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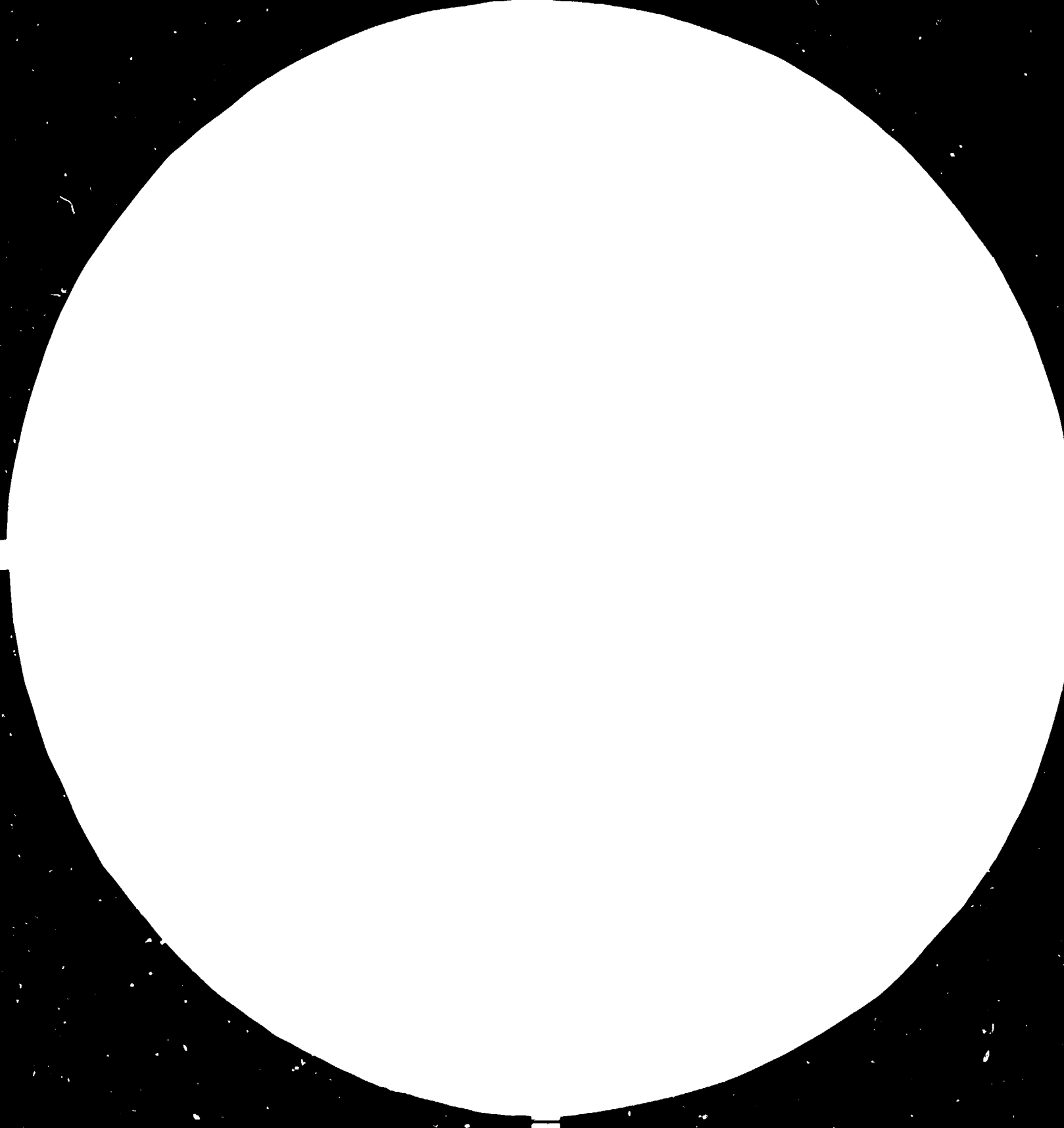
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2.0 25

2.5 22

3.15 20



3.6 18



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March, 1984

Assistance to the  
Bangladesh Jute Research Institute  
Technological Wing  
Bangladesh

DP/BGD/75/013/11-52  
Bangladesh Chemical Finishing of Jute and Jute Products

Technical Report  
Prepared for the Government of Bangladesh

by

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United Nations Development Programme

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This report has not been cleared with the United Nations Industrial Development Organisation which does not, therefore, necessarily share the views presented.

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Abstract

This Technical Report is based on the two-months work of the consultant in chemical finishing of jute and jute products in the Bangladesh Jute Research Institute (Technological Research Wing) at Dhaka since 9 February 1984 till 8 March 1984. (return mission)

The expert has evaluated the activities of the Institute's chemical laboratories and Pilot Plant facilities for the year 1983, and worked with the counterpart on improving and developing processes for chemical pretreatment, bleaching, dyeing, printing and finishing of jute and jute products.

The report contains expert's findings and recommendations to the Bangladesh Jute Research Institute (T.R.W.)

The suggestions related to the technological research programme for the year 1984 and for the future in the field of chemical finishing of jute products, are enclosed.

