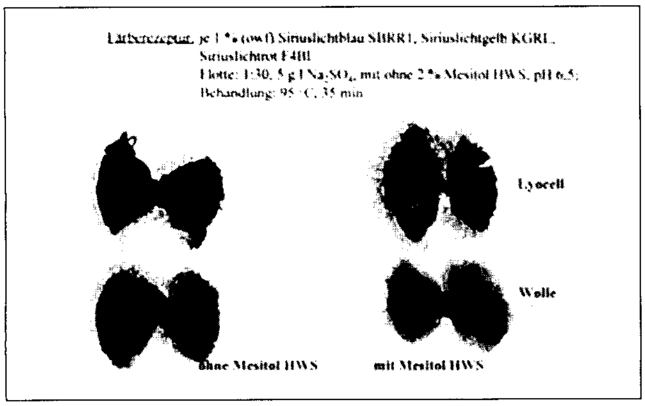

Fig. 5

An addition of the resist agent Mesitol HWS during dyeing of blends of lyocell and wool did not affect in a lot of cases the bath exhaustion or staining of the lyocell component of the blend by direct dyes (Fig. 5, Table 3). In other cases (e.g., in case of dyeing with Sirius Supra Red KGRL, Table 3), however, a more intense colouration of the lyocell was achieved if the resist agent Mesitol HWS was present compared to reference dyeings without Mesitol added (Table 3).

Colour values of lyocell and lyocell/wool dyed with different Sirius Supra dyestuffs (in each case 1%) at 95° C in 35 min, with/without Mesitol HWS added.

Fibre materials	Treatment	DE	DL	Da	Db
Lyocell flock	Sirius Supra Blue SBRR1	60.9	-56.6	2.3	-22.2
	Sirius Supra Yellow K-GRL	58.7	-15.3	11.9	55.4
	Sirius Supra Red F4BL	56.2	-36.2	42.8	4.0
Lyocell + wool	Sirius Supra Blue SBRR1	65.2	-63.5	2.4	-14.6
	Sirius Supra Yellow K-GRL	63.3	-15.4	18.5	58.6
	Sirius Supra Red F4BL	66.9	-56.2	35.3	8.9
	Trichromaticity: all three dyestuffs	67.8	-67.5	3.5	-5.8
Lyocell flock	Sirius Supra Blue SBRR1; with Mesitol HWS	67.6	-65.9	1.6	-15.1
	Sirius Supra Yellow K-GRL; with Mesitol HWS	68.1	-24.2	24.7	58.7
	Sirius Supra Red F4BL; with Mesitol HWS	68.5	-57.5	36.2	8.8
	Trichromaticity: all three dyestuffs; with Mesitol HWS	67.4	-67.2	2.8	-4.3
Lyocell flock	Sirius Supra Blue SBRR1; washing off with Levogen BF	62.5	-57.1	-4.1	-25.1
	Sirius Supra Yellow K-GRL; washing off with Levogen BF	58.7	-17.2	12.3	54.8
	Sirius Supra Red F4BL; washing off with Levogen BF	56.1	-37.2	41.7	4.2
Lyocell + wool	Sirius Supra Blue SBRR1; washing off with Levogen BF	70.8	-68.4	5.0	-17.6
	Sirius Supra Yellow K-GRL; washing off with Levogen BF	65.6	-55.3	39.1	11.0

Table 3

Acid and metal complex dyes were used in combination with direct dyestuffs for dyeing of the wool component of the blend CLY/wool.

Lyocell flock was dyed at first in a one-bath dyeing together with wool top by dyebath procedure. Pastel and deep shades as well as tone-in-tone effects were achieved by selection of appropriate dyestuffs (Fig. 6-8).

As dye component for the lyocell component, the direct dyes Sirius Supra or Solophenyl and for the wool component acid dyestuffs (Supranol) or 2:1 metal complex dyes (Lanaset) were selected. Mesitol HWS was used as resist agent for the wool component.

As shown in Fig. 9, short dyeing times of 35 min are sufficient for dyeing of both blend components in acceptable depths of shade. In all cases, higher wet fastness properties were found for the wool component of the blends compared to the lyocell component (Table 4, 5).

The fastness data given in Tables 4 and 5 are satisfactory for cellulosic fibres dyed with direct dyes.

Lyocell flock/wool top which were dyed together with 1 or 1.6 % Sirius Supra Blue SBRR1 and Supranol Navy R (4 %) at 95° C in 35 min with Mesitol HWS added.

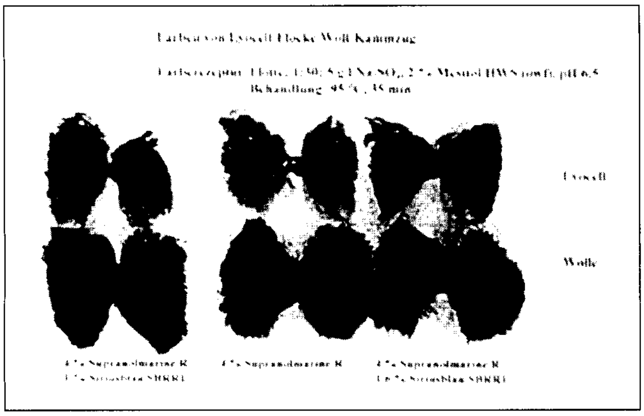

Fig. 6

Lyocell flock/wool top which were dyed together with 1.5 or 3 % Solophenyl Red 4GE and Lanaset Red G (0.8 or 1.5 %) at 95° C in 60 min with Mesitol HWS.

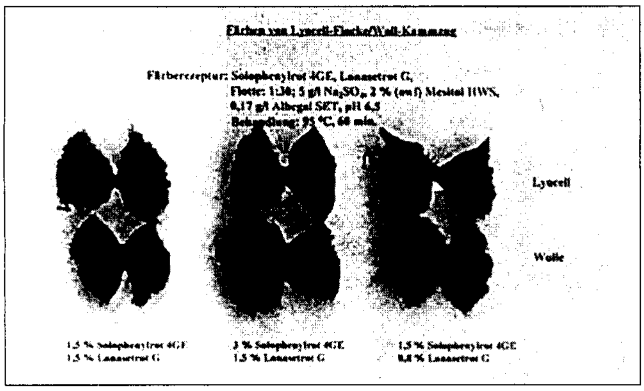

Fig. 7

Lyocell flock/wool top which were dyed together with 1 % Solophenyl Yellow GLE and 0.8 or 1 % Lanaset Yellow 4G at 95° C in 60 min with Mesitol HWS.

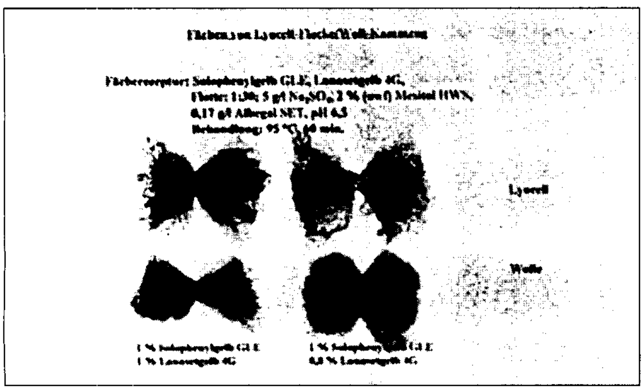

Fig. 8

Colouration [as DE and (-DL)] of the lyocell and the wool component of CLY/wool blends which were dyed at 95° C in 35 or 60 min with Sirius Supra Blue SBRR1 (1 %) and Supranol Blue RLW (4 %).

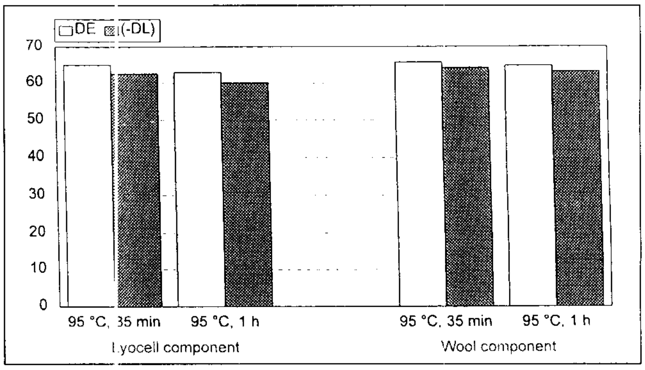

Fig. 9

Beside dyeing experiments of lyocell flock in combination with wool top, lyocell/wool roving yarns and lyocell/wool fabrics were used furthermore. Level dyeings in sufficient depths of shade (Fig 10 – 12) and satisfactory wet fastness properties were achieved using the dyestuff combination direct/acid or metal complex dyestuff (Table 4, 5). Pastel shades of lyocell/wool fabrics could be obtained by low-temperature dyeing (here: 23° C, 2 h). The weave did not affect the dyeing result of lyocell/wool fabrics with direct and acid dyestuffs. Most often, uneven dyeings were achieved in case of densely woven lyocell/twill fabrics. An optimization of the dyeing recipes has to be developed.

