## OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

## DISCLAIMER



## FAIR USE POLICY

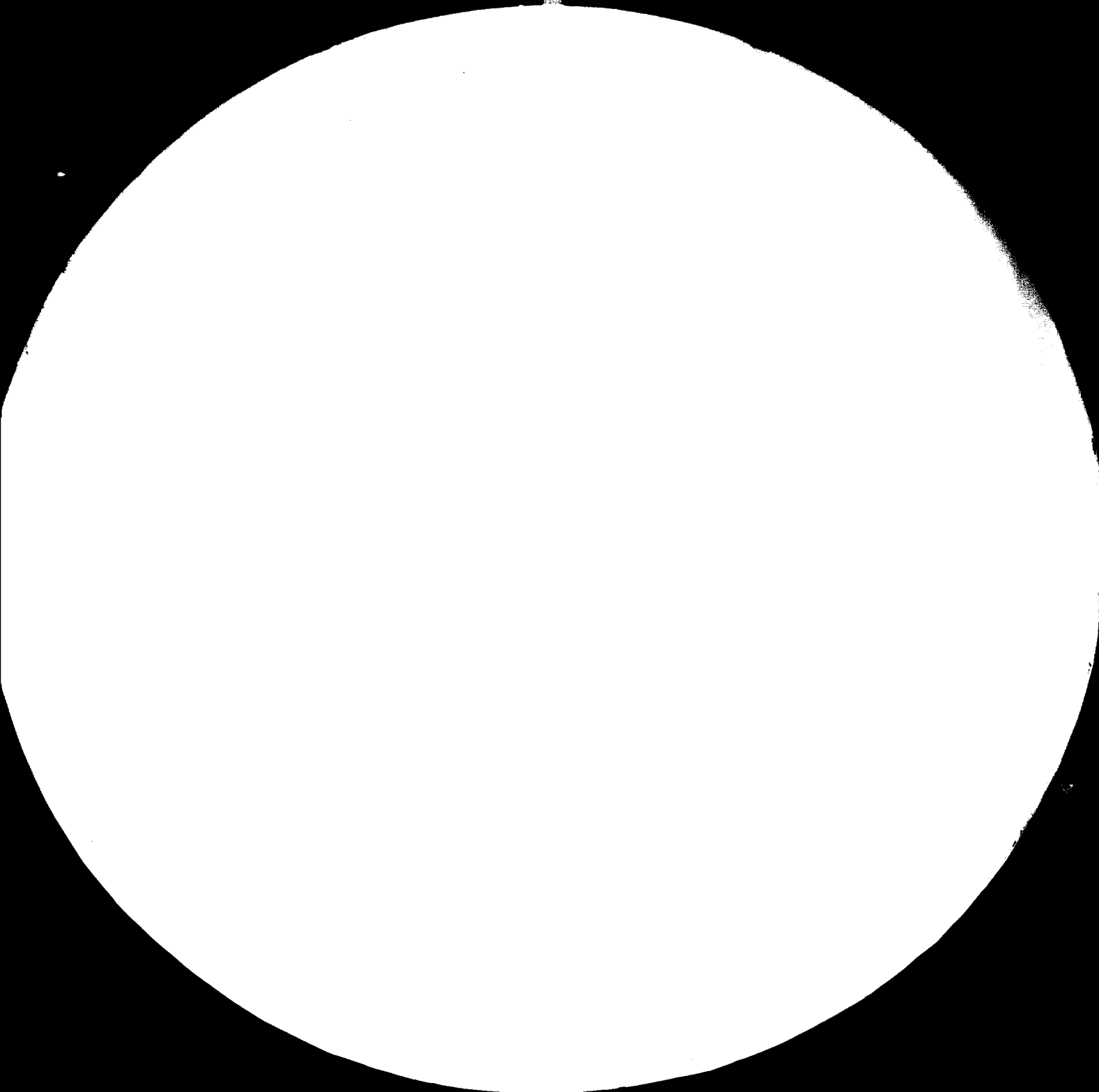


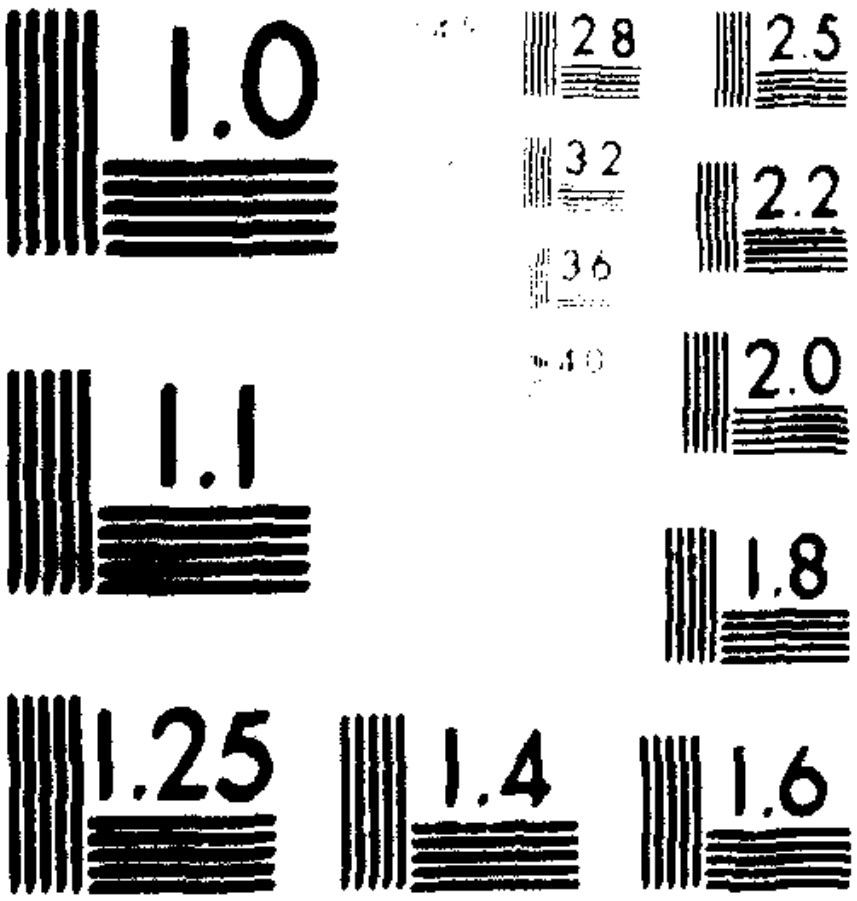
## CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





12563

RESTRICTED

MAY 1983
ENGLISH

DIVERSIFICATION AND DEVELOPMENT OF NEW FABRICS
PHASE II

DP/IND/76/023/11-02/31.7.B
INDIA

# Final Report: Bleaching, Dyeing, Printing and Finishing of Knitted Goods

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

Based on the work of dipl. eng. Verka P. Boeva
Dyeing and Finishing Expert

United Nations Industrial Development Organization
Vienna

618

CONTENTS

ACKNOWLEDGEMENTS

The work of the UNIDO Dyeing and Finishing Expert was greatly assisted by the co-operation of the following organizations:

- United Nations Industrial Development Organization, Vienna.
- United Nations Development Programme, Office of the Resident Representative, New Delhi, India.
- The South India Textile Research Association (SITRA), Coimbatore, India.

The Expert would also like to express her gratitude to the Director of SITRA, Mr.T.V.Ratnam, to the Honorary Adviser Mr.K.Sreenivasan, to the Project Leader Dr.V.R.Sivakumar, to the Head of Chemistry Division, Dr.S.Sivakumaran and to all staff of SITRA for their guidance, assistance and good co-operation for the realisation of the expert's task.

## SUMMARY

The project Diversification and Development of New Fabrics, Phase II (IND/76/023) aims to develop further the expertise of SITRA staff and the staff of all local knitting mills in relation to the needs of knitting industry of South India and the new trends in knitting technology. This mission (January-May 1983) was to help, develop and advise on research, training and technical services for the finishing sector (bleaching, dyeing, printing, high finishing). After surveying local industry, two training programmes were developed and run successfully:

- Finishing of knitted fabrics and garments for advanced finishers.

