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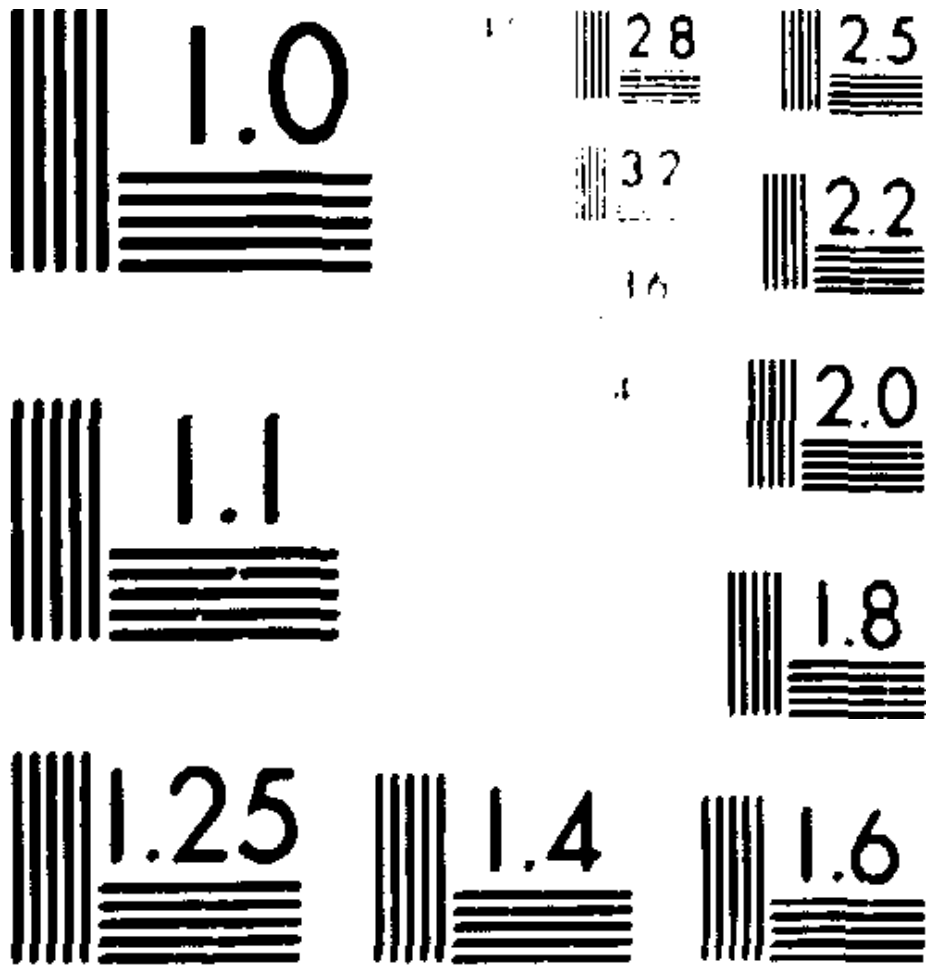

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16 March 1983
English/Arabic

TEXTILE DEVELOPMENT CENTRE, PHASE II

DP/EGY/77/008

EGYPT.

Technical report*: Wool Dyeing and Finishing

Prepared for the Government of Egypt
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Donald Terrington,
Expert in Wool Dyeing and Finishing

United Nations Industrial Development Organization
Vienna

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ABBREVIATIONS

D and F	Dyeing and Finishing.
ITMA	International Textilmaschinenaustellung.
IWS	International Wool Secretariat.
TDC	Technical Development Centre - Alexandria.
STIA	El-Nasr Spinning and Weaving Co.
V	Visit.
BEIDA	Misr BEIDA Dyers.
ICI	Imperial Chemical Industries.
QC	Quality Control.
pH	Measure of alkalinity and acidity.
WIRA	Wool Industries Research Asscciation.
r.p.m.	Revolutions per minute.
m/min	Metre/minute.
S/R	Shrink-resist.
OBAs	Optical Brightening Agents.
IWTO	International Wool Textile Organization.
ASTM	American Society for Testing and Materials.
BS	British Standards.
ISO	International Standards Organization.

ABSTRACT

From the start of the mill visits it became obvious that if any overall improvement was to be made in the quality of wool cloths, practical assistance including knowledge of maintenance as well as correct machine settings and operation would be necessary in three areas of wool cloth production:

1) Top manufacture-starting from raw wool.
2) Drawing and spinning-worsted and woollen.
3) Weaving and designing.

Therefore a quick observation of these departments was undertaken at the start of the mill visits to provide necessary information to advise the D and F department and to provide background details for the recommended visits by advisers in the above areas.

Mill visits were restricted to the public sector which accounts for almost the entire production of woollen and worsted cloths. It is of interest to note that no wool finished products are being exported, which is not the case with cotton and cotton/man-made fibre blend fabrics. Therefore export knowldege is already available with the mills and eventual export of wool cloths or made-up garments should be considered, if only to offset foreign exchange on raw materials, spare parts, new equipment, dyes and chemicals.

Because of restriction on time, technical assistance in the mills was limited to general advise on processing and machine operation, review of modernisation programmes and, when necessary, trials. The seminar was also oriented to provide additional practical and theoretical knowledge on D and F of wool cloth, auxiliaries and machine selection for modernisation.

Training of D and F staff was done through discussions at TDC and on the spot training during mill visits. Advice has been given by outlining further follow-up programmes and a system to organise a technical service operation. A work programme for development work, possible collaboration with dyestuff and chemical manufacturers, IWS and other international wool textile institutes has been provided. International books, periodicals and journals pertaining to wool have been suggested, to enable the D and F staff to keep themselves up-to-date. On completion of the visits of the three suggested advisers and after modernisation of D and F departments, a future follow-up visit by a D and F adviser is recommended.

It is important to introduce training schemes for mill technicians and machine operators, therefore outlines of such programmes are provided in D and F. Recommendations have been made for one or two staff members of TDC D and F department to visit ITMA to observe and report on developments on D and F machines. INTERLAB recognition of TDC laboratory is also desirable.

Detailed recommendations have been given and it is hoped that over a period of time most, if not all of them will be implemented. The recommendations outlined in the technical report should not be difficult to introduce and control.

ACKNOWLEDGEMENTS TECHNICAL DEVELOPMENT CENTRE

Eng. Magdi El Aref - Deputy General Manager for Technical Affairs.

Chemist Abdel Hamid Khairallah - Director D and F Department.

Eng. Yusr Allam - Assistant D and F Department.

Eng. Samyia Selium - Technician D and F.

Chemist Hassan El Kassrawy - Technician D and F.

I would like to express my appreciation to the above members of the TDC staff for their whole hearted assistance during a two months visit as UNIDO Adviser in wool D and F from 20 December 82 to 19 February 83.

Having received enthusiastic assistance from chemist Abdel Hamid Khairallah, my counterpart, it gives me pleasure to especially mention his name and I hope that he will continue in the same manner in the future with the work we have done and planned together in the past two months.

ASSIGNMENT

Post Title - Expert in Dyeing and Finishing of Wool.

Duration - Two months.

Duty station - Alexandria with travel within the country.

Duties -

1. Visit woollen mills to study their problems in dyeing and finishing.
2. Give practical advise on how the problems can be overcome.
3. Give a seminar to mill engineers and chemists on modern techniques in dyeing and finishing of wool.
4. Train members of the staff of TDC to the extent possible.

The expert will also be expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on further action which might be taken.

1 - ACTIVITIES

1:1) Introduction

The raw material (greasy wool) is purchased from Australia, mostly merino wools and New Zealand for crossbred wools. The total amount of imports per year is dependent on the quantities required and specified by individual companies. The actual purchase is verified and ordered by a wool Purchasing Committee, consisting of the public sector mills' senior management, technologists and purchasing managers. This Purchasing Committee, is supervised by the Chairman of BEIDA. Direct imports by individual mills are also granted by the committee for speciality items e.g. 80's quality wool tops and for certain mills direct import of crossbred wools for processing into yarns within their own units. However it must be understood that BEIDA process almost the entire imported raw wool into tops, both ecru and dyed, in addition to wool-blended tops with polyester, polyamide, acrylic, linen and mohair, and supply all the mills in Egypt with their tops requirement. BEIDA export a small amount of tops to Yugoslavia. Therefore it is a comparatively easy matter to control the quantity and quality of raw wool imports. The total import of wool is 20,000 - 25,000 tons per annum, between 60 - 70% merino and the balance crossbred and speciality tops. Polyester and viscose fibres are manufactured indigenously, acrylic fibre is imported as dyed tow. Polyamide is only melt-spun.

Most of Egypt's wool textile mills are located in the northern and middle Delta, with one company in Upper Egypt, and are usually subsidiaries of larger cotton and cotton/man-made fibre blends textile mills. Wooltex near Cairo is the only mill whose main production is wool. Each mill has its own specific wool D and F department. Mehalla and STIA also have their individual making-up units which are entirely for their own production.

The only wool end-product exported is hand knotted carpets and kelims, manufactured from a blend of New Zealand and local wools.

1:2) Mill Visits

Mill visits of extended duration were restricted to the public sector, STIA, Mehalla, BEIDA and Wooltex, and in some cases follow-up visits were also made. Broadly speaking all the mills had similar problems to a greater or lesser degree, from their starting material to the finished cloth. Some of the less obvious problems were defined through a systematic analysis of random samples drawn during mill visits.
The technique was demonstrated to the TDC D and F staff at each mill visit, who also carried out all the necessary tests in the independent laboratories at TDC. This method served a double purpose, firstly to check the in-plant quality control at the individual mills, secondly as part of TDC D and F staff training. After an analysis of the test results, processing techniques and alterations were studied, trails recommended and carried out at the particular mill until the difficulties were, as far as possible, solved. Unfortunately, this is only part of the problem, machine operation methods require to be altered for further improvement of quality. Dyes and chemicals used require special care in selection to improve compatibility and ultimate cloth quality. The machines themselves require better maintenance, in addition to improvement in the services supplied to them. Technical staff need to keep themselves up-to-date on national technical matters, through technical meetings and collection of internationally available information. This could be organised periodically by the TDC D and F staff and the establishment used for the meetings. Upgrading of technical control over individual machine operations by constant periodical observation, checking and instructions is required.

Improvements in housekeeping and material transportation should be made. Modernisation should be carefully studied, preferably by a committee of technologists to avoid unnecessary equipment. For further detailed information on individual mills Appendix 1. may be referred to.

The private sector mills processing wool are at the present time a small part of the overall wool production and mainly consist of carpet and knitwear manufacture. There is an insignificant wool cloth production. Because of limited time factor only one visit was made in the private sector to obtain background information. Once they have expanded and become more established it will be helpful to provide technical assistance, but at the moment this would not be desirable. A small write-up on one of these mills can be found in Appendix 1.

There are two public sector chemical manufacturers ISMADYE one of these, is the only one to manufacture wool dyes from imported intermediate products. ISMADYE produce 22 acid dyes, mainly used by the private sector, and 8 after-chrome dyes, also used by the public sector. Significant expansion of production needs is to be carried out if the wool textile industry is to become fully self-sufficient on indigenous production of wool dyes and chemicals. A long term plan should be evolved to do this and thereby save foreign exchange. Details are available in Appendix 2.

1:3) Books periodicals and Journals

Because the TDC library and information centre had limited information and references for wool a number of books, periodicals and journals were suggested. A list of these books etc , can be found in Appendix 3. The TDC D and F department was, in addition provided with a more detailed and comprehensive list, which can be referred to once the original order arrives, with the view to order more technical books etc, for general use in the library, but in particular to keep the D and F staff up-to-date.

1:4) Seminar

The seminar lectures have been included in the report because of their practical nature, and it is envisaged in conjunction with each individual mills report, that they will be useful to the technical staff to implement some of the recommendations. For instance, because surface fibre is an important factor in finished cloth, a detailed account of correct grinding of ledger blades and cylinders for shearing machines is included. Lecture No. 1 outlines traditional wet and dry finishing processes and machines, but also new equipment and continuous processing which has been introduced over the past decade. Chemical finishing is included because of its importance to meet the modern demands required of wool textile and products. Lecture No. 2 outlines the main points to be considered when modernising a wool dyehouse in particular, but also general points to be taken into account for modernisation of a wool D and F department. Lecture No. 2b provides information of a practical nature on the lesser known area of textile auxiliaries for wool, with a general outline of dye selection for a particular end-product. Refer to Appendix 4 for details.

1:5) Articles for Publication

Three papers were written for publication in the Textile Consolidation Fund Information Bulletin, on wool finishing, printing of wool/polyester blends and damage to wool which can happen during dyeing. These being the first articles especially for wool they are intended to have the two-fold effect of creating more interest in the wool fibre amongst technicians to improve wool products and to promote other articles on wool to be published. Refer to Appendix 5 for details.

1:6) D and F Work Programme for Training

A detailed scheme has been worked out for training the D and F staff, whilst at the same time evaluating all the available dyestuffs and auxiliaries used in the wool textile industry. During the two month tour programme training of local staff as been limited to on the job training during mill visits, providing written information and discussion whilst at TDC.

The training programme includes:

water analysis - dyeing trials with all the different classes of wool dyes - dyeing 100% wool fibres in loose stock, tops, hank, package and woven fabric - dyeing wool/man-made fibre blends on atmospheric and high temperature equipment - testing for quality control of dyed samples - preparation of colour patterns in self shades and binary combinations - preparation of colour triangles with the three primary colours - study of the effect of dyeing auxiliaries and special wool finishes on dye ability and fastness. Refer to Appendix 6 for details.

2 - RECOMMENDATIONS

2:1 Introduction

During mill visits recommendations were given for each individual mill and can be referred to in section 1:2 and Appendix 1. The following recommendations will give a general outline for the mills but concentrates on technical service to be provided by TDC D and F department, which includes training, collaboration with International Organizations to introduce new developments and techniques, particularly chemical finishes and products. To encourage improvements of indigenous dyes and auxiliaries manufacturers should expand their products for wool. Quality control systems for dyeing and finishing and general improvements in standard processing techniques, including economic and commercial studies should be introduced.

2:2 General

To upgrade end product quality from receipt of raw wool, all equipment in use should be checked, over-hauled and adjusted where necessary. To assist in this work it will be beneficial to have the assistance of three experts in the following disciplines:

a) Top manufacture, starting from raw wool.
b) Drawing and spinning worsted and woollen.
c) Weaving and designing.

At the same time a review of the complete modernisation programme in the above sections of the wool textile industry can be made. The possibility of a package deal with machine manufacturers should not be overlooked, provided all textile units can agree.

After upgrading is complete as mentioned above a further visit by a wool D and F expert will be desirable.

Potential for export of wool and wool/blend cloths should be studied, particularly in the middle East and Africa, as a first step with the long term view to make the wool textile industry in Egypt self-supporting in raw materials, spare parts, new equipment, dyes and auxiliaries.

Savings on foreign exchange can also be made providing the indigenous dyestuff and auxiliaries manufacturers are expanded to cover the complete range of requirements for the textile industry. The possibility of collaboration with one of the International Dyestuff and Auxiliaries manufacturers to start such a complex in Egypt should be considered.

2:3 Training Schemes

A training scheme for the TDC D and F staff has been suggested which includes new chemical processes, dyeing, and evaluation of results by laboratory work. Appendix 5 may be referred to for details. This will supplement the training already given which has been restricted to on-the-spot training during mill visits and evaluation of laboratory test results by the D and F staff on samples drawn during these visits.

Some of the problems encountered at the mills could be attributed to deficient machine operation, maintenance and service supplies owing to insufficient technical knowledge of the technologists. Therefore, it is recommended that training schemes are organised by TDC D and F staff to cover the above areas. A start has been made with lecturers on versatility, flexibility and correct process methods for wool, during the seminar. Machine operation and maintenance service supplies will be more difficult; lectures could be organised on these subjects, but the practical part will be more difficult, due to the lack of facilities even for laboratory-scale pilot plant trials at TDC for worsted and woollen cloth processing.

On-the-job training at the mills (although it is undesirable as it interferes with production) will be the only solution at the present time. Training will become more important when modernization is complete.

2:4 Technical Service

Technical service should become more active within the wool textile industry in D and F. Random quality control checks for in-plant processing should be frequently taken. This will serve a dual purpose, to check quality of production and individual mills' own quality control results and methods. It will also provide the opportunity to introduce quality control systems directly relating to D and F, which is necessary in some of the mills. The system has been adequately demonstrated to TDC D and F staff during mill visits and it is a useful tool in tracing the cause and assisting to solve problems which occur in D and F. Evaluation of individual machine processing techniques, in D and F should be used to eliminate problems caused through machine operation. The information derived there from in conjunction with test results should be utilised to rectify problems which may arise in D and F of wool. Initially, to generate improvement in standard processing techniques, three of the important public sector mills to be concentrated on are STIA, MECHLLA and WOOLTEX.
Economics and cost studies should be investigated with a view to cost savings in dyes, chemicals and processing methods through the use of long runs for the most rational production. Factors to be examined: quality of finished cloth, amount of rejects and reprocessing and quality of through-put per unit cost. Particular attention should be given to the availability of materials required, i.e. raw material, dyes and chemicals etc., and predetermination of potential bottle-necks, e.g. spare parts supply.

2:5 Collaboration with Organizations and Institutes

Efforts should be made to collaborate with national organizations and institutes, preferably of international standing. Joint Ventures should be organised to introduce new techniques, special finishes and products.

A development project of this type may be arranged with the IWS branch in Cairo as follows:

a) Enhancement of design characteristics by finishing, on worsted cloth produced in weaving.

b) Minimising chromium contamination from chrome dyeing.

c) Pad-batch piece dyeing.

d) Printing of light weight wool/polyester blend woven fabric.

e) Wet transfer printing of all wool/polyester fabrics, etc.

Development work and small scale trials could be carried out at TDC Alexandria followed by bulk trials at e.g. STIA factory after agreement between STIA and TDC has been reached. This arrangement is essential as TDC Alexandria does not have production-size D and F equipment for wool.

2:6 Tour Programme TDC Laboratory Recognition

The International Textilmaschinenausstellug (ITMA) arrange an exhibition every 4 years, the next being at Milan (Italy) in October 1983. It is recommended that a senior representative and one other staff member from the D and F department at TDC be designated to attend the exhibition to observe first hand new textile equipment, but particularly to make a report on all new equipment and developments in D and F of wool, cotton and man-made fibres.

INTERLAB is a laboratory whose test results are accepted and recognised internationally. It is recommended that TDC apply for membership.

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APPENDIX I

VISIT TO EL-NASR SPINNING AND WEAVING CO. (STIA) ON 1-2-3-4 JANUARY 1983.

SUMMARY

The visits were made to familiarise with the Egyptian Wool Textile Industry in general and the dyeing and finishing departments in STIA organisation processing all-wool and wool-blends in particular.

To review and suggest modifications to improve the process routines, quality control procedures, give recommendations for modernisation, and assist to solve problems which exist in the dyeing and finishing sections at STIA.

ACKNOWLEDGEMENTS

Eng. A. Abu-El Wafa - Mills Sector Manager.
Dr. Salah El-Din Oweiss - Worsted Mills General Manager.
Chemist. Aziz Karkour - Head of wool dyehouse and finishing
Eng. Fatima Diab - Chief dyehouse and finishing department
Eng. Abdel Fattah Maged - Chief of dyeing department.
Chemist. Nabil M. Ebrahim - Chief of finishing department.
Mech. Eng. Sobeih S. Mesalam - Maintenance and Service.

INTRODUCTION

El-Nasr Spinning and Weaving Co., (STIA) is a large multi-fibre oriented textile manufacturing mill in the public sector. The worsted mill being only a section of the mill complex. The visit was entirely concerned with the worsted mill and in particularly the dyeing and finishing departments.

BACKGROUND INFORMATION

The mill produces 2,050,000 linear metres of cloth per annum, working approximately 300 days per annum. in continuous 3 shift working ie. 24 hours per day. The production consists of all wool worsteds 400 gm/metre, 55/45- polyester worsted blends 250 gm/metre, 45/55-wool acrylic blends 250 gm/metre, 60/15/25- wool/fibro polyester blends 450 gm/ metre (khaki overcoatings), and 60/15/25- wool/polyester/polyacrylic 450 gm/metre (Heavy Military Serges).

Starting material is tops either ecru or dyed from BEIDA (The only top manufacturing unit in Egypt). A very small percentage of speciality fibre tops is purchased direct from overseas by STIA. These tops are dyed in STIA's own dyehouse, which also dyes tops received from BEIDA dyers to supplement their shade range as and when required. There is also rectilinear re-combing and gilling after dyeing and backwash drying.

Drawing and spinning is production balanced, and there are 13,000 spindles, consisting of 7,000 ring and 6,000 cap all fairly old espacially the cap spinning which is the old Bradford system. Some modern twisting 2 for 1 and winding is also in use Yarn counts range between 32 Nm and 58 Nm.

Weaving is done on 98 Hattersley looms, approximately half being old type with the balance Hattersleys new type with no overhead structure. The looms are supplemented by 3 warping machines (sectional) one of which is modern (Benninger). Pirn winding on Schweiter. Burling and mending on 250 tables, more than twice the amount of what could be considered as standared.

