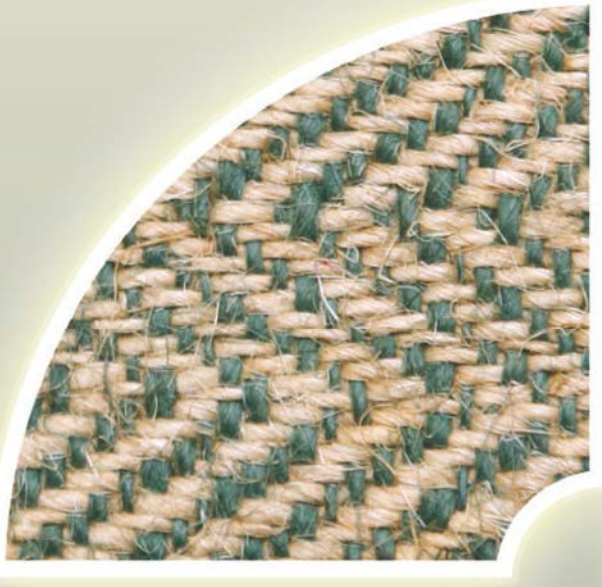
Indian Council of Agricultural Research

ICAR-National Institute of Research on Jute & Allied Fibre Technology

(ISO 9001:2008)

ICAR-NIRJAFT



ANNUAL REPORT 2015-16

ANNUAL REPORT

2015-2016

ICAR - NATIONAL INSTITUTE OF RESEARCH ON JUTE AND ALLIED FIBRE TECHNOLOGY
(ISO 9001 : 2008)
Indian Council of Agricultural Research
12, Regent Park, Kolkata 700 040, India

ICAR - NATIONAL INSTITUTE OF RESEARCH ON JUTE & ALLIED FIBRE TECHNOLOGY (ISO 9001 : 2008)
12, Regent Park,
Kolkata-700 040, India.

Phone	033 2471 1807 (Director)
	033 2421 2115/6/7 (EPBX)
Gram	JUTLAB
Fax	+91 33 2471 2583
E-mail	nirjaft@vsnl.net
Website	www.nirjaft.res.in

Editor-in-Chief
Dr Debasis Nag, Director

Executive Editor
Dr. Surajit Sengupta

Compiled by
Dr. Surajit Sengupta

Photography & Art
Sh. Kaushik Mitra

Technical Assistance
Sh. Shibaditya Ghosh

Published on :
June, 2016

Design & Printed by
Florence Offset Process Pvt. Ltd.
6A S. N. Banerjee Road, Kolkata - 700 013
Ph. : 2265 0018, Fax : 2217 8116

Contents


भाकृअनुप
ICAR
nirjaft

FOREWORD

Micro, Small and Medium Enterprises (MSMEs) across the world are the vehicles for faster, sustainable and overall economical growth. They play an important role in the equitable economic development of country. In India, the major advantage of this sector is its employment potential at low capital cost and that's why is known as a founding pillar of socio-economic fabric. With more than 44.7 million enterprises, this sector generates more than 101 million jobs; second largest sector after agriculture. It also contributes 40% of total industrial manufacturing and 43 % of India's total exports. There are over 8,000 products ranging from traditional to high-tech items, which are being manufactured by the MSME sector in addition to providing wide range of services. In modern era, with the development of Indian economy and rapid expansion of trade, this sector has emerged not only as a means to lift up the per capita income but also a vital mechanism for a larger transformation of Indian economy.

However, as far as natural fibre based products are concerned, according to an internal estimate, its present export is approx. INR 800 crores mainly dominated by jute and other allied fibres and during the next few years, the target can be set at INR 2500 crores. Improvement in raw material supply, product generation, delivery mechanism, price stability, product diversification, skill upgradation and design and development are some critical components for success. In view of challenge faced from cheaper prices of synthetics substitutes, more thrusts have been given on diversification of jute products. Hence, the need of the hour is proper blending of marketing with technology and quality assurance.

For development of Micro, Small and Medium Enterprises (MSMEs) on diversified natural fibre products, a design awareness programme, DAP, needs to be focused to develop a holistic map of MSME clusters and units by exploring through industrial functions and activities. The design expert/s will generate design information about products, market scenario, technology, communication, research & development, and various industrial functions along with human factor study for ergonomics, safety, convenience, learning and skill up gradation through design research. Also the programme will provide design remedies for identified opportunities through design clinic workshop. The workshop will help participants to understand the holistic scenario of cluster and benefit them with the support of design expert/s, for design intervention in opportunity areas explored during the programme.