- Finishing of knitted fabrics and garments for finishers-beginners.

There was an input of finishing equipment as follows:

"Floataire" Cubex washing machine, "Mathis" laboratory heat setting stenter, "Roaches" laboratory jet dyeing machine, "Thies" high temperature laboratory package dyeing machine, "Adkins" portable manual press, "Ahiba" Polymat laboratory dyeing machine and the following machines produced in India:

Steam pressing table, Tumble drier, Industrial laundering machine, hydroextractor, steam boiler, winch back dyeing machine, Printing table.

New building was constructed completely answering requirements and dimensions for finishing section. All equipment were installed in this new building in the presence of the expert.

On the expert's instruction the knitting mills - Leela Hosiery Mills in Tirupur town purchased mercerizing machine for circular knitted goods 'Stabilo-Flow' from 'Thies', West Germany. The owner of the same mills is planning to purchase a new range for stabilising the dimensions of circular knitted goods from 'Moris Heliot', France, again following expert's instructions. The implementation of the both machines will improve the quality and aesthetical appearance of knitted garments. The objectives of the mission were achieved with a fair degree of success. It is recommended that the knitting finishing section be further developed as a self-dependent section for research and implementation activities. As well as existing training programmes new ones should be developed to meet the needs of knitting industry. Also, research programme on textile finishing of new textile materials as Polyester, Acrylic and their blends should be undertaken.

## INTRODUCTION

The Project 'Diversification and Development of New Fabrics - Phase II (IND 76/023) was submitted to the UNDP by the Government of India on 12 November 1979 and signed by UNDP 12 December 1979. This project named UNIDO as the Executing Agency with the Ministry of Industry as the Indian Government Co-operating Agency acting through SITRA. The project is of three year duration commencing April 1980.

This project has two phases

During the first phase the UNDP/UNIDO assistance concentrated on the improvement in yarn quality, training in knitting technology and the provision of technical services to the knitting industry. Phase I has been completed.

The present second phase aimes to build upon the achievements of the first phase and to develop further the expertise of SITRA staff and the all staff of local knitting industry in relation to the needs of the knitting, dyeing and finishing, and the garment manufacturing industries. It will also extend appropriate research and development activities in those areas related to the needs of the knitting industry and related industries, it will also institute technical liaison and training courses in these areas of industrial activities.

Under the Phase II of this project the participation of the following experts were required. Consultant, Training

Adviser, Clothing Expert and Dyeing and Finishing Expert. The mission of the Dyeing and Finishing Expert is split in two parts:

| | | | |
|---|---|---|---|
| I | Part | - | 6 weeks |
| II | Part | - | 4 months and a half |

This report concerns II part.

The duties proposed for Dyeing and Finishing Expert were outlined in Job Description (See Annexe i).

The assignment for the I Part covered the period from 10 January 1983 to 21 May 1983.

## FINDINGS

In the first part of my mission in SITRA in 1981, I prepared a project for laboratory and semi-industrial equipment for the Finishing Section.

Immediately after my arrival now I was acquainted with the situation of this planned equipment. All machines and apparatuses were supplied, but not installed. It was constructed a new spacious building in direct closely to knitting and Garment Manufacturing Sections. All finishing machines were available in this building. The erection of the boiler has started before the assembling of other equipment. For this purpose it was made a partition of detached room in the new building. After finishing of assembling of the boiler and laying of connecting pipes and electrical fittings all finishing machines and apparatuses were installed. Since the building is very big (with dimensions: length 18.3 m; width 16.8 m) there is a possibility for increasing of Finishing Section in future and for installing new machines.

As well as in my first visit now I paid a visit to some mills (see annexe-ii). I didn't find out any change of machines and technologies applied in comparison with the situation in 1981. The equipment consists of open type winch backs, centrifuges, calenders (old construction without devices for relaxing of the fabric and improving of it's dimensional stability). These calenders have a possibility only to roll the fabric, but not to plait it. Nobody is doing control of shrinkage after washing and checking the dimensional stability.

In some of the mills bleaching is carried out at open air in cement tanks using the mostly prolonged technology. The washing and rinsing are carried out manually in these tanks.

The drying is in two varients in open air:

- using direct sun light
- under shelters

For dyeing they are using reactive dyes. Only for some special colours, in which the reactive dyes show low colour fastnesses they are using selected vat dyes. In reactive dyeing I ascertained big diversions from the optimum technology for dyeing. The quantity of alkalies in most cases is considerably higher than this prescribed in the catalogues. That's why the colour yield is low. For dyeing dark shade for example the requisite amount of dyestuff is 4-5%. In this case they are using 7-8% dyestuff. The process of dyeing is unnecessary prolonged, sometimes to 2 hours. In some mills they are using acetic acid for neutralisation of alkalies after reactive dyeing. This is the reason for some change in the hue and some hardness in the handle of the fabrics. In some colours the fastnesses are low, not answering the possibilities of reactive dyes.

Mostly the fabrics have hard handle in spite of softening carried out after bleaching and dyeing. There are two reasons for this. First this is a big density in knitting process. Second this is unsatisfied quality of the softeners used.

The situation in printing is not better. It is carried out with pigment dves using manual screen method without fixing after printing. The printers are making only drying in direct sun light.

In 1981 I suggested the import of mercerizing machine for tubular knitted goods "Stabilo Flow" from "Thies", West Germany and continuous line for stabilizing the tubular knitted goods from "Moris Heliot", France. Now I found that in Leela Hosiery Mills, Tirupur this machine was purchased and will be installed in the end of May 1983. The same owner is planning to import the continuous line for Stabilizing from Moris Heliot, France. This equipment will improve the quality and aestetical view of knitted garments in considerable degree.

After the acquaintance with the situation of technological process and available equipment in the local mills I prepared two programmes for training courses.

- Training course for advanced finishers
  - from 4 till 9 April 1983
- Training course for beginers-finishers
  - from 18 till 22 April 1983

  (see annexes-iii and iv)

Two courses were run successfully in the indicated dates (see annexes v, vi, vii, viii, ix, x). The amount of participants took part in these courses and their level of qualifications you can see in annexes xi, xii, xiii, xiv.

It is necessary to be mentioned that there is a big difference in the education and qualification of the participants. The people who are working in the big mills of woven industry have a high qualification and are familiar with many new methods in finishing processing. But those who are from small knitting mills they are with not sufficient qualification and are familiar only with the basic finishing treatment.

The results of courses are satisfied. The participants listened carefully the lectures, asked questions and took part in discussions and practical exercises.

In the period between my two missions Mr.Narasimhan (SITRA Fellow) has spent 6 months in UK as a UNIDO fellow for taking up training in the field of finishing of knitted fabrics and garments. In spite of the programme prepared by me in my first mission, the training was not carried out according to this programme. Nevertheless Mr.Narasimhan showed up high diligence and was received the necessary qualification. He is working permanently for improving his own qualification and increasing his knowledge. At the present he is in condition to make self-dependent research work in the field of bleaching, dyeing and high finishing of knitted fabrics and garments.

In comparison with 1981 the Finishing Section (Chemistry Department) of SITRA now is expanded. At this moment in the section there are four fellows working. The leader is Dr.Sivakumaran. They are carried out extensive research in the field of dyeing, stabilising of dimensions, mercerizing, high finishing with synthetic resins, etc. The specialists of this department are rendering permanent help to the finishing mills in South India.

During the time of my mission here I had many discussions with the people from Knitting and Finishing Sections on the topics of their research programmes. All assistance asked from me by SITRA staff was given in my best way.

## RECOMMENDATIONS

1. It is recommended to offer to all Finishing Knitting Mills a new technology for combine (one-bath) bleaching with Sodium Hypochlorite and Hydrogen Peroxyde on purpose of decreasing the expenditure of water and electrical power (The both are especially of short supply in the South India). For this purpose see annexe-xv.