2 large well equipped physical and chemical testing laboratories.

MODERNISATION OF SPINNING AND WEAVING

Plans have been initiated to instal 38 new Sulzer weaving machines in an air conditioned area, with Uster automatic tying in machines. New drawing spinning, twisting, and cone winding, installed in an air conditioned areas, is being considered by the management, but which will be essential if the Sulzer machines are to run satisfactory.

DYEING AND FINISHING
GENERAL

The dyeing and finishing department is housed in a modern large building, some of the machines are of the older type, housekeeping and maintenance is good. However, more detail should be given to preventive maintenance and machine check lists instigated. A further improvement could be colouring of all service supply pipes and machine areas according to International Standards. Consideration may also be given at a later stage to correct lighting efficiency for a particular working area in addition to noise control.

These last few remarks apply not only to the dyeing and finishing but to the entire worsted mill, the whole objective being to improve worker environment aspects, and because of this higher production, improved efficiency and superior quality, as the human element plays an important part particularly in labour intensive and batch operation production.

Dyeing and finishing department process approximately 6,750 linea-meter per 24 hours working 3 shifts i.e. 2,250 metres/shift. Pieces are between 50-70 metres in length with widths of about 1.50 metres.

EQUIPMENT INSTALLED

WET FINISHING

1-3 bowl crabbing machine-old type, mostly used for light weight cloths.

1- Open beck elliptical winch.
   used for scouring delicate fabrics and bleaching.

1- Open width scouring.
   Old type - not in use.

2- Dolly's wood - old type - not in use. 4 draft.

2- Zonco (Italy) - 15 draft high speed dolly scourers with (wood rollers) automatic controls for temperature, time and liquor ratio, washing off jets and baffle plate.

1- Zonco (Italy) Scour mill 4 head - 3 piecess per head. (wood rollers) 8-12 pieces per load. Pneumatic controls for roller and trough pressures, in addition to controls mentioned for dolly scourer.

4- Rotary milling machines old type not in use

2- Scutchers - automatic - old type.

2- Hydro - (Broadbents).

DYEING

6- Atmospheric pressure winch dyeing machines - 5 draft stainless steel (Peggs) used for piece dyeing all wool, wool/polyester with carrier, wool/terylene dyeing, wool/ acrylic blends and wool/nylon blends. Top dyeing on all wool tops.

1- Sample dyeing winch stainless steel (Peggs) to supliment production machines.

1- Atomospheric top dyeing machine (Pegg). Old open beck type. processes per round 200 Kg of tops.

1- Hydro (Broadbents).

1- Atomspheric hank dyeing machine (Tima). 250 Kg capacity. Used for hand knitting yarn only.

1- ma 4 - bowl back wash drum dryer for top processing.

DRY FINISHING

1- Multi layer and bay tenter with weft (mechanical) straightener, over feed, pad mangle (Smiths) and heat setting/E. Gordon - whiteley - Veloset).

1- Famatex multi layer tenter with over feed.

2- Old steaming and brushing machines.

1- Shearing machine (Vollenweider) with waste extractor, cutting 1-back 2-face.

1- Wm , Whiteley shearing machine old type with waste extractor.

4- Atomospheric pressure blowing machines standard type.

Wm. Whiteley and Textima.

1- Auto-clave decatising (Raxhon) not in working order, although brand new.

1- Wire raising - double action (pile and counter pile) old type - Arbach.

1- Rotary press-old type not in use. (Kettling and Braun).

2- Open width paper presses with 4-hydraulics-electric heating (Arthur Heatons U.K. Goldabini - Italy) not in use.

1- London shrinking machine (Kettling & Braun) with steaming roller, hot plate and cooling cylinder.

1- Gas singeing machine with brushing. No beater 2 double jets - Comerio Spain.

NEW EQUIPMENT

STIA are in the process of modernisation their old equipment and have already installed some new machines. Further additional new machines are envisaged and after discussions the following have been tentatively decided on. Although manufacturers are named, these may alter according to tenders received.

Open width Scourer - Hemmer Kontilana.
Continuous Crab-Hemmer Konticrab.
Rope dolly Scourer-Hemmer 15 drafts (wood rollers).
Hydro-extractor.
High pressure jet piece dyeing machine - horizontal.
8 to 10 pieces per charge note: not beam dyeing.
Hank dryer-batch.
High pressure top dyeing machine 350 Kg per charge
Scholl - W.G.
Wet tenter - automatic weft straightener-over feed-heat setting-cooling zone-Krantz.
Steaming double brushing machine.
Blowing machine-standard atmosphere.
Weft straightener for Famatex tenter.
Auto-clave decatiser-Biella-Kettling and Braun-Sellers but capable of processing 8-10 pieces per charge.
Automatic or semi-automatic Rotary press with conditioning unit.
Conditioning-dewing or damping machine

On reviewing the possible new equipment it was pointed out that the modern trend is to transfer pieces in roll form in large batches. Secondly that a foulard could replace the hydro-extractor, an added advantage apart from being more efficient is that it can be placed in line, and continuous with the new tenter,

after scutching. Standard atmospheric blowing machines in the final finishing routine are being replaced by auto-clave decatising. Taking into consideration the condition of the Raxhon and its potential production a new auto-clave decatiser capable of processing 8-10 pieces per charge should be considered. This additional equipment will be required when Sulzer looms go into production.

In the long term a water softening plant-base exchange may be obtained, particularly if as anticipated STIA are going to have their own tube well in addition to the city supply. For wool textile processing water should be between 2.5-5°. English hardness free of suspended solids and metal contamination.

PROBLEMS AND RECOMMENDATIONS

Difficulties were being encountered in finishing an afgaline type fabric i.e. running marks, setting defects, cover, and a presentable end product. The cloth had been manufactured from top dyed worsted yarn (plain weave) which is not condusive to the finish required. The Dyeing and Finishing was attempting to make a woollen cloth from a worsted cloth. which is an expensive method of manufacture.

Teepol (Shell) is used in crabbing but it must be remembered that high temperatures coupled with alkalinity deteriates wool fibre. Weak organic acids e.g. acetic acid may be considered in crabbing top dyed worsteds. Wool cloth finishing differs extensively from cotton and cotton blended fabrics, which are usually processed by a set routine. Wool finishing is flexible there is no set routine and any individual process can be repeated at a later stage e.g. crabbing as a first-operation and again after scour-mill to eliminate running marks.

It is often said that worsted cloth is made in spinning and weaving, whilst woollen cloths are made in Dyeing and Finishing.

This terminology is true, and it is incorrect to imagine that the D & F can correct any faults from previous processes. Finished burling and mending may to some extent improve them. To upgrade quality, improvement is also essential in the spinning and weaving departments. In the D&F the operator at each individual process must be held responsible once he has processed the cloth i.e. Faults must be reported <u>before</u> processing.

The present dyeing techniques are satisfactory using the complete range of wool dyes except for reactives, with the required auxillaries. Consideration may be given to use a sequestering agent in wet processing if the water hardness becomes excessive. Oxidation and optical bleaching is also done.

Details of correct worsted yarn steaming operations were given to the spinning department. Samples of grey and finished cloths and water sample were taken for testing and analysis. A second follow up visit is being arranged to discuss the results and observe machine operations and recipes, to suggest where improvements may be made.

TDC/V. 2

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VISIT TO MISR BEIDA DYERS
ON 10-11-12 JANUARY 1983

SUMMARY

This factory is important to the wool textile industry being the only indigenous company to process raw wool, including blends with polyester polyamide and acrylic to top stage both dyed and ecru.

Because the quality of tops and top dyeing standards are important to produce a high quality end product in subsequent spinning, weaving, dyeing and finishing. Observation of the complete processing routines was done, with particular reference to the dyeing department.

ACKNOWLEDGEMENTS

Mr. Omar Ismail - Chairman.

Eng. Yassin El Zarka - General Manager Dyeing and Synthetic Section

Dr. Ahmed El Nagaawt - Director Manager Dyeing and Synthetic Section.

Eng. Waguih Khalil - General Manager Maintenance Wool Section.

Chemist Mrs. Hafiza - Director Dyehouse.

Eng. Kamal Sarhan - General Manager Quality Control.

INTRODUCTION

Misr Beida Dyers is in the public sector. The main activity is processing local cotton and cotton/polyester blends, into woven finished fabric prints and self shades for fashion wear ladies and gents. Cotton upholstery cloth is also produced. Building extensions to house new cotton equipment to update the processing is ready. Eventually a garment making up section will be added. The wool section is only a part of this large textile complex.

BACKGROUND INFORMATION

BEIDA process all the raw wool imported into Egypt from Australia and New Zealand. Most of the imported wool is 19-21 micron merino, but crossbred wool is also imported.

Acrylic fibre comes from overseas tow dyed, viscose. polyester and polyamide are indigenously manufactured.

Production consists of tops both dyed and undyed of all wool and various percentage blends of wool with, viscose, polyester, polyamide and acrylic. The mill usually work's on average 1½ shifts 300 days per annum i.e., 12 hours per day producing about:-

	metric tons per annum
White wool tops.	4,600
White polyester tops	900
pre-dyed acrylic tops	1,600
Dyed wool tops	1,200
Miscellaneous tops	300
Total production	8,600

On a full 24 hour 3 shift working the wool section should produce between 14,000 - 15,000 metric tons per year. About 20% of the production goes to the private sector, hosiery units and carpet manufacturers in particularly, with a small quantity to worsted weavers. Tops manufactured at BEIDA are also exported to Yugoslavia.

TOP MANUFACTURE

Raw wool after removal from the bales is scoured in Taylor-wadsworth scouring trains, old harrow rake type with dryer. There is also a grease recovery plant. Wool is then transfered pneumatically to the card bins, for carding. Unfortunately the card clothing particularly on the swifts is

worn out and needs replacing. Carded wool is then combed mostly on old Noble combs, there is comparatively new recterliniar combing too. Combing is followed by normal gilling operations and wool is made into commercially standard tops.

A quantity of the tops is processed into singles and twisted worsted yarns in BEIDA's own drawing and spinning section. Loose fibre dyed in the dyehouse is also broke into staple lengths. Some of the equipment is old Smith Prince and Stells, however, there are newer machines continental system of drawing and spinning. There is also few 4 head frames of REPCO self-twist spinning. A good woollen system which processes crossbred wool and hard and soft waste from the worsted section. Consisting of : Spencer Halstead Vortex oiling and blending, 3 Tatham 12 bank cards and balanced ring spinning frames for condenser bobbins.

An air-conditioned physical testing laboratory, with up-to-date equipment fully utilised.

DYE HOUSE

GENERAL

The dyehouse is well organised in a modern building with comparatively new equipment. No modernisation is envisaged in the near future. Top and loose fibre dyeing carried out on wool, polyester and polyamide. Melange printing of tops and space dyeing of yarn is also done.

A good chemical testing laboratory is used for shade matching and testing. Economics of the dye recipes are regularly monitored but not to the cost of quality. At the present time 1 : 2 modified metal complex dyes are being valued.

EQUIPMENT INSTALLED

2 - Top presses for loading into dye canister-Longclose.
4 - Atmospheric top dye machines - 250 kg capacity automatic controls liquor circulation time/temperature rise - time periods - Longclose.
2 - Packers for loose fibre.
2 - High Pressure loose fibre dyeing machines - 250 kg capacity - automatic controls - Longclose.
1 - High Pressure top dyeing machine - 75 kg capacity - automatic controls - Longclose.
4 - High pressure top dyeing machines - 250 kg capacity- automatic controls - Longclose.
1 - Hydro extractor.
1 - 2 bowl backwash dryer.
1 - Steamer - new
1 - Melange machine for tops - old type.
2 - Space printing machines - own manufacture.

PROBLEMS AND RECOMMENDATIONS

On enquiries with the dyehouse staff it was stated they had no problems or difficulties. This was confirmed in further discussions. BEIDA use standared dye recipes:-

Dark shades - Afterchrome
Medium shades- 1 : 2 Metal comples.
Light shades - Reactive which are also used on medium

shades when brightness is required.

Standard procedure of seperate dyeings for different fibres is carried out followed by backwash dry-gill blending and/ or recombing (Noble and Continental) - gilling as required. Oxidation - reduction bleaching done in the past, only optical brighteners used now particularly for crossbred yellow wools in certain shades for carpet yarns. Base-exchange water softening plant in use.

Technical information was supplied to the technical manager on the following subjects:-

1) Basolan DC process for shrink-resist treatment of wool tops using Konrad Peter Pad and Fleissner backwash dryer.
2) The new kroy-hercosett process for treatmentof wool tops up to super wash standareds for knitting yarns.
3) Dylan process to meet super wash standareds.
4) Wet transfer printing of wool.
5) Printing wool/polyester blend fabric.
6) Minimising chromium contamination from chrome dyeing.

Samples of tops were taken of all dye classes for testing quality of dyeing. Water sample was also taken for testing and analysis. If found necessary because of the test results a second visit to BEIDA will be arranged.

TDC/V.4

CONFIDENTIAL

VISIT TO MISR SPINNING AND WEAVING COMPANY - MEHALLA EL KUBRA ON 15- 16- 17- 18- 19- 20 JANUARY 1983

SUMMARY

This factory is probably the largest multi-fibre textile unit in the Middle East. The visit was restricted to the wool sector including garment making-up, but in particular the dyeing and finishing departments which process all wool and man-made fibre wool blends in woven cloth.

Process routines quality control and modernisation possibilities were reviewed. Problems in D and F were discussed and successful trials carried out. Details provided on D and F of Worsted/Mohair blended cloths.

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Dr. Eng. Mohammed W. El Ghoroury - Chairman.
Mrs Tomader El Hawary - Sector Manager Quality Control and Research.
Mr. Abdel Khalet Awad - Sectors Manager Wool Processing.
Mrs Layla Ayad - General Manager Wet Processing Dyeing and Finishing.
Dr. Mosaad Kamal Sadek- Manager Wool Dyehouse.
Mr. Effat Awad Allah - Manager Wool Wet and Dry Processing.
Mr. Abdel Aziz Salama - General Manager Garment Making-up.

INTRODUCTION

Misr Spinning and Weaving Co. Mehalla El Kubra is a very large textile mill, main production being cotton and cotton/man made fibre blends both woven and knitted. The worsted/woollen mill is a section and itself is medium/large size. There is also a garment making up department with Italian collaboration for wool and wool/blend cloths into ladies and mens wear.

BACKGROUND INFORMATION

Mehalla receive 21 micron tops ecru and dyed from BEIDA. In addition by license of the Wool Textile Committee directly import New Zealand cross-bred wool about 500 tons/annum, 35 microns for defense cloth and blankets and speciality tops. Woollen processing use Mehalla's hard and soft waste, broken tops and noils.

Woollen department consists of the following 2 oiling, opening and blending units (Platts) and 1 new Italian system, followed by 4 woollen cards for coarse, medium and fine counts with balanced ring spinning frames, cone and pirn winding.

A special section for acrylic knitting yarn manufacture with Hacoba yarn bulking and ball making machine. Also REPCO self twist spinning for hosiery/knitting yarn, which is followed by a steam setting operation.

In worsted section 1 American manufacture opening, scouring and drying train used for New Zealand wools to make worsted yarn for service uniforms, carding, gilling, combing, drawing and spinning follows.

A seperate drawing and spinning unit air-conditioned for tops received from BEIDA. Singles yarn clearing is done before twisting on Schlaforths machines West Germany and Japanese Murata machines with the new splicing technique for joining yarns.

Weaving department has 4-Benninger sectional warping machines one of which is new. 200 Crompton-Knowles (USA) looms, -150 standared, -40 blanket and 10 jacquard looms, cone and pirn winding. About 200 mending tables, pieces are marked for mending checked after mending. There is also warp sizing; for cotton warp blankets.

Physical and chemical laboratories well equipped, centrally controlled, with Q.C. staff in each department,for random sampling.

MODERNISATION OF SPINNING AND WEAVING

Considering new singles yarn winding machines with electronic clearers. Additional looms double rapier Somet, Ruti or Sulzer woollen looms with auxillary equipment, looms will weave direct from cones eliminating pirn winding. The equipment if installed will increase production.

MAKING UP

The department had fairly old equipment manual cutting and garment pieces were moved manually for each operation. The visit was particularly made to examine finished pieces received from D and F. Production of 2 piece finished garments was 500 mens and 500 ladies in 8 houus working all for local market. Five year agreement with Italian collaborators not to export.

Problems as follows:-

1) Width variation in same quality even with a 2% ± allowance for 148 cm.
2) Checks not straight, specifically in ladies cloth.
3) Shrinkage in garment pressing above a 1% weft and 2% warp allowance, usually 5% and above shrinkage.
4) Finish not constant on same quality.
5) Glaze marks, water marks, more than 1% variation in shade in many qualities.

DYEING AND FINISHING

GENERAL

Production working 3 shifts 300 days per annum is 4,500,000 linea metres, consisting of :-

3,000,000 worsted all wool and manmade/wool blends.

1,000,000 woollens.

500,000 Blankets.

cloth made as follows:-

Light weights wool/polyester 45/55 - 180gm/m, polyester/linen 75/25 - 180gm/m , polyester/polyamide 70/30-180 gm/m , all wool 180 gm/m , wool/mohair 75/25-180gm/m.

Medium-heavy wool/polyester 45/55 - 240 gm/m , wool/ nylon 75/25 - 240 gm/m , wool/acrylic 60/40 - 240 gm/m , service uniforms wool 350 gm/m .

Hand and machine knitting yarns for ladies wear in 100% wool - wool/polyamide - wool /polyester - wool/acrylic blends - 100% acrylic high bulk yarns.

EQUIPMENT INSTALLED

WET FINISHING

1- Tenter, wet decatising, potting - new - Gessner USA, not in use.
3- Wet tenters - one with weft straightener, manual, pad, heat setting, cooling unit - Krantz. W. G..
8- Standared milling, single head wood rollers - old.
2- Double head large milling - old.
2- Milling-new-Hemmer-W.G. not in use.
10- Dolly scourers - 4 woolens - 6 worsteds - old.

1- Scour mill combined, 2 heads - Hemmer W. G. not in use.
1- Crab 3 bowl with pad mangle - Gessner USA.
2- Hydro-extractors - with mechanical load, unload,
2- Double action wire raising (not in tandem).
1- Double action wire raising - Gessner USA - new.
1- Teazle raising - old - not in use.
2- Perch - factory made.
1- Yarn bulking winding machine - Hacoba.
1- Double gas, plate singeing - high speed 150 m/min Gessner - USA.

DYEING

1- Jigger atomospheric.

1- Jet 2 tuber Scholl - WG.

10- Winches (piece) atmospheric 3-4000 litre, 4-2000 litre, 3-3000 litre.

4- Top dyeing atmospheric-Obermaier

1- Top High Pressure - Theiss.

4- Hank atmospheric - 3 doubles stick - 1 single stick Obermaier.

4- Hydro - extractors.

1- High speed tube piece dyeing atmospheric - Scholl.

1- 2 bowl backwash drum dryer - old.

1- 5 bowl stainless steel back wash drum dryer - Ilma Italy.

1- Hank dryer, trays, yarn, loose stock, slubbing -old.

1- Continuous feed loose stock dryer.

DRY FINISHING

Finish mending done.

2- Perch - automatic, not in use.

2- Factory made perch - North light.

4- Standared atmospheric pressure decatising.

3- Double shears - Vollenweider - Swiss.

1- Polishing shear - Gessner USA - not in use.

1- Cropping - old - not in use.

1- Steam brush.

1- Damping - spray.

1- Open width press - 4 rams.

1- Relaxing - steam - loop dry.

1- Intermediate perch.

1- Autoclave decatiser - Gessner USA - not in use.

2- Cuttling, rolling - old.

PROBLEMS AND RECOMMENDATIONS

The main difficulties were as follows:-

1) Checks not strainght - Improvements could be made by correct use of manual weft straightener, machine operation, leading and tail wrappers of 5 to 7 metres at the start and finish of every batch for drying.

2) Water marks (moire effect) - Requires control of tension and weight at the crabbing machine - Probable remedy is lifting of top roller after piece is run on and head and tail wrappers.

3) Cloudy appearance holes and damages - mainly caused by dolly top roller weight and buff ups (entanglement of piece).

4) Difficulty in control of pH in dyeing - purchase of portable pH metre necessary.

5) Condensed water marks from decatising - caused by wet steam passing through wrapper into piece. Improvement by regular check of steam traps and additional ones where necessary. Boiler pressure to be maintained to ensure dry steam. Blowing cylinder nipples to be checked.

6) It is thought that Dyeing and Finishing should rectify all spinning and weaving faults. This may be possible in certain cases by finished mending and reprocessing, but, not all cases. The correct procedure is to remedy faults at the source - Therefore an inspection committee

from spinning, weaving, designing, D & F to be formed to examine all faulty pieces, deci· where the fault is caused and remedial action take.. Quality production is team work and close liason between departments.