Debasis Nag

(Dr. Debasis Nag)
Director, NIRJAFT

NIRJAFT, a premier institute of post harvest research of jute and allied fibres has developed thirteen number of new products or processes in the reporting year, some of them have enough potential for commercialisation to serve entrepreneurs, industries and farmers. Utilisation of agro-waste, advanced fibre extraction, fibre and fabric evaluation, utilisation of lesser known fibres, processing for new/eco-friendly products and nano finishing are addressed by the developed technologies. Following number of projects are carried out during 2015-16 and completed, extended , started from 01 April, 2016.

Division	Number of projects			
	Carried out	Completed	Extended	Started
Quality Evaluation and Improvement (QEI) Division	5	4	1	2
Mechanical Processing (MP) Division	8	0	6	2
Chemical and Biochemical Processing (CBP) Division	8	3	0	3
Transfer of Technology (TOT) Division	4	1	0	1
External Sponsored projects*	8	4	0	4
Total	33	12	7	12

* The projects are sponsored by Department of Science and Technology, Govt. of India; National Funds for Basic Strategic and Frontier Application Research in Agriculture, ICAR; Coordinated Research Project (Fibre Platform), ICAR; National Agricultural Science Fund, ICAR and National Jute Board, MoT, Govt. of India.

- Two patents were filed during this period.
- Three MOU were signed with external agencies.
- In the reporting year, forty two research papers, two books and several other documents were published.
- Scientists of the institute are regularly presenting their research output in the national and international forum as well as in the institute for dissemination and feedback by the experts. During 2015-16, research paper presented in seminars/conferences were forty nine whereas in-house presentations were twenty nine.
- The institute has organised twenty four training programmes on different aspects of jute &

allied fibres, twenty six front line demonstrations on retting technology and participated in four exhibitions.

- Institute also organised eighteen programmes including two memorial lectures, two brain storming sessions by innovation cell.
- One IMC meeting, one RAC meeting, one PMEC meeting, three IRC meeting and three ITMC meeting were held during 2014-15.
- The institute is running as per the norms of ISO 9001:2008.
- FMS-MIS has been successfully working.
- The institute budget was Rs. 3,20,00,000/- (Plan) and Rs 14,83,00,000 (Non-plan), out of which the actual expenditure was Rs. 2,64,11,869 (Plan) and Rs.13,90,83,423 (Non-plan). Resource Generation of the institute was Rs. 45,93,805 /-.
- Fund received from external sponsored projects: Rs 23,38,437/- .
- All the approved civil and electrical works has been completed. Institute has procured ten instruments to support the research.

Institute

The institute was formerly known as Jute Technological Research Laboratory (JTRL) and was set up by the Indian Central Jute Committee, Government of India on the recommendation of the Royal Commission on Agriculture in 1936 at Calcutta. The institution was officially established on January 3, 1939 by Lord Linlithgow, the then Viceroy and Governor-General of India. In 1965, it became a constituent unit under the centralized administrative control of the Indian Council of Agricultural Research (ICAR), New Delhi, and has been renamed as the National Institute of Research on Jute and Allied Fibre Technology (NIRJAFT) on 1996, to carry out basic and applied researches related to post harvest processes of jute and allied fibres such as mesta, linseed/flax, sisal, ramie, banana, sunnhemp, pineapple leaf, dhaincha, coconut fibre and other lesser known long vegetable fibres. NIRJAFT is also committed to pursuit the knowledge transfer and economic development activities that benefit the local, regional and national constituents.

The institute is located on the southern fringe of Kolkata, known as Tollygunge, with a total plot area around 17,628 sqm. During last seven decades, the institute was flourished with multifarious disciplines and carved a niche as a centre of excellence for research on jute and allied fibres catering to the entrepreneurs and industry. The institute is adequately equipped with the state of the art laboratories having sophisticated tools, instruments and processing machinery.

Mandate

- Conducting basic and strategic research on processing jute & allied fibres and their agro-residues for promotion and up gradation of quality fibres and development of value added products.
- Design and development of instruments and machinery for jute and allied fibre processing and quality assessment.
- Skill development and business incubation service on jute and allied fibre technologies.

The administration is headed by the Director and he manages the system with the help of Management Committee, Joint Council and Grievance Cell. The R & D is being managed by Research Advisory Committee and Institute Research Committee. The R&D programmes of the institute is implemented through the following four divisions, three ancillary sections, and library.

Quality Evaluation and Improvement (QEI) Division:
The division is engaged in research on fibre extraction, evaluation, quality assurance and grading. Up gradation of quality, evaluation of physiochemical properties, chemical modification of jute and allied fibres are the major contribution of this division including extraction of useful chemicals from agricultural by-products of fibre crops.

Mechanical Processing (MP) Division:
The division carries out basic and applied research on mechanical processing, quality control and product development from ligno-cellulosic & long vegetable fibres. Improvement of process, productivity & product quality; design & development of product, machinary & instrument; quality assessment on geotextile, agrotextile, apparel, packaging, automotive and industrial textiles are the main areas of research of this division.