2. It is recommended for all Finishing Knitting Mills where there are available pin-stenters and padding mangles to implement the new technology for mercerization of tubular knitted goods (patent of 'Sandoz' company - Switzerland). See annexe-xvi.

3. It is recommended to make corrections in the technology used for dyeing with reactive dyestuffs on purpose of saving dyestuffs, auxiliaries, water, electrical power and time and for increasing the colour fastnesses. For this purpose it is recommended:

- to reduce the quantity of alkalies to optimum value indicated in the corresponding catalogue of the firm producer.
- to reduce the quantity of the dyestuff used.
- to stop acidifying with acetic acid after dyeing.
- not to prolong unnecessary the dyeing process.
- to reduce the quantity of electrolytis to optimum value indicated in the corresponding catalogue of the firm producer.

4. It is recommended to check the value of the shrinkage after washing in all Finishing Knitting Mills and when this value is high than the normal to make a new treatment of the fabric for it's correction.

5. It is recommended to dry the wet fabrics only under the shelters and gradually to switch to drying in drying machines.

6. Since the rubber filament used for producing of rubber bands for lady's slips and gent's briefs, has a low fastness to high temperature and washing agents it is recommended to make prior bleaching of the yarn used for knitting of these bands. This way after knitting of the band it is recommended to carry out only washing, drying and calendering.

7. The producers of lady's shirts and gent's shirts are interesting in great degree of stiff interlining for collars and cuffs. That's why it is recommended to implement the technology for stiffening with some resins and auxiliaries made in India. It is recommended to use the following recipe:

| | |
|---|---|
| 100 g/l | Auximine EU |
| 25 g/l | Auxinol PE |
| 20 g/l | Silicone AU 331 |
| 5 g/l | Catalyst SLM |
| 10 g/l | Magnesium Chloride |
| 100 g/l | Auxicol PV |

8. Since there is a desire to establish a new factory for knitting and finishing of Polyester-silk in Coimbatore District it is recommended to use the project for indispensable equipment which is given in annexe-xviii in two varients.

9. It is recommended to supply some spare parts for laboratory heat setting stenter. 'Mathis' indicated in annexe-xix.

10. For the realisation of research and development programme under Finishing Section it is recommended that some additional machines are provided. They are as follows:

- Calender for tubular knitted goods
- High speed stirrer for preparing printing pastes

11. It is recommended that Mr.R.Rajendran and Mr.S.Rajendran (the both are Finishing Section fellows) should attend a training course available at 'Sandoz' laboratory in Bombay and visit the leading textile companies in Bombay.

12. It is recommended to start permanent contact with the leading firms produced dyestuffs and auxiliaries from Europe and Japan and to subscribe to news bulletins of these companies in the field of textile finishing.

13. It is recommended to extend the research and development programme for Dyeing and Finishing Section with some more topics. These are as follows:

- Optimum technology for dyeing of Polyester/cotton blend using carrier method in winch back machine. Selection of suitable dyestuffs, carriers and other auxiliaries.

- Optimum technology for printing of Polyester/cotton blend useful for the printing equipment available in the local mills. Selection of suitable dyestuffs, thickners and other auxiliaries.

- Construction of thermopress for baking the pigment prints on shirts.

- Construction of dryer vertical type for tubular knits for local mills.

14. It is recommended to make corrections in the technology used for dyeing with vat dyes for the purpose of saving dyestuffs, auxiliaries, water, electrical power and time. For this purpose it is recommended

- to put the optimum amount of alkali indicated in the catalogue.

- to add the dyebath 2 g/l Glucose for dyes susceptible to over-reduction.

15. It is recommended to start production of printing motifs on paper for fusing onto the ready-made garr . The following is the technology:

| | | |
|---|---|---|
| Recipe: | Polyvinylchloride | 500 g. |
| | Dibutylphtalate | 300 g. |
| | Pigment dyestuff | x% |

Printing on silicone paper by hand screen method. Drying 15 sec. at 60-70°C: The parameters for fusing are as follows:

| | |
|---|---|
| Pressure | 200 $g/cm^2$ |
| Temperature | 180°C |
| Time | 20 sec. |
| Vacuum | 10 sec. |

Annexe-i

UNITED NATIONS

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
UNIDO

9 January 1981

PROJECT IN THE REPUBLIC OF INDIA

INTERNAL

JOB DESCRIPTION
DP/IND/76/023/11-02/31.7.B

| | |
|---|---|
| Post title | Dyeing and Finishing Technologist |
| Duration | Six months |
| Date required | April 1981 |
| Duty station | Coimbatore |
| Purpose of project | To strengthen and develop the capacity of the South India Textile Research Association (SITRA) to undertake research, provide specialist advisory services and to conduct training courses for the benefit of the spinning, knitting, dyeing and finishing and making-up mills and factories in the southern part of the country. |
| Duties | Working in co-operation with the Director and Project Leader at SITRA, the expert will specifically be expected to; |

1. Carry out a survey on practices in the bleaching, dyeing, printing and finishing of knitted fabrics and garments together with the associated dyeing and finishing of yarn;

2. Become familiar with the current mode and scale of operations;

3. Give advice on the specification and planning of laboratory-scale equipment and instrumentation for the bleaching, dyeing, printing and finishing of textile materials, especially those of knitted fabrics and garments;

..../..

Applications and communications regarding this Job Description should be sent to: Project Personnel Recruitment Section, Industrial Operations Division UNIDO, VIENNA INTERNATIONAL CENTRE, P.O.Box 300, Vienna, Austria

4. Give advice on a continuing research programme in dyeing, printing and finishing, including the development of equipment and instrumentation for use both internally and by the industry;

5. Assist in the internal training of SITRA personnel;

6. Assist in the development of training courses for industrial bleachers, dyers, printers and finishers;

7. Assist in setting up a technical service facility at SITRA in dyeing and finishing;

8. Give advice on a United Nations fellowship programme of overseas visits, lasting six months; this programme will include training in the dyeing, printing and finishing of knitted goods.

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.

Qualifications: University degree - and preferably a post-graduate qualification - in Colour Chemistry, Textile Chemistry or Chemical Processing; extensive experience in the dyeing and finishing of knitted fabrics and garments especially those from cotton and cotton blended yarns; knowledge and experience of the printing of knitted goods an asset.

Language: English

Background Information: During the first phase of this project, UNDP/UNIDO assistance concentrated upon improving the quality of the yarn, on training in knitting technology and on providing technical services to the knitting industry.

The present phase aims to build upon the achievements of the first phase and to further develop the expertise of SITRA personnel in relation to the needs of the knitting, dyeing and finishing and making-up industries. It will also extend appropriate research and development activities in these areas related to the needs of the hosiery and related industries, on both a short-and long-term basis. It will also introduce technical liaison and training courses in these three areas of industrial activities.