Explanatory Notes

BJRI	Bangladesh Jute Research Institute
BJRI (TRW)	Bangladesh Jute Research Institute (Technological Research Wing)
UNIDO	United Nations Industrial Development Organisation
BJMC	Bangladesh Jute Mills Corporation
DF	Dyeing and Finishing Department
TC	Technical Chemistry Department
C	Chemistry Department
B	Biochemistry Department
PP	Pilot Plant Department

CONTENTS

	Page
Summary of Findings and Recommendations .....	5
1. Introduction .....	7
2. Findings related to the Chemical Finishing of Textiles in BJRI (TRW) in 1983 .....	7
2.1 Laboratory and Trial Production Facilities .....	7
2.2 Activities in the field of chemical pretreatment, bleaching, dyeing, printing & finishing .....	9
2.3 Co-ordination and co-operation between BJRI (TRW) and BJMC/Private Jute Industries .....	14
3. Consultant's activities .....	15
3.1 Evaluation of the Technological Research Work for 1983 in the field of chemical finishing of jute and jute products .....	15
3.2 Suggestions related to the Technological Research Programme for 1984 in the field of chemical pre-treatment, bleaching, dyeing, printing and end-finishing .....	17
3.3 Consultations .....	20
3.4 Visits to factories .....	21
4. Conclusion and recommendations .....	23
4.1 Summary .....	23
4.2 Recommendations .....	24
Annex I Consultant's Work Programme .....	27
Annex II Recipe for pigment printing with petrol-free emulsion thickening .....	29
Annex III Dyeing of jute/polyester, jute/polyacrylic and jute/polyamide blends .....	30

Summary of Finding and Recommendations

1. In the field of printing and finishing the production trial facilities have been extended in 1983 by the procurement of the locally made hand operated flat screen printing table and a three-bowl calender (UNIDO/UNDP input). The mercerizing machine and a steam generator await erection. (Paragraph 2.1)
2. The installation of a steam generator will enable to use steam in some printing, dyeing and finishing processes. The procurement of a steamer is recommended. (Paragraph 2.1)
3. In 1983 progress has been made in dyeing and printing but relatively less in bleaching. (Paragraph 2.2)
4. Some promising methods of resin finishing and flame-proofing of jute goods by means of locally made in BJRI (TRW) melamine-formaldehyde precondensates have been developed on a laboratory scale. (Paragraph 2.2)
5. A new project concerning with the development of indigenous dyes and dyeing techniques for jute materials may be put into Annual Work Programme for the year 1984. (Paragraph 3.2)
6. In respect to better consolidation of efforts it would be advisable to determine the time limit for solution of specially valuable processes. (Paragraph 3.1)
7. The relations between the jute manufacturers (especially from the private sector) and BJRI (TRW) have shown some improvement, but there is still need for better co-operation. (Paragraph 2.3)
8. The direct visits to factories paid by the teams of BJRI (TRW) senior research workers together with the UNIDO/UNDP consultants initiated in the middle part of 1983, appear to be very useful for the better collaboration between the Institute and the Jute and Textile Industries. (Paragraph 3.4)



9. The equipment of the PP Department with the Xenotest-apparatus and a tensile strength tester is recommended. (Paragraph 3.1)
10. The range of applied modern dyestuffs and auxiliaries should be enlarged. (Paragraph 3.1)
11. Some new printing screens specially designed to the needs of external market are necessary. (Paragraph 4.2)

## 1. Introduction

This project at the Technological Research Wing of the Bangladesh Jute Research Institute, which comes within the United Nations Development Programme for Bangladesh, has the aim of providing assistance to develop the capability of BJRI for technological research and development work related to the products of the jute manufacturing industry. The consultant's part of the project is in the field of chemical pretreatment, bleaching, dyeing, printing and finishing of jute and jute products.

Jute is still the country's most important export commodity and also local raw material for the country's most important industry.

In view of the increasing competition from synthetics, the existence of the jute industry will depend on the increase of its productivity and the development, through research, of better products and new end-users.

The chemical finishing of jute goods based on the latest technologies, is a valuable factor in the improvement of jute yarns and fabrics for both the local and the international market. With regard to the actual existing in BJRI (TRW) laboratory and trial production facilities, the UNIDO's project objective is to improve and develop the chemical pretreatment, bleaching, dyeing, printing and end-finishing processes for jute products for various new uses of jute. All the processes should be commercially applicable.

Two previous Technical Reports have been submitted, dated February 1982 and December 1982 respectively. The present report describes the activities of the project in the field of chemical finishing of jute and jute goods during 1983 with the suggestions related to the research programme for the year 1984 and for the future.

## 2. Findings related to the Chemical Finishing of Textiles in BJRI (TRW) in 1983

### 2.1 Laboratory and Trial Production Facilities

During 1983 a Fabric Mercerizing Machine (Wakayama Ltd.) and a

3-bowl Calender (Hunt & Moscrop) have been delivered. In February 1984 the Calender has been installed and is already operational. A Mercerizing Machine awaits erection.

Although actually the decision to procure and install a Flat Screen Printing Machine has been postponed it would be advisable to have such machine in BJRI for the future. The multicoloured fashionably designed printed fabrics could have a great meaning for the improvement of market potential of jute products.