Lyocell/wool fabrics which were dyed with Sirius Supra Blue SBRR1 (0.8 %) and Supranol Navy R (2 %) at 95° C in 35 min with Mesitol HWS added.

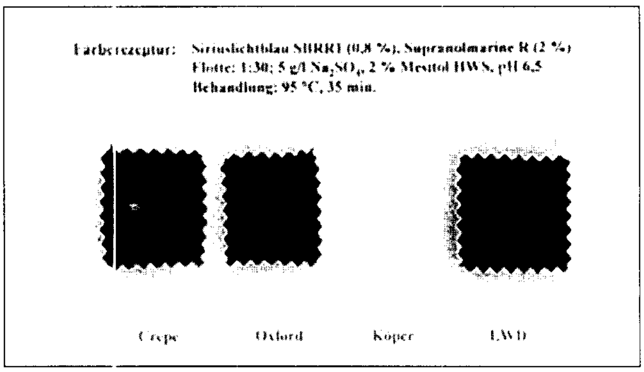

Fig. 10

Lyocell/wool fabrics which were dyed at 95° C in 35 min with Sirius Supra Yellow KGRL (0.5 %) and Supranol Yellow 4GL (3 %) with Mesitol HWS.

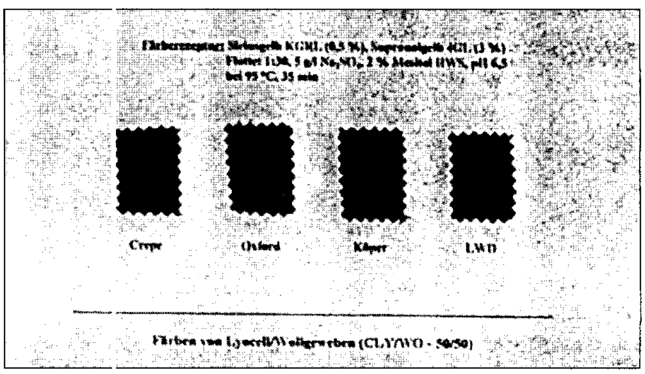

Fig. 11

Washing fastness of lyocell flock/wool top or lyocell/wool roving yarns dyed with Sirius Supra- and Supranol dyestuffs (according to IWS TM 193, 1976) - evaluation according to ISO 105-A02/A03.

Fibre materials	Dyeing	Colour changes	Staining of wool	Staining of cotton
Lyocell	Sirius Supra Yellow KGRL (1 %)/Supranol Yellow 4GL (6 %); 95° C, 1 h	4-5	5	2-3/3
Wool	" "	5	5	4-5
Lyocell	Sirius Supra Blue SBRR1 (1.6 %)/Supranol Navy R (4 %); 95° C, 1 h	5	4-5	1-2
Wool	" "	5	4-5	3
Lyocell	Sirius Supra Red F4BL (1 %)/Supranol Red BL (4 %); 95° C, 1 h	2-3	4-5	2
Wool	" "	4/4-5	4/4-5	4
Lyocell/wool roving yarn (40/60)	Sirius Supra Red F4BL (1 %), Supranol Red BL (4 %); 95° C, 35 min	5	4 (-5)	(1-)2
Lyocell/wool roving yarn (70/30)	" "	4 (-5)	4	2
Lyocell/wool roving yarn (80/20)	" "	4	4	2

Table 4

Fastness to perspiration of lyocell flock/wool top or lyocell/wool roving yarns dyed with Sirius Supra- and Supranol dyestuffs (according to DIN 54020) - evaluation according to ISO 105-A02/A03.

Fibre materials	Dyeing	Colour changes	Staining of wool	Staining of cotton
Lyocell	Sirius Supra Yellow KGRL (1 %)/Supranol Yellow 4GL (6 %); 95° C, 1 h	4-5/5	5	4-5
Wool	" "	4/4-5	4-5	4-5
Lyocell	Sirius Supra Blue SBRR1 (1.6 %)/Supranol Navy R (4 %); 95° C, 1 h	4	4	3/3-4
Wool	" "	4-5/5	4	3-4/4
Lyocell	Sirius Supra Red F4BL (1 %)/Supranol Red BL (4 %); 95° C, 1 h	3	4-5	4
Wool	" "	4-5	4/4-5	4
Lyocell/wool roving yarn (40/60)	Sirius Supra Red F4BL (1 %), Supranol Red BL (4 %); 95° C, 35 min	5	(3-) 4	2-3
Lyocell/wool roving yarn (70/30)	" "	(4-) 5	3- (4)	2-3
Lyocell/wool roving yarn (80/20)	" "	5	3	2-3

Table 5

Lyocell/wool fabrics which were dyed at 95° C in 35 min with Sirius Supra Red F4BL (0.5 %) and Surpanol Red BL (2 %) with Mesitol HWS added.

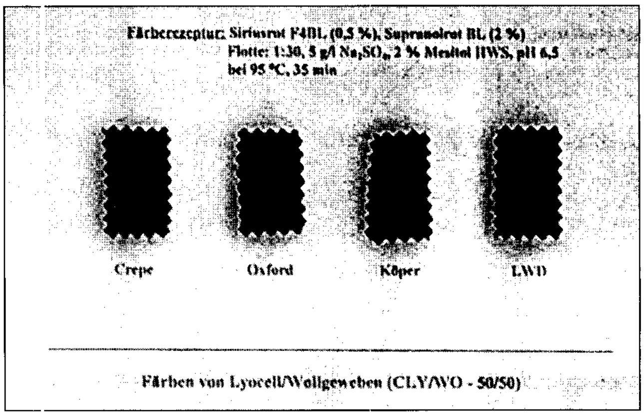

Fig. 12

Strong fibre swelling in the wet state and the tendency to fibrillation are fundamental problems during wet processing of lyocell materials [1-3, 7]. Both phenomena could complicate the dyeing of the fibre blend lyocell/wool. According to our present experiences which were obtained during dyeing of lyocell and lyocell/wool only by bath exhaustion procedure in laboratory dyeing machines, the high tendency of lyocell to swelling causes no problems during dyeing of blends of lyocell and wool. However, the swelling of lyocell/wool fabrics during industrial wet processing has to be investigated. The situation is different for the fibrillation of lyocell fibres: even in laboratory scale dyeing fibrillation occurs. It is known that the tendency to fibrillation is markedly higher during hank finishing than during laboratory dyeing [12]. No different fibrillation of lyocell was detected by light microscopy in presence or absence of wool.

Enzyme catalysed aftertreatments using Perizym 2000 were successfully used in order to remove fibrils formed during dyeing of lyocell [12].

3.3 Experiences in dyeing of lyocell/wool with reactive dyestuffs

Lyocell can be dyed quite easily with reactive dyestuffs, e.g., Cibacron F dyes (Fig. 13, 14). During dyeing of lyocell with Cibacron F-R (1 %) at 50° C (30 min) nearly a 90 % bath exhaustion was achieved (Table 6).

Lyocell flock and wool top which were dyed at 50° C in 60 min with Cibacron F-R (1 %) at different pH-values.

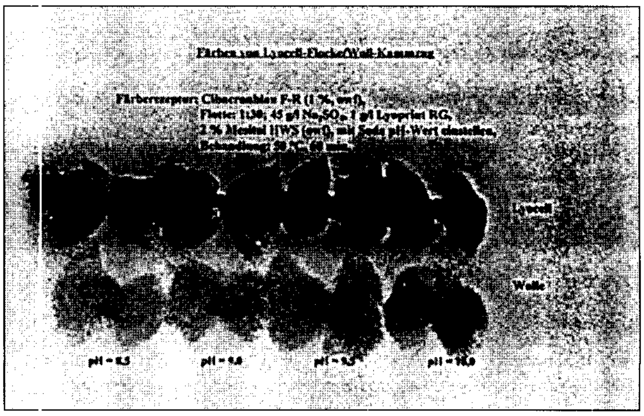

Fig. 13

Lyocell flock and wool top which were dyed at 50° C in 50 min with Cibacron F-R (3 %) and Lanasol Blue 3 G (3 %) at pH 8.5.

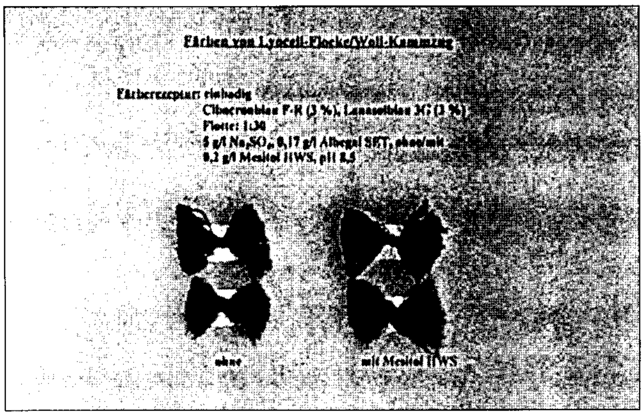

Fig. 14

Influence of the pH-value during dyeing of lyocell flock and wool top with Cibacron dyestuffs (1 %) at 50° C, 30 min on the bath exhaustion of the dyes, the colouration (as DE and DL of the lyocell component of the blend) and on the alkali solubility (AS) of the wool.

pH-value	Bath exhaustion in %	DE	DL	AS in %
8.5	88.2	63.7	-51.2	16.2
9.0	88.0	62.4	-49.9	17.7
9.5	88.5	60.1	-46.2	18.2
10.0	89.7	60.4	-47.0	19.9

Table 6

During reactive dyeing of blends of wool and cellulosic fibres, the exact pH adjustment or the exact dosage of the alkali amount required for a sufficient fixation of the reactive dyes to the cellulose fibre [5, 6] is essential to prevent an alteration of the wool component of the blend. It is known that wool is subjected to partial hydrolysis [6] and/or to formation of new crosslinks during exposure to alkali at higher temperatures [6, 13]. Lanthionine [6, 14] and lysinoalanine [15] are crosslinks which can be formed in alkaline medium in the protein fibre wool.