Annexe-ii

Organizations and Firms Visited and Discussions Held

| | |
|---|---|
| Tuesday<br>1-2-'83 | 1. India Dye House,<br>Tirupur (Mr.Ramani)<br>(Bleaching and dyeing of knits) |
| | 2. Leela Hosiery Mills<br>Tirupur (Mr.Gangadharan)<br>(Dyeing and Garment manufacturing) |
| | 3. India Overseas Hosieries<br>Tirupur (Mr.Jagannathan)<br>(Dyeing and Garment Manufacturing) |
| | 4. J.J.Mills,<br>Tirupur (Mr.Balu and Mr.Manoharan)<br>(Knitting, dyeing, bleaching and garment manufacturing) |
| Wednesday<br>30-3-'83 | Madura Coats Ltd.,<br>Madurai (Mr.A.Subramaniam - Research and Technical Manager)<br>(Spinning, weaving, finishing) |
| Monday<br>25-4-83 | 1. T.M.Knitting Mills<br>Tirupur (Mr.N.Palaniswami)<br>(Knitting, Calendering, Garment manufacturing) |
| | 2. Sonar Dyeing and Screen Printing Works<br>Tirupur (Mr.A.Anandan)<br>(Dyeing, Bleaching, Printing) |
| | 3. Tirupur Textiles Private Limited,<br>Hosiery Division, Tirupur<br>(Mr.Jayabal)<br>(Knitting, Calendering, Garment Manufacturing) |
| | 4. Reliance Dyeing Works<br>Tirupur (Mr.Parthasarathi and Mr.Palaniswamy)<br>(Bleaching, dyeing, calendering) |

| | |
|---|---|
| Wednesday<br>27-4-'83<br>Thursday<br>28-4-'83 | Tantex Company<br>Tanjavoor (Mr.N.Chandrasekar)<br>(Knitting, bleaching, dyeing, printing,<br>garment manufacturing) |
| Thursday<br>3-5-'83 | Tirupur Textiles Private Limited<br>Hosiery Division<br>Tirupur (meeting with all engineering staff) |
| Thursday<br>12-5-83<br>Friday<br>13-5-'83 | BTRA<br>Bombay (Dr.S.M.Betrabet and Dr.Bandyopadhyay) |

Annexe-iii

Syllabus - Knits Finishing Training Course
For advanced finishers

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 1. | Methods for scouring and bleaching of knitted fabrics: | Dr.Sivakumaran | 1 |
| | 1.1 Scouring and bleaching of 100% cotton and cotton/viscose blend. | | |
| | 1.2 Scouring and bleaching of cotton/polyester blend | | |
| | 1.3 Scouring and bleaching of 100% Polyester | Mrs.Boeva | 1 |
| | 1.3.1 Thermosol method | | |
| | 1.3.2 Exhaustion method | | |
| 2. | Dyeing of knitted fabrics from 100% cotton and cotton/viscose blend with reactive dyes: | Dr.Sivakumaran | 1 |
| | 2.1 Different kinds of reactive dues | | |
| | 2.2 Exhaustion method and requisite equipment for this method | | |
| | 2.3 Continuous method of dyeing with reactive dyes | Mrs.Boeva | 1 |
| 3. | Dyeing of knitted fabrics from 100% cotton and cotton/viscose blend with direct dyes: | Dr.Sivakumaran | 1 |
| | 3.1 Methods for fixing the dyes and strengthen the colour | | |
| | 3.2 Values of colour fastnesses | | |
| | 3.3 Methods for correction when the dyeing is out of levelling | | |

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 4. | Dyeing of Knitted fabrics from 100% cotton and cotton/viscose blend with vat dyes: | Mrs.Boeva | 1 |
| | 4.1 Different methods | | |
| | 4.2 Methods for correction when the dyeing is out of levelling | | |
| | 4.3 Value of colour fastnesses and methods for their determination | | |
| 5. | Dyeing of knitted fabrics from 100% Polyester | Mrs.Boeva | 1 |
| | 5.1 Different types of methods | | |
| | 5.2 Different types of dyes | | |
| | 5.3 Requisite equipment | | |
| 6. | Dyeing of knitted fabrics from cotton/polyester blend | Mrs.Boeva | |
| | 6.1 One-step and two-step methods of dyeing with direct and disperse dyes. | | 1 |
| | 6.2 Two-step dyeing with reactive and disperse dyes and with vat and disperse dyes. | | 1 |
| | 6.3 Dyeing with blended dyes. Different types of blended dyes. Thermosol method of dyeing | | 1 |
| 7. | Printing of knitted fabrics from 100% cotton and cotton/viscose blend. | Dr.Sivakumaran | 1 |
| | 7.1 Pigment printing | | |
| | 7.2 Printing with reactive dyes<br>7.2.1 Pretreatment of the fabric<br>7.2.2 Preparing of printing paste<br>7.2.3 Methods for steaming<br>7.2.4 Washing | | |

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 8. | Printing of knitted fabrics from 100% Polyester | Mrs.Boeva | 1 |
| | 8.1 Pretreatment of the fabric | | |
| | 8.2 Preparing of printing paste and printing | | |
| | 8.3 Fixation of the dyes | | |
| | 8.4 Washing | | |
| | 8.5 Drying | | |
| 9. | Printing of knitted fabrics from cotton/polyester blend: | Mrs.Boeva | 1 |
| | 9.1 Pretreatment of the fabric | | |
| | 9.2 Preparing of printing paste and printing | | |
| | 9.3 Fixation of the dyes | | |
| | 9.4 Washing | | |
| | 9.5 Drying | | |
| 10. | Mercerization of knitted fabrics from 100% cotton and cotton/ polyester blend. Alkalization of knitted fabrics from 100% Polyester | Mrs.Boeva | 1 |
| | 10.1 Requisite equipment | | |
| | 10.2 Technology and recipes | | |
| | 10.3 Effect of mercerization and alkalization. | | |
| | 10.4 New method of mercerization - Sandoz - Switzerland | | |
| 11. | New machines for finishing of knitted fabrics and garments: | Mrs.Boeva | 1 |
| | 11.1 Machines for dyeing | | |
| | 11.2 Machines for stabilization of dimensions | | |
| | 11.3 Machines for screen and transfer printing | | |

| No. | Subject | Lecture | Duration in hours |
|---|---|---|---|
| | 11.4 Continuous ranges for wet treatment | Mrs.Boeva | |
| | 11.5 Machines for treatment in organic solvent | | |
| 12. | New methods for 'fancy' printing of knitted fabrics and garments: | Mrs.Boeva | 1 |
| | 12.1 'Burn-off' printing | | |
| | 12.2 Foam printing | | |
| | 12.3 Metal printing | | |
| | 12.4 Discharge printing | | |
| | 12.5 Batik printing | | |
| | 12.6 Flock printing | | |
| 13. | Finishing of knitted fabrics & Garments with special auxiliaries: | Mrs.Boeva | 1 |
| | 13.1 Softening | | |
| | 13.2 Antistatic finishing | | |
| | 13.3 Antishrinking finishing | | |
| | 13.4 Flameproof finishing | | |
| | 13.5 Soil-release finishing | | |
| | 13.6 Anti-crease finishing | | |
| 14. | Laboratory and semi-industrial finishing equipment necessary for the laboratories of knitting industry: | Mrs.Boeva | 1 |
| | 14.1 Equipment for wet treatment | | |
| | 14.2 Equipment for dry treatment | | |
| | 14.3 Equipment for printing | | |

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 15. | Experimental dyeing of knitted fabric from 100% cotton with reactive dyes:<br>15.1 In winch back machine<br>15.2 In laboratory dyeing machine 'Polymat' | Mr.Narasimhan | 3 |
| 16. | Experimental dyeing of knitted fabric from cotton/polyester blend with disperse and reactive dyes:<br>16.1 In winch back machine<br>16.2 In jet dyeing machine | Mr.Narasimhan | 6 |
| 17. | Experimental dyeing of knitted fabric from 100% polyester with disperse dyes:<br>17.1 Carrier method in which back<br>17.2 High Temperature method in jet dyeing machine | Mr.Narasimhan | 5 |
| 18. | Acquainting with the equipment of Chemical Division of SITRA | Mr.Narasimhan | 3 |
| 19. | Dyeing of 100% Acrylic and blends of polyester/acrylic and acrylic/cotton. | Mrs.Boeva | 1 |

Total 36 hours

6 days x 6 hours

Verka P.Boeva
UNIDO Expert
Coimbatore

January 1983.