7) Difficulty being experienced in D and F worsted/mohair mixtures. The following are the required process routines, which may be varied according to circumstances and finish required. It must be rembered that finished width loss should be 5-10% and gain in length 0-1% to give the lustre and worsted/mohaire handle. for 9-10 oz/linear yard cloths.

a) Full Yorkshire crab 2 bowls, 2 steams, batch on roller stand overnight.

b) 1 nip roller and drum dried with tension no width control.

c) Plate singe both sides.

d) Double scour open width, detergent and soda ash, followed by detergent only.

e) Piece dye with fast acid colours:-

Xylene Lt Yellow 2 GP)
Azo Rubinole 3 GP) Sandoz
Alizarine Lt Blue 4 GL)

with 3% acetic acid (exhaust with formic acid) 10% glaubers salt and dyeing assistant.

f) Tenter 1-2" over wet width, holding length

g) Shear 2 ends back and face on 1 back 2 face shear

h) Perch.

i) Decatise (small roller) blowing machine.

j) Auto-clave decatise.
Possible variation after item d scour, to tenter 1" over width holding length and autoclave decatise, rest of routine follows.

8) Marking of machines areas with yellow/black diagonal lines in all departments. In wet finishing and dyeing particularly under roof beams so as to avoid condensation droppings and stained pieces i.e. no carts to be left in the area. Services to be coloured according to International Standards.

9) Machine operator training is essential. Detailed instructions on proper machine operation.

10) It may be noted that faults from spinning and weaving can not necessarily be removed in D and F. Similarly faults in wet processing can not necessarily be removed in dyeing. Each department and operator (therefore operator training essential) is responsible for their own faults.

11) Improvement in general house keeping. Consideration at an oportune time to introduce transportation of pieces in large batch roll form.

12) Preventive maintenance schedules to be introduced with specific check lists for individual machines.

13) Improvement in worker environment through light valve and noise control.

14) Improved inventory for dyestuff stock, to avoid having to mix dyes even of same class and type from different manufacturers. Even from same manufacturer dyes are not necessarily compatable in relation to exhaustion

curves. Once a recipe, method and routine has been proven and established it must be continued. Alterations should be considered after successful trials have been carried out.

15) Standardisation and rationalisation of processes and chemicals in wet finishing i.e. similar to item 14.

16) Designs developed in weaving, particularly in worsted suitings should be enhanced e.g. a cord must be maintained and not flattened by crabbing or any excessive pressure.

MODERNISATION POSSIBILITIES

1) Mezzanine floor for dyehouse colour kitchen and offices for observation of entire dyehouse. Dye dispencing and chemical additions with automatic controls for dye machines all housed in colour kitchen. Glass frontage on both sides with overhead visible view of entire dyehouse.

2) In long term consideration for a WIRA PH monitor which displays dye liquors continuously as required and pH digital readings with acid, alkali additions.

3) Instrumental colour system providing individually costed matchings, effect of different lights predicted, rapid matching of new shades, accurate shop floor corrections and accurate redyeing.

4) Eventual replacement of piece dyeing machines with low liquor ratio type jet soft flow atmospheric pressure and high pressure. Followed when necessary with latest low liquor ratio machines for top, loose stock and hank.

Depending on through put shade-wise continuous top dyeing can be evaluated.

5) In wet processing the frontage over looking the department in the dyehouse mezzanine floor can be used for office and observation.

6) Consideration be given to replace 10-old dolly's with 4-new 15 draft high speed machines.

7) Addition of a new continuous Konticrab-Hemmer. W.G.

8) As the wet and dry finishing is in two distinct areas, each discipline should be the responsibility of two seperate technologists, thereby ensuring on the spot control.

9) In the dry finishing department a new automatic autoclave decatiser would be useful to improve stability and finish-8-10 piece load. Manufactured by Biella - Italy - Kettling and Braun W. Germany, Sellers - U.K. Auto-clave decatising is gradually replac-ing paper press, particularly when the cloth goes directly to making up. The aesthetics of paper press is only an advantage when cloth is sold by suit lengths.

10) The two rotary presss may be replaced by a modern type with steam, and metal detector before the nip followed by a conditioning unit a part of the machine after the nip. Rotary press is used on certain cloths immediately before auto-clave decatiser, which is usually the last finishing operation before cuttling or rolling.

TRIAL

On first examination of the piece dyed rib worsted suiting (ottoman type) the faults of water marks and cloudy effects appeared to be caused by crabbing and dolly scour.

Trials were therefore arranged to pinpoint where the problem occured and to establish remedial measures.

91 Piece No. 1

Random piece taken from ordinary production having been processed as follows:-

Singed - 2 double gas singeing 125 metres/minute.

Scoured - Dolly, 1% sodium carbonate 1.5% nonionic detergent Nekanil 910 (BASF). ½ hour at 50°C - 2 hours wash final cold rinse.

Crab - 2 ends, batched on at 90°C without wrappers, water let of then repeated in second bowl, no chemical additons run off through cold bath.

Tenter - for inspection.

185 Piece No. 2

Crey blown - 2 ends.

Scoured - as piece No. 1

176 Piece No. 3

Grey blown - 2 ends.

Scoured - on dye winch 1% Nekanil 910 - 50°C - ½ hour - ½hour wash final cold rinse.

Dyeing -

All 3 pieces were then put in the same dye winch and boiled off for 10 minutes - wash off for 10 mins and finally cooled to 40°C. Total weight of pieces 90 Kg.

Dye chemicals then added as follows and the pieces run for 5 minutes at 40° C. All chemicals predissolved and diluted filtered into vessel.

4% + ½ gm per litre sulphuric acid = 4 Kg 600 gm.

3% Sarabid OL = 2 Kg 700 gm.

11 % Glaupers Salt = 10 Kg anhydrous.

Dye Recipe

maroon Shade

750 gm Palatine Bordeaux RN (BASF).

250 gm. Stanomina Blue 2 G (Acna Italy).

200 gm. Chromalan Yellow GR (Chempol Yugoslavia)

Liquor ration 1:30. The dyes were dissolved and filtered into dye vessel. Difficut to check pH but pH paper gave about 3.0. Dyeing started 1.15 pm. finished. 4.45 pm. Raised to boil over 45 minutes, boiled for 1 hour 15 minutes, warm washed for ½ hour then cooled to 40°C. Removed hydro-extracted and tentered, The pieces were not neut-ralised.after dyeing, but will be after inspection to check if neutralisation with ammonium sulphate causes any fault.

Because of difficulty in determining pH, samples of dye liquor taken at start. 80°C - 10 minutes after boil and before washing off for laboratory testing. Samples of grey and finished cloths and water samples before and after softening were taken for testing and analysis. A second f llow upvisit if necessary will be arranged to discuss the results.

Evaluation of trial

91 Piece No. 1

Very heavy water marks cloudy appearance and dolly marks with holes.

185 Piece No.

No water marks, cloudy appearance

176 Piece No. 3

No water marks or cloudy appearance, but, 5 wrong ends through entire piece may be polyester yarn. Probably caused through mixing of cones in spinning or weaving yarn store.

Remarks

It seems water marks and to some extent cloudy appearance caused in crabbing. Dolly scour also contributes to cloudiness and damages.

Dyeing technique can be improved by use of pH meter temperature controlled.

Methods to rectify these problems have been suggested.

TDC/V. 6.

CONFIDENTIAL

VISIT TO EL-NASR SPINNING AND WEAVING CO. (STIA) ON 29-30 JANUARY 1983.

SUMMARY

This second visit was made as a follow-up after analysis of the test results on samples taken during the first visit.

Recommendations

On examination of different cloths during the visit it was observed that the shearing needs to be improved to ensure cleaner pieces so far as surface fibre is concerned. A detailed method for setting and grinding of ledger blades and cylinders was therefore provided, which if correctly followed will enable excess surface fibres on worsted and woollen cloths to be removed.

A second observation of importance was the fact that no machine was available for conditioning the cloth i.e. dewing or damping machine either spray or suction drum type. Moisture content of cloth is an important factor in traditional worsted cloth finishing to enhance and improve the handle, appearance and aesthetics.

Thirdly an auto-clave decatiser in working order will semi-permanently set the finish previously applied inaddition to imparting cloth shrinkage stability.

As can be seen from the test results analysis of the water sample gave a pH result of 5.5,which was substantiated by the pH of the aqueous extract of all the fabrics. Water pH needs to be made neutral. Iron content of water needs to be watched to avoid iron stains, also hardness to be reduced to between 5 - 9^{o} English hardness.

Analysis of the test results enclosed confirmed that cloth shrinkage in one or two samples was excessive, but requires only small adjustments.Except for one or two isolated items dye fastness was good. Oil and grease content was high in only two cases and needs improvement. Alkali solubility in all the 100% wool fabrics is very low and immediate action is essential to correct this fault alkali solubility for all wool cloth, is usually between 12 - 18%. Advisable to carry out Urea-bisulphite tests to confirm low alkalinity.

In general dyeing and finishing is good and only requires a little more effort to improve the standared, further. This will be possible providing the recommendations outlined above and in the first visit are followed.

WATER ANALYSIS OF SAMPLE COLLECTED FROM EL NASR SPINNING AND WEAVING CO.(STIA)

TEST	METHOD APPLIED	RESULTS
pH value	pH paper	5.5
Alkalinity	Titration with 0.02N-HCl using Methyl Orange as indicator	I85.I8 p.p.m of $Ca\ Co_3$
Suspended solid	Filteration method	Nil
Dissolved solid	Drying method	0.069 gm/I00ml-H_2O
Total solids	Suspended + Dissolved	0.069 gm/I00ml-H_2O
Total hardness	Ethylen diamine tetra acetic acid	I75 p.p.m $Ca\ Co_3$
Iron content	Colourimetric Thiocyanate reagent	63 mg per litre.

NOTE: Total hardness = I75 p.p.m $Ca\ Co_3$
= I7.5 French hardness (FH)
= I0.25 English hardness (EH)

TEST RESULTS OF SAMPLES FROM

11	Acrylic/ P.S	68/32	213	82.3	79.3	2/30	16	150	0.33	0
12	Acrylic/ P.S	72.2/27.8	196	85.3	81.6	2/33	15	157.9	0	0

KEY:

_____ Immediate investigation for improvement

------ Improvement desirable

2.85	2.57	65.3	54.2	17.8	24.4	7.46	4.64	4-5	4-5	4-5	4-6	4-5	4-5	4-5	4-5	0.05	5.5	0.48
2.55	2.57	67.25	48.5	15.2	12	5.5	7.01	4-5	4-5	4-5	4-5	4-5	4-6	4-5	4-5	0	6.5	1.1

TDC/V. 7.

CONFIDENTIAL

VISIT TO THE EGYPTIAN MILL FOR SPINNING AND WEAVING OF WOOL (WOOLTEX) ON 5-6-7 FEBRUARY 1983

SUMMARY

This factory is the largest wool oriented textile unit in Egypt, which is not a subsidary to a larger cotton complex. There are three individual mills, situated some distance from Cairo centre and several kilometre from each other, namely - Shubra-El-Khema mill, Moustored Mill and Embaba mill.

Acknowledgements

Chemist Mouhir Ezz El Din	-	Chairman.
Eng. Said Hamed	-	Sector Manager (Shubra).
Chemist Samir Rayad	-	General Manager Research and Quality Control.
Eng. Hamed Amir	-	Sector Manager (Moustored).
Eng. Nadia Gauda	-	Manager dyehouse.
Chemist Wafik El Gazar	-	Sector Manager (Embaba).
Eng. Salah Tawfik	-	Manager Finishing.

Introduction

Wooltex is in the public sector. The main activity is processing wool into woven finished fabric and a small quantity of knitted fabric into finished berets. The Shubra-El-Khema mill is used as the head office and has a spinning, weaving, knitting and workshop section, dyeing and finishing being done at the Moustored Mill. The Embaba mill is a complete vertical unit processing ecru tops into cloth. The estimated distance between Shubra and Moustored will be 3 kilometre whilst Embaba will be 6 kilometre.

Background Information

Shubra-El-Khema produce about 1,800,000 linear metres of woven fabric worsted and 60,000 metre woollens, Embaba approximately 1,670,000 linear metre of worsted woven fabric which gives a total production of 3,530,000 linear metre per annum, working two full shifts and a partial third 300 days per annum. Cloth weights per linear metre are between 350 - 500 gm. in 100% wool, - 85/15 wool-polyester, 40/60 wool-polyester or drylon, 50/50 wool-viscose. A 250 - 300 gm per linear metre is also manufactured in a 40/60 wool-polyester blend. There has been difficulties in selling wool/polyester blends at retail level due to the high promotion of wool mark, the pure

wool label. Providing it does not effect the indigenous production of polyester by creating excessive stocks, it will be an advantage to increase all wool production and derive full benefit from IWS wool mark promotion.

Shubra-El-Khema have 12,344 worsted spindles old cap and ring. Some of the ring are comparatively new also the drawing. No single yarn clearing done. Total number of looms 272, although several years old 100 of the looms are Saurer which are the newest. Moustored have 9,872 old worsted spindles and 182 looms, 100 of which are Saurer of the same vintage as at Shubra.

Equipment Installed

Wet Finishing - Moustored

3 - Single bowl crabbing machines - Kettling and Braun - old.
1 - 3 bowl and single steam crabbing machine - Kettling and Braun.
1 - Hydro-extracter - old.
2 - Stocks (beret milling) Kettling and Braun.
4 - Milling standared type - Raxhon - old.
1 - open width scourer - Kettling and Braun - not used.
2 - wood dolly's - old.
5 - Dolly's - Kettling and Braun.
1 - 6 draft dolly - Hemmer.
1 - Singe machine - 2 plate (copper) 2 double gas jet - Parex.

Dyeing

16 - Dye winches 4 drafts - 4 old wood not in use.
1 - Hydro - extractor.
1 - Side paddle - old - for berets - 50 kg.
1 - Overhead paddle - small-not is use.
1 - Melange machine - old.
2 - Steamers - one old - new under repair.

1 - 5 bowl backwash dryer - old type.

6 - Hank dyers stainless steel, 4-45 kg, 1-100kg, 1-200kg.

1 - Atmospheric top dye machine 50kg - Peggs.

2 - H.P. top dyeing machines - not coupled - 150 kg.

1 - Press for dye cannister top packing.

1 - Hydro-extractor.

1 - Hank dryer.

1 - Loose stock dryer.

Dry Finishing

1 - Tenter - Hunter - old not in use.

1 - Tenter pin and clip with overfeed and slot extractor - Krantz.

1 - Tenter - very old obsolete.

5 - Atmospheric decatising - 3 good Wm. Whiteley, Kettling and Braun.
Raxon - 2 very old obsolete.

2 - Rotary press - obsolete.

1 - Dewing machine - Mountford - obsolete.

6 - Shearing machines - 2 single Kettling and Braun - 4 double cutters - 2 obsolete.

1 - Cylinder and ledger blade grinding machine.

2 - Double action raising machines.

1 - Teazle raising.

2 - Open width presses - double rams - Raxhon and Kettling and Braun.

4 - Inspection machines.

1 - Rigg and rolling machine.

Wet Finishing - Embaba

1 - 2 bowl crabbing - old.

1 - Pad mangle - old.

4 - Dolly's - old.

2 - Open width Scourers - old not in use.

2 - Hydro-extractors - old type.

3 - Milling machines standared - Raxhon - Fairly old.

Dyeing

1 - Top dyeing open beck - not used old - 100 kg.

1 - Top dyeing 100 kg - old type - Belgium made - 100 kg.

1 - Loose stock dyeing machine - 200 kg - Ilma, used for tops.

1 - Hank dyer - 25 Kg.

5 - Jiggers - old.

11 - Winches - old.

1 - Hydro - extractor - old type.

2 - 2 bowl backwash dryers - old - Ilma and Fleissner.

Dry Finishing

1 - Tenter - no weft straightener or cooling unit - slot extractor - only 2 years old - Krantz - overfeed - thermosett.

1 - Single pass tenter - obsolete - Kettling and Braun.

3 - Shearing machines - old - Muller.

2 - Double blade shears - old.

1 - Decatising - Raxhon.

1 - Autoclave decatising - Biella KD - unused 2 years - requires complete overhaul - only 7 years old.

2 - Rotary press - old.

2 - Raising machines - old - not in use.

2 - Hydraulic paper presses - Italian.

2 - Inspection machines.

Modernisation

Tenders for new machines have been requested as follows:-

1) 5 bowl backwash dryer.

2) H.P. top dyeing machine - 300 kg.

in addition to others. This type of adhoc modernisation to be

discontinued and a complete review of new machine requirements to be undertaken on the outlines given in recommendations.

Problems and Trials

One of the main problems was the number of neps in dyed tops and ecru tops received from BEIDA. These varied between 370 - 2592 per kg in chrome, reactive and acid dyed dark shades in 64s - 66s quality wool. Light shades after dyeing usually had a 25% increase in number of neps over the undyed tops as received from BEIDA which are between 900 - 1500 neps/kg. Neps increase after dyeing occured irrespective of type of dye or dyeing technique. Average fibre length and number of short fibres less than 25 mm was not known. It was mentioned that the number of neps increased during the summer months.

A second problem was the waste thrown out during intersecting gilling after dyeing, the same problem was also found in the drawing section on undyed tops being used to produce ecru yarn.

A dyeing trial was set up so that samples could be drawn at the various stages of dyeing for laboratory analysis. Samples of water were also taken for the same purpose. Auxiliaries used in wet processing and dyeing were:-

Nonidet Et 143 (Shell) non-ionic detergent.

Hostapon T (Hoechts) anionic wetting dispersing agent.

Albegal B (Ciba/Geigy) levelling agent for reactive dyes.

Irgasol DAM (Ciba/Geigy) levelling agent, polyester, acrylic, wool.

Irgalon BT (Ciba/Geigy) EDTA sequestering agent.

No pH meter was available to control the dyeing operation therefore samples were drawn of dye liquor at various intervals for laboratory testing of pH at TDC. Liquor circulation speed was not known which for wool top dyeing should be about 18 litres per kg, per min atmospheric conditions.

Samples taken of top and dye liquor as follows:-

Top as received

Washed in dye vessel with Nonider 1% for 10 min at 40°C.

Washed off.

Dye with 2:1 metal complex Etgalan Black BGL. all auxiliaries pre dissolved and filtered and circulated 5 mins.

Washed in dye vessel with Nonidet.

Backwash dryer

Dye liquor samples.

Before dye addition.

5 minutes after start.

30 minutes after start.

1 hour after boil.

Tests to be carried out at TDC D and F laboratory.

Full water analysis.

pH of various dye liquor samples.

colour measurement of various dye liquor samples.

pH of aqueous extract of tops at different stages of process.

Alkali solubility of tops at different stages of process.

Oil and grease content at different stages of process.

Short fibre content at different stages of process.

Nep count at different stages of process.

Analysis of gilling waste powder of undyed and dyed tops.

After analysis of results and a conclusion reached a second followup visit will be made by the TDC and D and F department. However comments on observations made during this visit will be found in recommendations.

Two charts have been appended to show the amount of neps and thick place, which are acceptable in commercial yarns, taking into consideration, mean fibre diameter and yarn count.

Recommendations

The problems of excessive neps and waste during intersecting gilling can be attributed to many causes at wooltex.

Condition and moisture content of tops as received to be tested against international standareds for oil and moisture content.

Number of short fibres in top which will increase number of ends of fibres per given weight and on mechanical agitation increase neps.

Maintenance of equipment to be improved, machine settings, particularly faller pins in intersecting gill boxes.

Housekeeping to be improved, particularly machine cleanliness.

Operative training on correct machine settings and actual method of correct operation of machines to be introduced.

In plant quality control to be implemented on the methods already discussed.

Handling of tops in all departments and transportation requires improving, this comment applies in all departments at Wooltex.

On examination of several pieces at grey perch before finishing the assesment of spinning and weaving was very low. These departments require a lot of improvements. D and F can not be expected to produce high quality cloth from the standared of pieces received. Individual technicians at each process must be held responsible to make improvements. Quality of yarn was below any international standared if compared with Uster tables. Slubs in warp and weft were very common particularly in mixture yarns where 100% terylene while slubs 4-8 cms in length were excessive. Named selvages caused slack lists.

Modernisation

Because of the condition of dyeing, wet and dry finishing equipment at Moustored and Embaba consideration to establish a single central finishing unit at Moustored on semi-continuous equipment must be seriously studied and implemented as soon as possible. There are only a few machines worth reconditioning which may be installed at Embaba as a standby unit or preferably to process woolens and berets thereby keeping the new plant specifically for worsted and high quality woollen cloth finishing.

However, it must be realised that drawing, spinning and weaving in the long term also require modernising with consideration given to air-conditioning.

It will be advisable to obtain the services of a consultant on two short term visit, to evaluate available areas, cloth types for dyeing and finishing, required equipment to be installed, along with a material flow chart. The second visit, after the equipment is installed, to observe machine trials and establish correct machine operations and dyeing and finishing procedures and techniques.

Equipment to be considered as follows:-

Wet section

Continuous crabbing machine (Hemmer).
High speed rope scourer (Hemmer, Sellers, Zonco).
Combined scouring and milling (Hemmer, Sellers, Zonco).
Hemmer also maunfacture a continuous open width scouring range which follows the continuous crabbing machine consisting of soaping station, squeezing rollers, milling duct, dwell stage, dip sucker, hydro-extraction rollers , compensating rollers and rinsing unit.