Dyeing of wool-cotton mixtures represents always a challenge for the dyer. The influence of the alkali amount and of the pH-value on the dyeing result during dyeing of lyocell/wool with Cibacron dyes were studied by keeping the pH-value during dyeing constant by titration with Na2CO3 (Table 6) At pH-value 8.5, a similar bath exhaustion of the reactive dye and a sufficient colouration of the lyocell component of the blend was achieved as at high pH (10-10.5). The fibre blend lyocell/wool can be dyed in a sufficient depth of shade at pH-values around the neutral point (pH 5.5-6.5) (Fig. 15). As shown in Table 6, an increasing partial hydrolysis was achieved with increasing pH-value applied during dyeing of lyocell/wool with reactive dyes (increasing alkali solubilty). The threshold of tolerance for alkali solubility of wool is 20.

No significant alterations in the amino acid composition of the wool component of lyocell/wool blends which were dyed with reactive dyes near the neutral point (pH 5.5 - 8.5) were found by amino acid analysis. Lanthionine was not detected.

Colouration of the lyocell component of CLY/wool after dyeing with Cibacron Blue F-R (1%) at 50° C in 50 min.

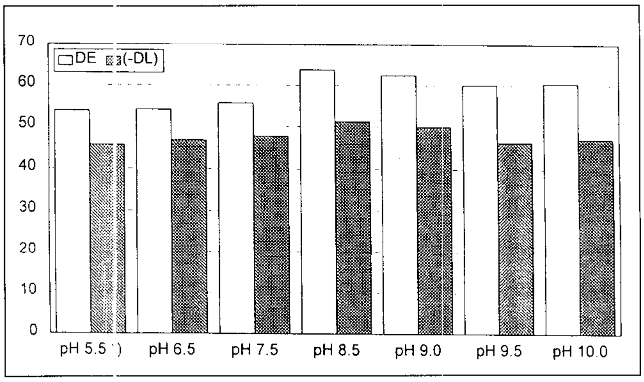

Fig. 15

(-Bromacrylamide dyes (Lanasol) were used to dye the wool component of the fibre blend lyocell/wool. Dyeings were performed as well in a one-bath as in a two-bath/two-step procedure. Lyocell/wool blends were dyed in a one-bath process at 50° C (50 min) at pH 8.5 in sufficient depths of shade at pH 8.5 (Fig. 15). In a two-step procedure, the lyocell component was dyed at first at 50° C in 50 min at pH 8.5, afterwards the wool was dyed at 95° C in 1 h, in other trials the wool component was dyed at first at 95° C in 1 h, in other cases after the wool dyeing an enzyme catalysed treatment with Perizym 2000 was performed in order to remove fibrils followed by a dyeing of the lyocell component. After both procedures, level and deep dyeings were obtained (Fig. 16). Care has to be taken during two-step dyeing, where at first the lyocell and than the wool component were dyed that a thorough removal of excess unreacted dyestuff was achieved because this can be extracted during dyeing in the second step into the dyebath and can adsorb onto the wool resulting in off-shades. The usually applied aftersoaping after

Fig. 18. Lyocell flock and wool top which were dyed in two steps: in the 1st step with Cibacron Blue F-R (4 %) at 50° C in 50 min and in the second step with Lanasol Blue 3G (1.5 %) at 95° in 60 min.

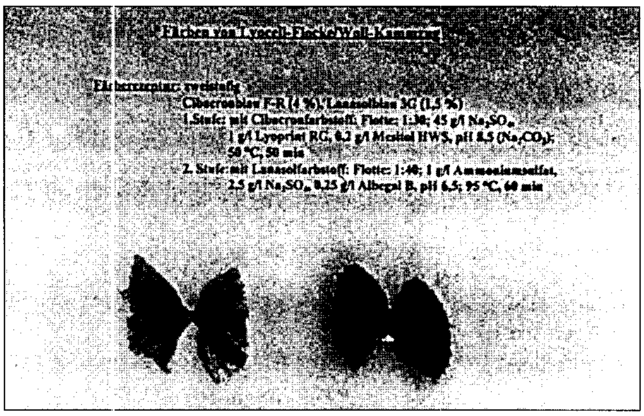

Fig. 16

reactive dyeing of cellulosic fibres (usual means a treatment with NaOH at 60° C) has to be modified for lyocell/wool blends in order to minimize the danger of the initiation of a fibrillation of lyocell [12, 16], and on the other hand of a significant alteration of the wool component of the blend by a high alkali dosage [6, 13, 14].
In our studies, lyocell/wool was treated after reactive dyeing experiments with moderate soda or ammoniak dosages at pH 9.5 (50° C, 20 min).

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TEXTILE PROCESSING TECHNOLOGY DEVELOPMENT DIVISION

Hiroshi NAMIKAWA, Unitika, Japan

1. Introduction

In co-operation with Moririn, Unitika will introduce „Lyocell by Lenzing®" cellulose fibres (hereinafter named „Lyocell" for short) produced by Lenzing AG (Austria), the world's largest manufacturer of rayon staple fibres. These fibres are manufactured in a technologically advanced process as a result of solvent spinning and Unitika is examining the development of textiles made of fibres of this kind. At the end of July of this year, when the Lyocell factory starts up, development work on "new rayon" can really begin.

When developing "New Rayon", special advantages of the Lyocell fibre, which have done away with the shortcomings of previous cellulose fibres, became very apparent, however, some specific problems were encountered when blending with other textiles with respect to spinning, knitting and various other forms of processing. Nevertheless, we feel positive that the Lyocell fibre will become a permanent feature in the next century, far beyond the scope of the clothing industry, due to its wide range of applications.

We are hurrying along the development of a wide range of products in which we will exploit the excellent properties offered by Lyocell. Today, I will focus on only one of these areas, namely knits made of Lyocell by Lenzing®, which I would like to introduce to you here as a new kind of cellulose fibre product.

2. The Situation of cotton in Japan and the market for knitted products

The development of supply and demand with regard to cotton products in the Japanese market between 1990 and 1995 show that since the Plaza agreement domestic production has been on the decline although demand has remained the same, and imports are on the rise. There has been a shift from semi-finished products, such as cotton yarns, to finished products (articles of clothing). In the recent past, imports already exceeded 80%. The amount of consumption regarding cotton and blended cotton products reaches a total of 289 000 tonnes per annum which were actually processed to finished products in 1995 from the total amount required on the domestic market of 865 000 tonnes. Consumption with respect to finished products only, can be divided into woven and knitted ones.

Consumption with respect to knitted fabrics, makes up for only one third of the figure for woven goods, namely 77 000 tonnes per annum. It becomes clear that this quantity can roughly be divided into seven product groups whereby the consumption rate looks as follows for the individual groups: 82 % of total consumption is attributed to the groups of underwear - 48%, sports shirts and T-shirts - 23 % and sports clothing - 1 1 %. The remaining percentages divide in general into socks - 9%, pyjamas 7% and pullovers etc. From this one can see that neither the amounts consumed nor the number of products is excessively high.

In normal circumstances, knitted fabrics made of cotton and blended cotton products are made up of a series of stitches made of spun yarns, which display fluff, neps and natural irregularities such as yarn defects etc. For this reason, the yarn quality and additional finishing treatments have more effect on the outer appearance and handling of the knitted product and, therefore, a high quality technique when spinning, knitting and with regard to finishing processes is an absolute must. On the other hand, the fact that knitted fabrics do not have the same dimensional stability as other fabrics, as a result of the properties typical for knitted fabrics, means that the number of potential products, and, therefore, the amount of fibres consumed, is limited.

The first impulse when considering all of these facts is to assume a very unfavourable costbenefit ratio and very low level of efficiency.

With knitted goods, it is easier than with woven fabrics to manufacture these in small quantities, various designs or within a very short time, with circular knitted products in particular, due to the many different knitting variations available (combinations of different yarns, a wide variety of knitting forms etc.).

Thus one can cater for different requirements in a very simple and precise manner within the potential product range for knitted fabrics and thus react in sufficient time to what might sell well in a market in which it is becoming increasingly difficult.
Thus, one does not have to depend so much on imports.