In 1983 a special table approximately 5.5 metres long as well as some new screens have been ordered and procured by PP Department. This extends the BJRI (TRW) printing facilities but to a limited (up to three colours only) extent.

In 1983 within the UNIDO/UNDP inputs a Steam Generator has been procured. There is now the possibility to use steam in some technological processes in the Pilot Plant Department. Especially the printing with reactive dyestuffs requires steaming, which is usually done by means of a steamer combined with a printing machine. Hence the need for a steamer should be kept in mind for the next step of BJRI (TRW) implementation as well as a Cylinder Dryer.

According to consultant's Second Technical Report, dated December 1982, a "Rolling-device" for the "Pad-Roll" method applicable for some kinds of desizing, bleaching, dyeing and resin finishing processes should be put into mechanical operation and located in a heated chamber. Till now no progress has been made in this field. This might be due to lack of coordination between the Pilot Plant Department and the people responsible in BJRI for the mechanical arrangements.

#### Dyestuffs and Chemical Agents

A great deal of chemicals, dyestuffs and auxiliaries necessary for chemical finishing of jute goods are to be imported from the developed countries. The local production in this field is still very poor. To have the jute textiles on international standard level it

is necessary to enlarge considerably the range of different kinds of dyestuffs and finishing agents.

In BJRI an important research project is further going on successfully with an aim to establish methods of production of resin precondensates based on locally available raw materials. In comparison to the previous experiments with urea-formaldehyde resins the range of research work in 1983 has been extended to the melamine-formaldehyde precondensates.

#### Library

In 1983 a new supply (more than 30) of scientific books has been ordered. A lot of them are concerned with chemistry and chemical finishing of goods. They partially came under the Netherlands Literature Programme. Subscriptions for the following textile journals for the year 1983 have been made as follows:

- Journal of the Textile Institute
- Textile Horizon
- Textile Progress
- Melliand Textilberichte (english edition)
- World Textile Abstracts
- Textile Asia
- Journal of the Society of Dyers and Colourists
- Nature
- Jute Development Journal

#### 2.2 Activities in the field of chemical pretreatment, bleaching, dyeing, printing and finishing

##### General Survey

General survey is based on the Annual Technical Report of BJRI (TRW) for the year 1982 issued in April 1983, the Half-Yearly Technical Report for the year 1983, some parts of the draft of the Annual

Technical Report for the year 1983 and Consultant's direct observations and discussions with all people concerned.

#### Chemical Pretreatment

The results of an extensive research work on the project "Mercerization of jute materials" by means of caustic soda and liquid ammonia have been submitted in the Annual Technical Report for 1982. In 1983 some experiments have been done by means of potassium hydroxide as a mercerizing agent.

A method of alkali pretreatment by means of caustic soda solution at a concentration of about 18% called "woollenisation" has been further utilised on a commercial scale in the Pilot Plant Department, where a significant quantity of Novocel yarns and Novotex fabrics have been handled.

#### Bleaching

According to the previous suggestions in the project "Bleaching of jute materials to develop economic method of bleaching" some experiments in bleaching at higher temperature (60°C) by Pad-Batch method using hydrogen peroxide as a bleaching agent and sodium silicate as a stabilizer were performed.

The losses of weight, length, breadth and strength and the whiteness were measured.

#### Dyeing

The project "Dyeing on jute materials" has been divided in 1983 into three sub-projects according to the class of dye i.e. basic, azoic combinations and direct dyes.

Attempts was made to improve the wash fastness and the light fastness of a basic dye, (Victoria Blue B) but without any considerable success. It is recommended to carry out next experiments with selected dyestuffs only.

For the azoic dyeing, jute and cotton fabrics have been compared, and the dyeing has been done by both padding and exhaust methods. In comparison to the previous experiments the second bath component was salt instead of base. The last method is more convenient for the mill practice but it requires good stabilised salts, which are more costly. The fastness to washing and rubbing was very good (between 4 and 5 according to the international scale). The results of the light fastness measurements were not yet available. In the next experiments the range of azoic combinations should be enlarged.

The methods of the improvement of wash and light fastness properties of direct dyestuffs by means of copper compounds have been studied with good results. It would be advisable to carry out further the research work on dyeing with direct dyes using different kinds of after-treatment i.e. with potassium dichromate, formaldehyde and selected resin precondensates.

In PP Department the dyeing with reactive (for jute) and vat (for cotton) dyes has been carried out on a semi-production scale.

#### Printing

In 1983 the printing facilities have been extended by the procurement of a locally made hand operated flat screen printing table. Although the length of the table is rather small (5.5m) it enables to carry out the printing experiments on a Pilot Plant scale (the width app. 140 cm). The surface of the table is gas-heated from its back side.

Because of the existance of open fire no work should be done in pigment printing by means of an emulsion thickening, containing significant amount of high volatile, flammable agent (white spirit). To overcome this drawback a new recipe which does not require a high volatile component is recommended in Annex II. At present the research work is going on on the Pilot Plant scale in printing with reactive dyestuffs.

Some new screens with completely new designs have been ordered in February 1984 according to the recommendations of the UNIDO's Design Expert Ms. M. Nettles in order to improve market potential of jute goods especially in United States of America and Europe.