Chemical and Biochemical Processing (CBP) Division:
The division is exclusively working on chemical/ biochemical processing, quality control and product development from ligno-cellulosic & long vegetable fibres. It has major contribution on pulp & paper; bleaching, dyeing & finishing; particle & fibre board; composites from jute and allied fibres. Nano technology and biomass utilization are also important areas where scientists of this division are working.

Transfer of Technology (TOT) Division:
The mandate of this division is to transfer institute's technologies, develop entrepreneurship providing technical training and capacity building, arrange front line demonstrations and participate in different exhibitions, fairs, melas etc for promoting the developed technologies. It is also developing the project profile of viable technologies and rendering technical assistance for incubators.

Design, Development and Maintenance (DDM) Section:
The objective of the section is to assist in design and development or modification of machinery/prototype, equipment, instruments etc. for institutional purposes. It is also engaged in customary maintenance of machines and instruments; civil & electrical infrastructure of campus; security aspects, new infrastructure building activities; monitoring of car etc.

Quality Assurance (QA) Section:
This section deals with evaluation of fibre quality and grading of jute and allied fibres. It is associated with CRIJAF in All India Network Project (AINP) for jute and mesta. The section coordinates the system for acquiring and maintenance of ISO certification of the institute.

Priority setting, Monitoring & Evaluation (PME) Cell:

The PME cell helps in designing and monitoring the R&D programs of the institute. It is responsible for convening meetings of the Staff Research Council, Research Advisory Committee, in-house lectures and compiling the monthly, quarterly, half-yearly and annual technical reports of the institute. This unit also coordinates in technical inquiries from the council as well as Parliament questions from time to time.

Library:
It acts as a centre of repository for scientific and technological information of jute & allied fibres

including other ancillary disciplines by maintaining a large number of books, journals, reports, reprints, pamphlets. the library has developed suitable infrastructure for computerized operation.

Staff position as on 31.03.2015

Category	Sanctioned posts	Posts filled	Posts vacant
RMP	01	01	00
Scientific	44	19	25
Technical	60	49	11
Administrative	35	20	15
Skilled Support Staff	41	26	15
Auxiliary (Canteen Staff)	04	04	00
Total	**185**	**119**	**66**

The institute has efficient administrative section under guidance of The Director to support the research and dissemination activities. It also contains well managed guest house called scientists' home, trainees' hostel, and farmers' hostel. It is also equipped with auditorium, conference hall, conference room and meeting room to organise seminar, meetings and other programmes regularly.

At a Glance

New products/process /machine/instrument/technology developed:

- Digital colour and luster meter for jute and ramie
- Application of enzymes for making pulp and paper
- Functional finishing of jute textile by nanoparticles
- PALF extractor with the provision of multi-leaf feeding and delivery mechanism with collection of the processed leaves.
- PALF-Silk-Ramie Blended Apparels
- Portable Coconut Fibre Strength Tester
- Water proof jute based woven carry bag
- Sulfated castor oil colloid as substitute of conventional JBO emulsion for jute spinning.
- Ornamental jute – matt stick fabric
- Process technology of coarse and rigid fibres like sunhemp and banana in needle punched nonwoven system including machine modification.
- Handy colour range indicator meter
- Printing with natural dyes on bio scoured, bleached and double mordanted jute fabric.
- Tissue paper and sanitary napkins from Jute Pulp

Patent : a) Filed: Two

Training/workshop organized: Twenty four

Program organized:

- In-house seminar- Twenty Nine
- Brain storming session (Innovation lecture) on "An industry in search of its lost legacy". Lecture delivered by Shri Subha Kirti Mazumder, Director General, Indian Jute Mills Association and former Jute Commissioner.
- Brain storming session on "Regeneration and Introspection with Changing Environment". lecture delivered by Sh. Sudhir Bhargava, Director, M/S Agroman Systems Private Ltd., Mumbai & Hon'ble Member of Governing Body of ICAR.
- Third C R Nodder Memorial Lecture delivered by Prof.(Dr.) Mangesh. D. Teli, Professor, Fibre & Textile Processing Department, Institute of Chemical Technology, Mumbai on *"Glimpses of R&D Experience in Fibres and Chemical Processing of Textiles"*.
- 78th Foundation Day Lecture by Dr. B.S. Bisht, Ex-Vice Chancellor of G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand and presently Director, Birla Institute of Applied Sciences, Bhimtal, Uttarakhand.
- 5th Dr. P. B. Sarkar Memorial Lecture delivered by (Prof.) D. Chattopadhyay, Vice-Chancellor, Amity University, Kolkata and Ex-Pro-Vice Chancellor (Academic affairs), University of Calcutta on "Smart Materials and Chemical Industries."
- Celebration of 100th birthday of Dr S B Bandopadhyay, Former Director of NIRJAFT.
- 67th Institute Management Committee meeting.