Moreover, in the recent past we are caught in the grips of a trend in which catchwords such as "compact styling", "soft and light" and "comfortable worn next to the body" etc. have become of major importance - a fashion trend which represents a very positive development for knitted products.
It is to be expected that these knitted products will make major inroads on the casual wear sector in the not too distant future.

In our role as fibre and textile manufacturers we have set ourselves the goal, in light of the current market situation, of deliberately making use of our techniques and know-how in order to show off to advantage the special properties of Lyocell in a new group of products. A set of the products with which we wish to conquer the market and open up new horizons in the future.

3. Lyocell knitted fabrics

3.1 The goal we are pursuing with Lyocell knitted fabrics

When developing knitted fabrics one of the key factors which will decide how a product is accepted will be whether the product displays the essential properties needed for knitted fabrics in the clothing industry, namely:

- A knitted fabric without any remarkable yarn irregularities or fluff
- The continued good appearance of the knitted fabric following repeated washing (little fluff, very little shrinkage after washing and excellent crease resistance etc.)
- good properties with respect to hygroscopicity and water absorption

and how, in addition, other properties which give the material the touch of a high class product greatly superior to cotton, e.g.

- a peach-skin appearance like that of silk
- deep colour shades, beautiful colours
- moderate elasticity, bouncing feeling
- softness, drapeability

can be united in one product depending upon the application and the fabric.

3.2 The task of Lyocell knitted fabrics

Lyocell has a major task to perfonn in the field of developing knitted fabrics in particular. Since knitted fabrics are built on a knitted structure, they are both soft and elastic on the one hand, but on the other hand the structure does not hold together very tightly, the stitches are not dimensionally stable throughout and the surfaces of the yarns are sensitive to friction or similar influences, which can in the final analysis easily lead to the formation of fluff and pilling.
Lyocell knitted fabrics particularly form lots of fluff and fibril fibres in a wet and swollen state caused by mechanical abrasion due to high fibrillation which results in serious damage to the appearance.
The results of an experiment in which the aim was to determine to what extent different preliminary treatments would affect the appearance of Lyocell products after repeated washing show that a spun-dyed Lyocell yarn (Ne 30/2) was subjected to four different preliminary treatments commonly used on cotton fabrics which means the four treatments mentioned below:

Treatment 1: "singeing treatment in the yarn"
Treatment 2: "singeing treatment in the yarn with a high twist"
Treatment -i: "mercerizing treatment in the yarn"
Treatment 4: "singeing and mercerizing treatment in the yarn"

A fabric was knitted using a 12 gauge flat knitting machine with Ne 30s two ply yarn together and this was washed repeatedly. The changes in the appearance of the knitted fabric were evaluated in five-grades following the washing procedures. If one assumes that a Lyocell knitted fabric should reach a value of at least three grades after being washed twenty times over (within the five-grade evaluation scale) to be considered acceptable by the clothing industry, then one recognises that this represents a great difficulty with respect to untreated Lyocell knits, i.e. fabrics where only the yarns were dyed.
To make sure that the knitted fabric still looks good after repeated washing, the fabric was subjected to preliminary treatments in the following sequence. Treatment 4 – treatment 2, treatment 3, treatment 1.

The result shows that it is necessary to remove fluff from the spun yarns whereby this in itself does not suffice. Fluff also forms during washing as a result of friction which has to also be removed if the knitted fabric is to still look nice after repeated washing.

The preliminary treatments make the knitted fabric look good even after repeated washing due to the following effects: treatment 1 burn out the fluff, treatment 2 strengthens the cohesive strength of the individual yarns and treatment 3 (mercerizing treatment) draws the yarns, which have a tendency to stretch, together; it hardens them and prevents fibres from falling out.

It should, however, not be left unsaid that the tests carried out have merely examined the appearance of the knitted fabric after repeated washing and have completely ignored any influences on handling etc.

The success of Lyocell knitted fabrics will most certainly be determined by how one reacts at the individual stages of the product process i.e. when producing the yarns themselves with regard to the knitted fabrics and the individual additional treatments to specific tasks such as the reduction, removal or avoidance of fluff and what can be done in addition in order to confer special properties on individual products, such as those described at the end of 3. 1.

Now a few words on the knitting process itself. Apart from the different preliminary treatments, the yarn itself is of importance in the sense of what yarns are used when knitting and what additional treatments are carried out.

3.3 Products planned for Lyocell knitted fabries

First of all, I would like to say something about the Lyocell yarns used with knitted fabrics: since we are dealing here with staple fibres, it is necessary to spin first. The spun yarn has a tendency to produce natural irregularites and fluff.
When comparing the properties of a spun Lyocell 30s yarn with the properties of a cotton yarn of the same count, one can see that the Lyocell yarn has a good strength, moderate elasticity and only a very few irregularities. One can assume that the favourable fineness, fibre length, elasticity and natural crimp look will contribute to the quality and spinnability of the fibre in addition to the fibre strength of Lyocell.
If, in addition, the knitted fabric looks good (good strength, very few irregularities), it is also the case that natural irregularities and fluff always occur in a spun yarn. For this reason, according to the goal one is pursuing with regard to the individual products, it might become necessary in some cases to begin with product improvements with the actual yarn itself.

Singeing and high twisting treatment with regard to the yarns, prove to be effective measures with respect to fluff reduction and the prevention of fibre fall-out. Composite yarns made of Lyocell staple fibre in the sheath with- filament yarns in the core help to minimise the irregularity and shrinkage of the yarns. A similar result can be reached with composite yarns made of Lyocell staple fibres in the sheath with man-made staple fibres in the core. Composite yarns made of Lyocell yarns, cross twisted one or two of filament yarns in particular, prevent fibres falling off.

This does, however, represent a problem with regard to some applications and products since the fabric is very heavy as a result so that one always has to take care to make the yarn as light as possible.

To improve properties with regard to shrinkage, the avoidance of crease formation, the improvement of the lightness of the fabrics and handling etc., the spun Lyocell yarn can be knitted with polyester, nylon etc. in particular, which are characterised by a high shrinkable yarn, a hollow filament yarn etc. (so as not to impair the knitting structure).

In the examples given above, I have restricted myself to the tasks of Lyocell which result from the nature of the spun yarn and from the yarn structure of the knitted fabrics. I have named some examples from the point of view of physical structure, but I would also like to add that in the case of Lyocell knitted fabrics, it is in any case necessary to employ various additional chemical treatments depending on the requirements of the individual products, such as enzyme treatments and cross-linking treatments etc.

3.4 Examples for products made of Lyocell knitted fabrics

The goals we set ourselves for our products for clothing applications (with the exception of underwear) are for example only slight changes in the appearance following repeated washing, as little fluff as possible and for the material to look and feel like "stonewashed silk".

An example for a knitted fabric made of a yarn by Lyocell cross-covered with two polyester mono-filaments, gives a product which demonstrates good elasticity and dimensional stability. In addition, it develops a typical tint as a result of the same peach-skin effect as with woven fabrics.

It becomes clear that it has been possible to produce a yarn with reduced fluff formation and fibre fall-out after washing.

In a fabric in which a Lyocell yarn is knitted using a Lyocell yarn with a high shrinkable polyester filament yarn. One can see that the treatment of the fluff has been successful and that it was possible to produce a product which is similar to "stonewashed silk" in its appearance.

High shrinkable polyester yarn is a great help in attaining high density knitted fabrics.

A knitted product in which the two outer sides are made of Lyocell yarns and the middle one is made of a polyester filament yarn provides an article of clothing which is light and dimensionally stable. The dimensional stability is good and the appearance is similar to "stonewashed silk".

We considered it particularly important that a knitted fabric for underwear was not subjected to many changes in handling and in the appearance of the product even after repeated washing because of an effective anti-fibrillation treatment. Since, depending upon whether this kind of treatment is carried out or not, there will be considerable differences in the amount of fluff and the fibril fibres which protrude after each wash. Since Lyocell also absorbs much more water than cotton, a treatment against sweat is simple particularly when it is important to remove tlie unpleasant feeling of humidity which occurs at the start of sweating.

Lyocell knitted fabrics are highly appreciated particularly since they have the properties and appearance of silk in addition to the properties of other natural fibres, such as cotton etc.. From now on we will focus our attention more and more on products made from this material until it has become a complete market success.

4. Concluding remarks

When examining the development of knitted fabrics, we concentrated on circular knitting. There are of course a wide range of possibilities for other knitting methods. To help these fascinating Lyocell products make inroads on the market in a more efficient manner, it is important that all stages of production, from the fibre through to the finished product, are well tuned one to the other. It is also important that we all work together, exchanging information etc.

For the future I hope that, starting with Messrs. Lenzing, anyone dealing with Lyocell will intensify co-operation and promote product development in this area, in line with consumer requirements, so that we can introduce the "product group with something that little bit special to offer", namely "knitted fabrics" made of Lyocell and Lyocell mixed yarns, to the market with new momentum and at the right time.

BRAGHENTI – A DIVISION OF THE RATTI GROUP AND WORLD LEADER IN THE PRODUCTION OF SILK FABRICS OF THE HIGHEST QUALITY.