#### Finishing

The yellowing of bleached jute has been attempted for prevention by the treatment of epichlorohydrin vapour (using different time of exposure) on alkali treated (using different percentage) fabrics. The reflectance values of the bleached treated and untreated samples before and after exposure to sun light show prevention of yellowing but the result is not satisfactory.

This is a long term project. In previous years attempts were made and other methods like acetylation and benzoilation have been studied. It would be advisable to compare the results by evaluating the treated (in different ways) samples in Xenotest machine along with new prepared ones. The next method to be studied is based on alkali treatment and desizing of grey jute fabric followed by repeated bleaching with sodium chlorite ( $\text{NaClO}_2$ ) and sodium sulphite ( $\text{Na}_2\text{SO}_3$ ) aftertreatment according to the french recipe from L' Institute Textile de France (the particular recipe has been translated and transmitted to the people concerned).

In order to improve the resiliency of jute carpet by chemical means the treatment with epichlorohydrin vapour on the alkali treated scoured and bleached jute fabrics has been done further. The crease recovery angles and the loss of tensile strength have been measured. The crease recovery angles of the jute fabrics increased satisfactorily by this process but the strength of the fabrics has been found to be lost. The best results obtained till now concerned with fabrics treated with 8% sodium hydroxide solutions for 5 minutes followed by the exposure to the epichlorohydrin vapour for 10 minutes. It would be advisable to present the results in graphs instead of long tables. To complete the research work the important factor for carpets i.e. the abrasion resistance should be also measured.

For modern finishing of jute goods some resin precondensates are required. The very important long term project "To develop suitable resin precondensate for jute materials" is going on satisfactorily in the Chemistry Department. In comparison to the previous results concerning with the synthesis and evaluation of urea-formaldehyde resin precondensates the work in 1983 has been extended to the next group i.e. melamine-formaldehyde resin precondensates. An extensive research work has been done. Effect of impregnations time and temperature and concentration of chemicals on percent crosslinking and add-on on the fabric by urea-formaldehyde and melamine-formaldehyde resins have been studied. The relationship between the resin add-on and the crease recovery angles, the tensile strength, the flexural rigidity and moisture regain of treated jute fabrics have been established. Also the use of melamine-formaldehyde resin precondensate as a component in an impregnating liquor for fire proofing of jute fabrics has been tested. Because of promising results the process appears to have commercial possibilities. To complete the work satisfactorily some experiments on microscopic and spectroscopic examination may be accomplished in modern Laboratories abroad.

Another project concerning with durable (wash fast) fire retardant process for jute products by means of ammonium dihydrogen phosphate and urea but without melamine-precondensate resin in Pad-Dry-Cure system is carried out in the TC Department. A fabric is regarded as flame proofed if it provides no afterflame, less than 4 seconds after-glow period and char length less than 3.5 inches by verticle bunsen burner flame test. From the experiments it was found that treatment of the jute fabrics with solution of urea and  $\text{NH}_4 \text{H}_2 \text{PO}_4$  in the ratio 1:1 in Pad-Dry-Cure-Wash system could provide fabrics which passed this test. The fire-resistance property remains almost unimpaired after bleaching with tap water for 1 hour. But it should be advisable to test wash fastness of the samples according to the international scale. The flame-proof effect is however combined with significant loss of strength (about 40%).

The impregnation of jute goods with ammonium dihydrogen phosphate, ammonium chloride and borax solutions by physical barrier method in Pad-Dry system (non wash-fast) did not procure proper results till now. Probably the add-on of chemicals (up to 6.6%) was too small. It should be enlarged up to 15% and in the next experiments the range of add-on between 7 and 15% ought to be checked.



Because of the need for rot-proofed jute goods attempts have been made to protect jute materials from degradation by treating them with selected rot proofing chemicals. In previous years the rot-proofing of such goods has been successfully completed on a laboratory scale by means of copper nephtemate and Cuprex. In 1983 according to request from BJMC the research work on different type of jute yarns with Preventol PNF, Preventol GD and Dodigen, supplied by BJMC, has been done on a Pilot Plant scale. Good results have been found for yarns processed with 1.5% concentration of above mentioned commercial products. The attempts to use locally easy available chemicals like copper sulphate, sodium carbonate and tamarin seed gum as a binder are not completed till now.

The project " To use jute as reinforced plastic materials" (as construction materials and wood substitute) will be continued in 1984.

### 2.3 Co-ordination and co-operation between BJRI (TRW) and BJMC/ Private Jute Industries

In 1983 relations between the manufacturers and BJRI have shown some improvement as a result of the emergence of a private sector following the denationalisation of the Bangladesh Jute Manufacturing Company. BJRI plans to set up coordinating committees with the private company Associations, in addition to that already operating with the BJMC.

Some small private firms are deeply interested in modern technologies for jute, offered by BJRI (TRW). They are for instance: Ajanta Printing and Dyeing Works, Bangladesh Small and Cottage Industries Corporation, Dhaka-Bagdad Carpet Factory etc.

In 1983 more than 2000 kg. and about 5000m of Novocel yarn and Novotex jute fabrics have been produced in Pilot Plant Department of BJRI (TRW) as per requirement of private organisations.