- Three ITMC Meeting.
- Three IRC Meeting
- RAC Meeting
- Independence day and republic day celebration
- Swach Bharat Mission activity by NIRJAFT employees.
- Mera Gaon Mera Gaurav activity
- Jai Kisan Jai Vigan activity
- Workshop on "Role of Information Technology in Library Management in Digital Era"
- Vigilance Awareness Week celebrated. An awareness lecture by Sh. Altamas Kabir, The Hon'ble Former Chief Justice of India in the closing ceremony.
- Four workshops on Hindi as official language.
- Hindi Fortnight Celebration

Publication:

- Research papers: Forty eight
- Book: Two
- Book chapter: Sixteen
- Technical bulletin/manual/report/leaflet/brochure: Thirteen
- Popular article: Five

Research paper presented in seminars/conferences: Twenty one

Memorandum of Understanding signed : Three

Inhouse seminar: Twenty nine

Front line demonstration: Twenty six

Participation in exhibition: Four

Awards: One

Resource Generation: Rs. 45,93,805.00

Fund received from External sponsored projects: Rs 23,38,437.00

Instrument procured:

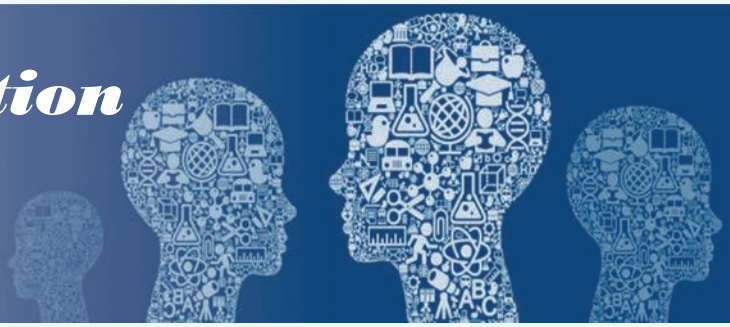
Gray scale
Geotextile friction apparatus
Weighing balance with computer & accessories
U.V Spectrophotometer
Orbital Shaker
Orbital Incubator shaker
Gradient ratio test apparatus
Ultrasonic processor (sonicator)
In plane permeability test apparatus
Cone drop tester
Infra colour Beaker dying machine
Rotary Digester
Apparent opening size tester

Vat for tipping paper
GPS instruments
Banana Liquid Sap Extractor
Deep Freezer Vertical model
Geotextile testing attachment (Static Puncture, Burst Strength Test)
Traceable Infrared dual lasers thermometer with type K probe

Machines Sold

- NIRJAFT Power Ribboner (3 nos) fabricated and supplied to Jute Corporation of India (JCI), Chapadanga DPC, Hooghly on April 06, 2015.
- NIRJAFT Banana Fibre extractor was fabricated and supplied to ICAR Research Complex for North Eastern Hill Region, Tripura Centre, Lembucherra, Tripura -799 210 on January 09, 2016
- Single Roller Banana Fibre Extractor with the following provisions has been upgraded: (1) Provision of an additional roller to avoid the backward dragging of pseudo-stems for getting fibre from the full length, (2) Provision of delivery mechanism for the extracted fibre

Quality Evaluation & Improvement Division



Priority areas of research

- New and improved retting technologies
- Improved fibre extraction machineries
- User friendly grading system
- By-products and waste product utilization through extraction of value added chemicals/ products
- Improved automation and portability of testing equipments for Ligno-cellulosic materials
- Life cycle analysis from fibre extraction to disposal

Achievements

- Handy colour range indicator meter has been developed
- Laboratory type Colour Lustre meter using LED has been developed
- Developed PALF extractor has the provision for multi-leaf feeding of green pineapple leaves.
- Modified delivery mechanism of PALF extractor helps in collecting the processed leaves at one end.

QEI-13: Design and Development of a Commercial Extractor for PALF

Dr L K Nayak & Dr Avijit Das

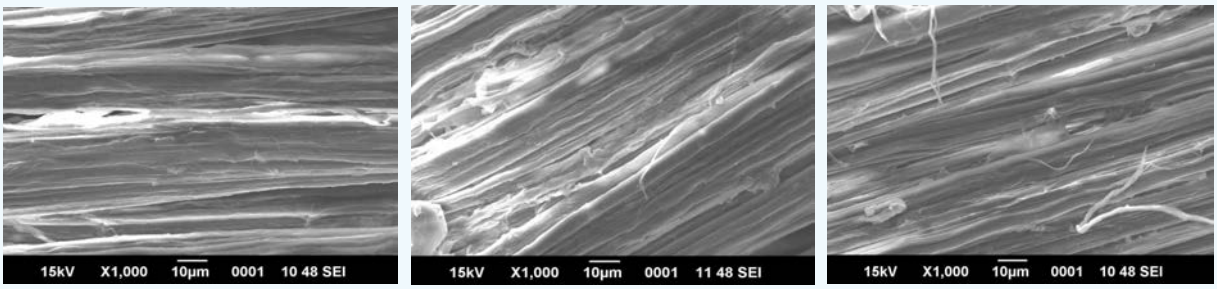
The process of extraction of long vegetable fibres is of great importance since the quality as well as the quantity of extracted fibres is strongly influenced by the methods of extraction employed. The process of fibre extraction from the pine apple leaf can be done either manually or with the aid of machines. The manual process involves stripping off the fibre from the retted leaf. In this method, a lot of fibre is lost and the entire process is also very laborious. In the mechanical process, the green leaves are crushed in a raspador machine. The soft green parts of the leaves are crushed and washed in water and the thread is taken out.