Marco Colombo, Braghenti, Italy

Historically, the company is a leading producer of linen fabrics (uni and patterned, both in smooth and Jacquard qualities). It is recognised for its high quality and its careful and constant research work in the field of engineering and style as well as by the conscientious development of samples and colour scenarios which translate into sophisticated products of a high quality and a high creative input destined for ladies' and men's wear.

Braghenti invests the same amount of precision and conscientiousness in fabrics made of cotton, silk, wool and fibre blends which round off the product range for spring/summer as well as for autumn/winter and includes various types and thicknesses ranging from lingerie to shawls to coats.

BRAGHENTI has received certification in accordance with ISO 9000 and has a modern production facility, comprising ultra-modern looms and a samples department equipped with a shearing machine for samples and some looms, used solely for experiments on new products, and which is an advertisement for the company.
Particular attention is paid to the research and development of new finishing processes so that BRAGHENTI can have the advanced technologies on the market at its disposal.

Apart from products made of natural fibres, those traditional Braghenti products, the company has always conducted research work in the field of fibre blends with a high innovative input whereby fibre blends, fabrics and structures made of natural, man-made and synthetic fibres are researched and realised with the goal to produce pleasant and innovative fabrics.

The innovative fibre produced by Lenzing is in agreement with this research philosophy and BRAGHENTI was able to test this in the course of the last collection.

In an effort to „enrich" the natural fibre landscape, new fibre blends were created and some fabrics in Lyocell/linen and Lyocell/cotton, both piece-dyed and yarn-dyed, were developed which display interesting characteristics with respect to visual appeal and wear comfort.
Developments are currently being elaborated for the autumn/winter season 1998 which are marked by the BRAGHENTI philosophy and are made from fabric blends with natural fibres.

MARKETING AS EXEMPLIFIED BY THE MERCHANDISING OF LYOCELL

Schafheitle, Texcel, UK

1. SUMMARY

Marketing is described by the author as the logical maturation of sales skills. He draws a parallel between technical processes that enhance the core product and marketing, which techniques complement the scope of conventional sales abilities. The expectation of benefits to all participants in the making, the selling, the retailing and the wearing of textile products made with Lenzing Lyocell, the „ultimate cellulosic fibre", is seen as pivotal in product innovation.

The introduction to, and the positioning of Lenzing Lyocell on all levels of the textile chain, as early as viable pilot plant output allowed utilisation both overseas and in Europe, is described as a noteworthy step towards the fibre producer's close involvement at all times in all sectors of textile manufacturing.

It follows that the merchandising of Lenzing Lyocell capitalised on this close integration in the textile chain. Small surprise that centrestage both in the merchandising strategy applied and in field activities was given to the fabric, as is woven and knitted, finished, made-up and distributed with great professionalism by all partners in all international markets served by Lenzing Lyocell.
A short summary is included on the marketing tools that are available, and emphasis is placed on the Company's receptiveness to clients' needs for customised advertising.

"Marketing" cannot by any stretch of the imagination be called a fundamentally new idea. Both name and ideology sprang on the world some decades ago. Those of us who were born before the fifties have quite understandably been reared in the belief that this new technique was going to be indispensable in making a product saleable.

Of course, it can help to do this and lots of other things very well indeed. Basically, however, and after a long career in international marketing, I have come to understand "Marketing" as the process of maturation of good salesmanship. Whichever way we look at marketing, irrespective of its description, it always embodies the principles and the talents of salesmanship as practised throughout the ages.

It is widely accepted that utilising proven achievements and sensibly applying sublimation (not in a chemical sense!) will often result in an altogether more viable concept than enforcing radical change. As is demonstrated in, for example, art it is rarely the revolutionary who will enjoy lasting esteem but the evolutionary.

2. LECTURE

Thus "Marketing" is the art of giving added substance to the business of selling and buying while simultaneously reaching far back into product research and far ahead into consumer likes and dislikes. It is, not surprisingly, the logical evolution of the act of selling.

Likewise, it could be argued that in the past a good salesman was an equally good marketing man though neither he nor his clients would have known the term "Marketing" then.
The good salesman excelled at selling himself and his ware. As an accomplished salesman he pursued his goals with dexterity. His clients views were always important to him.

He untiringly solicited their custom. He applied himself to the full scale of customer and market opportunities as capably as his modern counterpart in "Marketing".

One way to explain the nature of "Marketing" in the textile industry, and particularly so in the fibre sector, is to look back at events similar to to-day's: then it was the introduction of Lycra, the last truly new fibre; now it is a new fibre Generation, born and raised shortly before the turn of.the century: Lyocell.

In the seventies, Du Pont ran seminars called "Proposal Selling".

Selling what?

You heard correctly: Not a product - but a proposal.

The straightforward sales approach was turned into a rather complicated scenario of proposing a proposal. A successful sale was assumed whenever the proposal led to a counter proposal that was an affirmation of a need that could subsequently be filled by effecting a sale.

Though new and workable, it is nevertheless debatable whether this novel practice resulted in a higher sales performance compared with that achieved by the old-fashioned way. But it had all the trimmings of an innovative method, and it contained the germ for holistic assessments and actions.

As there are many textile technicians present today, I may be forgiven for saying - simplifyingly perhaps - that in essence " Proposal Selling" could very well be likened to a technical process which was then in the course of being developed - core spinning of Lycra. Or, worded differently and especially with a view to the nature of this talk: "Proposal Selling" represented both cause and effect of encapsulation and enhancement while retaining the essential function.

With the introduction of "Marketing", the relatively down-to-earth process of orthodox selling became embedded in a mass of company-specific requirements that fell broadly into the following familiar formula:

The RIGHT product, at the RIGHT time, at the RIGHT price, for the RIGHT customer, for the RIGHT end-use.

As we have seen, the novelty of "Marketing" was not dissimilar to a mantle covering a central function. While the workings of this inner function were anchored in traditional practices, the vibes from practising the novel "Marketing" techniques in the early 1960's certainly were nothing short of the revolutionary.

Henceforth, "Marketing" was to make an ever increasing contribution to a Company's obtaining and maintaining a sustainable competitive advantage.

Theodore Levitt, a marketing expert, found what I believe is the most appropriate meaning of "Marketing":

"People don't buy products, they buy the expectation of benefits."

This applies to anything that is being bought, be it raw material or finished product, services, time or expertise.

Viewed from a textile angle, Levitt's analyses may also serve as a blueprint for the progressive positioning of a new fibre from one manufacturing step to the next. Fibre at source is - in most textile applications - quite incapable of fulfilling a controlled function in its own right unless transformed by successive processes. At the beginning of such a process. the fibre material is but a single component or: to use the above phraseology - a core that requires embedding as well as the beautifying into the sum total of a finished product. Only in its assembled form does the fibre material add up to a viable end-product.

Clearly, all operational stations from fibre spinning to garment acquisition are inherently capable of producing and passing on added benefit.

Not surprisingly, this long'chain of transformation was bound to be a key consideration in all marketing deliberations centering on the Lenzing Lyocell venture. This was reflected in the tailor-made marketing strategy which proved to be fundamental to the successful introduction of Lenzing Lyocell:

As a "good salesman", and we may assume the host company to be just that (or else we would not now be here), the Lenzing company has responded well to the challenges of often turbulent markets.

Throughout the 50 years of its existence, the company has had to prudently select and assess areas of external and internal needs to achieve commercial and financial success. It has succeeded in manufacturing a widely acknowledged and competitive product range.

Traditionally, its principal points of market reference were the spinners and the fabric manufacturers.

With the prospect of Lenzing Lyocell entering the international textile landscape, an enterpreneural decision was taken by the Lenzing Lyocell Management to address the entire textile chain. By the very nature of this transformation from a conventional framework of business into a strategy of innovative market operations, the "good salesman" had transcended into a "good marketing man."
Lenzing Lyocell recognised at an early stage that a concentrated approach of progressive distillation was required.

The appropriateness of this market access would ensure optimum input and application of know-how originating at all levels of what in cellulosic fibres is essentially a very longwinded road from "forest to fashion".

In responding so enterprisingly to the "expectation of benefit" referred to earlier, a major objective was successfully accomplished. "Benefit", of course, also means good return on time, effort, money and loyalty invested at all levels from spinner to consumer.

With the advent of the start-up of the new Lyocell plant, Lenzing Lyocell made a point of manifesting a declared interest in getting involved at all manufacturing levels of the textile chain, principally or marginally, as necessities and market research would demand.

A concise and practical marketing strategy was implemented, ranging from product development (conjunctively with customers) to the availability of a well-organised labelling service.

Corporate and product advertising was commenced and well received. The information provided was factual, attractively presented on environmentally friendly paper and exceptionally well supported and complemented by the "Lenzing Reports".

Now that the industrial production of Lenzing Lyocell - the ultimate cellulosic fibre - is imminent, a more emotional and end-use targeted advertising campaign will be launched in the major trade media in key markets.

Of privotal importance is the Lenzing Lyocell technical service which operates in close proximity to the various sales departments, and separately geared to development- and trouble-shooting assignments.

Sales personnel have already been in action for some time in near and far-flung areas, and product managers have recently and strategically been placed in priority markets.