Annexe-iv

Syllabus : Knits Finishing Training Course For No-advanced Finishers (Beginners)

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 1. | Methods for scouring and bleaching of knitted fabrics from 100% cotton, cotton/viscose, cotton/ polyester: | Dr.Sivakumaran | 2 |
| | 1.1 Requisite equipment | | |
| | 1.2 Scouring and semi-scouring | | |
| | 1.3 Bleaching with sodium hypochlorite | | |
| | 1.4 Bleaching with Peroxide | | |
| | 1.5 Combined bleaching with sodium hypochlorite and peroxide | | |
| | 1.6 Optical brightening | | |
| | 1.7 Softening | | |
| | 1.8 Hydroextraction | | |
| 2. | Dyeing of knitted fabrics from 100% cotton and cotton/viscose with direct dyes. | Mrs. Boeva | 1 |
| | 2.1 Different kinds of direct dyes | | |
| | 2.2 Technology of dyeing | | |
| | 2.3 Methods for fixing the dyes and strengthen the colour fastnesses | | |
| | 2.4 Hydroextraction | | |
| | 2.5 Methods for correction when the dyeing is out of levelling | | |

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 3. | Checking the colour fastnesses & quality control:<br>3.1 Fastness to wash<br>3.2 Fastness to distilled water<br>3.3 Fastness to perspiration<br>3.4 Fastness to rubbing<br>3.5 Fastness to ironing<br>3.6 Light fastness<br>3.7 Fastness to hypohlorite<br>3.8 Fastness to peroxide | Dr.Sivakumaran | 1 |
| 4. | Dyeing of knitted fabrics from 100% cotton and cotton/viscose with reactive dyes:<br>4.1 Different kinds of reactive dyes.<br>4.2 Technology of dyeing<br>4.3 Washing<br>4.4 Hydroextraction<br>4.5 Colour fastness | Dr.Sivakumaran | 1 |
| 5. | Dyeing of knitted fabrics from 100% cotton and cotton/viscose with vat dyes:<br>5.1 Different methods of dyeing<br>5.2 Dyes and auxiliaries<br>5.3 Requisite equipment<br>5.4 Methods for correction when the dyeing is out of levelling | Mrs. Boeva | 1 |
| 6. | Dyeing of knitted fabrics from 100% Polyester:<br>6.1 Different methods of dyeing<br>6.2 Dyes and auxiliaries<br>6.3 Requisite equipment | Mrs. Boeva | 1 |

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 7. | Dyeing of knitted fabrics from cotton/polyester:<br>7.1 One-step and two-step methods of dyeing with direct and disperse dyes<br>7.2 Two-step method of dyeing with reactive and disperse dyes, with vat and disperse dyes. | Mrs.Boeva | 1 |
| 8. | Printing of knitted fabrics and garments from 100% cotton, cotton/viscose and cotton/ polyester with pigment dyes:<br>8.1 Pretreatment of the fabric<br>8.2 Preparing of printing paste and printing.<br>8.3 Fixation of the dyes<br>8.4 Requisite equipment | Mrs.Boeva | 1 |
| 9. | Transfer printing:<br>9.1 Requisite equipment<br>9.2 Different types of transfer paper<br>9.3 Printing conditions | Mrs.Boeva | 1 |
| 10. | Drying and calendering of knitted fabrics:<br>10.1 Requisite equipment<br>10.2 Technological parameters | Mrs.Boeva | 1 |

| No. | Subject | Lecturer | Duration in hours |
|---|---|---|---|
| 11. | New machines for finishing of knitted fabrics and garments:<br>11.1 Machines for dyeing<br>11.2 Machines for stabilization of dimensions<br>11.3 Machines for screen and transfer printing<br>11.4 Continuous ranges for wet treatment | Mrs. Boeva | 1 |
| 12. | Experimental dyeing of knitted fabric from 100% cotton and cotton/viscose with direct dyes in winch-back | Mr.Narasimhan | 3 |
| 13. | Experimental dyeing of knitted fabric from 100% cotton and cotton/viscose with reactive dyes in winch-back | Mr.Narasimhan | 3 |
| 14. | Experimental bleaching of knitted fabric from 100% Cotton and Cotton/viscose in winch-back | Mr.Narasimhan | 3 |
| 15. | Experimental dyeing of knitted fabric from cotton/polyester with direct and disperse dyes:<br>14.1 In winch back<br>14.2 In jet machine | Mr.Narasimhan | 6 |

Total 27 hours

4 days x 6 hours

1 day x 3 hours

Verka P.Boeva
UNIDO Expert
Coimbatore

January 1983

Annexe-v

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION
P.B.No.3205, Coimbatore Aerodrome P.O., Coimbatore-641 014 India

VII/2/ Date 10 March '83

Dear Sirs,

You will be aware of the growing importance of knitted outerwear garments. Polyester and cotton T-shirts, jerseys, etc. of impressive appeal are the fashions of the day, particularly among the young and young-spirited commuters. Needless to say, the aesthetic appeal, comfort and functional properties of the knitted outerwear are the result of the chemical treatments imparted to them. With a view to equip the processers for better understanding of the operations involved and the modern developments in the field SITRA is arranging a training programme on the chemical processing of knitted fabrics with Mrs.Verka P.Boeva the UNIDO Expert, now at SITRA in key role.

It would be of interest to note that woven fabric processers can diversify to knitteds also without much of investment because the basic chemical aspects of the processes involved pertaining to knitteds and wovens are the same. With this in mind, SITRA has pleasure in offering the training programme mentioned above to woven fabric processers also.

The details about the programme are given in the enclosed sheet. You are welcome to participate in the programme.

Thanking you,

Yours faithfully,

Sd/-

Dr.S.Sivakumaran
HOD Textile Chemistry

Encl:

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION
P.B.No.3205, Coimbatore Aerodrome P.O., Coimbatore-641 014 India

VII/2/ /83 Date 10 March '83

Dear Sirs,

Sub: Training Programme on Chemical Processing of Knitted Fabrics.

---

The South India Textile Research Association (SITRA), Coimbatore is arranging a Training Programme in Chemical Processing of Knitted Fabrics.

Mrs. Verka P.Boeva, the Visiting Expert in Chemical Processing from the United Nations Industrial Development Organisation (UNIDO), now at SITRA, will personally conduct, deliver lectures and supervise the training programme. Besides Mrs. Boeva, the course will be addressed by the Inter Disciplinary Specialist Faculty at SITRA. The programme will comprise of lectures and practical sessions. During the session, Mrs. Boeva will also be available for discussions on problems faced in the industry.

The programme will cover the following topics:

1. Scouring, Bleaching, Dyeing, Printing and Finishing of 100% Cotton, Cotton/viscose blends, 100% polyester and polyester/cotton or polyester/viscose blends.

2. Quality Control Measures.

3. Machinery particulars.

4. Recent developments in the techniques of chemical finishing.

contd.. 2

A full time programme of 6 days duration commencing on Monday April 4, 1983 and concluding on Saturday April 9, 1983 from 10.00 A.M. to 5.00 P.M. daily has been scheduled at SITRA, Coimbatore.

A nominal course fee of Rs.300/- per candidate will be levied for participation in the programme. Lunch and Coffee will be provided by SITRA. Certificates will be distributed to those who ensure a minimum of 90% attendance.

Nominees for the programme should have had practical managerial or supervisory experience in the chemical processing and should be able to follow lectures in English.

Candidates will be admitted to the programme on a 'first come first served basis' subject to the fulfilment of minimum requirements relating to practical knowledge and experience of the chemical processing and ability to understand and speak English.

Enclosed is a nomination form for sponsoring candidates for the programme. Kindly have the form duly completed and mailed to SITRA, Coimbatore on or before March 23, 1983.

With kind regards,

Yours faithfully,

Sd/- T.V.Ratnam
Director

Encl: Nomination form.

Annexe-vi

NOMINATION FORM*

PROGRAMME ON CHEMICAL PROCESSING OF KNITTED FABRICS

(SITRA, Coimbatore, April 4 - 9, 1983)

Name of Factory & Address :

Name of Participant :

Designation :

Educational Qualifications :

Experience in chemical processing of fabrics in industry :

Cheque for Rs.300/- payable to South India Textile Research Association, Coimbatore enclosed.

Cheque No. Date: Bank:

Place:

Date :

Signature

*If more than one candidate is deputed, particulars may be given in separate typed sheets.