So far, no concerted effort has been undertaken to extract the fibre on a commercial scale. Automatic and semi-automatic machines developed by different R&D organizations are not suitable for operation in case of small holdings as prevalent in Eastern, North-Eastern and Southern parts of the country growing pineapple. Under these circumstances, portable on farm decorticating machines are expected to serve the purpose most effectively.

The ICAR-NIRFAT designed Pineapple Leaf fibre extractor is having the provision of multi-leaf feeding system (Figure-QEI 13.1); where a number of green pineapple leaves can be fed to the extractor. The leaves are then scrapped by a scrapping roller in which the upper waxy surface is removed for easy microbial action during the retting operation. After scrapping, the leaves are passed through a combing roller; that gives serrations on green scrapped leaves. It functions on the same way a comb works on human hair. Finally the scrapped & combed green leaves collected at the delivery end with the help of conveyer belt. This machine scratched green leaves (*scrapped & combed*) are ready for further unit operation i.e. retting. Retting of these leaves can be done by conventional method or by the application of enrichment bacterial culture. The time of retting is reduced to 3-4 days in the case of enrichment culture retted leaves than the conventional method (6-7 days).

Figure QEI 13.1. Pineapple Leaf Fibre Extractor with multi-leaf feeding system

Characterization of the extracted fibre (retted in different methods) was done with the help of SEM, PXRD and TGA analysis. The controlled samples were retted in the water whereas; enriched bacterial culture was applied in the other two conditions.



Control PALF | Extracted by enrichment culture 01 | Extracted by enrichment culture-02

Figure-QEI 13.2: SEM Photographs of Pineapple Leaf Fibre

The SEM photographs of controlled sample (Figure-QEI 13.2) shows the presence of gummy materials in between the individual fibres, where the gummy materials are removed after the application of enrichment bacterial cultures in the retting process .