Singeing and wet raising not considered.

Dry Finishing

Cloth drying range will follow (if fabric is not for dyeing) which should be made up as follows:- two Foulards for squeezing or chemical application, J-box for relaxation, automatic weft straightener, overfeed, drying section, heat setting section for wool/polyester and cooling zone.

After inspection a high speed shear one back two face followed by rotary press, conditioning and relaxing. The final operation will be auto-clave decatising (Biella KD, Kettling and Braun, Sellers), followed by inspection and rolling. Semi-decatising, paper press and damping machine are not considered, Transportation of cloth will be by large roll carriers.

Dyeing Section

There is a wide scope for selection of dyeing equipment, which to some extent depends on personal preference in addition to characteristics and amount of automation required. However, machine sizes should be taken into consideration after analysing lot size requirements, particularly for H.P. top dyeing and wool/polyester piece dyeing machines. For HP all wool piece dyeing equipment a soft-flow type will be desirable.

When new dyeing equipment is installed it will be worth while to have a modern dyehouse colour kitchen situated on a mezzanine floor, over looking the dyehouse. The colour kitchen will dispense dyes and chemicals and house automatic controls for all dye vessels. WIRA's pH moniter and dye liquor colour display, which allows the dyer to make additions to individual dye vessels to control pH during dye cycle will also be desirable.

TABLE IV

EXPECTED OR AVERAGE VALUES FOR THE NUMBER OF THICK PLACES PER 1 000 METRES BASED UPON THE RESULTS OBTAINED ON THE COMMERCIAL YARNS*

YARN LINEAR DENSITY (TEX)	Nm	MEAN FIBRE DIAMETER (μm)				
		18	20	22	24	26
14	79	124	277	575	-	-
16		80	179	371	-	-
18		54	121	252	-	-
20	42	38	86	178	347	-
22		28	63	130	254	-
24	40	21	47	98	191	352
26		16	36	75	147	271
28		13	28	59	115	212
30	32	10	23	47	92	169
32		8	18	38	74	137
34		7	15	31	61	112
36	23	6	12	26	50	93
38		5	10	22	42	78
40		4	9	18	36	66
44	22	3	6	13	26	48
48		2	5	10	20	36
52		2	4	8	15	28
56		1	3	6	12	22
60		1	2	5	9	17
64		0,8	2	4	8	14

* These values correspond to an overall mean fibre length of about 63 mm and CV of fibre diameter of 23 per cent as measured on fibres removed from the yarn.

TABLE V

AVERAGE OR EXPECTED NUMBER OF NEPS PER 1 000 METRES FOR DIFFERENT YARN LINEAR DENSITIES AND FIBRE DIAMETERS (COMMERCIAL YARNS)*

YARN LINEAR DENSITY (TEX)	Nm	MEAN FIBRE DIAMETER (μm)				
		18	20	22	24	26
14		40	73	125	-	-
16		31	57	97	-	-
18	48	25	46	78	-	-
20		21	37	64	-	-
22		17	31	54	-	-
24	40	15	27	46	-	-
26		13	23	39	-	-
28	32	10	18	30	49	-
32		9	16	27	44	-
34		8	14	24	39	-
36	28	7	12	21	35	-
38		6	11	19	32	50
40		6	10	18	29	45
42		5	9	16	26	41
44	22	5	9	15	24	38
46		4	8	14	22	35
48		4	7	12	20	32
50		4	7	12	19	30
52		4	6	11	18	28
54		3	6	10	16	26
56		3	6	9	15	24
58		3	5	9	14	22
60		3	5	8	13	21
62		3	5	8	13	20
64		2	4	7	12	19

* These values are considered representative of yarns comprising fibres having a mean fibre length of about 63 mm, a CV of fibre length of about 48 per cent and a CV of fibre diameter of about 23 per cent.

TDC/V. 8

CONFIDENTIAL

VISIT TO SMALL SCALE PRIVATE SECTOR CARPET YARN DYEING AND MANUFACTURING FACTORY AND YARN DYEING ONLY FACTORY ON 1-2 FEBRUARY 1983

SUMMARY

The visits were made to obtain information on the private sector. It is understood that between 25-30% of all wool imported into Egypt is consumed by the private sector carpet, knitwear and worsted manufacturers.

El-Sabbagh Carpet Manufacturers - Alexandria

Eng. Hazem El-Sabbagh - Owner.

Introduction

This firm dyes only 50 kg per month of carpet yarn in 100% wool manufactured from a blend of Indigenous and Iraq wool.

Hand knotted carpets are manufactured on two hand looms using approximately 3 kg/metre square of wool yarn, with a knot density of 16 - 36 per square centimetre. Carpets are of Oriental design in 2 x 3 - 1 x 1.5 - 1.5 x 2.2 metre in size.

Dyeing

Dyeing carried out in a copper or brass vessel in hank form by manual movement and turned on wooden sticks. Between 7 - 10 shades are normally used per carpet design. The designing is done on petit point paper.

Prior to dyeing the hanks are scoured with 1% soda ash and 1% detergent, at 70°C for ½ hour followed by a warm then cold wash.

Dyeing is carried out using 2:1 metal complex dyes, sulphuric acid and auxiliaries to pH 4 followed by washing and drying at ambient temperature.

Future expansion

1) Doubling production by two extra looms and increasing yarn dyeing to 100kg per month. Hank dyeing machine (Peggs) under consideration and moth proofing during dyeing.
2) Flat screen printing of carpets and rugs on commission basis.
3) Application for wool mark license.

El-Hedaya Dyehouse - Alexandria

Mr. Samid - Owner.

Introduction

This is a commission dyehouse dyeing all wool and wool/nylon blends in a single bath for Kelims, carpets and rugs. Yarns are made from local wool, the polyamide is manufactured indigenously by Misr Rayon - Kafr El Dawar.

Dyeing

Capacity of dyeing is 100 - 150 kg per/day in one 50 kg dye vessels for hanks, manual handling.

Dyes used are acid and chrome mainly imported from Eastern/European countries, imported by the Egyptian Government.
No scheme for modernisation or expansion.

TDC/V. 3

CONFIDENTIAL.

APPENDIX 2

VISIT TO DYESTUFFS AND CHEMICAL COMPANY ISMADYE ON 13 JANUARY 1983

SUMMARY

This factory being the only indigenous dyestuff manufacturer, a visit was made to evaluate dyes and auxillaries, which are specifically made for the wool textile industry. Particularly to observe the standared of dyes and quality control methods.

ACKNOWLEDGEMENT

Dr. Moustafa Ibrahim - Director of Quality Control.

INTRODUCTION

The factory is in the public sector and manufactures twenty two basic type acid dyes and eight chrome dyes (after chrome application) for wool. The amount is only a small percentage of the production the bulk for abvious reasons being oriented to cotton and man-made fibres. The company imports intermediates for wool dye manufacture and at present have no policy to extend their range of wool dyes.

One wetting and levelling agent for wool dyeing is manufactured ISMAWET, which is similar in character to Nekal BX by BASF. There is a new project underway to manufacture nonionic and anionic detergents which will be suitable for wool and stable to water.

QUALITY CONTROL FOR WOOL DYES

Testing facilities are excellent but the standared depth of dyestuffs being produced was variable, which could cause difficulties if not accurately assessed in industrial dyeings.

WOOL DYE USAGE

The bulk of acid and chrome dyestuffs is consumed in hosiery and carpet yarn dyeing. Chrome dyes are also used by public sector mills e.g. BEIDA and STIA, particularly for darker shades, for the worsted trade.

REMARKS

Unless more positive action is taken to manufacture at least partially produce a complete range of wool dyestuffs. The wool textile trade will always be dependent to a large extent on foreign imports and the relevant foreign exchange expenditure. The cost of imports for dyes and auxilliaries will also proportionally increase if modernisation coupled with increased production in the wool textile industry takes place.

TDC/V. 5

CONFIDENTIAL

VISIT TO EGYPITAN STARCH YEAST AND DETERGENT COMPANY ON 26 JANUARY 1983

SUMMARY

A visit was made to enquire about manufacture of auxiliaries in general, but particularly for the wool textile industry.

ACKNOWLEDGEMENTS

Mr, Ernest George Ofiesh - Production Sector Manager
Eng. Bakri M. Abou-Egla- General Manager Research and Quality Control.

INTRODUCTION

The factory is in the public sector and manufacture a limited quantity of auxiliaries for the wool textile industry. Considerably larger quantities are made, about 90% of auxiliary production for the cotton industry. However, bulk of the manufacture appears to be for the domestic market in house-hold detergents.

At the present time the company has no plans to extend their range of auxiliary products. Development work is being carried out to add an anti-corrosive agent to the Lubrostatic agent already manufactured, Because of complaints from knitting industry, in regard to rusting of equipment. There is no production of dyestuffs of any kind.

AUXILIARIES PRODUCED

Olein soap neutralized in alcohol with an iodine value of 80. The price about L.E. 0.800 in comparison to detergent price of about L.E. 2.000. Egyptol a biodegradable nonionic detergent.

Lubrostatic anti-static agent made from a mineral oil which is self emulsifiable in water. Used in wool spinning as an emulsion and in knitting as a lubricant and anti-static agent.

Espycon a wool fabric milling agent cum detergent stable to hard water.

Suplafine soft a nonionic softening agent and sublafine a cationic softener.

REMARKS

Limited interest in auxiliaries for wool, due to the small demand by the wool textile industry and their main production lines in other areas i.e. cotton textile industry and domestic market.

APPENDIX 3

BOOKS PERIODICALS AND JOURNALS

Recommendations for books periodicals and journals to be obtained as soon as possible. Providing they are not already in the TDC library Information Centre.

1) Air Conditioning in Textile Mills.
2) Carding Spinning and Dyeing.
3) Case Studies in Pollution Control in the Textile Dyeing and Finishing Industries.
4) Colour Index Volumes 1 to 6.
5) Colour Terms and Definitions.
6) Combined Scouring and Milling.
7) Dyeing and Chemical Technology of Textile Fibres.
8) The Dyers' Art.
9) Dyes and Dyeing.
10) Encyclopedia/Handbook of Materials, Parts and Finishes.
11) The Finishing of Wool Fabrics.
12) Fire Resistant Handbook.
13) Fluorescent Whitening Agents.
14) A Guide to the Identification of Animal Fibres.
15) A Guide to Sources of Information in the Textile Industry.
16) Handbook of Textile Testing and Quality Control.
17) How to find Out About the Wool Textile Industry.
18) A Laboratory Course in Dyeing.
19) Moth-Proofing of Wool.
20) Package Dyeing.
21) Permanent Setting of Wool.
22) The Production and Properties of Wool and Other Animal Fibres.
23) Stain Removal.
24) Textile Auxiliaries.
25) The Textile Institute and Industry.
26) Journal of the Textile Institute.
27) Textile Progress.

All the above are available from:

The Textile Institute,
International Headquarters,
10 Blackfriars Street,
Manchester M3 5DR,
United Kingdom.

28) Wool Handbook (in three volumes).
W. Von Bergen - Interscience.
29) The British Wool Manual - Columbine Prass.
30) The WIRA Textile Data Book - WIRA.
31) Dyeing and Chemical Technology of Textile Fibres.
E.R. Trotman - Griffin.

32) The Theory and Practice of Wool Dyeing
C.L. Bird - Society of Dyers and Colourists.
33) A Handbook of Textile Finishing.
A.J. Hall - National Trade Press.
34) Introduction To Textile Finishing.
J.T. Marsh - Chapman and Hall.

JOURNALS

35) American Dyestuff Reporter.
36) Bayer Farben Review.
37) Canadian Textile Journal.
38) Dyes and Chemical Tech. Bull (Du Ponts).
39) Effluent and Water Treatment Journal.
40) Hoechst News.
41) International Dyer.
42) International Textile Bulls - Dyeing - Knitting - Spinning and Weaving.
43) Journal Society of Dyers and Colourists.
44) Material Handling News.
45) Permac Bowe Review.
46) Textile World.
47) Wool Science Review (IWS)

APPENDIX 4

SEMINAR

DYEING & FINISHING OF WOOL AND WOOL BLEND FABRICS

SATURDAY 12 FEBRUARY 1983

MR. DONALD TERRINGTON
UNIDO ADVISER IN DYEING & FINISHING OF WOOL

Textile Quality Control Centre, Gamila Buhreid Street,
El Siouf - Alexandria on Saturday 12 February 1983.

Programme

10.30 - 10.45	Welcome and Introduction
10.45 - 11.15	Lecture No.1 Wet & Dry finishing of wool and wool blends.
11.15 - 11.30	Discussion
11.30 - 11.45	Break
11.45 - 12.15	Lecture No.2 a) Consideration for new dyeing machine selection b) Role of auxiliaries in wool dyeing.
12.15 - 12.30	Discussion.

صندوق دعم صناعة الغزل والمنسوجات
مركز تطوير الصناعات النسجية
شارع جميلة بوحريد ـ السيوف
تليفون : ٤٦١٠٣ ـ ٦٨٦٤٣
٦٨٣٤٧ ـ ٦٨٠٧٧

تلغرافيا : فونتكس اسكندرية
كيس بريد السيوف
مرفقات :

الاسكندرية فى / / ١٩

تحية طيبة وبعد

تتشرف بدعوة سيادتكم ومن ترون ترشيحه من السادة الفنيين لحضور الندوة الفنية عن " صباغة وتجهيز الأقمشة الصوفية والصوفية المخلوطة ، التى سيعقدها خبير هيئة الامم المتحدة (اليونيدو) فى الصباغة والتجهيز MR. DONALD TERRINGTON.

وذلك بمقر مركز مراقبة الجودة التابع لصندوق الدعم بالسيوف بالاسكندرية يوم السبت الموافق ١٢ فبراير ١٩٨٣ فى تمام الساعة ٩٫٣٠ صباحا ووفقا للبرنامج المرفق .

وترجو ادارة الصندوق ان تخطر بأسماء السادة المرشحين من قبل سيادتكم قبل موعد انعقاد الندوة وبأى عدد ترونه .

وتفضلوا سيادتكم بقبول فائق الاحترام ،،،

نائب
المدير العام للشئون الفنية

" مهندس / مجدى العارف "

LIST OF INVITEES.

EGYPTIAN CO. FOR SPINNING AND WEAVING OF WOOL. CAIRO.

MISR SPINNING AND WEAVING CO. MEHALLA EL KUBRA. MEHALLA.

EL NASR FOR DYEING AND FINISHING CO. MEHALLA.

BEIDA DYERS. KAFER EL DAWAR.

EL NASR WOOL AND SELECTED TEXTILE CO. "STIA".

INDUSTRIAL ESTABLISHMENT FOR SILK AND COTTON (ESCO) CAIRO.

DAMNHOUR FOR CARPETS & UPHOLSTERY.

CAIRO FOR DYEING AND FINISHING.

ISMADYE. KAFER EL DAWAR.

ORIENT LINEN AND COTTON CO.

STARCH AND YEAST AND DETERGENTS.

- INTERNATIONAL WOOL SECRETARIAT.
  9 GABALAYA STREET.
  TONSI BLD.
  ZAMALEK
  CAIRO.
  P.O.BOX 129.

SEMINAR

LECTURE NO. I

12 FEBRUARY 1983.

SYNOPSIS

Traditional finishing for worsteds, wool/polyester blend fabrics and woollens has been outlined. Faults specific to manufacture have been enumerated.

Individual finishing processes and flexibility along with possible defects and corrective measures for wool and wool blends have been explained in detail. Modern trends in machine manufacture for wool cloth finishing have also been included.

Chemical and proof finishes in addition to continuous finishing for wool/polyester blends are mentioned.

SEMINAR LECTURE NO. 1

WET AND DRY FINISHING OF WOOL AND WOOL BLENDS

Introduction

Cloth finishing is one of the most important textile processing stages as the correct application of the various techniques improves the appearance, handle and wearing properties of a fabric. New developments both physical and chemical from scientific research over the past two decades have brought improvements to the performance of articles made from wool or wool blends. These developments have enhanced the finishers skill but have not replaced it and there is today a need for greater understanding of the basic requirements of cloth finishing to produce a fabric on which these new developments can be satisfactorily applied. Finishing can be divided in general, into physical and chemical applications. However, it must be remembered that the basic raw material and subsequent processing upto grey cloth state is very important in the production of quality fabrics.

The paper gives a general outline of processes for finishing woven fabric made from woollen and worsted spun yarns in all wool or blends of wool and man-made fibres. Cloth finishing is flexible therefore the routines described may not be routines which you would choose and you may be correct as the optimum routine is dependent on the conditions of cloth

structure available machinery and services therefore processes must be adjusted accordingly.

Finishing Routines

Diagram 1. outlines finishing routine for worsted fabrics.
Diagram 2. Outlines finishing routines for wool/polyester blend fabrics.
Diagram 3. outlines finishing routines for woollen fabrics.

Batch Preparation

Pieces sorted into required number per batch in qualities and shades. Pieces which tend to roll in wet processing e.g. prunelle weaves, or are liable to running marks should be bagged, i.e. selvedges sewn together to form an endless tube. Machines are available to do this automatically.

Diagram 1.

FINISHING ROUTINES - WORSTED FABRIC

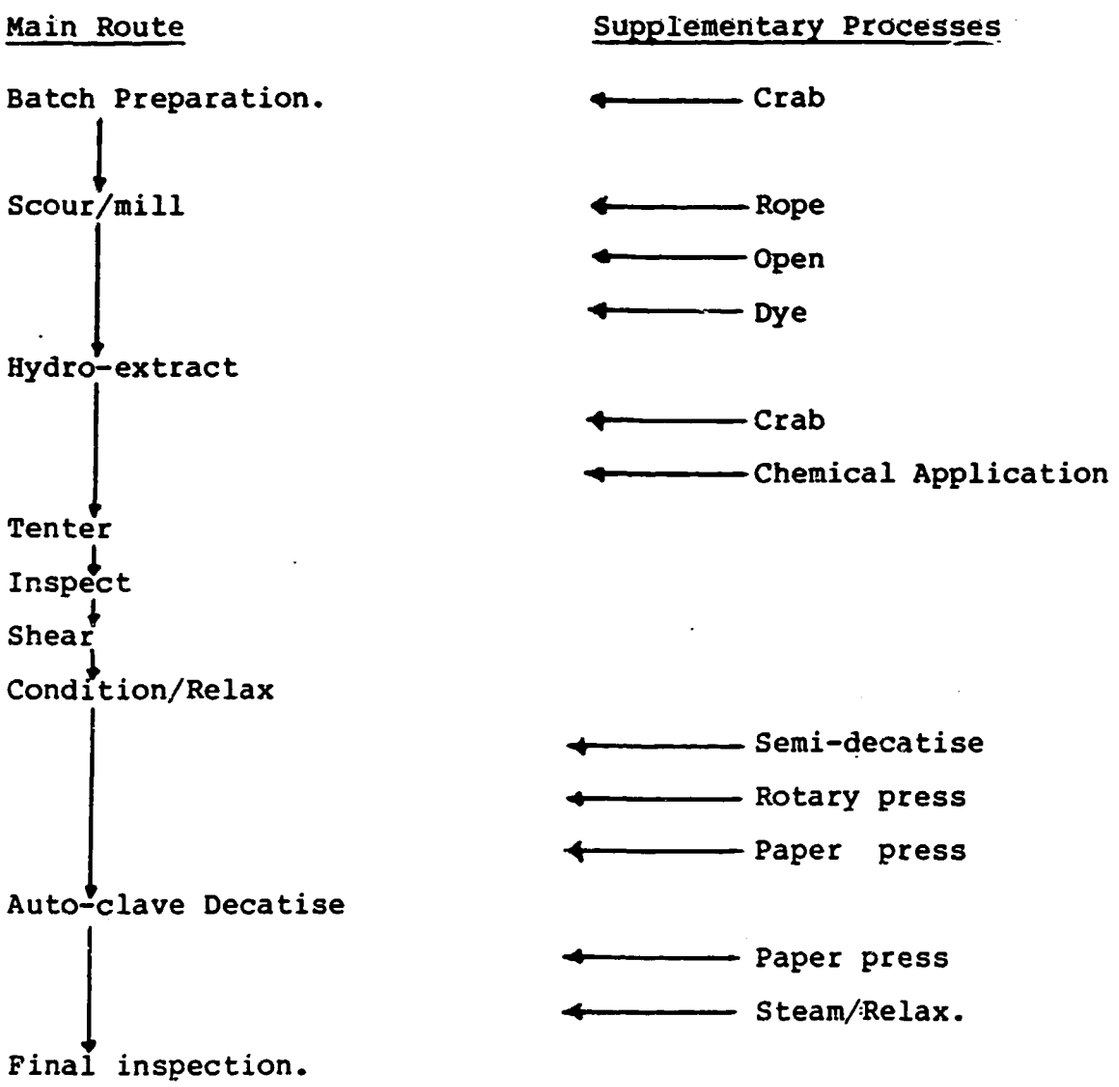


Diagram 2.