In the foreground of the company's merchandising strategy stood the need to intelligently move Lenzing Lyocell along the textile chain. Customers normally have a choice and Lenzing Lyocell, being second on the scene, was going to require a tailor-made market approach.

Clearly, there appeared to be little sense in the company's simulating what was generally acknowledged to be an excellent advertising campaign by our competitor. Besides, there were very real restrictions imposed on us by the constricted availability of fibre from only a small pilot plant at Lenzing. Widespread trade publicity at this point in time would almost certainly result in a flood of requests that the company could not handle adequately.

A different vehicle was needed to convincingly carry the new product into the awareness and onto the machines of manufacturers.

That the market was ready for the new product became clear quickly. That the market favoured a second supplier, was equally certain.

What, then, could be more appropriate than letting the new product demonstrate its potential and distinction in practical application? What better advertising could there be but a commercially viable flow of industrially produced merchandise incorporating Lenzing Lyocell?

Thus was born the idea of giving centrestage to the fabric.

Merchandising leverage was now required to pull and push within the framework of an operationally adequate coverage of interlinking partners in the entire textile chain.

The substance of all merchandising is the fabric. All revolves around it:

What does the consumer associate himself with in the first place?

The fabric.

The buyer is compulsively drawn to it by virtue of its colours and textures and, quite irresistibly, reaches out to touch the material.

We encounter here a phenomena which need not be artificially created in marketing alchemy. Once the fabric is materially present, a logical sequence of events, familiar to us all, takes place which has been described, rather aptly, by the description "from sheep to shop".

By adopting the policy of fabric promotion, Lenzing Lyocell quickly made respectable inroads into the textile chain.

The benefits from the introduction of a new fibre were evenly spread and so was what risk there always is, too. If the fibre, the yarn, the fabric, the dyeing/finishing and the garmentmaking add up to a product of appeal and sales potential, it can be safely assumed that the idea of merchandising, focussing primarily on the fabric, has indeed suceeded.

Efforts were concentrated on accommodating the operational fabric merchandising into various support activities:

Technical service worked flat out to create conditions conducive to a high standard of processing at all levels of manufacturing. Great emphasis was placed on creating optimum dyeing and finishing conditions and parameters. The assistance and interest given by the industry were invaluable.

Sales/Marketing personnel were in a constant rota calling on key manufacturers, initially preparing the scenario for the first fabrics made with Lenzing Lyocell from the pilot plant, and subsequently stepping up activities concurrent with the momentum created by the imminent coming on stream of the brand new Lenzing Lyocell plant. Again, current and prospective customers showed more than cursory interest and it is much to their credit that fabrics made with Lenzing Lyocell have now successfully entered on the scene - looking and feeling magnificent.

Merchandising channels in key countries and across-the-border links were opened up, including contacts to garment manufacturers and retailers. Transparency of the flow of merchandise up and down, and across, the international textile chain gradually came into focus. Principal key players in their respective end-use areas were invited to put Lenzing Lyocell to practical use. Spinners, weavers - and increasingly knitters - as well as dyers and finishers were programmatically assisted and accompanied in their progress in utilising Lenzing Lyocell. It is thanks to their expertise, and also due to the input of know-how from so many specialised sources, that products made with Lenzing Lyocell already have a distinct personality of their own.

On the eve of the coming on stream of the Lenzing Lyocell plant, all merchandising stops are out and activites in many market- and end-use areas are now in full swing and will obviously expand as regular supplies of Lyocell begin to make an impact on the market.

We are confident that our partners on all manufacturing levels will be eager to participate in this exciting phase in the life cycle of a new generation of fibres. Their interest and inclination to impart advice and Information will greatly assist us in creating the right marketing-mix and marketing tools.

It is our understanding that merchandising with the emphasis on fabrics that have been produced on industrial equipment, and can be reproduced on such equipment, and have the support of companies who are in the business to sell and make a profit, is the most efficient marketing tool, under the prevailing circumstances, for Lenzing Lyocell.

As a direct result of our merchandising activities, we accumulate and prioritize more market intelligence which will serve to shape our future policies and will allow us to make pragmatic decisions. The target is clear: optimum utilisation of Lenzing Lyocell at all time.

It goes without saying that as we widen our basis we shall selectively look into further product advertising, ideally co-operation with our partners in the textile chain.

We recognise that it is expected of us to make products with Lenzing Lyocell known in retail. We shall engage in dialogue with all partners in the trade and will aim to prove to each and all to be helpful in the actions we take.

In summarising, I would like to reassert that maximum efforts will be made to equip Lenzing Lyocell and products made from it with all technological excellence that can be expected from a good parentage throughout the textile chain. In merchandising such products, the creative input from all at Lenzing Lyocell is vital, and assured.

Today "Marketing" is truly all-encompassing. Understanding its workings as well as its yields requires from us, and at the same time encourages us, to be "good salesmen" in the old fashioned sense as well as in the context of modem "marketing".

Selling after all is sharing: efforts, knowledge, success and pride.

LENZING LYOCELL OPPORTUNITIES FOR KNITTED FABRICS IN THE UNDERWEAR AND LADIES' OUTERWEAR SECTOR VIEWED FROM THE POINT OF VIEW OF PRODUCTION AND MARKETING

Kargel Roger, Grentner Jersey AG, Switzerland

1. INTRODUCTION

Our product range comprises jersey fabrics made of cotton, silk, wool, linen, viscose, synthetic fibres, micro fibres and Lycra for day and nightwear, lingerie, outerwear, shirts, blouses and leisure wear as well as bed linen and home textiles whereby underwear is the major segment. Each month we produce approximately 350,000 meters of fabric which corresponds to about 70,000 kilograrns of yam. Our export share totals 70%.

Our customers are in the medium to upper market segment. Greuter-Jersey is one of the most important suppliers of lingerie fabrics in Europe.

A joint fabric collection has been compiled for outerwear with the Swiss textile companies, Seidendruckerei Mitlödi and Jacquardweberei Gessner, since 1.1.1995 and sold by the name of GMG (Greuter, Mitlödi, Gessner) via our own network of representatives in fifteen countries.

Now to me personally. I work as creative designer at Greuter Jersey AG and am responsible for designing the collection for the different areas, for specific customer developments and product developments at all stages which brings me to the subjeet of my talk.

I first came into contact with Lyocell by Lenzing three years ago. At last, a new innovation in the field of textile fibres and a new challenge for the textile pipeline.

So at the very start, I would like to mention some of the excellent properties which speak in favour of Lyocell by Lenzing compared to viscose spun qualities since these are, if it all, most comparable in terms of touch and drape:

- A much higher wet tenacity and lower shrinkage
- Deep dyeing
- Fibrillation
- Completely new handles
- The ecological aspect

These facts were so persuasive that I began work on product developments in the woven fabric sector at that time. The first step is always the most difficult and numerous tests were necessary, as well as financial commitment, to build up the know-how to create high quality, high-class and incomparable woven fabrics from Lyocell. At the beginning it was almost impossible to achieve level dyeing and no post-fibrillation and these problems had to be mastered first before one could launch such an expensive product on the market. After one year of intensive development work, we were already in a position to offer some fabrics in the ladies' outerwear sector. These fabrics had the power to persuade as a result of the silky, warm and flowing handle and above-average technical values achieved with Lyocell. All the same, as with everything new, these first Lyocell developments were viewed with a degree of scepticism by the market. This can be explained by the fact that Lyocell was an unknown product and had a high price. To explain this: Lyocell was compared with spun viscose and was thought to be a modified viscose product.

Moreover, some garment manufacturers had already had their first negative taste of qualities in which the fibrillation was not yet mature - uneven dyeing results and bad pilling behaviour. Moreover, Lyocell was only available to a limited degree. All of these points meant that initially Lyocell was a project kept in reserve which one presented whenever one wished to show off something new. Today, some three years later, the situation is a bit different.

That was a brief look at the past and now let us get back to the actual subject of my talk „Jersey made of Lyocell".

When I was given the chance to start to work for Greuter-Jersey 1 1/2 years ago I set myself the goal of developing Lyocell by Lenzing in fine circular knitted jerseys and introducing my own experience with woven fabrics. At this time, Greuter Jersey had already entered the market with Tencel qualities so that we were able to put this experience to use in the further development. Tencel is AXIS-treated at Greuter-Jersey which prevents fibrillation of the fibre and excludes post-fibrillation when washing. In terms of appearance one receives a smooth and silky flowing touch comparable with a Micro Modal or viscose quality. We endeavoured to finish the knitted fabrics with a peach-skin effect (peach skin) to get away from the relatively simple AXIS process of TENCEL and thus distance ourselves from other happenings in the market. We wanted these fabrics to be usable in lingerie as well as in ladies' outerwear which demanded different weights and yarn titres. Moreover, we had the idea to develop very functional jersey fabrics with a corresponding share of Lycra. Moreover, good shrinkage values, and a 60° C wash, tumble-drying and a formaldehyde content of below 60 ppm were at the top of our list of requirements.

These were our goals, but now let us have a look at the individual stages of development.