(Kindly return this Form duly completed on or before March 23, 1983 to THE DIRECTOR, SITRA, Coimbatore-641 014)

## Annexe-vii

Schedule for advanced course

| Day/Date | 10.00-10.45 | 11.00-11.45 | 12.00-12.45 | 2.00-2.45 | 3.00-3.45 | 4.00-4.45 |
|---|---|---|---|---|---|---|
| Monday 4-4-1983 | Scouring & bleaching of 100% cotton, cotton/viscose, cotton/ polyester (SS) | Scouring & bleaching of 100% polyester (VPB) | Dyeing of 100% cctton and cotton/ viscose with reactive dyes (SS) | Experimental dyeing of 100% cotton (NLN) | | |
| Tuesday 5-4-1983 | Continuous method of dyeing with reactive dyes (VPB) | Dyeing of 100% cotton & cotton/ viscose with direct dyes (SS) | Dyeing of 100% cotton & cotton/ viscose with vat dyes (VPB) | Acquainting with the equipment for finishing in SITRA (NLN) | | |
| Wednesday 6-4-1983 | Dyeing of 100% Polyester (VPB) | Dyeing of Cotton/ polyester (VPB) | Dyeing of cotton/ polyester (VPB) | Dyeing of cotton/ polyester (VPB) | Printing of 100% cotton & cotton/ viscose (SS) | Printing of 100% polyester (VPB) |
| Thursday 7-4-1983 | Printing of cotton/ polyester (VPB) | Mercerization 100% cotton & cotton/ polyester Alkalization 100% Polyester (VPB) | New machines for finishing (VPB) | New methods for 'fancy' printing (VPB) | Finishing with special auxiliaries (VPB) | Laboratory & semi-industrial equipment (VPB) |
| Friday 8-4-1983 | Experimental dyeing of cotton/polyester (NLN) | | | Experimental dyeing of cotton/polyester (NLN) | | |
| Saturday 9-4-1983 | Dyeing of 100% Acrylic & blends Acrylic/poly-ester & Acry lic/cotton (VPB) | Experimental dyeing of 100% Polyester (NLN) | | Experimental dyeing of cotton/polyester (NLN | | |

VPB: Verka P.Boeva-15 NLN: N.L.Narasimhan-17 SS: Dr.S.Sivakumaran-7 12.45 Lunch -2.00

Annexe-viii

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION,
P.B.No.3205, Coimbatore Aerodrome P.O., Coimbatore-641 014 India

VII/2/ /83 Date 22nd March '83

Dear Sirs,

Sub: Training Programme on Chemical Processing of Knitted Fabrics II

---

The South India Textile Research Association (SITRA), Coimbatore is arranging a Training Programme in Chemical Processing of Knitted Fabrics. This course will help, those who are already in the line of knitting industries to expand their knowledge to the dyeing and finishing of knitted fabrics also.

Mrs. Verka P.Boeva, the Visiting Expert in Chemical Processing from the United Nations Industrial Development Organisation (UNIDO), now at SITRA, will personally conduct, deliver lectures and supervise the training programme. Besides Mrs.Boeva, the course will be addressed by the Inter Disciplinary Specialist Faculty at SITRA. The programme will comprise of lectures and practical sessions. During the session, Mrs. Boeva will also be available for discussions on problems faced in the industry.

The programme will cover the following topics:

1. Scouring, Bleaching, Dyeing, Printing and Finishing of 100% Cotton and viscose and polyester blends.
2. Quality Control Measures.
3. Machinery particulars.
4. Recent developments in the techniques of chemical finishing.

...2...

A full time programme of 5 days duration commencing on Monday, April 18, 1983 and concluding on Friday, April 22, 1983 from 10.00 A.M. to 5.00 P.M. daily has been scheduled at SITRA, Coimbatore.

A nominal course fee of Rs.300/- per candidate will be levied for participation in the programme. Lunch and Coffee will be provided by SITRA. Certificates will be distributed to those who ensure a minimum of 90% attendance.

Nominees for the programme should have had acquantance with the textile (preferably knitting) industry and should be able to follow lectures and discussions in English.

Candidates will be admitted to the programme on a 'first come first served basis' considering their practical knowledge and experience in the textile (preferably knitting) industry and ability to understand and speak English.

Enclosed is a nomination form for sponsoring candidates for the programme. Kindly have the form duly completed and mailed to SITRA, Coimbatore on or before April 17, 1983.

With kind regards,

Yours faithfully,

Sd/- T.V.Ratnam
Director

Encl: Nomination form.

Annexe-ix

NOMINATION FORM*

PROGRAMME ON CHEMICAL PROCESSING OF KNITTED FABRICS-II
(SITRA, Coimbatore, April 18-22, 1983)

Name of Factory & Address :

Name of Participant :

Designation :

Educational Qualifications :

Experience in knitting industry :

Cheque for Rs.300/- payable to South India Textile Research Association, Coimbatore enclosed.

Cheque No. Date: Bank:

Place:

Date :

Signature

*If more than one candidate is deputed, particulars may be given in separate typed sheets.

(Kindly return this Form duly completed on or before April 7, '83 to THE DIRECTOR, SITRA, Coimbatore-641 014).

Annexe-x

Schedule for Beginners Course

| Day/Date | 10.00-10.45 | 11.00-11.45 | 12.00-12-45 | 2.00-2-45 | 3.00-3.45 | 4.00-4.45 |
|---|---|---|---|---|---|---|
| Monday 18-4-1983 | Methods for scouring and bleaching of 100% cotton, cotton/viscose, cotton/polyester (SS) | | Dyeing of 100% cotton and cotton/ viscose with direct dyes (VPB) | Dyeing of 100% cotton and cotton/ viscose with reactive dyes (SS) | Dyeing of 100% cotton and cotton viscose with vat dyes (VPB) | Dyeing of knitted fabrics from 100%Polyster (VPB) |
| Tuesday 19-4-1983 | Checking the colour fast-ness and quality control (SS) | Dyeing of cotton/ polyester (VPB) | Printing of 100% cotton, cotton/ polyester with pigments (VPB) | Transfer printing (VPB) | Drying and calendering (VPB) | New machines for finishing (VPB) |
| Wednesday 20-4-1983 | Experimental dyeing of100% cotton and cotton/viscose with direct dyes (NLN) | | | Experimental bleaching of 100% cotton and cotton/viscose (NLN) | | |
| Thursday 21-4-1983 | Experimental dyeing of cotton/polyester with direct and disperse dyes (NLN) | | | Experimental dyeing of cotton/polyester with direct and disperse dyes (NLN) | | |
| Friday 22-4-1983 | Experimental dyeing of 100% cotton and cotton/viscose with reactive dyes (NLN) | | | | | |

VPB: Verka P.Boeva-8 NLN: N.L.Narasimhan-15 SS: Dr.S.Sivakumaran-4 12.45 -2.00 Lunch

Annexe-xi

List of Participants - Advanced Course

| S.No. | Name | Designation | Organisation |
|---|---|---|---|
| 1. | A.Anandan | Partner | Sonar Dyeing & Screen Printing Works, Tirupur |
| 2. | V.Aravind | Partner | Verkots Processors, Tirupur. |
| 3. | S.M.Banerjee | Mng.Director | Sreepathy Hosiery Mills Tirupur |
| 4. | N.Chandran | Mng.Partner | India Dyeing, Tirupur |
| 5. | N.Chandrasekar | Supervisor | Tantex, Thanjavoor |
| 6. | N.Duraiswamy | Processing | Tamil Nadu Co-op.Processing Mills, Erode. |
| 7. | B.N.Ghosh | Partner | Gopal Hosiery Mills, Calcutta. |
| 8. | A.Ilangovan | Project Manager | Hosiery Processing Unit, Trivandrum. |
| 9. | A.C.Kalidas | Dyeing Master | City Processors, Tirupur |
| 10. | K.K.Kothari | Partner | Kothari Hosiery Factory, Calcutta. |
| 11. | V.S.Menon | Manager | Leela Hosiery Mills, Tirupur. |
| 12. | M.Manoharan | Partner | Jay Jay Processing, Tirupur. |
| 13. | M.Meyyappan | Asst. Manager | Kwality Textiles, Pollachi |
| 14. | A.Palaniswamy | Proprietor | Tirumalai Dyeings, Tirupur. |
| 15. | K.Ravindran | Finishing Master | Premier Mills, Belathur |
| 16. | V.K.Somakumar | Partner | Sonar Dyeing & Screen Printing Works |
| 17. | P.Sivakumar | Manager | Thirumalai Dyeings, Tirupur. |
| 18. | S.Subramaniam | Manager | Vasantha Dyeing & Printing Works |
| 19. | P.Subramaniam | Manager | Premier Dyeings |
| 20. | S.N.Subramaniam | Factory Manager | Cbe Pioneer Mills, Erode |
| 21. | P.S.Vijayaraghavan | Tech.Consultant | Tamil Nadu Process, Tirupur. |
| 22. | D.Viswambaran | Processing Manager | Mysore Spg.& Mfg.Co., |
| 23. | P.Venkatachalam | Partner | Shanmugha Dyeing Works |