FINISHING ROUTINE - WOOL/POLYESTER FABRIC

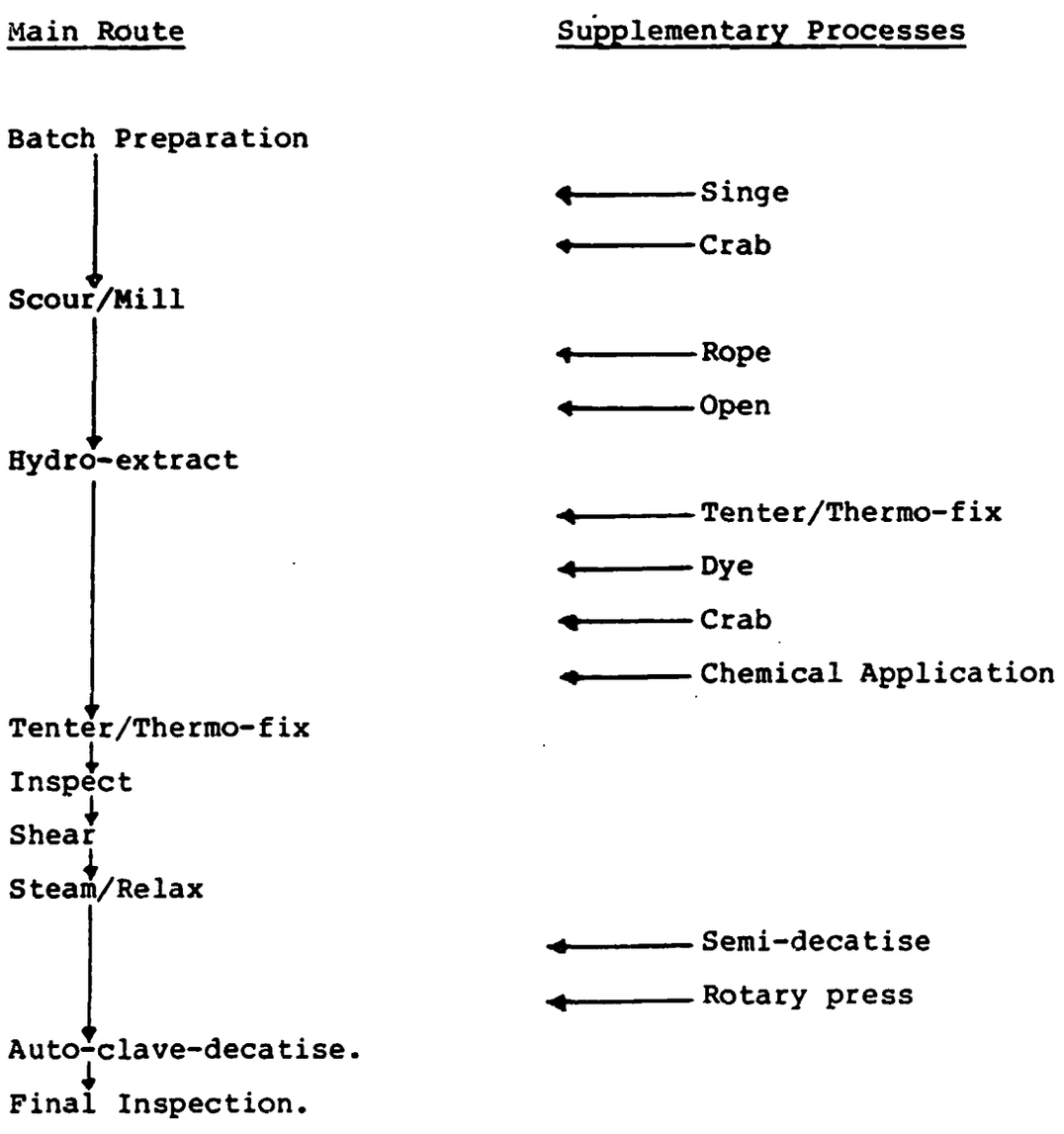
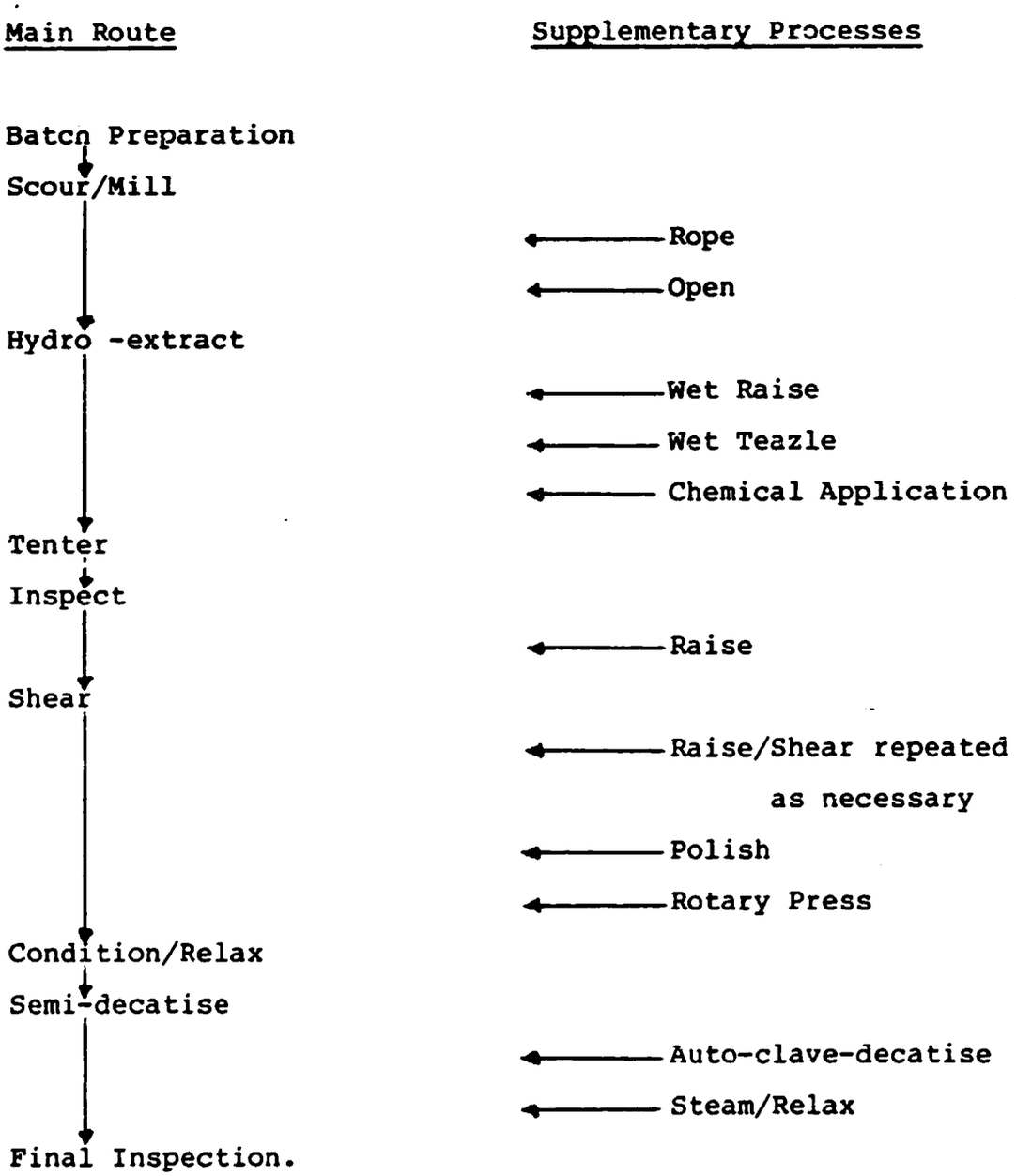


Diagram 3.

FINISHING ROUTINE - WOOLLEN FABRICS



In commission finishing fabrics are examined for faults before processing-light weigth fabrics are examined through the piece from behind in a North light. Manufacturing defects in woven cloth are:-

"Faulty interlacing"i.e., trailed in threads caused by wrong lifting of harness, bent reeds or wrongly sleyed ends.

"Thick threads"cause uneven slubbing, bad piecing or defective spinning.

"Slack threads"in warp,carless piecing or loose beaming in weft yarn running too loosely from spool or cone, shuttles rebounding or to uneven delivery of yarn.

"Tight threads" in warp careless warping caused by joining of a broken thread without the insertion of an extra pieces of yarn or by threads being caught in the eye of healds. In weft due to eneven winding or threads catching in shuttle.

"Warp stripiness" due to uneven yarns, defective warping, sizing or beaming, unevenly spaced harness or defective reeds.

"Stripes" in weft by uneven or wrong yarn ,faulty let off or take up motion unequal distribution of moisture in weft yarns, wrong picking of weft or in fine worsteds by allowing looms to stand idle for too long.

"Broken warp or weft threads" i.e. cracked stripes due to different elasticity properties of yarn used.

"Faults near edge of piece" cause bad warping, defective temples, poor selvedge construction or rough treatment resulting in tears or holes.

"Streaks" due to dirty carding.

"Marks" warp direction dirty or rusty reeds.

"Damage" due to shuttle traps.

"Holes" due to a variety of causes.

"Stains" oil (careless oiling) may contain iron.

"Mildew" due to fibre being wet at sometime and allowed to heat up (sweat) and dry slowly over a long period.

Singeing

Singeingis of two types gas flame singeing both sides of fabric at the same time and plate singeing, usually made of copper, singeing only one side per pass.With low pilling polyester/wool blends shearing may be sufficient to remove surface fibres. Fabrics having a sculptured surface effect or made from blends or single fold soft twist woollen apun yarns and worsted/mohair mixtures singeing may still be necessary to prevent pilling and ensure a fabric without surface fibres after shearing but in general singeing is no longer advised or required on wool/polyester fabrics.

Problems which may develop in singeing.

"Burns or holes" caused by stoppage or to slow passage.

"Hard beads" from polyester fibres.

"Discolouration" effect of heat on addatives in previous processes.

Crabbing

Is only necessary on fabrics in which the design would slip during wet processing e.g. plain weaves or hop-sacks made from high twist yarns and tightly set in the loom, or fabrics which would crease mark e.g. wool/mohair blend fabrics. In addition to setting the fabric crabbing also gives handle and compactness and depending or severity and tension flatness and lustre.

Crabbing can be done on a simple two bowl machine or the traditional "Yorkshire Crab" consisting of two bowls and two steaming rollers, with potting roller and water cooling tank. It is essential that the fabric is reversed to avoid ending, weak organic acids are sometimes used in crab bowls also detergents which facilitates wetting and cleansing.

Cloths which have been rope scoured or piece dyed (dyes must be fast to crabbing) very often contain creases which can be removed in tentering by increasing the stretch in the weft direction, but causes greater relaxation shrinkage. An alternative method is to use a continuous crabbing machine such as the Konticrab (Hemmer). This machine has a drum temperature of up to 160°C and effectively removes creases and has a smoothing and polishing effect on the fabric. It can also be used for setting loom state fabrics as an alternative to the equipment described.

Defects in setting operations:-

"Inadequate setting" due to use of too low a temperature.

"Listing" the piece dyes darker along the lists.

"Tendering" due to excessive tension or strongly alkaline setting liquors.

"Water marks or moire effects" due to excessive tension and weight.

"Yellowing" due to excessive alkali in crabbing liquor.

Rope Scouring

Is the preferred method of scouring for most types of woollen and worsted fabrics because it releases temporary stresses and the rollers give a compressing or squeezing action and thereby a small milling effect which produces a fuller softer handle. Open-width scouring on the same cloth would produce a thin papery handle.

Modern rope scourers are of the high cloth speed type built into a stainless steel bowl with hard wood rollers. Cloth speeds of 100, 135, 200 metres/minute are used. Slower speed for scouring the two faster speeds to give a milling action to the cloth. At the fastest speed cloth is thrown against an adjustable baffle to increase milling effect. A spiral attachment can also be fitted which enables the full load of pieces to be sewn and scoured in a continuous rope, which enables the pieces to be delivered to the next stage of processing without re-sewing and so reduces handling costs.

Defects in Scouring are:-

"Oil Stains and/or dirty pieces" caused by incomplete removal of oil.

"Loss of handle and colour bleeding" caused by scouring at too high temperature or concentrated alkali.

"Washer marks" by running in same fold minimized by cross drafting or bagging.

"Cockled pieces" caused by to in-adequate setting so distortion of desigh and structure occurs.

"Excessive shrinkage" due to excessive mechanical treatment, time of treatment should be reduced or open width scour.

"Faults by allowing wet pieces after scour to lie about to long" causing modification of dye affinity and staining because alkali migrates particularly to folds and concentration increases on drying out, avoided by neutralising after scour.

"Longtitudinal creases" may result from sewing pieces with to large a stitch.

"Curled list" redesign list.

"Holes and rub marks" caused by foreign bodies in machine or by excessive pressure of dolly rollers, which causes chaffing, can be avoided by careful work and correct top roller weight, particularly when pneumatic loaded.

"Wood stains" usually occurs in new dollys or when wood begins to rot, to be avoided by periodic examination and roller skimming when necessary.

Open-width Scouring

Although rope scouring gives the best results as regards handle, certain light weight worsted fabrics e.g. tropicals, where a crisp, open structure is desirable, gaberdines where a well defined twill is required and all pieces which would mark or crease if processed in rope form e.g. alpaca fabrics require to be scoured in open width.

Disadvantage of open width scouring is that the cloth does not receive the same compressive action as in rope form, cloths therefore tend to handle thinner. Attempts have been made to increase compressive action in open width but with little success. One of the popular machines for open width scouring is the Kontilana (Hemmer) with a full width milling trough where cloth is pushed by a piston action against the retarding effect of pressure rollers. Some milling action is produced which improves handle of light weight worsteds or wool/polyester fabrics, but is not a replacement for milling which requires anything but a small degree of consolidation.

Possible defects are similar to those itemised under rope scouring, with obvious eliminations.

Combined Scouring and Milling

Traditionally milling has been carried out as a separate operation either before scouring (greasy milling) or after scouring (soap milling) or incertain cases acid milling , in which case a washing off process must follow, which is labour intensive and requires much handling. These problems have been overcome for most fabrics by the use of combined scouring and milling machines.

The machines usually have three cloth speeds and rollers have adjustable pressure to give a squeezing action when required. Automatic cycle controls are usually fitted as standard.

In this type of machine scouring will first take place at a cloth speed of 100 m/min with no pressure on milling lid, followed by rinsing then squeezing at the slow cloth speed of

70 m/min by applying pressure to the front rollers. A milling agent is added and milled at cloth speed of 150 m/min with pressure being applied to the lid. Machine capacities vary between 200 - 600 Kg of dry cloth.

Savings in process time up to 50% are obtainable and results comparable as regards clean-liness and handle with those obtained by conventional processing. Only in cases of exceptional heavy milling e.g. army great coating, heavy meltons, billiard cloths would it be necessary to use a conventional milling machine.

Defects in milling which may occur in combined scour/mill but certainly in standared milling are as follows, scouring faults already itemised may also occur in scour/mill.

"Mill riggs" are streaks running length ways but not necessarily parallel, caused by cloth becoming permanently creased promoting local milling in the folds. May arise from excessive pressure on the rollers or over-filling machine, prevent by bagging or frequently open-ing and shaking the cloth. May also be removed by tentering then dry raise on gig (teazle) and milling stocks.

"Chafing marks" caused by cloth being trapped between inside at top roller or excessive pressure and rollers slipping over cloth.

"Shade defects" caused by blowing steam directly onto cloth when endeavoring to maintain high temperature during milling operation.

"Uneven milling" due to uneven distribution of milling liquor.

"Colour bleeding" fast to milling dyestuffs should be used.

"Cockled pieces" arise from presence of wrong yarns i.e. different composition twist or count have different shrinkage and give rise to irregularities.

"Curling lists" due to wrong construction of selvedges or excessive milling.

"Stains" arise from alkali migration, mildew, iron etc., as in scouring.

Rope Opening and Hydro-Extraction

The Traditional way of removing excess water from wool piece goods was by centrifuge. The modern approach is to open the fabric mechanically to full width when previous processed in rope form and pass it over a suction slot or through a foulard. Efficiency of suction slots is dependent on fabric perosity and density therefore the preferred water extraction method for woollen and worsted fabric is a full width foulard with rubber squeezing rollers and a chemical impregnation trough.

An important point is that the extraction efficiency of the foulard is increased by first passing the cloth through the trough containing water at 70°C. This lowers the viscosity of the water which is then squeezed out more easily. The heat energy used in hot padding is more than compensated for by saving in heat energy during drying process, because of reduced amount of water to be evaporated.

Defects should be minimal in this operation and limited to mechanical damages and stains.

Cloth Drying

A cloth drying range should be made up as follows:-

a) Foulard for squeezing out or chemical application.

b) J-box for relaxation.

c) weft straightener.

d) over-feed.

e) Drying section.

f) Heat setting zone.

g) cooling zone.

Foulard for squeezing has been described above, but it should be noted that when frequent chemical applications have to be made, it is necessary to have two foulards in-line.

After squeezing, the cloth should be relaxed in a J-box which should hold about 500 m of fabric. At a drying speed of 20m/min this will allow the fabric to relax for 20 mins and is useful to remove the tensions which may cause distortion of the design along the length of the cloth.

A weft straightener should be installed before the cloth is fed into the tenter, which is usually done by running the cloth over a convex and concave roller system. The rollers can be adjusted to apply a restraining action on that part of the cloth which is distorted.

In addition to relaxation the drying range must include overfeed, 6 - 8 % over-feed should be applied as this completes the relaxation and helps to further remove any distortion.

The traditional dryer for woollen and worsted fabrics is the multi-layer tenter. The machine is built up in sections of 3m long containing 6 layers of cloth. Drying capacity of each section for cloths of 500gm/m 150 cm wide is about 200 Kg/h per section.

The number of drying sections to dry the production of a mill can be calculated by assuming the weight of water to be evaporated is equivalent to 50% of the dry weight of cloth e.g. a mill produces 2 million metre/year fabric weighing 500gm/n linear equivalent to 1,000,000 Kg working 2000 h/year will have to evaporate.

$$1{,}000{,}000 \times 0.5 \div 2000 = 250 \text{ kg/h.}$$

allowing for 70% efficiency and about 10% re-runs the required capacity will be.

$$250 \div 0.7 \div 0.9 = 400 \text{ kg/h evaporation.}$$

Therefore a 2 section 6 layer machine would be required.

If wool/polyester fabrics are to be processed, thermo-fixation will be necessary, this is usually carried out by increasing the temperature of the bottom two layers either by electricity or oil. The heat setting required conditions are 170 -180^{o}C for 20 - 30 seconds. It is important that the cloth is evenly and properly dry before entering the heat setting zone. The drying and heat setting sections should be followed by an efficient cooling section.

The steam consumption of a multi-layer tenter is usually about 1.8 kg steam for 1.0 Kg of water evaporated.

Drum dryers are avaliable in which cloth passes over a perforated drum which is connected to or contains a suction fan. These have good thermal efficiency providing the denisty of cloth does not excessively restrict the air-flow.

Drying Controls

are available which regulate the speed of the tenter according to whether the cloth is too wet or too dry. These work satisfactory on light weight man-made fabrics blends where the

initial moisture content is low and the cloth requires drying to zero moisture content.

All wool cloths require drying ideally to 15 - 16% of moisture, but this is difficult to obtain without unacceptable variation in the moisture content across or along the length of the cloth, which will eventually cause variation in finish. It is usual practice to over dry the cloth to about 10% moisture content to be certain of level results.

Most controls system work on the principle of measuring the resistance of the dried cloth to an electric field, which varies according to moisture content and converted to read moisture content % and is used to control cloth speed. A development by WIRA measures the difference between cloth temperature and a wet bulb temperature of the atmosphere within the drying machine both measurements being made near the exit of the machine. It has been established that when cloth temperature is 8°C higher than wet bulb temperature the equilibruim relative humidity is 60% and the wool cloth will have a regain of 15% $\pm$ 2%. This relation ship holds good for all fibres both natural and man-made. Electric signals from the temperature probes are subtracted and the resultant temperature difference is fed into an automatic cloth speed control.

Defects in drying:-

"Baking of cloth" resulting in loss of handle and possibly in yellowing.

"Damaged cloth" usually because cloth comes off pins and/or clips during tentering.

"Marks from tenter pins" advisable to use stainless steel minimum size compatible with strength to handle the heaviest cloth.

"Scorch marks" due to insufficient tension and sagging cloth coming in contact with heating units.

Shearing

Shearing of worsteds fabrics is best carried out on a machine having three shearing heads with the first cylinder operating on the back of cloth and two on face. On modern machines speeds up to 50 m/min is possible which require automatic lifting of cylinders. Only one passage is necessary on most worsted or wool/polyester fabrics providing the shearing heads are well maintained. For the personal directly concerned with shearing machine grinding a special instruction hand out is available.