2. KNITTING

The structure, weave and density play a role, which should not be underestimated, with regard to the appearance of Lyocell jersey fabrics at a later date, which should not be underestimated. With respect to knitting, Lyocell has tumed out to be unproblematic with very good running properties. Difficulties are encountered later when finishing as a result of the fabric being drawn off in tubular forrn, either by flat-folding or rolling up the fabric; in both cases wrinkles occur which become visible again at the dyeing stage.

3. FINISHING

If the untreated knitted fabric is ready, then the most demanding part now takes place, namely finishing. Our experience in the woven fabric area helped us initially, however, this is only applicable to Jerseys. Compared to a fabric which is area stabilized where every thread is firmly worked into the fabric, jerseys represent a highly elastic structure with a thread which lies relatively open as a result of the knit formation. This leads to greater problems with jerseys at the finishing stage than with woven fabrics. Thus, here are some general points on the behaviour of Lyocell knitted fabrics when finishing. As you have already heard, the Lyocell fibre is very demanding and effective and requires particular attention during the finishing process. This begins with the incoming untreated fabric for which different criteria have to be determined at the very outset:

1. Which side of the fabric is to be outside when finishing ?

2. In what kind of processing condition does the fabric enter the company (possibly cutting open in an untreated state) ?

3. Setting prior to the dyeing process since the fabric blows up during the process

4. The optimum division of parts to equip the dyeing machines (weight, number of ropes)

5. The optimum machine selection i.e. experimental values which fabric will operate best on what machine

Following classification for the wet process, the most important part of finishing begins for the Lyocell fibre, i.e. fibrillation. By this we mean splitting the solid and strong crystalline fibres in the longitudinal direction. An alkaline pH value, a high temperature, strong mechanical stress and a low bath-to-fibre ratio are very important for sufficient fibrillation. The machine which satisfies these requirements is the Air-Flow (Air-Jet) which is, therefore, very suitable for this treatment. One differentiates between primary and secondary fibrillation. Irregular, long-stapled fibrils occur during primary fibrillation. Primary fibrillation has to be sufficient otherwise pilling will form on the article of clothing when it is subjected to household washing. Secondary fibrillation is a deliberate process in which short and regular fibrils occur. Thanks to the good control of this process, this results in the so-called „peach skin" or other surface effects. To remove the irregular long-stapled fibrils one starts with defibrillation respectively the enzyme treatment. Here again, an optimum pH value is important. The enzymes are activated at a processing temperature of approximately 60° C and remove the excess undesirable fibrils from primary fibrillation. At a certain temperature these enzymes die off and the process is finished. At all phases of these three working cycles, it is absolutely essential that the fabrics are checked:

a) Has sufficient primary and secondary fibrillation taken place?
b) Does the enzyme treatment suffice (removal of excessive fibrils)?
c) Depending upon the assessment, the corresponding process has to be prolonged or topped up.

With respect to the dyeing process, some more important parameters have to be taken into consideration. Optimum process (temperature, time, metering) is the most important factor. The chemicals are also selected on the basis of experience values, the wrong preventive agent against running creases can provoke a high number of abrasive points which can no longer be eliminated. Other problems are the blowing up of the knitted tube during the dyeing process which might result in unevenness. Optimum dyeing depends on the interaction between the chemical and physical possibilities which have to be ascertained in long series of tests for each company depending upon the machinery.
The final finish of Lyocell knitted goods is designed individually. Customer wishes are decisive here with respect to the requirements made of the fabric and how it should behave later.

To finish one can say:

Lyocell has an elastic, lively, flowing and silky handle as a result of fibrillation. Secondary fibrillation leads to „peach skin effects" which can be controlled by various treatments. We recommend a tumbler treatment to remove the disruptive fibrils and obtain a soft handle. The selection of chemicals at the final finishing stage is dependent on fastness requirements and wash shrinkage etc.

Furthermore, good effects can be achieved by blending the fibre with other components such as Lycra for example. There are no limits to the imagination. The finishing of Lyocell knitted fabrics is not without its problems but, by taking care, this can be resolved and one is awarded with a beautiful fabric appearance.

Greuter-Jersey has been testing Lenzing Lyocell for one and a half years, with all the ups and downs which one can experience with a fibre of this complex nature at the development stage.

We started with smaller batches leading up to larger optimum production quantities which were necessary to achieve a high reproducible standard of quality. In this way, we were able to satisfy the demands made of Lyocell jerseys. For the large-scale tests alone, we had to use about half a tonne of material without having sold one single meter. Co-operation with our partners at all stages was very important and together we made some new discoveries. At the end of this series of tests we believe that an incomparable jersey product from Lyocell resulted which has the power to persuade due to its beautiful and silky warm flowing handle with a peach-skin effect as well as its inner values:

Compared to viscose and Modal, Lyocell most closely resembles cotton with regard to its properties. Lyocell looks drier and is less soapy than Modal and viscose in particular. Lyocell produces the best values with regard to the dry and wet crease angle and can be most positively influenced by high-grade finishing. Following high-grade finishing dry and wet creasing is at a level which could so far only be achieved with blends of cellulosic and synthetic fibres. The dry strength is above the value for cotton of medium quality, and the wet strength is around the same level as cotton. The high wet strength of the Lyocell fibre allows for stability in wet processing of a high level as yet unknown. The result is low levels of elongation of the material in wet finishing, caused by fabric tension, which means excellent residual shrinkage values can be easily attained. The wash shrinkage is accordingly very low. Very good values are already achieved in this respect in the wide finished condition. In the same way, dimensional stability is one of the great advantages of the Lyocell fibre. When it comes to swelling, Lyocell is very close to cotton.

Positive effects like these are not possible with the cellulosic fibres in use until now.

Valid Öko-standards are satisfied by the content of forrnaldehyde of the fibre. We achieve values of under 60 ppm. Upon request, our Jerseys made of Lyocell can also be finished without any formaldehyde at all.

Apart from the purely technical peculiarities of this fibre, the ecological aspect with respect to fibre production should not be forgotten. The recycling of the solvent used (97 - 99 % recovery) produces advantages which will grow in significance in the future in a society sensitive to environmental issues.

To finish, the advantages and sales arguments in favour of jerseys made of Lenzing Lyocell.

- A wonderful silky warm and flowing handle with a peach-skin effect
- Sympathetic to the skin/wear comfort
- Deep and brilliant colours
- Good washability (up to 60'C wash)
- Good shrinking behaviour
- Dimensional stability
- A low content of formaldehyde
- Ecological aspect

It goes without saying that we are not dealing with a cheap product since the base material is expensive as is the finishing process. This is a noble, superior and high-quality jersey fabric. The entire textile pipeline has a great responsibility to only put on the market tested Lyocell fabrics of a mature quality so that a high-quality image will be instilled in the end-consumer in the long-term. A new and good product can otherwise very quickly become an outsider. The consumer is at the end of the line. On the basis of his own experience, he will ultimately decide whether we will be successful with Lenzing Lyocell products.

Greuter-Jersey will, therefore, proceed with the care necessary with respect to marketing and in the initial phase will introduce Jersey made of Lyocell from Lenzing to only a few selected customers in the underwear and ladies' outerwear sector so as to allow important experimental values made on behalf of the clothing industry to flow into product development. It would appear to me that it is very important that the fibre manufacturer, Lenzing, accompanies these efforts in an advisory and market-oriented manner. We are dealing with a product which is not well known by the end-consumer and has no lobby. Comprehensive measures of promotion will be necessary to position Lenzing Lyocell correctly in the market.

The first steps have already been taken to successfully introduce new textile innovations Lenzing-Lyocell-Jerseys to the market. If we are successfal here, we will all derive pleasure from Lenzing Lyocell. If we employ the amount of care a high-class product like this deserves.

To finish, I would like to thank our partners for the close and constructive cooperation we have enjoyed. Thanks to this cooperation we were able to create new jerseys from Lyocell. In particular, we should like to thank Lenzing for their support at all phases of this development.

At Greuter-Jersey we have a vision. The vision is to make jersey fabrics from Lyocell by Lenzing.

LYOCELL FIBRES AND THE TEXTILE LABELLING LAW

Hans-Joachim Koslowski, Deutscher Fachverlag GmbH, Germany

Since 1971 all textiles must give some indication of the type and weight distribution (in %) of the textile raw materials used (indication of the raw material content) for the end-user in accordance with the textile labelling law (new edition from 1986).

The correct labelling of the materials is, on the other hand, also the basis for the care labelling which is very important (and not prescribed by law).

The term „Lyocell fibres" was introduced by BISFA, Brussels, and the Federal Trade Commission (FTC), USA, for the cellulose fibres produced in accordance with the new solvent spinning technique and this has since been accepted by the EU Commission. According to appendix 1 (designation of textile fibres), 1. 41 of the textile labelling law, these fibres can be designated as „Lyocell". It would, on the contrary, be wrong to designate these as viscose or Modal for fabrics which are made from or with these new fibres.