Negotiations are now going on regarding the agreement between the Private Sectors and the Institute on possibility of the BJRI Tech. Research Wing conducting the Second Training Three Month Course on " Jute Technology" with the bleaching, dyeing and finishing problems involved.

### 3. Consultant's activities

According to the UNIDO job description DP/BGD/75/013/11-52/31/7/B (return mission) jute consultant on dyeing and finishing of jute and jute products, attached to the Bangladesh Jute Research Institute (Technological Research Wing) at Dhaka was expected to work with the counterpart on the improvement and development of processes of bleaching, dyeing, printing and finishing of jute and jute products.

#### 3.1 Evaluation of the Technological Research Work for 1983 in the field of chemical finishing of jute and jute goods

Special emphasis has been given to the Dyeing and Finishing, Technical Chemistry and Pilot Plant Departments regarding their range of research work and their facilities. Relevant findings and suggestions are submitted in this Report in detail in Chapter 2.

On the whole the progress on research in the field of chemical finishing of jute and jute products is going on according to programme. Here the great contribution of Mr. M.A. Salam, Chief of Division is to be emphasised.

Comparing the results achieved in various fields of finishing it is evident that in 1983 more attention have been paid to dyeing, printing and finishing problems as to pretreatment and bleaching. It has been done in conformity with previous Consultant's suggestions because in last few years some interesting methods of alkali-pretreatment and bleaching have already been developed and introduced into the practice on a Pilot Plant scale. The installation of a new mercerizing machine will create in 1984 new research and development work in the field of alkali pretreatment. A new

project " Comparative studies on effect of pretreatments between similar goods of white and tossa jute for evaluation for textile uses" will be put into the Annual Work Programme for the year 1984.

Actually the installation of a hand-operated flat screen printing table enables to carry out the printing experiments on a Pilot Plant scale and to introduce some new modern designs for test marketing in the near future. The installation of a Calendering Machine will be very useful for the advantageous appearance of jute goods.

The research work carried out on a laboratory scale in 1983 sometimes lasted too long in several projects. In respect of greater consolidation of efforts it appears to be advisable to determine the time limit for solution of specially valuable processes.

For the DF, TC and PP Departments the possibility to have the results of light fastness and tensile strength measurements as fast as possible is of great importance. Hence the implementation of a second Xenotest machine (already existing but not under operation because of lack of some spare parts) and a testing apparatus for determining the tensile strength specially installed for need of these Departments is recommended.

In order to keep the jute textile production on an international level it is necessary to enlarge the range of applied modern dyestuffs and finishing agents. The use of jute blends with synthetic fibres like polyester or polyacrylic fibres, which is expected to be created in the near future, requires the application of disperse dyes in combination with other selected dyes. The dyestuff's producers in the developed countries offer special mixtures of dyes for that purpose. The early procurement of proper dyestuffs would be advisable. (See Annex III)

Apart from the latest technologies in respect of the development of economic dyeing methods for pure jute the new project is to be expected i.e. "Development of indigenous dyes and dyeing techniques for jute materials". The research work plan is to study the natural locally available colouring materials for their suitable use in the dyeing of jute products. Bangladesh is rich in dye plants. Fourteen of them have been selected by the Bangladesh Small and Cottage Industries Corporation.

3.2 Suggestions related to the Technological Research Programme for 1984 in the field of chemical pre-treatment, bleaching, dyeing, printing and end-finishing

Most of the projects already described in p2.2 will be continued in 1984. After discussions with people concerned, in respect of some comments given in p.3.1 the proposals for the Technological Research Programme of BJRI (TRW) for the year 1984 in the field of chemical finishing are as follows:

Objective No. 6 : To develop methods of bleaching, dyeing and printing

Consists of three previous and two new projects:

DF Bleaching of jute materials

- a. To develop methods of bleaching of jute products
- b. To study the economy, efficiency and qualities of products
- c. To measure the whiteness/brightness of the products.

DF Dyeing of jute materials

- a. To study the dyeing properties of different classes of dyes and to establish standard dyeing methods for jute materials
- b. To establish dyeing methods for modified jute fabrics including union and blended fabrics.
- c. To measure and improve fastness properties to washing, dry cleaning (for selected goods) and rubbing.
- d. To measure colour change due to light according to international scale and suggest standard for jute.

DF Printing of jute fabrics

- a. To study the printing properties of different classes of dyes and to establish standard printing methods for jute fabrics.
- b. To measure fastness properties to washing, rubbing and light.

DF Comparative studies on effect of pretreatments between similar goods of white and tossa jute

New  
Recruit

To study the effects of pretreatments of the some grades of C. capsularis and C. olitorius fibres for evaluation for textile uses.

DF Development of indigenous dyes and dyeing techniques for jute materials

New  
Recruit

To study the natural locally available colouring materials for their suitable use in the dyeing of jute products.

Objective No.7: To change the chemical and physical characteristics of jute by chemical means

This objective remain divided into three projects. Two of them are connected with chemical finishing:

TC Study and prevention of photochemical changes of jute

- a. To establish chemical methods for prevention of yellowing of natural and bleached jute.
- b. To establish chemical methods to prevent loss in strength by light.
- c. Structural studies on chemistry of lignin.
- d. To measure whiteness/brightness.