Annexe-xii

SITRA Programme for Advanced Finishers - Batch 4.4-9.4.1983

Profile of Participants

1. Status of participants

| Designation | Number of participants |
|---|---|
| Owner/Managing Director/Partner | 12 |
| Manager/Management staff | 7 |
| Technical Consultant | 1 |
| Project Manager | 1 |
| Supervisor | 1 |
| Total | 22 |

2. Educational Qualifications of Participants

| Education | Number of participants |
|---|---|
| Post graduate | 2 |
| Graduate in Engineering | 3 |
| Graduates B.A/B.Sc./B.Com | 7 |
| Diploma in Handloom Technology | 2 |
| Pre-University Course | 3 |
| S.S.L.C. | 5 |
| Total | 22 |

3. Experience in Chemical Processing in Industry

| Experience in years | Number of participants |
|---|---|
| Less than 1 year | 1 |
| 1-5 | 11 |
| 6-10 | 7 |
| 11-15 | 3 |
| Total | 22 |

Annexe-xiii

List of Participants - Begimers Course

| S.No. | Name | Designation | Organisation |
|---|---|---|---|
| 1. | V.Govindarajan | Partner | Ragunath Knitting Co. Salem. |
| 2. | R.Kannan | - | Giri Tex, Tirupur. |
| 3. | A.V.Krishnan | Marketing Manager | The Vijayakumar Mills Ltd., Tirupur. |
| 4. | A.Loganathan | Partner | Gentex, Tirupur |
| 5. | M.M.Manohar | Partner | Yuvaraj International, Tirupur. |
| 6. | PL.Nagalingam | Partner | Swarna Kaleeswara Knittings, Tirupur. |
| 7. | S.Nagarajan | Managing Partner | Spy Knit-wears, Tirupur |
| 8. | N.Palaniswami | - | T.M.Knittings, Tirupur |
| 9. | M.Rajalingam | Proprietor | Bharati Knitting Co., Tirupur. |
| 10. | M.Rama Muthu | Production In-charge | The Vijayakumar Mills Ltd., Tirupur. |
| 11. | R.Rammohan | Partner | Malathi Knitting Co. Salam |
| 12. | P.Sathyamurthi | Partner | Devi Knitting Co., Tirupur. |
| 13. | M.Shanmugasundaram | - | c/o Dr.N.Nachimuthu, Tirupur. |
| 14. | A.Somasundaram | Managing Partner | Arun Knitters, Tirupur. |
| 15. | V.R.Somasundaram | Partner | Padmasree Knitting Mills Tirupur. |
| 16. | S.Soundararajan | Proprietor | LSR Dyeing Factory, Tirupur. |
| 17. | B.Srinivasan | - | Mayura Knitting Mills, Tirupur. |
| 18. | M.G.Subash | Managing Partner | Karur Knitting Co., Karur. |
| 19. | K.M.Subramaniam | Staff | Devi Knitting Co., Tirupur |
| 20. | Mr.Syed Barkath | Partner | Conti Garments, Tirupur |
| 21. | P.Thiagarajan | Manager | Sivakumar Textile Processors, Tirupur. |
| 22. | M.N.Venkatesh | Partner | Sree Seetharam Hosieries Karur |
| 23. | R.Moorthy | Supervisor | Thirukumaran Tex,Tirupur |
| 24. | M.Venkatachalam | - | Subramania Sayasalai, Tirupur |

Annexe-xiv

SITRA Programme for Beginners Finishers - Batch 18-22.4.1983

1. Profile of Participants

| Designation | Number of participants |
|---|---|
| Owner/Managing Partner/Partner | 17 |
| Manager/Management staff | 5 |
| Supervisor | 6 |
| Total | 28 |

2. Educational Qualifications of Participants

| Education | Number of participants |
|---|---|
| SSLC | 4 |
| PUC | 9 |
| BA/B.Sc./B.Com | 10 |
| BE/B.Tech | 3 |
| M.Sc. | 2 |
| Total | 28 |

3. Experience in Chemical Processing in Industry

| Experience in years | Number of participants |
|---|---|
| Nil experience | 21 |
| 1-5 | 4 |
| 6-10 | 2 |
| 11-15 | 1 |
| Total | 28 |

Annexe-xv

One-bath Bleaching of 100% Cotton Knitted Fabrics

In the bath for bleaching (Liquor ratio 1:14) with temperature 25°C add

1 g/l washing agent (Sandopan DTC)
1 g/l caustic soda 36°Be'

Load the fabrics and treat 30 min. Then add

3 g/l Active chlorine

and treat 45-60 min. The pH must be 10.5-11. Then raise the temperature to 60°C for 10-15 min and add in the bath

0.5 g/l water glass (or organic stabilizer)
4 ml/l Peroxide 35%

Treat at this temperature 10 min. and raise the temperature to 85°-90°C. Bleach 60 min. Stop the heating and after 15 min. add

0.5% Optical brightening agent (dissolved and strained previously)

Treat 20 min. and drop the bleaching bath.

Rinse in running water to pH 7

In new bath with temperature 40-50°C put
2 g/l Softening agent.

and treat 20 min.

then unload the bath. Centrifugate 20 min.

Annexe-xvi

## Technology for mercerization of circular knitted fabrics of 100% Cotton and Cotton/Polyester blend

This technology is applicable to the equipment available in some of the mills of South India. For this purpose it is necessary to avail the following machines: Padding mangle, Heat Setting Stenter, Winch-back and Centrifuge. This technology by the patent method of 'Sandoz', Switzerland is applicable only with the original products of 'Sandoz'.

The circular knitted fabric must be open by cutting on one side and batched off in the carrier. The fabric must be impregnate in the Padding mangle with the following solution:

| | |
|---|---|
| 340 ml/l | Caustic soda 44°Be' |
| 30 ml/l | Water glass (Sodium Silicate) |
| 50 ml/l | Mercerol Sandoz SM liquid |

| | |
|---|---|
| Temperature of padding liquor | - 40°C |
| Concentration | - 19°Be' |
| Speed of the fabric | - 15 m/min. |
| Pressure of the rolls | - 1,8 kg/cm$^2$ |

Leaving the Padding Mangle the fabric is entering in the heat setting stenter with the same speed (This speed is for Stenter with 4 chambers - total length 12 m).

Temperature of the chambers:

I chamber 150°C II, III and IV Chambers 160°C.

Overfeeding - 0

Adjustment of width of the fabric = Finishing width required + 10% of it

After leaving the stenter the fabric must be washed immediately. It is advisable not to leave the fabric for more than 2 to 3 hours without washing. The washing is carrying out in Winch-back into three steps.

I Step - Washing with pure water
Temperature : 70-80°C
Duration : 10 min.
The fabric must be put in warm water only, but not in cold water.

II Step - Rinsing with pure cold water

III Step - Washing in water with 1 ml/l Acetic Acid to pH 7 the fabric must be washed after stentering within 2 to 3 hours time. Otherwise it will bring local moisture and spots on the fabric. It is recommendable to carry out the mercerization before dyeing. If mercerization is carried out after dyeing to have in mind that the dyestuffs must be stable to alkali.