Modern shearing cylinders are of large diameter with 24 spirals rotating at 2000 rpm giving 48,000 cuts/min. The beds are either hollow or solid or a combination of each or speciality beds. Hollow beds allow knots on the underside of the cloth to pass under the ledger blade and shearing cylinder without damage.

A problem exists in shearing fabrics woven with tuck-in selvages to avoid damage of the thicker selvage. This can be over-come by using a sliding bed which can be moved to clear one selvage whist the other is run clear of the cylinder. A newer development is the piano bed in which segments of the bed over which the selvage runs can be lowered automatically.

Cutting defects are as follows:-

"Lean cloth" due to excessive cutting.

"Poor appearance" - Due to inadequate setting up of cutting head.

"Holes" - Due to knots or thick places in cloth.

"Damage" - Usually because piece end stitching caught in ledger blade or piece has run slack.

"Marks across piece" - due to starting and stopping machine and dirty ledger blade.

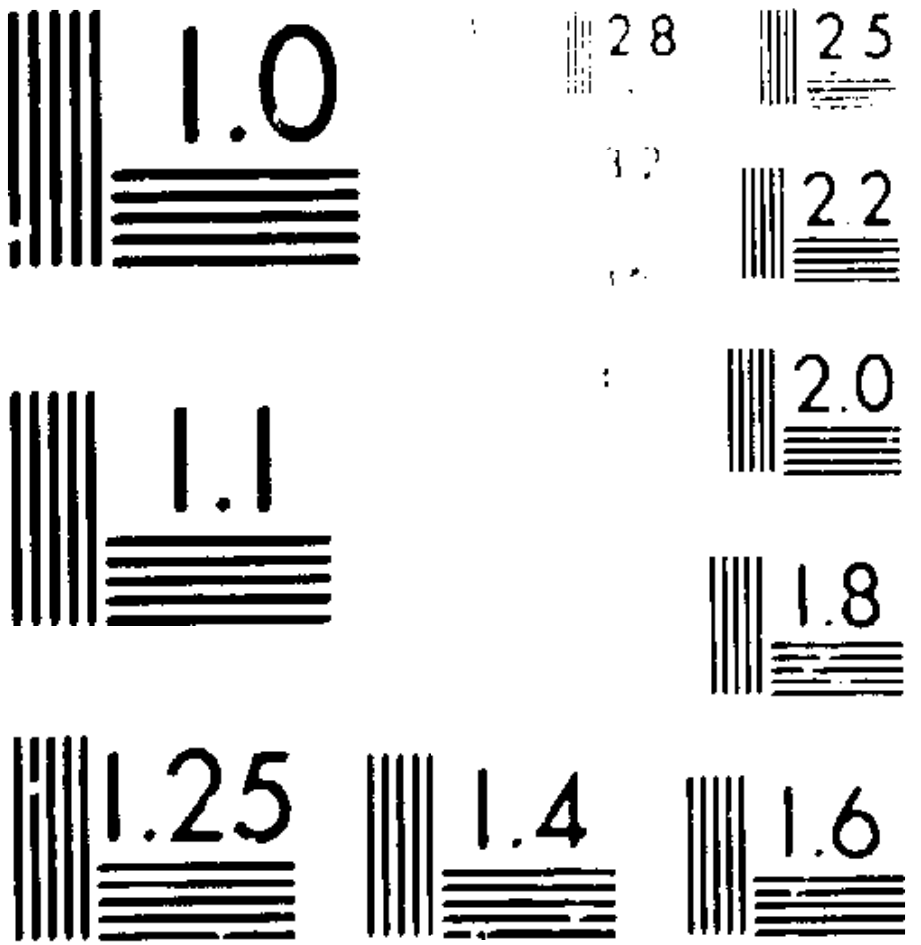
"Uneven cutting" - due to taking deep cuts, dull cutting parts or uneven distribution of moisture or grease in piece.

Raising

Raising today is generally done on double-action machines with 24 rollers. The Lower production teazle raising machine is only used on special fabrics e.g. high quality face cloths such as billiard cloths, metal teazle are replacing natural ones.

The double action machine is usually run in tandem with one machine raising one side of the fabric and the second machine either the same side or the reverse side, done through different threading arrangement.

Pieces can be raised either wet or dry or a combination of either. Dry raising is preferred as regards ease of handling but to obtain the best finish on certain fabrics e.g. fine velours, drawn or moss finishes, wet raising is necessary.


1.0
2.8
2.5
2.2
1.1
2.0
1.8
1.25
1.4
1.6

Defects in raising as follows:-

"Streaks" - caused by uneven tension in warp or weft threads as it produces surfaces of different raising susceptibilities, may also be due to poor teazle setting.

"Damaged lists" - often due to curling or badly designed selvages.

"Uneven raising" due to unequal distribution of moisture or dirt which alters the raising power of various parts of the fabric.

"Over raised and under raised" - due to creasing.

"Weak cloth" - due to over treatment.

"Uneven pile" - raising to rapidly.

Napping process is applied to fabrics previously raised and whose dense pile has been cut level. Consists of rubbing the cloth between two surfaces, lower plush covered and fixed, upper rubber covered and heavily weighted and moving with a reciprocating or rotary motion according to type of finish required.

Certain types of fabric piles are made more attractive by increasing their lustre. In brief cloth passes over a positively driven felt blanket which holds it against a revolving heated ridged roller which polishes the fabric.

Rotary press

The rotary press can be used for giving a final press to woollen fabrics, but length wise stretch by too much tension and pressure will cause excessive relaxation of the cloth during making-up.

Rotary press also dries out the cloth to some extent but modern machines are fitted with conditioning units to replace the moisture and relax the fabric. This type of machine is suitable for smoothing wool/polyester cloths and some all worsted fabrics before subsequent setting processes.

Defects are usually crease nips, glaze marks through slippage, damages and over and uneven processing.

Relaxing and Conditioning

It is important that wool or blended fabrics are relaxed before the final setting process or problems will arise in making-up and wear of the garment. Many machine types are available but the most suitable are those in which the cloth is steamed in a relaxed condition while being transported on a horizontal supporting table or moving belt.

Wool fabrics should be conditioned to have 14 - 15% regain a too high regain will give a stiff boardy handle during decatising, too low regain will give a thin handle with reduced set. Suction drum machines are available for adding moisture to the fabric but have a low production and moisture addition. The preferred conditioning is by spraying but the conditioned cloth should be allowed to rest 2 - 4 hours and covered over to allow absorption of the moisture into the wool fibre.

Defects should be minimal during this operation.

Decatise

Three systems are available:-

a) Semi-decatising (batch).

b) Semi-decatising (continuous).

c) Auto-clave decatising (batch).

Semi-decatising operates at atmospheric pressure and is suitable as the final finishing process for some woollen fabrics. Degree of set is only moderate. Several machines are available for continuous semi-decatising and give comparable results, but feed cloth tension free without elongation and are suitable for woven or knitted fabrics.

Full or auto-clave decatising machines operate with an over pressure of about 1 atmosphere at temperatures up to 120^{o}C and in some cases above. Finish obtained is permanent to normal tailoring processes, but care must be takem not to produce excessive shine. Steaming time should be 2 - 4 minutes and steam flow outside to inside of the roll to prevent condensation and to give more efficient steaming.

To reduce the risk of yellowing because of the high temperature pieces should have 14 - 15% moisture content and at pH 6.5 - 7.0 slightly on acid side. If too acid the setting effect is reduced. White or pastel shade pieces can be pretreated with an optical brightening agent of the type which react only at temperatures above 100^{o}C e.g. photine HV (Hickson and Welch U.K.).

Defects in decatising which occur are mostly permanent, therefore should be avoided. Main faults arise from use of wet steam and uneven treatment. Pieces should be reversed i.e. blown twice to avoid ending. Insufficient tension on fabric will produce poor setting, lustre, and wavy appearance,

excessive tension will give cloth a papery handle. Short wrappers give rise to uneven results due to local escape of steam and excessive local action. Metal stains are quite common and arise from interaction of metal compounds and sulphur compounds formed during decatising.

Cloth boiling

Production of lustrous surface by boiling essential for several wet raised cloths such as beavers. Too expensive for low cost fabrics and decatising is substituted. Fabrics, usually after wet raising wound onto rollers, covered with cotton wrapper top and bottom. Piece must be straight selvage over selvage, roll then placed into a tank fitted with steam and water supply and exit. Acetic acid 1 part to 500 water added at 70°C. Treatment carried out for 12 hours after which roll is removed and allowed to cool naturally. This may be repeated as required for high class fabrics, depending on lustre required. Cloth may be decatised before boiling to reduce the number of boilings. Many face cloths are dressed between boilings.

Paper Press

Traditionally in England worsted mens wear fabric were paper pressed at 30 - 45°C and hydraulically pressed for two periods of 8 - 10 hours. Paper pressing gave a firm, smooth, lustrous (not shiny) finish, but was applied at low temperatures. Any heat application e.g. Hoffman press in excess of the press temperature removed most of the benefits obtained. However paper pressing was a point of sale between mill and merchant. Today the bulk of mens wear wool cloth goes direct to garment factory and the aesthetic benefits of paper pressing are neither required or appreciated.

Paper pressing is still used on high quality suitings intended for markets where cloth is bought in suit lengths, and where cloth is bought in lengths and handle and appearance are still a major selling point. The static press was superseded by the intermittent press which produced similar results. It is unlikely however that any new finishing installation would include paper pressing unless aimed at a specific market as mentioned above.

One of the main reasons for the decline of paper pressing was the practice of "spongeing" done in N. American countries to remove all relaxation shrinkage before tailoring, but what it effectively did was to remove all the finish so carefully applied by the finisher. To over-come this it was necessary to apply a more permanent finish and this led to the modernisation and for their development of auto-clave decatising (which in fact had been done in late 1920's) and paper pressing became obsolete except in special circumstances.

Chemical and Proof Finishes

Chemical and proof finishes have come into vogue over the pass two decades, which is an extensive subject in itself, therefore only a brief outline will be given in this paper.

Shrink-resistance and dimensional stability i.e., anti-felting processes have been developed over many years, mainly for knitwear although flat setting on woven fabrics using sodium bisulphite on presensitising with monoethanol amine sulphite has been done in the past for handle, stability and creasing. Oxidation treatments based on permonosulphuric acid or dichloro-isocyanuric acid (DCCA) are most commonly applied to tops by continuous processing in pad-mangle-batch or by batch

exhaustion methods to knitted garments or to woven or knitted piece goods. The latest development for top continuous process S/R is the IWS Kroy/Hercosett process, using gaseous chlorine prior to a back wash dryer which is used for anti-chlor treatment, rinsing, Hercosett resin application and so-oftener bowl followed by drying.

Additive S/R processes using resins such as Synth-appret LKF (Bayer) Zeset TP (du Pont) which may be applied from organic solvent, LKF also from aqueous emulsion are also available.

Moth-proofing processes are comparatively simple and providing the cloth is dyed can be an additive in the latter part of the dyeing operation. Dielmoth (Shell)Mitin LA (Ciba/Geigy) Evlan (Bayer) Mystox (Catomance) are extensively used.

Water, oil, and soil repellent finishes can be applied to wool collaboration with the various chemical manufacturers is desirable.

Although wool is naturally flame retardant flame-proofing processes have been developed using titanium and zorconium complexes applied by batch or continuous processing, before, after or concurrently with dyeing at the boil, or by the use of fluorides as complexing agents instead of citric acid at temperatures as low as 50^{o}C. The national IWS office may be contacted for details of application.

Wool finishing in the future may slowly move away from traditional pure finishes on certain fabrics to those conferring easy-care properties. Technologies are already available to enable the finisher or wet-process-or to satisfy this demand, although improvements are continuously being made, with regard to easy-care and cheapness of application. Therefore cloth

finishers must keep themselves updated on all aspects of finishing particularly easy-care processes and chemical finishes.

Continous Finishing

It is a technically feasible proposition for worsted fabrics to be continuously finished, machines are available to carry out the processes. However such an installation would inevitably lead to lack of flexibility, which is still very necessary in view of the wide variety of fabrics in relatively short runs that are presently produced by the wool textile industry. Flexibility has already been mentioned in the opening paragraphs of the lecture. Continuous finishing will require long runs 1000 m/h or more of standared fabrics to be successful.

A continuous finishing range should be arranged so that fabric can be run from section to section on rolls in large batches without any intermediate break, but at the same time it should be possible to run each section separately when required. In this way the plant can also be intermittent - batch wise according to available fabric and required processing conditions. The economic advantages and the opportunity to include complete automatic control make a continuous finishing plant a very attractive proposition. The following is a section-wise outline of continuous processing for wet and dry finishing for wool/polyester mens wear fabric 300-500 gm/m.

Section 1		Production
2 operators	Batch preparation	1000 m/h
Section 2	Wet Processing	
1 operator	soaping.	1000 m/h
	Washing.	
	Rinsing.	
Section 3	Drying	
1 operator	Pad-water extract	1000 m/h
	Pad-finish application	
	Relax - J. box	
	Dry	
	Thermo-fix.	
	(Dyeing if required).	
Section 4	Inspection	
2 operators		1000 m/h
Section 5	Shearing	
1 operator		1500 m/h
Section 6		
1 operator	Rotary press	1000 m/h
	Condition	
	Relax.	
Section 7	Auto-clave decatise	1000 m/h
1 operator		

Total machine operators	9	)	
Chemical dispensary	1	)	
Internal transport	2	)	per shift
Maintenance	2	)	
Supervisor	1	)	
Manager	1	)	
Total	16		

Working 1 shift per day would produce approximately 2,500,000 linear metres per annum.

NOTE

The names of machine makers referred to have been given as examples only. Other machine makers whose names have not been mentioned produce machinery equal in performance to the ones mentioned.

SEMINAR

LECTURE NO. 2

12 FEBRUARY 1983

SYNOPSIS

Considerations necessary in addition to flexibility and economics for selection of new modern wool dyeing equipment has been outlined.

The role of auxilaries in wool dyeing has also been included in lecture No.II b.

SEMINAR LECTURE NO. IIa

CONSIDERATIONS FOR NEW DYEING MACHINE SELECTION

Introduction.

When assessing advanced technology in the wool textile processing industry there are three major considerations:-

1) To improve cost effectiveness by increasing output at less cost per unit of production without loss of quality.

2) To provide more effective use of man power in producing more to at least the same quality standards.

3) To conserve energy and resources by using less, particularly water. Apart from the economic benefits of treating less effluent, there is the benefit of decrease in pollution.

Developments

Keeping these objectives in mind pressure dyeing machines for processing textile fibres and yarns in many forms have been developed. A pressure dyeing machine is one in which textile materials other than fabric are loaded in a carrier,held stationary and through which dye liquor is circulated by means of pump pressure. The standared model consists of a pressure Kier and liquor circulation system. It is sealed from the atmosphere and pressure applied to the whole system so that liquor temperature can be raised up to 140^{o}C irrespective of altitude. These machines are inherently suitable for dyeing and in most cases bleaching the following textile materials using appropriate carriers.

1) All types of natural and synthetic loose material and staple fibres. Dyed in pack cages prior to subsequent processing and spinning. Complete mechanised loading and handling is available for this type of dyeing.

2) Continuous filament acrylic or polyester tow prior to stretch breaking, polyester or blended worsted yarns again using pack cages.

3) Combed or carded sliver in ball or coiled top prior to gilling, drawing and spinning into worsted yarn.

4) Yarns of all types natural or synthetic or blended fibres in many package forms! - cheeses, conical packages, soft muff package of high bulk yarns, texturised continuous filament, packages of open-end spun yarn, and repco spun yarn, warp beams of cotton, viscose, cotton/polyester blend yarns and large packages of all types of carpet yarn approximately 2 - 2.5 Kg of yarn on each cone, cheese, or muff.

Economics

Economy in processing is by the combination of reduced liquor ratios, high liquor flow rates and simplicity of design giving ease of operation and control, e.g. traditional methods of hank dyeing requires liquor ratios of 16 : 1 for heavy carpet yarns in large machines, and for other yarns ratios around 30 : 1 . The latest machines are designed to operate with a variable liquor level.

a) Low level 2.5 :1 when dyeing heavy high density packages, at ratios 3 : 5 or 4 : 1 with bulky spun yarn packages and without exceeding 4.5 : 1 for the longest liquor ration when package dyeing.

b) In some cases it is advisable just to cover the material carrier with liquor when ratio is still about 6 : 1 to 8 : 1.

c) For some applications fully flooded operation with the pressure kier filled with liquor the liquor ratio is then 9 or

10 :1 change from one mode of operation to another should be made in seconds by means of one value and one switch.

Use of low liquor ratios reduces consumption of heating energy by more than 50% and water and chemicals by 60 - 70% with proportional reduction in filling and draining times.

Operations

Rapid and accelerated dyeing programmes are achievable which are level dyed because of the rate of liquor flow through the material. With full flooded operation, the rate of flow will be in the order of 40 litres/min/kg and the complete processing bath circulated through the material 4 or more times each minute. With small volume liquor circulation is 12 times each minutes without using larger pumps or higher horse power motors. The high bath circulation is the basis for obtaining quicker and rapid dyeing programmes. Increased rates of liquor circulation facilitate faster rates of temperature rise and less time at the dyeing temperature to achieve levelness, thereby shortening the dyeing cycle. This saves electric energy and increases production.

The total dyeing cycle depends on the fibre types or combination of dyes in accordance with normal dyeing requirements. With rapid dyeing techniques dye cycle can be as low as 60 minutes on texturised polyester yarns. On the other hand with complex dyeing processes with multi-stage baths and finishing treatments the total cycle could be 5 hours e.g. dyeing of polyester: cellulosic blended yarns with the combination of disperse and reactives.

Selection Requirements

High pressure dyeing machines should have the following characteristics:-

1) Integral arrangements between kier and pump with as slow as possible rotation of impellors, a flow reversal system and material carrier seating.

2) Anti-turbulence flow diffuser for even distribution of flow throughout the system and arrangement to ensure correct pump performance at very low liquor levels.

3) Control valves for rate of flow, pressure and also for rapid filling draining and washing.

4) Full volume stock/expansion tank.

5) Controls for volume of processing bath.

6) Safety interlock sampling facilities.

7) Indirect heat exchanger for heating and cooling.

8) Remote operated pneumatically actuated valves .

9) Safety interlocked pressure cover, lifted and lower pneumatically.

10) Mixing/ heating system for preparing complete dye-baths for low liquor operation.

11) Automatic control systems (fully).

12) Facilities for operation with reduced batch loads and reduced liquor volumes.

General

When fully automated it is normal to utilise a dye kitchen for

each machine and in which location (usually a mezzanine floor) colour or chemical solutions are prepared in dispensary tanks in advance of the next dyeing and machines are kept virtually in continuous operation without any delays normaly associated with manual supervision. Size of machines varies 50 - 1000 kg. with single or multi-deck material carriers. High pressure dyeing machines can be coupled in pairs for flexibility.

If a colour kitchen is envisaged consideration should be given to install the WIRA pH monitor which enables, depending on unit size every dyeing machine to be checked instantly at any time at a central point. Liquor colour display is also available which enables dyer to watch dye exhaustion, optional printer gives permanent record of dyeing conditions using an automatic monitor sequence. I believe an adviser on Instrumental colour systems has already provided information on this subject, but a standared colour program suite would complete the dyehouse colour kitchen.

When blends of wool/polyester piece dyes are considered it is an advantage to dye at a higher temperature than 100°C or there abouts and a jet dyeing machine is required. Wool/polyester fabrics can be dyed at 108 - 110°C with savings in carrier, cycle time and gives similar strength, abrasion and wearing properties to fabrics dyed at just below 100°C for longer dyeing times in atmospheric winch. Jet machines are not generally suitable for all wool fabrics because of velocity of dye liquor. This has been overcome to some extent in soft flow machine types, in which cloth is circulated by a small winch and liquor over flow duct carrying the cloth with it.

Note

The names of machine makers referred to have been given as examples only. Other machine makers whose names have not been mentioned produce machinery equal in performance to the ones mentioned.

SEMINAR LECTURE NO. II b.

ROLE OF AUXILIARIES IN WOOL DYEING

Introduction

The role of dyeing auxiliaries in general is not well understood for several reasons:-

a) It is difficult to assess the performance or strength of auxiliaries, this being in marked contrast to the situation with dyes which have the easy discernible and differential property of colour.

b) There is no authoritive guide to textile chemicals as for example a companion publication to the colour index. In fact this would be very difficult to produce, due to the wide spread use of complex mixtures and variations in active content. The dyer therefore has no reliable guide to the chemical nature of individual products or to which products are similar.

c) There has been very little work published on the action of auxiliaries. Further-more, possibly resulting from the dearth of published work, textile chemicals and their properties do not usually figure strongly in the formal education of dyers and textile chemists.

d) The action of many auxiliaries used in dyeing can be explained in fairly simple terms which however inadequate in relation to absolute truth or even modern dyeing theory, can be used to predict to the action of a given product or select the right product for a given problem.

Therefore this presentation hopes to explain something of the action of the more common types of textile chemicals encountered in wool dyeing. Show that it is possible to assess the performance of these "colourless" products and

'that the selection of a given auxiliary in a particular situation owes more to science than magic, at least some of the time.