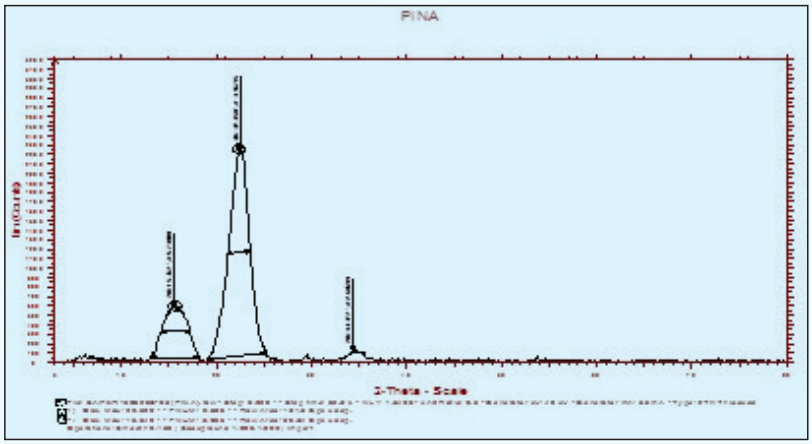


Figure-QEI 13.3: PXRD of controlled PALF samples

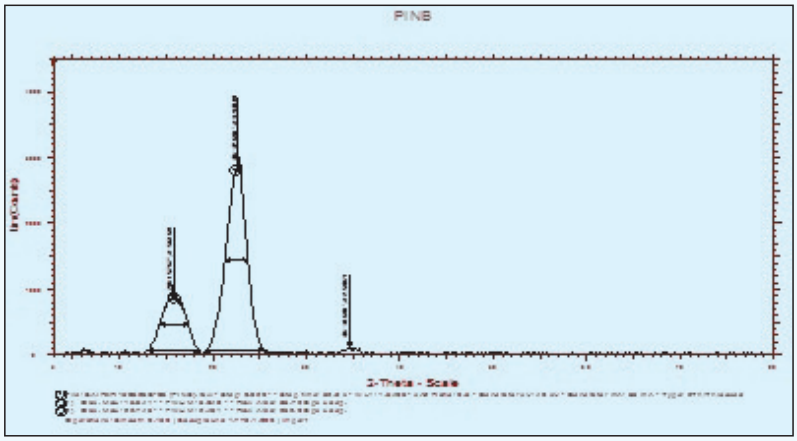


Figure-QEI 13.4: PXRD of PALF samples extracted by enrichment culture-01

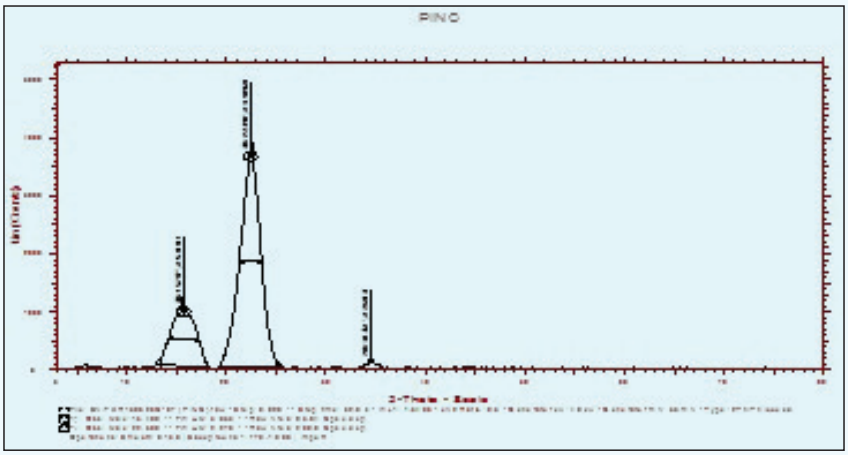


Figure-QEI 13.5: PXRD of PALF samples extracted by enrichment culture-02

From the PXRD studies, it was found that there is no deterioration in the crystalline & amorphous region of pineapple leaf fibre due to the application of bacterial culture in the enrichment culture retting (Figure-QEI 13.3 to QEI 13.5).

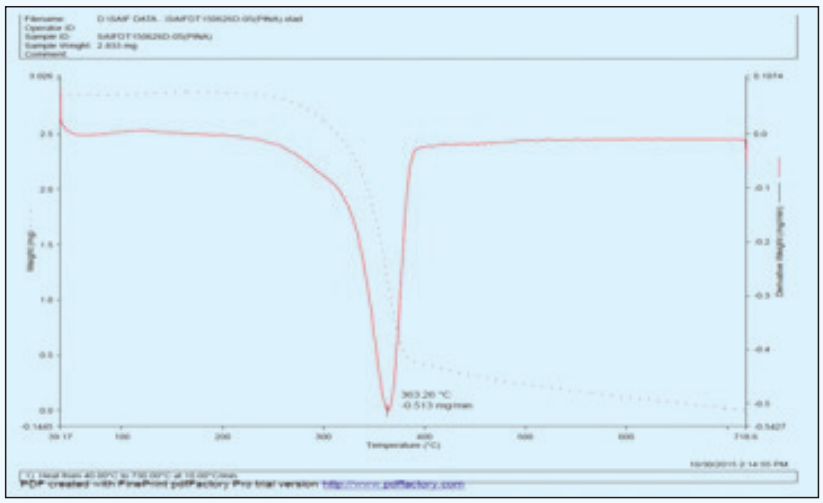


Figure-QEI 13.6: TGA Curve for the controlled PALF samples

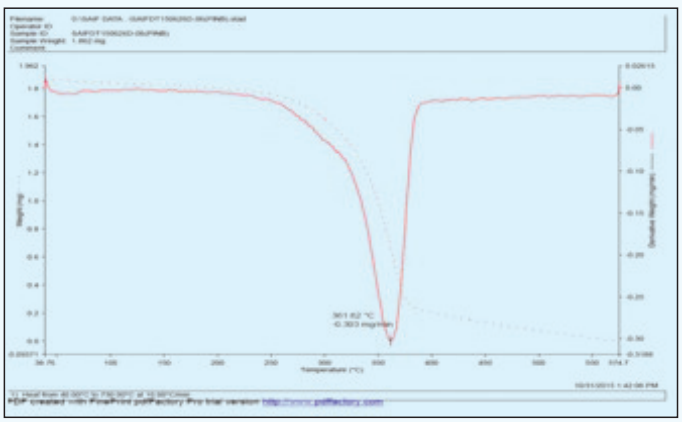


Figure-QEI 13.7: TGA Curve for the PALF samples extracted by enrichment culture-01