TC Effect of alkali on jute materials

To study the effect of alkali on jute materials.

Objective No. 8: To improve the market potential of jute products.

Eight projects belong now to this objective. Five of them are connected with chemical finishing. They are:

TC Improvement of resilience of jute carpets

To develop process for improvement of resilience of jute yarns by chemical means.

TC, C Development of fire retardant process for jute products

To develop fire retardant process for jute products:

- a. By chemical means
- b. By physical barrier method

PP Use of jute as reinforced plastic material

To develop jute reinforced plastics with different resins and evaluation of the products.

C Development of resin precondensate for jute products

To develop suitable resin precondensate for jute materials and evaluation of the products.

B Rot proofing of jute products

To develop rot proofing process for jute materials.

Objective No. 9: Trial production and technical services

The chemical processing in PP Department including alkali treatment, dyeing and finishing of jute products as well as the dyeing tests and analysis of dyes are involved.

The objective has the aim to produce different new jute products

for test marketing and to strengthen the linkages between the BJRI and the industry.

Objective No. 10: Miscellaneous

The process for production of branding ink is included.  
TC Dep.

3.3 Consultations

Many direct consultations and advices concerned with chemical finishing of jute goods were given by the consultant to the research workers in BJRI (TRW). Special care had been given to the following subjects:

- Chemical methods for prevention of yellowing of natural and bleached jute
- Printing technics and the use of petrol-free emulsion thickening for pigment printing
- Dyeing with basic dyes on jute
- Dyeing with direct dyes and the methods for the improvement of wash-fastness and light fastness properties
- Dyeing with combinations of disperse dyes with direct, reactive or vat dyes for the fabrics made of jute/polyester blends
- Effect of methylol-melamine and methylol-urea resin cross-linking on fabric properties of bleached jute
- Chemical methods for improvement of the resiliency of jute carpets
- The use of steam in some finishing processes
- Evaluation of the flame-proofing effects on jute fabrics
- The toxicological testing of fabrics and chemicals.

### 3.4 Visits to factories

During two-months mission to Bangladesh the consultant visited four scientific and research organisations located in Dhaka and twelve factories located in Dhaka and its suburbs, Feni and Chittagong district.

To the first group belong:

- Bangladesh Council of Scientific and Industrial Research
- Dhaka University, Chemistry Department
- College of Textile Technology
- Bangladesh Small Cottage Industries Corporation

The Bangladesh Council of Scientific and Industrial Research has a good modern equipment for fibre, yarn and fabric testing and for some technological experiments to be carried out on a laboratory scale.

The University of Dhaka and the College of Textile Technology have the basic equipment for teaching purposes. Also training, with screen printing processes involved, is one of the aims of the Bangladesh Small Cottage Industries Corporation.

Among factories there are:

#### a. Four jute carpet factories:

- Bengal Carpets Ltd., Savar, Dhaka
- Amin Jute & Carpet Mills, Sholoshaher, Chittagong
- Baghdad-Dhaka Carpet Factory, North Kattali, Chittagong
- Furat Karnaphuli Carpet Factory, Rangunia, Chittagong



b. Four jute mills:

- Ajanta Printing and Dyeing Works, Dhaka
- Kwality Jute Mills, Feni (private sector)
- Karnaphuli Jute Mills, Rangunia, Chittagong
- Chittagong Jute Manufacturing Co.Ltd., Kalurghat, Chittagong (private sector).

c. Two cotton mills:

- Ahmed Bawany Textile Mills Ltd., Demra, Dhaka
- Chittagong Textile Mills Ltd., North Kattali, Chittagong (private sector).

d. One woollen mill:

- Valika Woollen Mills Ltd., Nasirabad, Chittagong

e. One nylon mill:

- Pylon Industries, Chittagong

The attempts to visit a Rayon Mill located in Karnaphuli failed, because of lack of permission.

All the visited jute carpet mills have the facilities to bleach and dye jute either in fibre form like in Amin Carpet mill or in yarn form like in three others factories. The dyeing is always done by using reactive and direct dyes imported from the famous West-European firms: BASF, Bayer, Sandoz, Ciba-Geigy, Froncolor and ICI. The yarn dyeing is more attractive from the economical point of view but the penetration and uniformity of dyed jute is better when the dyeing is made in fibre form. The jute dyed with direct dyes is aftertreated with copper salts to improve the fastness to light and rubbing (upto 4-5 according to the international scale). The main problem for the mill practice is now the improvement of the resiliency of jute carpets. During the visit paid to Baghdad-Dhaka Carpet Factory in Chittagong it

was established that the experiments on a mill scale would be done in near future with the yarn processed according to the finishing method developed in BJRI (TRW).

The other visited jute mills produce mainly carpet backing cloth, hessian and various kinds of bags, which generally do not need any special finishing, except calendering. The Amin Jute Mills Ltd. has the facility of making felts by using jute wastes. The two visited cotton mills have the finishing departments with necessary equipment for mechanical (sheering and singeing machines, calenders) and chemical (mercerizing pretreatment, bleaching with J-Box system, dyeing and finishing) processes. The Ahmed Bawany Textile Mills Ltd., additionally has the printing facilities (Duplex roller and flat screen printing machine).