After the washing the fabric must be hydroextracted in the centrifuge. The drying is carrying out in the heat setting stenter at a temperature 160°C and with speed 20-25 m/min over-feeding 10-15%.

For increasing of dimensional stability it is recommendable to make the following finishing:

Impregnation of the fabric after hydro-extraction wet in wet on Padding Mangle with the following solutions:

| | |
|---|---|
| Finish KVS fl | 50 g/l |
| Sandolub NV fl | 25 g/l |
| Sandoperm FV fl | 0.5 g/l |
| Sandozin NIT fl 280% | 0.3 g/l |
| Acetic Acid | 1 ml/l |

pH 4

| | |
|---|---|
| Temperature of padding liquor | 25-30°C |
| Roller pressure | 1.8 $kg/cm^2$ |
| Temperature of the chambers | 180°C |
| Speed of the fabric | 15 m/min |

(when the total length of the chambers is 12 m)

Remark: After impregnation with mercerizing liquor the fabric acquired yellow-brown colour. At this stage the strength will decrease too much. After washing the fabric will acquire again the white colour and also strength. The advantage of this process is the increase in dyability and the economy of the dyestuffs 30%.

Annexe-xvii

Proposal for Indispensable Equipment for Modern Factory for Finishing of Circular Knitted Fabrics made of 100% Polyester.

I Variant

| Sort of finishing process | Indispensable equipment | Firms suppliers | Capacity per 8 hours |
|---|---|---|---|
| Slitting of the circular fabric | Slitting machine | 1. Arbach Machinenfabrik Reutlingen, BRD<br>2. A.B.Calator, Boras, Sweden<br>3. Monti S.p.A, Milan, Italy | More than 10000 m. |
| Stitching of the fabrics | Stitching machine | 1. Juki Industrial Co. Ltd., 23-3 Kabuki-cho 1-chome, Shinjuku-ku, Tokyo 160, Japan, Telex 22967 JUKITK<br>2. Rockwell-Rimoldi S.p.A. 7, Via E.Fermi (Quartiere Mirasole) 20090-Milano (Italy) Telex 312243<br>3. Union Special Corporation, 405N Franklin St.Chicago IL 60610, USA | More than 10000 m. |
| Presetting | Pin-Stenter | 1. Hirano Kinzoku Co. Ltd., Nara, Japan.<br>2. Kyoto Machinery Co. Ltd., 31 Oike-cho, Kisshoin, Minami ku, Kyoto, Japan.<br>3. Arbach Maschinenfabrik, Reutlingen, BRD. | In case of 2 chambers - 2300 m<br>In case of 3 chambers - 4600 m<br>In case of 4 chambers - 6900 m |
| Scouring | Winch-back | From India | In case of back capacity 2000 l 2500 m |

| Sort of finishing process | Indispensable equipment | Firms suppliers | Capacity per 8 hours |
|---|---|---|---|
| Hydro-extraction | Vacuum Hydroextractor | 1. Hisaka Works Ltd., 4-4 Hiranomachi, Higashi-ku Osaka 541, Japan<br>2. Maurice Heliot S.A. La Chapelle, St.Luc, France.<br>3. Tubular Textile Machinery, Woodside, N.Y. USA | 8000 m. |
| Stitching | Stitching machine | The same companies as the above. | More than 10000 m. |
| Thermo-setting | Pin-Stenter | The same companies as the above | As the above. |
| Transfer printing | Transfer calender | 1. Lemaire and Cie Roubaix, France.<br>2. Kannegiesser Ltd., P.O. Box 100, Brackley, Northamptonshire, NN 13, 5 DY, UK. Telex 837427.<br>3. Monti S.p.A, Milan, Italy | 2500 m |

Remark: Since the fabric will pass twice through Pin-Stenter the capacity of Pin-Stenter will be as follows:

In case of 2 chambers 1150 m.
3 chambers 2300 m.
4 chambers 3450 m.

II Varient

| Sort of finishing process | Indispensable equipment | Firms suppliers | Capacity per 8 hours |
|---|---|---|---|
| Slitting of the Circular fabric | Slitting Machine | 1. Arbach Machinen Fabrik Reutlingen, BRD<br>2. A.B.Calator, Boras, Sweden.<br>3. Monti S.p.A, Milano, Italy | More than 10000 m. |
| Stitching of the fabrics | Stitching machine | 1. Juki Industrial Co.Ltd 23-3 Kabuki-Cho, 1-chome Shinjuku-ku, Tokyo 160, Japan. Telex 22967 JUKITK<br>2. Rockwell-Rimoldi SpA 7, Via E.Fermi (Quartiere Mirasole) 20090-Milano (Italy) Telex 312243<br>3. Union Special Corporation 405N. Franklin St., Chicago IL 60610, USA | More than 10000 m. |
| Continuous Scouring | Open-width washing machine | 1. Hanayama Works, Japan Please contact with C.Itoh and Co. Ltd., 68, Kitakyutaro machi 4-Chome Higashi-Ku, Osaka, C.P.O.Box 117, Osaka, Japan<br>2. Hisaka Works Ltd., 4-4 Hiranomachi, Higashi-Ku, Osaka 541, Japan.<br>3. Kleinewefers GmbH, Krefeld, BRD. | 4000 m. |

| Sort of finishing process | Indispensable equipment | Firms suppliers | Capacity per 8 hours |
|---|---|---|---|
| Thermo setting | Pin-Stenter | 1. Hirano Kinzoku Co. Ltd, Nara, Japan.<br>2. Kyoto Machinery Co. Ltd. 31 Oike-Cho, Kisshoin, Minami-ku, Kyoto, Japan<br>3. Arbach Maschinenfabrik Reutlingen, BRD | In case of 2 chambers - 2300 m.<br>In case of 3 chambers - 4600 m.<br>In case of 4 chambers - 6900 m |
| Transfer Printing | Transfer Calender | 1. Lemaire and Cie Ronbaix, France<br>2. Kannegiesser Ltd., P.O.Box 100, Brackley, Northamtonshire, NN 13, 5DY, UK<br>3. Monti, SpA, Milano, Italy | 2500 m |

Annexe-xviii

Documents Received and Used as Background

1. The South India Textile Research Association,
Annual Report 1981-82.

2. United Nations Development Programme,
Project Document IND/76/023/A/01/37
Diversification and Development of New Fabrics-Phase II

3. Technical Report : Progress made and Preparation for Phase II,
Prepared by Dr.Burnip, Project Consultant.

4. Final Report : Developing Training Programme for Knitting
Industries of India, Prepared by Mr.Sterenberg,
Training Expert.

5. Technical Report : Bleaching, Dyeing, Printing and Finishing
of Knitted Goods by Mrs. Boeva, Finishing Expert, 1981.

6. Final Report of the Training Programme, Prepared by
Mr.N.L.Narasimhan, SITRA Staff.

7. Report to the Advisory Committee for Research and Its
Implementation, Activities of SITRA in 1982.

8. Reports of Twenty Fourth Technological Conference jointly
sponsored by ATIRA, BTRA, NITRA and SITRA, February 1983.

9. Terminal Report : Garment Manufacturing
by Mrs. B.Dickson, UNIDO Expert, 1982.

Annexe-xix

List of spare parts for Laboratory Steamer Type DBE made by Werner Mathis Ag, Switzerland.

1 set of Transport Chains (Stainless) Including Tensioners.

1 set Entrance Sealing

4 Glass Beads for Overtemperature Guard, 260°C

1 Portion of High Temperature Grease Type Unisilicon

10 Pin plates for Pin Frame

10 Pin Plates for Shrinkage + Measuring Frame

1 Calibrating Resistor 90/180°C Incl. Instruction

2 Pin Frames adjustable in length and width.
(Extra Large Model for use with Steamer DHE and Coater S.V.).

-:0:-