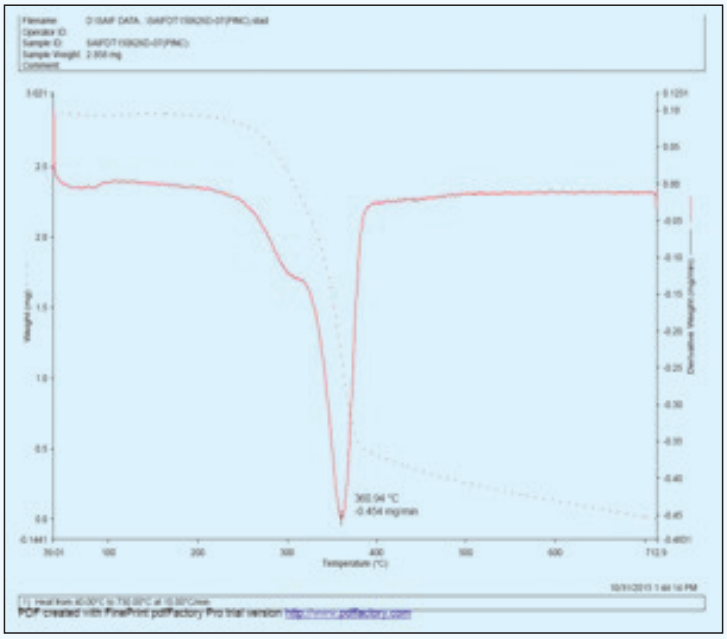


Figure-QEI 13.8: TGA Curve for the PALF samples extracted by enrichment culture-02

The thermal behaviour graphs (TGA curves) of the controlled samples and the enrichment culture retted samples were shown in (Figure-QEI 13.6 to QEI 13.8). The curves are in line with TGA of typical natural fibres.

Chief findings

- The developed extractor has the provision for multi-leaf feeding of green pineapple leaves.
- Leaves are processed with the combined action of scrapping & combing roller.
- Delivery mechanism provided with the extractor, helps in collecting the processed leaves at one end.

QEI-15: Performance Analysis of Crop Specific Agrotextiles

Dr Biplab Saha, Dr S Debnath, Dr S B Roy & Dr D Das

Experiments were carried out at Sriniketan, Gayeshpur, and Narendrapur under three different agro-climatic zones of West Bengal. In maize cultivation system available moisture varied from 10% in control to 22% in 400 gsm agro-textile mulched plots. Organic carbon (%), N (kg/ha) was found to be highest in case of 400gsm agro-textile mulched plots. Availability of P (kg/ha) was found to be higher in case of straw and polythene mulch plots (Table-QEI 15.1). Yield varied from 4q to 8.5q/ha. Highest yield was observed in 300gsm mulched plots followed by 350 and 400gsm plots.

Table-QEI 15.1: Nutrient status of soil after harvesting of maize

Serial No.	Treatments	OC %	N (kg/ha)	P (kg/ha)
1.	300 gsm	0.63	130	23.74
2.	350 gsm	0.75	132	21.95
3.	400 gsm	0.90	141	23.74
4.	Control	0.48	125	21.00
5.	Vermi compost	0.61	135	23.29
6.	Polythene	0.80	136	24.50
7.	Straw	0.56	130	24.54

In Gayeshpur, Nadia; experiment was conducted in bitter gourd production system. Pusa mousami variety of bitter gourd was sown in the middle of February, 2016 with 250, 300 and 350 gsm agro-textile mulches treatments and control. Available moisture capacity was found to be highest in case of 350 gsm agro-textiles after each irrigation (Figure-QEI 15.1). All the growth parameters were found to be higher in case of 300 gsm agro-textile mulches in case of bitter gourd. Highest yield of 30q/ha was obtained in 250gsm plots followed by 300 and 350 gsm agro-textile plots (Table-QEI 15.2).

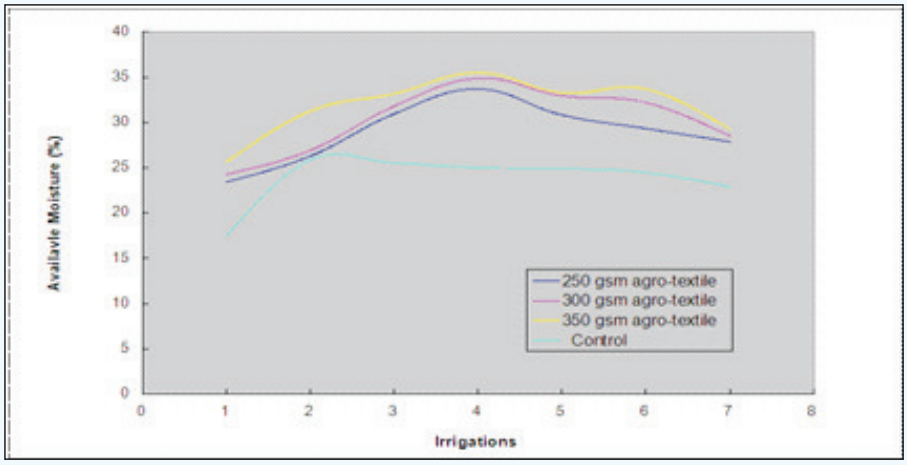


Figure-QEI 15.1:Variation of available moisture capacity in bitter gourd under different agro-textile mulches after each irrigation