The visited woollen mill, which at present produces mainly the 60/40 wool/polyacrylic yarn and fabrics from imported from Japan dyed fibres actually has no dyeing facilities. The existing hank-dyeing machine is not under operation. All machines for mechanical and chemical finishing except one termosetting oven are made in Japan.

The production capacity is at present not entirely utilised. The Pylon Industries produces yarn from Nylon 6 granules imported from Japan, Korea or West Germany. There is no dyeing facility in this factory.

#### 4. Conclusion and Recommendations

##### 4.1 Summary

The Bangladesh Jute Research Institute (Technological Research Wing) at Dhaka acting as the Government Institute, is the principal source of research and development work for the jute industry. The BJRI (TRW) has now the required basic technical facilities to carry out the research work on a large scale. The need for the development of new jute products based on the new

technologies can be realised on a pilot plant scale in the field of chemical pretreatment, bleaching, dyeing, printing and finishing. Generally the progress on research in the field of chemical finishing of jute and jute products is going on schedule accordingly.

In 1983 much progress has been made in dyeing and printing but relatively less in bleaching.

#### 4.2 Recommendations

Regarding the actual status of BJRI (TRW) in the field of chemical finishing of jute and jute goods, in order to achieve the best results in fundamental and applied research work the consultant suggests following recommendations:

##### Research work organization

1. In respect to better consolidation of efforts it would be advisable to determine the time limit for solution of specially valuable processes.
2. The teams of research workers from different Departments, grouped according to specified objectives, should continue the meetings at least every 2 months to discuss the progress and difficulties encountered in the research work.
3. It is necessary to demonstrate the chemical technology processes to the jute industry and to conduct some training courses for the mill personnel on a larger scale as it is done at present.
4. The direct visits to factories paid by the teams of BJRI (TRW) senior research workers together with the UNIDO/UNDP consultants initiated in the year 1983, appeared to be very useful for the better collaboration between the Institute and the Jute and Textile Industries in order to develop new jute products.

Research projects

1. Generally the same finishing projects, specified in the Work Programme for the year 1983, remain for the year 1984. Additionally there are two new ones concerning with comparative studies on effect of chemical pretreatment between similar grades of white and tossa jute and with the development of indigenous dyes and dyeing techniques for jute materials.
2. To the most important processes, which need special care belong:
  - the improvement of resiliency of jute materials
  - the fire retardancy of some jute goods
  - the methods for prevention of yellowing of natural and bleached jute
  - the production of fashionably designed coloured (printed, dyed) fabrics.
3. More attention should be paid to the publications in the Bangladesh Journal of Jute and Fibre Research.

Equipment

1. The installation of a steam generator which is expected in the first part of 1984 will enable to use steam in some technological processes in PP Department. The procurement of a whole-width steamer should be kept in mind for future.
2. Some new printing screens specially designed to the needs of external market are necessary. The surface of the flat screen printing table requires some improvement.
3. A "Rolling-device" concerned with the "Pad-Roll finishing method should be put into mechanical operation and located in a heated chamber.

4. To keep the jute textile production on an international level it is still necessary to enlarge the range of applied modern dyestuffs and auxiliaries. In respect of the possibility to use the blends of jute with synthetic fibres for garments and other new end-uses it is recommended to supply the DF and PP Departments with disperse dyes ( to use along with other kinds of dyestuffs suitable for jute).
5. To carry out the research work more intensively it would be advisable to equip the PP Department with the Xenotest apparatus ( already existing but not under operation because of lack of some spare parts) and a tensile strength tester.
6. For the next step of implementation of BJRI (TRW) the procurement of a singeing machine, a flat screen printing machine and a cylinder dryer for PP Department should be considered.

*Deenika Lytle*

Annex I

Consultant's Work Programme from 9 January-8 March 1984

- |       |                |   |
|-------|----------------|---|
| 9     | January, 1984  | - Departure from Poland and entry to duty   |
| 11    | January, 1984  | - Arrival in Dhaka  |
| 12-23 | January, 1984  | - Review of the Dyeing and Finishing Department activities  |
|       |                | - Visit to Ahmed Bawany Textile Mills Ltd., Demra, Dhaka  |
|       |                | - Visit to Bangladesh Small Cottage Industries Corporation, Dhaka   |
|       |                | - Visit to Bengal Carpets Ltd., Savar, Dhaka  |
| 24-31 | January, 1984  | - Review of the Technical Chemistry and Chemistry Department activities   |
|       |                | - Visit to Bangladesh Council of Scientific and Industrial Research, Dhaka  |
| 1-17  | February, 1984 | - Review of the Pilot Plant Department activities   |
|       |                | - Visit to Ajanta Printing and Dyeing Works, Dhaka  |
|       |                | - Visit to College of Textile Technology, Dhaka   |
|       |                | - Visit to the University of Dhaka, Chemistry Department  |
|       |                | - Consultations for BJRI (TRW) staff members in the latest technics of chemical finishing of jute and jute products |
| 18-23 | February, 1984 | - Visit to Kwality Jute Mills, Feni, Noakhali   |
|       |                | - Visit to Amin Jute Carpet Mills, Sholashahar, Chittagong  |
|       |                | - Visit to Baghdad- Dhaka Carpet Factory, North Kattali, Chittagong   |
|       |                | - Visit to Chittagong Textile Mills Ltd., North Kattali, Chittagong   |