Nach dem Textilkennzeichnungsgesetz (TKG) von 1971 in der Neufassung vom 14. August 1986, dürfen „Textilerzeugnisse gewerbsmäßig nur in den Verkehr gebracht werden oder zur Abgabe an letzte Verbraucher feilgehalten, eingeführt oder sonst in den Geltungsbereich dieses Gesetzes verbracht werden, wenn sie mit einer Angabe über Art und Gewichtsanteil der verwendeten textilen Rohstoffe (Rohstoffgehaltsangabe) versehen sind, die den in den Paragraphen 3 – 10 bezeichneten Anforderungen entspricht."
Das TKG gilt in der gesamten Europäischen Union und damit praktisch in Westeuropa.

Pflicht zur Textilkennzeichnung

Nach dieser Richtlinie über die Textilerzeugnisse sind die Bezeichnungen der Textilfasern, aus denen sich das Textilerzeugnis zusammensetzt, durch Etikettierung oder Kennzeichnung anzugeben, um auf diese Weise die Interessen der Verbraucher durch ordnungsgemäße Information zu schützen.
Die für den Binnenmarkt der Gemeinschaft bestimmten Textilerzeugnisse dürfen nur die Fasern enthalten, die in Anhang I der besagten Richtlinie aufgeführt sind. Die Anhänge zur Auflistung der Textilfasern sind dahingehend an den technischen Fortschritt anzupassen, daß darin die seit der letzten Änderung der Richtlinie entwickelten neuen Fasern aufgenommen werden.
Für neue Fasern wie Lyocell entsteht damit ein Problem, da sie logischerweise im Anhang I noch nicht aufgeführt sind. Zwar steht am Schluß dieser Liste unter Metall, Asbest, Papier „als Beispiel für Fasern aus verschiedenen und neuartigen Stoffen, die vorstehend nicht aufgeführt sind" und in Paragraph 3 des TKG „Für Fasern, die in Anlage I nicht aufgeführt sind, ist eine Bezeichnung entsprechend dem Rohstoff, aus dem sie sich zusammensetzen, zu verwenden."

Falsche Auszeichnung strafbar

Für neue Fasern sind somit keine eindeutigen Regelungen verfügbar und damit Probleme mit der Textilkennzeichnung programmiert. Andererseits werden bereits 1998 weltweit Kapazitäten für Lyocellfasern von über 100.000 t/Jahr verfügbar sein, was in der Größenordnung der Weltproduktion von Seide entspricht. Eine eindeutige TKG-Kennzeichnung ist somit unumgänglich. Der Textileinzelhandel ist verantwortlich für die Überprüfung der sachlich richtigen Auszeichnung im Sinne des TKG. Dies ist besonders bei Eigenimporten wichtig. Unterläßt er dies, kann er mit Geldstrafen bis zu 10.000 DM belegt werden.

Der Bundesverband des Textileinzelhandels (BTE) verwies dabei in einer Veröffentlichung in der „TextilWirtschaft" (6. März 1997) auf diesen bisher – „gesetzfreien" Raum. Darin heißt es: „Nach Meinung von Experten müßten diese Produkte bis zu einer endgültigen Regelung als „100 Prozent Viskose" deklariert werden. Zur Klarstellung hat sich der BTE bereits in der Vergangenheit an das zuständige Bundeswirtschaftsministerium mit der Bitte gewandt, den Faserkatalog des TKG zu aktualisieren."

Gattungsnahme Lyocell

Lyocellfasern werden bereits seit 1993 von Courtaulds in den USA nach der neuen Lösemittel-Technologie hergestellt und unter der Marke „Tencel" auch in Europa auf den Markt gebracht. In den USA hat die Federal Trade Commission (FTC) inzwischen eine Entscheidung für den Gattungsbegriff Lyocell für diese neuen Fasern getroffen (bereits 1992 hatte dies Courtaulds beantragt!), ebenso wurde in Europa von der Normenorganisation für Chemiefasern BISFA, Brüssel, der Gattungsname „Lyocell" festgelegt.
Inzwischen hat sich auch die EU-Kommission mit diesem aktuellen Problem befaßt. Dazu schrieb Dr. A. Krieger (BISFA, Brüssel) am 9. Mai 1997: „Die eigentliche Direktive über European Textile Names (Directive 96/73 und 96/74) ist am 16. 12. 96 erschienen. Das war das überfällige „good houskeeping", welches eine Vielzahl von älteren Regelungen neu zusammenfaßte und bereinigte. Ganz bewußt wurden in diesem Text keine Neuerungen eingeführt.
Damit wurde endlich eine saubere Ausgangslage geschaffen, damit wieder neue Fasern eingeführt werden können. Diese Art Änderung kann gewissermaßen „auf dem kleinen Dienstweg" gemacht werden, der aber immer noch hinreichend kompliziert ist, da selbstverständlich alle nationalen kompetenten Behörden Stellung nehmen wollen. Diese Behörden sind von Land zu Land nicht identisch und nicht identischen Ministerien unterstellt. DG XXIV hat mir versichert, daß jetzt das Genehmigungsverfahren abgeschlossen ist (die Texte haben selbstverständlich in den verschiedenen Sprachen zirkuliert) und daß die hier interessierenden neuen Namen für Chemiefasern, nämlich Aramid, Polyimid und Lyocell akzeptiert sind. Jetzt folgt noch eine letzte Phase der „Produktion" des Gesetzestextes, den die Kommission als „toilettage" bezeichnet, letzte Bereinigung, namentlich zwischen den verschiedenen Sprachen. Ich denke, das geht noch einige Wochen, bis dieser Text im Amtsblatt erscheint."
Auch der Referatsleiter Textil im Bundeswirtschaftsministerium in Bonn, Herr Schraven, bestätigte, daß in Kürze mit einer Veröffentlichung des Textes zu rechnen ist.

Weitere TKG-Probleme

Allerding sind dies nicht die einzigen derzeitigen Probleme mit dem TKG. Modisch aktuell wurden in Europa auch wieder Polynosics, die bis in die 70er Jahre auch in Westeuropa hergestellt wurden, heute aber nur noch in Japan und Polen produziert werden. Polynosicfasern werden nach einem modifizierten Viskose-Spinnverfahren hergestellt, wobei im Vergleich zur Viskose Fasern mit höherer Naßfestigkeit, höherer Alkalibeständigkeit und geringerem Quellvermögen entstehen. Die geringere Dehnbarkeit ergibt eine gute Formbeständigkeit der Textilien. Polynosicfasern können auch wie Baumwolle mercerisiert werden. Nach dem Textilkennzeichnungsgesetz müssen Polynosic-Fasern (als modifizierte Viskosefasern) mit „Modal" ausgezeichnet werden (und nicht mit Polynosic!).

Erhebliche Marktbedeutung für Strumpfwaren und Sportbekleidung haben elastische Garne erlangt, neben texturierten Polyester- und Polyamidgarnen vor allem die Elastangarne (früher Elasthan geschrieben). Hier wird häufig statt der erforderlichen Bezeichnung „Elastan" der bekannte Markenname „Lycra" für das Elastangarn von DuPont verwendet, also z. B. 89% Polyamid/11% Lycra (statt nach TKG 11% Elastan).

Faser-Kurzzeichen

Seit immer mehr Etiketten per Computer geschrieben werden, gewinnen Kurzzeichen (ISO 2076) für die eingesetzten Textilfasern an Bedeutung, z. B.: CO für Cotton (Baumwolle), WV für Schurwolle, PA für Polyamide, PAN für Acrylfasern oder CLY für Lyocellfasern. Diese Kurzzeichen sind aber eigentlich nur für den internen Gebrauch der Industrie (Produktion und Versand) erlaubt. Der Verbraucher hat ein Recht auf vollständige, verständliche Bezeichnungen (daher enthält das Textilkennzeichnungsgesetzt im Anhang auch kein Kurzzeichenverzeichnis mehr). Das Textilkennzeichnungsgesetz (TKG) ist auch noch nach 25 Jahren also immer noch erklärungsbedürftig.

Aktueller Anhang (Oktober 1997)

Inzwischen hat die EU-Kommission Lyocell auch als eigenen Fasergattungsnamen in das TKG aufgenommen. Im Amtsblatt der Europäischen Gemeinschaften vom 27. Juni 1997 wurde die Richtlinie 97/37/EG der Kommission vom 19. Juni 1997 zur Anpassung der Anhänge I und II der Richtlinie 96/74/EG des Europäischen Parlaments und des Rates zur Bezeichnung von Textilerzeugnissen an den technischen Fortschritt veröffentlicht.

Anhang I der Richtlinie 96/74/EG wird u. a. wie folgt geändert:
Hinzugefügt wird die neue Nummer 33:
- Der Text in der Spalte „Bezeichnung" lautet „Lyocell"
- Der Text in der Spalte „Beschreibung der Fasern" lautet „Durch Auflösungs- und Spinnverfahren in organischem Lösungsmittel hergestellte regenerierte Zellulosefaser ohne Bildung von Derivaten. Unter organischem Lösungsmittel ist im wesentlichen ein Gemisch aus organischen Chemikalien und Wasser zu verstehen."

Die Mitgliedsstaaten erlassen die erforderlichen Rechts- und Verwaltungsvorschriften, um den Anhang der Richtlinie 96/74/EG spätestens am 1. Juni 1998 zu entsprechen.