Level Dyeing Assistants

The common faults encountered in the dyeing industry are off-shade, inadequate fastness and unlevelness. Probably unlevelness represents the biggest problem. A dyeing is said to be unlevel when the material does not exhibit the same depth or shade over the whole of the material, skitteriness is commonly experienced in wool dyeing. The causes of unlevel dyeing can be subdivided into two groups:-

a) Material faults.

b) Dyeing and processing faults.

a) Material Faults

Foreign matter on the material such as soaps, fats, waxes, finishes, sizes, etc. can impede dyestuff penetration and cause unlevel dyeing. Variations in the substrate both in blends of different fibres or with wool fibre which are inherently of heterogeneous composition can lead to skittery dyeings. Uneven action of chemicals i.e. carbonising and chlorination of wool and physical influences such as light, heat and mechanical damage in preceding processes can also result in unlevelness.

b) Dyeing and Processing Faults

The dye itself plays an important role in levelling. Factors which are important are solubility, sensitivity to hard water, affinity, diffusion and migration properties. Some of these properties change with pH, temperature and electrolyte concentration all of which therefore require control. Unlevelness is often associated with the inherent nature of machinery, certain machine variables,

foaming or over loading. Even with optimum conditions in respect of machinery and loading, it is often impossible to obtain satisfactory levelness without using some dyeing assistant.

Control of Levelness in the Dyeing of Wool

In order to obtain level dyeings it is necessary to either control dye up take so that exhaustion occurs gradually over an extended period or to promote migration of the dyestuff, after initial adsorption, from areas of high dye concentration to areas of low dye concentration. There are several ways to control the rate and levelness of dyeing. To employ a slow rate of temperature rise and a controlled change in pH from conditions favouring dyeing solution, to conditions favouring dye on fibre, thus controlling the rate of exhaustion. Auxiliaries can be used which have affinity for the fibre and compete with the dyestuff for dye sites on the fibre and therefore reduce the rate of dye uptake.

Nonionic or cationic auxiliaries have affinity for the dye and will form a weak complex with dyes in solution, thus reducing dye mobility and in the case of cationic products, partially neutralising the electro-static attraction of an-ionic dye for wool. These products, particularly the ethoxylated amines, which combine cationic and nonionic properties, are the most important auxiliaries for controlling the rate of dye uptake on wool.

Control of Dye Uptake

To test the effectiveness of levelling agents a method was developed in which dye liquor is circulated in one direction, through a compact column of fabric discs. The liquor is heated indirectly by an ethylene glycol bath and the column of fabric discs compressed in a metal cylinder by a threaded insert to

give a constant density and resistance to flow. Dyebath conditions such as liquor ratio , temperature, speed of curculation etc. are variable and the effect of different additions can be assessed from the penetration column.

This slide shows the effect of increasing concentrations of Lyogen WD on the level dyeing of an acid milling combination. The discs shown have been taken from the dyed column of discs at equal intervals along the lengths of the column. W.D is an ethoxylated amine and in absolute terms is weakly cationic. In the context of levelling agents it must be considered moderately to strongly cationic and whilst Lyogen W.D and products like it are ideal for reducing the rate of dyeing and increaing combinability of chrome or acid milling dyes, it can cause precipitation with certain premetallised dyes.

These disc dyeings show precipitation of Lanasyn Grey N-L and Lanasyn Dark Violet R L Premetallised dyes by Lyegen W.D. as seen by the high concentrattion of dye at the top of the column compared with dyeing from no auxiliary. No such precipitation is experienced with Lyogen MS a highly ethoxylated amine with weakly cationic properties, and strong micelle forming ability which therefore enhances dyestuff solubility.

This slide shows the impaired alkaline perspiration and wet rubbing fastness of 1% Sandolan Milling Red N-6B when dyed with Lyogen W.D. or a typical amphoteric product as used for reactive dyeing of wool, Lyogen MS in contrast has no adverse effect on fastness.

So it is apparent that the best products for level dyeing with premetallised or acid milling dyes are long chain polyethoxylated amines like Lyogen MS with more acid dyeing dyes e.g. chrome dyes products like Lyogen WD type are more suitable as the more cationic products are effective at lower pH whereas less

cationic products are not. Lyogen WD type products can also be used with acid milling dyes and are particularly effective with relatively incompatible dyestuff combinations. Lyogen WD can also be used to dye milling dyes from more acid conditions than is usually recommended which reduces wool damage and yellowing.

Prevention of Skitteriness

Where coverage of tippy wool is the main problem the type of auxiliary selected may be different. Although cationic surfactants all improve coverage of dyeability variations, it is often necessary to use specialised products. The cause of skittery dyeing of wool lies in the action of light and weather on the tip of the wool fibre while it is on the sheep's back. This partially removes the epicule or outer sheath of the fibre which is hydrophopic and usually impedes the penetration of hydrophilic dyes into the wool fibre.

This is a schematic representation of a wool fibre and the initial penetration of a hydrophilic acid dye at the damaged fibre tip. Acid levelling dyes, however, migrate at the boil and therefore finally produce a non-skittery dyeing. A hydrophilic (polysulphonated) acid milling dye, however, does not migrate and the initial unequal penetration of the fibre results in a final skittery dyeing. The main effect with a straight shade of a single dye is a reduction in the colour yield but if a hydrophilic dye is dyed in combination with, for example, a more hydrophobic dye like the monosulphonated milling dye represented here, then the effect is to give two colours - this is called positive dichroism.

Wool reactive dyes represent aspecial case in the story of tippy wool, they are usually di or tri sulphonated (therefore very hydrophilic) and totally non-migrating. The levelling agents available before the introduction of wool reactive dyes were in adequate for such severely skittery dyeing dyes. There-

fore new levelling agents were introduced of an amphoteric nature.

This schematic representatioh shows the effect of Lyogen FN (an amphoteric product) on the skitteriness of dyeings with Drimalan F colours which are very hydrophilic. The premetallized dyes LanasynS and Lanasyn dyes being only slightly hydrophilic do not show skitteriness. Omega and Metomega chrome dyes are also similarly represented. The effect of products like Lyogen FN in the dyeing of Hercosett wool is entirely different. In this case not only has the hydrophobic epitcuticle been removed by chlorination, but also a very hydrophilic polymer layer has also been applied to the fibre.

We can see that with untreated wool, Lyogen FN increases the rate of dyeing by increasing the hydrophobic nature of the dye, but with hydrophilic Hercosett wool the effect is to reduce the rate of dyeing. Therefore, with Hercosett wool,amphoteric auxiliaries excert a straight forward levelling action as shown by these disc dyeings of Drimalan Red F-2BL.

This slide shows the effect of the recommended auxiliaries for the various types of metal complex dyes; non sulphonated, monosulphonated and disulphonated. Increasingly it appears that the complexity of the dyestuff ranges available and the combinations in which they may be used is leading to the development of very specialised products for coverage of tippy wool, based on the technology of the products originally introduced for dyeing wool reactives. Sandoz for instance now have three products of this general type.

Lyogen FN : Particularly recommended for dyeing Hercosett wool with reactive

Lyogen LR : particularly recommended for dyeing loose wool with reactives where it helps coverage of tippy wool and improves buildup and also for dyeing chlorinated wool garments or half-hose where it acts as a levelling agent and aids seam penetration which is usually the result of poor penetration during chlorination, this fault is analagous with tippiness.

Lyogen TP : particularly recommended for coverage of skitteriness of premetallised or acid dyes.

This slide shows the improved effect on skitteriness of reactive dyeing of Lyogen LR compared with Lyogen F.N. Before we leave levelling agentsIshould like briefly to mention penetration. This is often a problem with thick felts, hard twist carpet yarns etc. Several solutions have been put forward but often it is necessary to use acid levelling dyes, extended dyeing times and tolerate the lower wet fastness standareds. However disagregating products for example pyridine based Lyocol FDW (fromerly Tetracarnit) have been used and can markedly improve penetration.

Chemical stripping as such is beyond the scope of this lecture but it is often possible to level up dyeings with acid dyes or reduce the depth if the shade is too full by treatment with cationic surfactants. The slide shows the effect of Lyogen WD in removal of dye.

Conclusion

The world of textile auxiliaries has frequently been described as a jungle. Therefore I hope this presentation has been able to make it somewhat more penetrable. The subject of auxiliaries in wool dyeing can not be left without some reference to the

dyestuff themselves. The following table comprises the range of Sandoz wool dyes, which shows that the difference between the ranges lie not only in the nature of the bonds and dyeing conditions, but also in the field of application.

Applications

Sandolan E	Sandolan P Sandolan Fast P	Sandolan N
Knitwear Women's outer wear Knitting yarns in light and medium shades Hats Fast to light dyes for! Domestic textiles, Carpet yarns.	Knitwear Women's outerwear Knitting yarns Fast to lgiht dyes for! Domestic textiles Carpet yarns.	Women's outer wear. Slubbing, loose wool and yarns for: Men's outerwear uniforms (milling dyes) knit goods and knitting yarns. Hats. Loose wool and yarns for Domestic textiles and carpets.
Lanasyn LanasynS	Omega Chrome Metomega chrome	Drimalan F
Slubbing, loose wool and yarns for knitwear women's outerwear Men's outerwear Uniforms Domestic textiles	Slubbing,loose wool yarns and piece goods for knitwear women's outerwear Mens outerwear Uniforms Domestic textiles Navy and Black for superwash wool.	Slubbing, loose wool yarns and piece goods for women's over wear Knitwear Super wash wool Domestic textiles

Note

The name of the dyestuff manufacturer referred to has been given as example only. Other dyestuff manufacturers whose names have not been mentioned produce dyes & auxiliaries equal in performance to the ones mentioned.

APPENDIX 5

SUGGESTED FINISHING PROCEDURES FOR ALL WOOL AND WOOL/POLYESTER MENS WEAR CLOTH 350-500gm PER LINEAR METRE

ABSTRACT

Finishing routines for the above quality types have been outlined with particular emphasis on scouring recipes, and water quality. Worsted cloth finishing being versatile in its procedures additional processes have been included along with general routines for finishing of different wool cloth types. A paragraph on finishing of wool-circular-flat bed, and warp knitting is also included.

The information which follows is accurate to the best of our knowledge and is given without guarantee.

SUGGESTED FINISHING PROCEDURES FOR ALL WOOL AND WOOL/POLYESTER MENS WEAR CLOTH 350-500G/LINEAR METRE

1. Preliminary inspection.

The pieces are numbered and the grey dimensions and weight are recorded. The pieces are then made up into appropriate batches of similar qualities, width dimensions, design and shade.

2. Singeing.

Fabrics made from two-fold worsted/polyester yarns using low pill polyester fibres should normally not require singeing provided that the shearing process in subsequent processing is efficient. Where low pill polyester fibre is not used singeing is advisable to improve resistance to pilling. Fabrics for piece dyeing should not be singed until after dyeing. An alternative if the condition of the piece warrants it will be to scour before singeing followed by a washing off. Although there are two types of singeing, hot-plate and gas the later is more prevalent and referred to under this heading.

3. Scouring

Pieces not requiring milling are scoured on rope scouring machines using the following recipe

1st bath

3.0% sodium carbonate

1.0% non-ionic or anionic detergent on weight of fabric.

Liquor ration 3 : 1

Temperature 40^0C.

Time 10-15 min

Rinse 10-25 min

at 40^0C.

2nd bath

1.0% detergent as before

Liquor ration 3 : 1

Temperature 40^0C

Time 10 - 30 min.

Rinse 45-60 min at 40^0C

Cool and acidify with acetic acid at pH 5.5-6.0.

Note

The hardness both temporary and permanent in addition to the quality of water is of paramount importance. The following table shows average values found for water quality in wet processing:-

Test	Averages
1. Turbidity (Formazin units).	26 - 95
2. Colour (Hazen units)	12 - 43
3. Iron (mg/litre)	0.18 - 0.70.

4. Manganese (mg/litre)	0.09 - 0.77
5. Suspended solids (mg/litre)	2 - 4
6. Total hardness (mg Ca Co_3/litre)	30 - 50
7. Alkalinity (mg Ca Co_3/litre)	46 - 98

* The higher the value, the poorer the quality of water.

The above averages are for water used in raw wool scouring, loose wool dyeing, top dyeing, hank scouring, package dyeing, piece scouring and piece dyeing. Ideally water for processing wool should have a hardness of 3^0 - 5^0, English hardness but it must be realised that water at 0^0 is also not suitable.

4. Scouring and milling

For fabrics requiring a softer handle or a semi-milled finish using the combined scouring and milling machine the following are typical recipes:-

<u>All-wool fabrics</u>

Scour 3.0% sodium carborate.
2.0% non-ionic detergent on weight of fabric liquor ratio 3 : 1.
Temperature 30°C.
Time 20 min.

Rinse Water at 40°C for 10 min

Mill Liquor ratio 1 : 1
Temperature 30°C
Time 20 min.
1.0% non-ionic detergent.
(at the comensement of milling)

Rinse — Water at 40°C 30 min

Acidify — Acetic acid pH 5.5–10 min

Remove Excess water — 10 min

Total running Time 90 min.

Wool/polyester fabrics

Scour — 3.0% sodium carbonate
2.0% non-ionic detergent on weight at fabric
Liquor ratio 3 : 1
Temperature 40°C
Time 10 min.

Rinse — Water at 40 - 10 min

Repeat the scour and rinse cycles.

Mill — 1.0% non-ionic detergent
Liquor ratio 1 : 1
Temperature 30°C
Time 40 min.

Rinse — Water at 40°C - 30 min

Acidify — Acetic acid pH 5.5–10 min.

Remove Excess water — 10 min.

Total running Time 130 min.

5. Opening out to full width. Scutcher

6. Crabbing. Crabbing will be necessary on certain fabrics to remove running marks and creases caused during previous processing.

The temperature of the crabbing liquor should be as high as possible (as near as possible to 100^0C) without causing colour bleading of pre-dyed fabrics.

Note. Certain fabrics eg. Plain weave and hop-sacks may require crabbing <u>before</u> wet processing to prevent excessive creasing during scouring, milling and dyeing. There is little if any crabbing effect at temperatures below 60^0C.

7. Piece dyeing.

Wool/polyester fabrics should be heat set before dyeing as this reduces the risk of running marks and avoids dyestuff sublimation problems. It is absolutely essential that the heat treatment is perfectly uniform in order to obtain level dyeing. The pieces should be predried to an even moisture content prior to heat setting ie equilibrium drying.

8. Drying and heat setting

All pieces should be dried with upto 10% overfeed and the wool/polyester fabrics should be heat set at 170-180^0C for 30 seconds. A weft straightener before drying will be an advantage particularly for checks.

9. Inspection and intermediate mending

10. Shearing.

On a three cylinder machine shearing 1 back, 2 face, one or <u>two</u> passages should be sufficient on all fabrics.

11. Steam brush and condition

The pieces should be steam and brushed lightly to remove any loose fibres and conditioned to give 14-16% regain for all-wool fabrics and 7-8% for wool/polyester fabrics. After conditioning the fabrics must be allowed to rest for 2-4 hours to allow diffusion of the moisture into the cloth. Covering the pieces with a wrapper during this period also assists in conditioning the cloth.

12. Relaxation

The pieces require all strains removed by steaming in a tension free condition.

13. Auto clave decatise

To give a stabilised finish, the following is a typical cycle:
vaccum to 0.5 atm gauge absolute
steamat 1.0 atm over pressure for 3-5 min.
Vaccum to exhaust steam cool during unwinding.

14. Steaming.

Certain fabrics eg. dark shades, will require steaming after decatising to remove excessive lustre. This can be done on the relaxation machine,

15. Final inspection

16. Rolling and packing

17. Ware house and despatch

Additional finishing procedures for all-wool and wool/polyester mens wear cloth up to 300 g/m^2 which may be necessary.

a) Cloth carbonising containuous range (All wool). This process would be carried out immediately prior to the dyeing process. Certain fabrics will require carbonising and in most cases can be sent to carbonise before dyeing. Fabrics which have been dried will require wetting out before carbonising. This is usually done in a separate tank preceding the carbonising range. The following sequence should be used:-

Wet out	0.1% Lissapol N solution, room temperature squeeze to 50-55% moisture.
Acidify	4.5 - 5.0% H_2SO_4 , 0.02% Lissapol N , Solution at room temperature squeeze to 50-55% moisture.
Dry	90-95^{0}C to 10% moisture.
Bake	110-115^{0}C for 7-10 minutes.

Cloth speed 5-10 m/min depending on size of the baking section.

Crush	In rotary milling machine 10-30 min.
Neutralise	If the cloth is for piece dyeing reduction of the acid content can be carried out on the dye winch prior to piece dyeing using cold water rinses. If pre-dyed cloth, the following sequence should be used either on a dye winch or scouring (dolly) machine. Cold water rinse 15 min. 2% sodium carbonate solution 20 min. Cold water rinse 10 min.

b) Rotary press. The pieces may generally require a light pressure to give some consolidation before autoclave setting. A pressure of 2 ton gauge should be adequate. Moisture must be restored to 14 - 16% regain by the conditioning attachment on the machine. This process usually preceeds autoclave decatise.

c) Paper pressing. For many woollen fabrics decatising is the final process before inspection and despatch, as it leaves the fabric in a smooth condition with a small amount of lustre. An alternative to decatising for woollen fabrics is rotary pressing. However for worsted fabrics paper pressing between heated card board sheets contained in a vertical press at 2-5 tonnes pressure can be chosen. This is a labour intensive process and is being replaced by decatising worsted fabrics in an autoclave at higher temperatures than atmospheric-upto about 120^0C.

d) Raising. Certain fabrics such as velours and blankets require more fibres on the surface than is obtained during wet processing. This is achieved on a raising machine consisting of a cylinder having 14-28 wire covered rollers around its periphery over which cloth passes. The rollers rotate with a greater surface speed than the speed at which the cloth passes over them causing the wire points to penetrate the surface of the cloth thus raising fibres from the yarn. Several passages are required to give the desired results. Fabrics such as velours which require a smooth, dense fibrous surface need raising and shearing several times alternately. Blankets require a lofty surface cover to trap air between the fibres to give improved thermal properties.

Finishing routines. Having enumerated the different finishing processes and taking into consideration the various alternatives mentioned above. It must be realised that a very wide range of fabrics are produced by cloth manufactures and each type requires its own processing procedure. Typical routines are shown below for different cloths, but the alternatives outlined previous must be kept in mind.

	Cloth Type				
Finishing process	Mens wear worsted suiting	Ladies woolen dress	Velour coating	Melton coating	Blanket
Setting	x				
Scouring	x	x	x	x	x
Milling			x	x	x
Drying	x	x	x	x	x
Shearing	x	x	x	x	
Raising			x		x
Shearing			x		
Decatise	x			x	
Rotary press		x		x	
Paper press	x				
Shrinking	x	x	x	x	

The Finishing of wool knitted goods

Knitted goods are of two basic types - circular knitted which produces a tubular fabric with circumferences upto 150 cm - or flat bed knitted which produces garment blanks. In addition to these two there is also warp knitted fabrics which as the name implies knits full width fabric length. The principle of finishing is similar to that of woven fabrics, but the routines are not as involved and different machinery is used.

The tubular fabrics are generally processed in the tube form and then slit and opened-out to the full width after finishing, followed by cutting into garment panels and making up. Flat bed fabrics are partially made up into garments before the finishing operations.

With either type of fabric the first finishing process is to remove any oil and dirt. Tubular fabrics are washed on a gentle-action rope scouring machine or combined scouring and milling machine. Garments produced on flat-bed machines can be washed by an aqueous process, but the modern trend is to use a solvent cleaning machine, similar to those used in dry-cleaning establishments. The solvent is usually perchloro-ethylene to which can be added suitable auxilliaries to give various effects such as shrink resistance, softening or milling. The used solvent is recovered by distillation for re-use.

Final finishing involves steaming and pressing after the garment has been fully made-up.

PRINTING WOOL/POLYESTER BLEND FABRICS

ABSTRACT

A printing method has been developed for wool/polyester blends involving the use of the I.C.I. dispersol/procion PC dye system and a two stage steaming process. Commercially satisfactory results have been obtained on a semi-bulk scale on a light weigth 60/40 wool/polyester blend.

This blend meets requirements of the International Wool Secretariats (IWS) Woolblend Mark.

The information which follows is accurate to the best of our knowledge and is given without guarantee.

PRINTING WOOL/POLYESTER BLEND FABRICS

1. INTRODUCTION

The work on this printing method was initiated as a result of the development of a lightweight 60/40 wool/polyester blend fabric which had been processed on the cotton system. Although the method was developed for this fabric, it should be applicable to any weight of fabric and also to any blend composition.

The printing method consists of the following stages:

(a) Print the fabric with the specially selected pairs of dyes known as the Dispersol/Procion PC dye system (I.C.I.), the wool component of the fabric having been previously chlorinated.

(b) Carry out the fixation of the dyes by submitting the dried fabric to a two stage steaming process, firstly steaming the fabric for 10 - 20 minutes at 100°C, then secondly steaming for 6 minutes at 180°C.