- Visit to Karnaphuli Jute Mills, Rangunia, Chittagong
  - Visit to Furat Karnaphuli Carpet Factory, Rangunia, Chittagong
  - Visit to Chittagong Jute Manufacturing Co. Ltd., Kalurghat, Chittagong
- 24 Feb-5 March, 1984
- Work with the counterpart on improving and developing new processes for chemical finishing of jute and jute products
  - Preparation of the Final Report
- 6-7 March, 1984
- Departure from Dhaka to Vienna
- 8 March, 1984
- Debriefing in Vienna and completion of assignment.

Annex II

Recipe for pigment printing with petrol-free emulsion thickening

Procedure for grey, white or coloured printed fabrics

1. Shearing (once for both sides)
2. Singeing (once for both sides)
3. Alkali-pretreatment
  - 3.1 Desizing and Scouring
  - or
  - 3.2 Woollenisation
4. Bleaching (if desired)
5. Dyeing (if desired)
6. Printing

Pigment Printing

Necessary equipment: Hand-operated printing table  
mechanical stirrer (rotational speed about  
2000 cycles min.)  
stenter

Preparation of the emulsion thickening

The fundamental thickening:	830 - 840 g Water	
	100 - 130 g Lutexel HD	(BASF)
	20 - 30 g Luprimol HD	(BASF) (for handle's correction)
	50 - 0 g Helizerinbinder	(BASF)
	<hr/>	
	- 1000g.	

All the above mentioned components are mixed together by means of a mechanical stirrer. The components are added successively according to the list.

Print Paste

For 1000 g of the fundamental thickening  
10-60g of pigment dyestuff are mixed together  
Printing by means of the hand-operated screen printing device  
Curing on stenter 5 minutes at temperature 150°C  
No washing required.



Annex III

Dyeing of jute/polyester, jute/polyacrylic  
and jute/polyamide blends

Commercial names of dyes

- I. Ready made mixtures of disperse and vat dyes for dyeing of jute/polyester blends:
- Cottestren - BASF (West Germany)
  - Helasyn - BORUTA (Poland)
  - Polyestren - Casella (West Germany)
  - Resitren - Bayer (West Germany)
  - Teracoton - Ciba-Geigy (Switzerland)
  - Terantrene - ACNA (Italy)
- II. Disperse dyes for polyester fibres (only):
- Foron - Sandoz (Switzerland)
  - Terasil - Ciba-Geigy (Switzerland)
  - Palanil - BASF (West Germany)
  - Resolin - Bayer (West Germany)
- III. Cationic (Basic) dyes for polyacrylic fibres:
- (Antrachinone derivates - suitable)
- (Tri-phenylomhetane derivates - unsuitable)
- Astrazon (Bayer)
  - Deorlin and Deorlinlicht (Ciba-Geigy)
  - Basacryl (BASF)
  - Sandocryl (Sandoz)
- IV. Disperse dyes for polyamide fibres:
- Cibacet - Ciba-Geigy
  - Artisil - Sandoz
  - Perliton - BASF

V. Acidic dyes for polyamide fibres:

Monosulphonic derivatives suitable for dyeing in a slight acidic bath.

Methods of dyeing

Dyeing of jute/polyester blends

1. Dyeing with ready made mixtures of vat and disperse dyes.

Usually continuous two-step one-bath dyeing

The procedure:

padding-predrying (with infrared rays) - drying - Thermosol-treatment (dye fixation on the polyester component (45-60 seconds at temperature 190-200°C) - dye fixation on the cellulose component according to the Pad-Steam method - washing - rinsing.

2. Dyeing with combinations of disperse and reactive dyes

Usually continuous two-step one-bath dyeing

The procedure:

Padding-predrying with infrared rays - drying - Thermosol treatment (dye fixation on the polyester component 40-60 seconds at temperature 190-200°C) - dye fixation on the cellulose component according to the Pad-Steam or Pad-Roll - method or in a jigger, - washing, rinsing.

3. Dyeing with combinations of disperse and selected (with good light fastness properties) direct dyes.

Usually the exhaust one-bath method.

Procedure:

Dyeing in presence of a carrier, dispersator and ammonium sulphate in the first part of dyeing and sodium chlorite in the second part of dyeing, rinsing and washing as usual.

Dyeing of jute/polyacrylic blends

Dyeing with combinations of disperse or kationic (selected basic) dyes - for synthetic component and selected (with good light fastness properties) direct dyes - for jute.

Procedure:

One-bath exhaust method.

Dyeing in presence of a dispergator in the first part of dyeing procedure and sodium chlorite - in the second part; rinsing as usual.

Dyeing of jute/polyamide blends

Dyeing with combinations of light-fast direct dyes for jute and selected acidic dyes for polyamide component.

Procedure:

One-bath exhaust method.

Dyeing in presence of an auxiliary (for instance Albatax HW-Ciba-Geigy); rinsing as usual.