(c) Wash the fabric in alkaline baths of increasing temperature in order to ensure that all the excess disperse dye is removed, thereby eliminating any unwanted staining of the unprinted areas.

2. PRINTING METHOD

2.1 Fabric Preparation

The fabric preparation route developed for the cotton spun wool/polyester fabric is as follows:

Crab - Scour - Chlorinate - Dry - Heat Set.

The crabbing or setting is necessary to ensure that the lightweight fabric has no tendency to cockle when first wet out in scouring. For heavier fabrics, this step could probably be eliminated.

The fabric must be thoroughly scoured to remove any dirt or grease on the fabric and also any size which may be present on the fabric warp. Failure to scour the fabric correctly could lead to unlevel chlorination, and hence to variation in depth of shade on the final print.

It was found necessary, during the development work, to chlorinate the wool component of the blend in order to obtain the full depth of shade. Chlorination can be carried out either in open width or in rope form, but whichever method is chosen it is essential that the

chlorination should be level. If sodium bisulphite is used as the antichlor agent, then care should be taken to remove as much bisulphite as possible in the final rinse, as a large residue of this chemical would have a detrimental effect on certain of the Disperse PC dyes. Bleaching can be carried out after chlorination if desired, but the fabric pH should be adjusted after bleaching to the acid side (e.g. pH 5.5-6.0).

Drying should be carried out to obtain as stable a fabric as possible; any relaxation shrinkage in the fabric could cause problems during printing due to bad fitting of design. Heat setting the polyester component at the dry width of the fabric also helps to obtain a stable fabric.

2.2 Dyes

The dyes used for this process are known as the Dispersol/Procion PC dye system, consisting, at the present time, of nine matched pairs of disperse and reactive dyes. The system is designed for applications in printing polyester/cotton blends, and the disperse dye has been modified to become water soluble during washing-off. Although the conditions used for washing-off the polyester/cotton can not be used on the wool/polyester blend, there is great advantage in using these disperse PC dyes, and at the moment there would be no advantage in substituting any of the dyes in the system.

2.3 Print Paste

The recipes used for the stock paste, and print paste, are as follows:

Stock Paste		Print Paste	
Urea	50 g	Stock Paste	800 g
Manutex F (Alginate Industries)	50 g	Procion PC dye	x g
Calgon PT	5 g	Dispersol PC dye	2x g
Glycerol	70 g	Water to:	1000 g
Matexil PA-L (I.C.I.)	10 g		
Matexil PM-VP (I.C.I.)	5 g		
Citric acid	1 g		
Antifoam	1 g		
Water to:	800 g		

It was found, during initial trials, that the inclusion of high levels of urea (ca. 100 - 150 g/kg) in the print paste, led to excessive fibre damage, due to decomposition during the high temperature steaming step; therefore, only a small amount of urea is included in the print paste to aid dye solubility. To compensate

for the loss of humectant action from a larger quantity of urea, glycerine has been added to the paste. The thickener chosen for this process must be easily removable from the fabric after steaming. Certain thickeners tend to bake onto the fabric and cannot be removed, causing a stiffening of the fabric hand. Should a change of thickener be desired, care should be taken to see that it can be easily removed after H.T. steaming.

If a change of any other components of the print paste is required, the following points should be considered:

(a) The component must not decompose under the severe fixation conditions and lose its effect.

(b) The component must not decompose and cause damage to either of the fibres in the blend.

(c) The component must not decompose and have a detrimental effect on the yield of dye or the dye molecule.

2.4 Printing

The actual printing operation can be carried out on any conventional printing machine. Although only rotary and flat screen machines have been used, there should be no problems in using roller printing machines. Variation in the viscosity of the print paste to suit individual machines will not affect dye fixation.

Adhesives suitable for fastening the fabric to the printing blanket are subject to the type of printing machine used, and also to the weight and structure of the fabric being printed.

Drying after printing should not be excessive, but should allow the wool fibre to be as near to its natural moisture regain as possible.

To assist this, it is advantageous to run the printed fabric over sets of rollers to allow even cooling and uptake of moisture to take place prior to steaming. If the moisture regain of the wool fibre is low, then this can lead to drying out of the steam with subsequent loss of reactive dye fixation.

2.5 Steam Fixation

The first steaming stage, involving steaming at 100 - 102°C for 10 - 20 minutes, achieves fixation of the reactive dye on the wool. The most important factor to be considered in this part of the process is that the moisture regain of the steam must be as near 100% as possible. Significant drops in moisture regain, or fluctuations can cause variation in dye yield throughout the length of the printed fabric. Pressure steam is not recommended as it could cause premature hydrolysis of the disperse dye and affect the yield on the polyester.

Fixation of the disperse dye on the polyester, is carried out in an atmospheric high temperature steamer at 180°C for 6 minutes. So far, there have been no problems associated with this particular operation.

2.6 Washing-off

This is the most critical part of the printing process, and should be carried out with the greatest care. As the conditions used do not achieve full hydrolysis of the disperse dyes, the following wash-off, involving continuous soaping off to remove the unhydrolysed disperse dye, is employed:

(a) The fabric should be washed in cold water with ammonia (pH 9 - 10) present in the wash liquor at the earliest opportunity. The cold alkaline wash liquor must be changed regularly (5 to 10 minute intervals), until there is virtually no colour in the bath.

(b) The fabric is then treated at 40°C with ammonia (pH 9 - 10) and a dispersing agent (2 g/l); suitable dispersing agents are Sandopur DF (Sandoz), Matexil DN-VL (I.C.I.) and Ekaline F (Sandoz). The time of treatment should be 10 - 15 minutes, and if the bath is strongly coloured then it is advisable to set a fresh bath and repeat this step.

(c) The fabric is then treated at 80°C with ammonia and dispersing agent in the same quantities as above. The time of treatment is again 10 - 15 minutes, and at the end of that time, the print should be inspected to see if any backstaining is spoiling the white areas. If it is found that staining has occurred, then this stage must be repeated until the fabric has been cleared. So far it has only been necessary to repeat this stage once.

(d) Finally, the fabric should be given a cold rinse and then an acid sour with acetic acid to pH 5.5 - 6.0.

2.7 Finishing

After washing-off, the fabric should be hydroextracted and then dried in such a way as not to impose any strain in the fabric which would later cause relaxation shrinkage. Normal finishing procedures such as cropping and semi-decating can be carried out if desired.

3. CONCLUSIONS

Providing care and attention are paid to the steaming and washing-off procedures, there should be no problems in carrying out this printing technique. Continuous washing-off cannot be used as the liquor ratios are too short; a long liquor ratio is always desirable to reduce the backstaining potential.

Fastness values obtained with this printing method have shown a very

DAMAGE TO WOOL DURING STOCK DYEING

ABSTRACT

Stock-dyed wool is sometimes found to have been badly but inexplicably damaged in dyeing. It has been confirmed that when loose wool is too highly compressed during dyeing the severely bent fibres become kinked, buckled, or actually split at the point of deformation, the distortion being set into the fibres. Consequently excessive breakage occurs in carding, resulting in a poor spinning and manufacturing peformance. The main cause of high compression during dyeing is a high liquor-circulation pressure, usually occasioned by the demand for maximum production. It is recommended that when damage occurs under these circumstances the pump pressure and the loading should be reduced in favour of a better processing performance and a superior product. Chemical damage to wool and the changes it causes is also extensively discussed along with measures to be taken to rectify this fault.

The information which follows is accurate to the best of our knowledge and is given without guarantee.

INTRODUCTION

The dyeing of wool usually involves boiling it in a dye-liquor at some stage of processing. This is a chemical process which can therefore lead to some damage to the wool, depending on the temperature, time, pH of the liquor and the additives employed. These factors are controlled by the dyer so as to minimise the possibility of chemical damage consistent with level dyeing of the wool.

The adoption of techniques to minimise known causes of damage to wool during dyeing has been helped by the development of improved dyeing auxiliaries in recent years. Use of these has enabled wool to be dyed successfully with shorter dyeing cycles at a pH which results in least damage, and often at a lower temperature. Thus high standards of levelness and colour fastness may be achieved without the need for prolonged boiling or lengthy and expensive after-treatments.

A brief study of the customary dyeing practice has shown that:-

a) Experienced dyers are aware of the "optimum" dyebath conditions recommended for dyeing wool with minimum damage and they adhere to them as closely as possible.

b) Batches of most shades are stock-dyed in several lots, and when a shade correction is needed it is usually only necessary to redye one lot to correct the batch.

c) It is occasionally necessary to redye a whole batch because of an error, or to make use of waste wool, in such cases it is anticipated that some chemical damage may occur and allowance can be made for it.

However, it is sometimes observed that stock-dyed wool has been tendered to such an extent that severe difficulties arise during subsequent processing although the dyeing conditions have been such that chemical damage is unlikely to have been responsible.

In semi-worsted processing the following are the main areas of concern when such damage occurs:-

a) Excessive fibre breakage during carding, leading to poor gilling and spinning performance.

b) Inferior yarn strength and elongation properties, leading to low production efficiency.

c) Excessive waste and dust at all stages of processing, leading to a low yield of usable material.

In extreme cases the wool may be so severely damaged that it cannot be processed on semi-worsted machinery and it has to be transferred to woollen machinery on which it is processed as if it were a cheaper blend.

In such cases a careful examination of the dyeing recipes has shown no possible source of severe chemical damage. However a calculation based on the volumetric capacity of the dye-vessel and the degree to which the wool was packed down revealed that the locse wool was very densely packed or consolidated during dyeing, leading to the possibility of physical deformation of the fibre as a possible source of the damage.

Dry wool fibres subjected to strong bending forces such as when loose wool is pressed into a bale are little affected. However, wool fibres subjected to compression and then wetted as in some forms of artificial crimping and setting, show a marked loss of strength when subsequently stretched, due to a concentration of stress at the point of bending. This is reported to be due to the setting of a crimped configuration and is reversible if the fibre can be relaxed to relieve the stress, unless the angle of the bend has been sharp enough to cause rupture. It has been suggested that similar damage due to the setting of sharp kinks into the fibres might occur in stock dyeing if the wool is too

tightly packed into the dye vessel, because the dyeing process also sets the wool. This has been demonstrated both in laboratory trials, and under industrial conditions.

Study of packing-density and fibre bending effects

Initial laboratory work followed by trials under industrial conditions have been carried out, taking into consideration the following parameters:-

a) Bundle-breaking energies.
b) Microscopic examination of damaged fibres.
c) Examination of failure by bending.
d) Processing.
e) Fibre damage assessment.
f) Effect of different dyeing conditions.
g) Sliver and yarn strength properties.
h) Factors governing packing density during mill dyeing.
i) Effect of liquor circulation pressure.
j) Effect of temperature.
k) Effect of initial density.
l) Effect of dyeing time.
m) Comparison of density and damage.
n) Effect of fibre orientation.

Recommendations

Based on the findings and statisical analysis it was shown that stock dyeing wool of a high density is a cause of severe mechanical damage due to individual fibres being bent at sharp angles and set.

The high density can be caused by several factors:-

a) The pressure exerted by the liquor circulating pump, it is usually desired to obtain a high flow-rate of liquor which calls for a high pumping pressure.

b) An increase in the temperature of the wool and therefore

c) The initial packing densi comparison with the effec related to d)

d) The effective thickness o the distance the liquor h wool. This is related to flow and is also governed machine and of course the

Unfortunately the demand for necessarily involves maximu circulate the liquor through of which factors are expecte the damage to the wool. Thi in carding, giving a poorer with more slubs and ends dow manufacturing efficiency. T dyehouse is likely to be at later on in all subsequent s

It is clear therefore, that dyeing the causes of this sh to the likelihood of high pa (assuming that the chemical of reducing the density shou will probably be found to ha pressure and if so this shou of wool in the load should b so its resistance to the pas to the extent which allows passage of the dye liquor th possible to lower the temper use of suitable auxiliaries,

ncreases the swelling and plasticity
akes it more compressible.

has only a small effect per se in
of pump pressure but it is

the mass of wool being dyed, effects
to travel in passing through the
he pump pressure and the liquor
y the quantity of wool put in the
esign of the machine.

igh production from the machinery
loading, a high pump pressure to
e load and a high temperature, all
to increase the density and hence
has the effect of increasing losses
inning performance and production
and ultimately a poorer fabric
s the higher production from the
e expense of greatly increased costs
ges of processing.

undue damage is ocurring in stock
ld be sought with particular reference
ing density being responsible
onditions are satisfactory). Means
be examined. The circulating pump
a means of regulating its delivery
be reduced. Secondly the quantity
reduced to reduce its thickness and
ge of the liquor through it. But not
annelling of the liquor ie, easy
ugh a certain area. It may also be
ure a little , for example, by the

While such change will increase the dyeing costs by reducing production, a greater benefit is likely to be realised by the better performance processing wise and the superior qualities of the yarn. The advantages and disadvantages associated with the proposed changes have to be assessed with a view to obtaining a maximum reduction in damage to the wool at a minimum overall costs.

Chemical damage to Wool

Some 40 years ago a general investigation of damage caused by dyeing showed that some properties of wool were changed and the effects of various dyes and of dyeing procedures on spinnability, strength, abrasion resistance, and milling properties, were investigated. Since then many people have studied different aspects of the dyeing process. A brief review follows:-

Wool is a sulphur-containing protein and as such it is quite sensitive to the action of alkalies, even at very low concentrations at the temperature of a dyebath. The pH of the solution is perhaps the most important factor in chemical damage to wool. Various studies have been made of the effect of the pH and it has been found that minimum damage occurs at a pH of 4.0 - 4.5 while a pH range of about 3 to 8 is generally "safe". The control of the pH during dyeing has been studied, with particular emphasis on changes in the measured pH which can occur as a result both of chemical reactions such as the reduction of bichormate in chrome dyeing, and the effect of temperature on acid-base equilibria in water. Therefore studies were made on the effect on boiling wool - in aqueous solutions

at different pH values which showed that unless precautions were taken the pH tended to rise into the danger zone and the wool became tender. Wool is less sensitive to acids but prolonged boiling at too low a pH value, e.g. if a dyeing with 1 : 1 premetallised dyes with 8% of sulphuric acid has to be corrected, can cause acid tendering. (A power failure while such a dyeing is in progress can have disastrous results).

Chemical changes to wool generally involve the cystine-disulphide cross-linkages and the main-chain peptide bonds. Breakage of either results in a weakening of the fibre structure.. Many reactions of wool, both of the peptide chains, and of the side groups, some of which may result in damage, have been described by many people. In addition the chemical reactions of wool with chromium compounds have been investigated in detail and it has been found that some chemical damage and embrittlement of the fibres may occur. A change in the number of cross-linkages between the peptide chains can result in damage. While the removal of cross-linkages leads to changes in plasticity and weakening of the fibres, an increase in the number of cross-linkages may be expected to lead to a stiffening of the structure and possible embrittlement.

Chemical damage is progressive so it will gradually increase with time. It is therefore desirable to use as short a dyeing time as possible, consistent with obtaining good penetration, levelness, and exhaustion of the dyestuffs.

The temperature of the dyebath affects the rates of all chemical reactions in the system, including the rate of diffusion and absorption of dyestuffs. The temperature has there-

fore to be controlled so that the dyestuffs are absorbed evenly, and not too rapidly. The maximum temperature in conventional dyeing is the boiling point of the liquor which approximates to 100°C. The time at this temperature should be limited as discussed above.

Increasing the temperature further will accelerate the rate of dyeing and this is now possible by pressuring the machine. However, it will also rapidly increase the rate of damage to the wool as well, so the time at a high temperature under pressure must be strictly limited and the pH must be carefully controlled.

Although it is convenient it is not essential to dye at the boil. New dyeing systems designed to minimise damage to wool rely on lowering the dyebath temperature to reduce reaction rates and the addition of a chemical auxiliary to increase the rate of diffusion of the dyestuff in order to reduce dyeing time. The auxiliaries proposed include urea, formic acid, lactic acid, and benzyl alcohol as well as a number of trade products and also pretreatments. Recently more interest in low-temperature dyeing has been generated by escalating energy costs, fuel savings in many instances off setting the cost of the auxiliaryychemicals.

APPENDIX 6

DYEING & FINISHING SCHEME FOR WOOL & WOOL BLENDS IN T.D.C. DYEING & FINISHING DEPARTMENT

I. WATER ANALYSIS:

Samples of water being used in the mills to be collected periodically and analysied in the chemical laboratory for the following properties:-

Mg-hardness - Total hardness.
Suspended Solids - pH. Value.

If a water treatment plant is available (de-ionise, zeolite or permutite systems), the processing water should have a total hardness degree of 3 to 9 English units.

N.B. In case hard water is used in wool processing, the addition of sequestering agent such as calegon-T (hexameta-phosphate) is desirable in wool processing.

2. DYEING TRIALS:

A series of laboratory dyeing trials to be done according to the following systamatic order .

I. Dyeing with all types of dyestuffs available whether indigenous or imported.

e.g. Acid Acid Chrome
I-I Metal complex
2-I Metal complex
- Neutral dyes (super-milling acid dyes)
- Wool reactive dye.
- Chrome after treated.
- Meta-chrome (mordant dye)

N.B. The same substrate with the same auxiliaries should be utilised in every dyeing.

2.I. Dyeing I00% wool fibres in all forms,

- Loose stock.
- Tops.
- Yarn-package-hank.
- Woven fabrics.
- Knitted fabrics.

2.2. Dyeing wool blends with synthetics.

e.g. wool/polyester
wool/acrylic
wool/nylon.
wool/viscose.

3) Different dyeing processes are to be carried out on the available machines eg.

Atmospheric dyeing on winch for all wool, wool/acrylic, wool/polyester (with carrier), wool/nylon.

- Scouring and/or bleaching of material to be done on winch and jig.
- High temperature dyeing as follows:-

  H.T. autoclave, H.T. beakers, and jet.

  All wool blends with man-made fibres could be dyed on these machines. at about I05-I08^{o}C

General Note:

All the above mentioned work should be based upon:

- accurate weighing of dyestuffs, chemicals and auxiliaries
- accurate measurements of dyeing parameters temps, pH, time, concentrations, liquor ratio, exhaustion curves (specifically with reactive dyes).
- Economics as first priority of dyestuffs, chemicals, energy, and methods.
- Sources of every raw material including prices.
- Quality of raw material.
- Repeatability & reproduceability,
- Optimum levels of colour fastness based on standards.
- Durability of the textile fibre under test.

4) Testing for quality

Subsequent to above tr
instrumental quality c
followed, this include

a) Colour fastness to,
washing-milling-per
ironing - light - c
colour - dry cleani

b) Shade matching - Vi
- In
me

c) pH of water extract

d) Physical & mechanic
e.g. fabric structu
recovery, shrinkage
bursting strength,
and luster.

e) Chemical properties

Oil content, wool d
mechanical) via alk
test if alkali dama

5) Preparation of colo

- Full dyeing procedur
dye category self-sh
the most bright, blu
- Subsequent binary cc
dyestuffs in each ca
namely, yellow/red.
Within a concentrati
depth of shade.
- Tri-colour mixtures
depth of shade range
- Eventually, a simple
pattern book could b

ity control of dyed samples

trials, an integrated system of
y control and assesment will be
ides,

to,
perspiration-acid/alkali-potting-
- crocking - sublimation surface
aning.

Visual assesment.
Instrumental colour
measurement (colour difference meter)

act of dyed material.

nical properties,
cture, yarn count, crimp, crease -
age, weight, tensile strength-elongation
h, felting, surface handle, stiffness,

ies:-

l damage (alkaline, acid, oxidation,
alkali solubility and urea bisulphite
amaged,

olour patterns:-

dure to be done on each individual wool
-shade (the primary colours, preferably
blue, red, & yellow dyes).

combinations of the three primary
category to be very accurately done
d. Yellow/blue and Red/blue,
ation range less than I/I2 and over I/I2

es are to be dyed within the popular
nges.

ple colour atlas or colour triangle
d be prepared, for every class of dyestuff.

- The effect of O.B.A's on the brightness and fastness of shades could be investigated when maximum brighness is required in pastel shades.

6) Study of the effect of dyeing auxiliaries

All auxiliaries available (local or imported) to be evaluated for their efficiency in processing and dyeing in relation to improving the colour fastness handle cleanliness etc.

Popular auxiliaries in use are:-

Leveiling agents.
Protective colloids.
Retarding agents.
Stripping agents.
Anti-foam agents.
Water softeners.
Buffers.

7) Special wool finishes

Such as, Moth proof - insect proof.
Flame proof - water proof.
Resin finish - soil release.
Soft handle - stain proof.
antistatic - antishrink.
chlorination.

To study the application and effect of these finishes on the shade, colour-fastness and strength of the material.

Also to study the effect on finishing of these chemicals and amount of degradation of the wool. Resin finishes in particular.

Available finishing agents should be utilised on different woollen materials and the improvement gained to be evaluated by testing a sample before and after every trial.

References to be used

W.I.R.A. = Wool Industries Research Association.

I.W.T.O. = International Wool Textile Organisation.

I.W.S. = International Wool Secretariat.

A.S.T.M. = American Association of Testing and Material.

B.S. = British Standards.

I.S.O. = International Standards Organisation.