Table-QEI 15.2: Growth parameters of bittergourd under various agro-textile treatments

Treatments	Flower initiation (DAS)	Fruit initiation (DAS)	Yield (kg/10m^2)	Yield (q/ha)
T1 = 250 gsm agro-textile	28	34	2.98	29.8
T2 = 300 gsm agro-textile	29	36	2.82	28.2
T3 = 350 gsm agro-textile	29	36	2.64	26.4
T4 = Control	35	40	1.56	15.6

In Narendrapur, bhindi was grown as pre-kharif crop under 300, 350 and 400gsm agro-textile mulch treatments. Available moisture capacity was found to be highest in case of 400gsm agro-textile mulches and varied from 35.7% to 45.0% (Table-QEI 15.3). Comparing crop growth parameters, it was observed that no of leaves, height of plants, weight of leaves and yield of bhindi per plucking/plot was highest in case of 400gsm agro-textile plots. yield varied from 0.85kg/10m^2/plucking in control plots without mulching to 2.0kg/10m^2/plucking in case of 400gsm agro-textile plots (Table-QEI 15.4). Weed suppression varied from 27% in case of 300gsm plots to 63% in 400gsm plots over control (Figure-QEI 15.2). Comparing microbial population at root zone it was observed that nitrogen fixing bacteria rhizobium varied from 8.8x10^7 CFU to 24x10^7 CFU. Highest population observed in case of 400 gsm agro-textiles followed by 350gsm (Table-QEI 15.5). Around 34% and 56% fall in strength of 400 and 350gsm fabric were observed after 3 months of exposures as mulch at Sriniketan consisting of red and lateritic soil.

Table-QEI 15.3: Available moisture in Bhindi production sytem

Treatments	Initial Moisture Content(%)	1st Irrigation (%)	2nd Irrigation (%)	3rd Irrigation (%)	Before Harvesting (%)
Control	14.7	22.0	17.3	28.7	24
300 gsm	31.7	28.7	25.3	38.7	32.7
350 gsm	26.3	30.7	27.7	42.7	33.3
400 gsm	35.7	36.0	33.0	45.0	43.3
C.D	10.0	8.7	6.5	8.4	12.1

Table-QEI 15.4: Crop Growth Parameters in Bhindi Production System at RKMVU

Treatments	Number of leaves	Height of Plants (cm)	Weight of Leaves (g)	Yield(g)/ plot/picking
Control	10	27.6	3.27	820.7
300 gsm	12	31.4	7.26	1445.0
350 gsm	11	40.3	9.93	1796.7
400 gsm	13	39	11.6	1997.3
CD	1.5	4.6	1.9	349.6

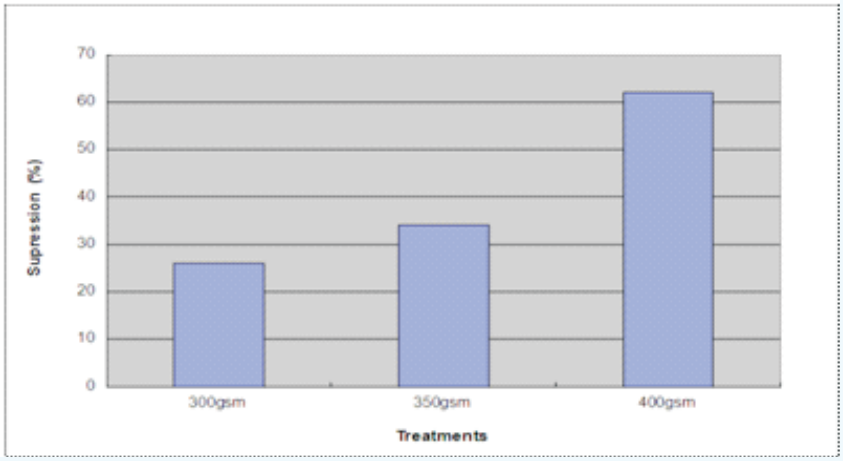


Figure-QEI 15.2: Weed suppression by different agro-textile mulches

Table-QEI 15.5: Microbial population under different mulches

Treatments	Total Bacteria	Rhizobium	Total Actenomycetes
Control	2.88×10^{9}	8.8×10^{7}	-
300gsm	3.71×10^{9}	13.5×10^{7}	8.4×10^{9}
350gsm	24×10^{7}	15×10^{7}	-
400gsm	48×10^{7}	24×10^{7}	-

QEI-16: Development of Electronic Colour and Lustre Meter for Jute and Mesta Fibre

Dr G Roy & Dr S. C. Saha

A conventional electro manual type colour luster meter has been developed a long time ago. In that instrument, an incandescent source of light and a Light Dependent Resistor was used to accept the reflected light from the sample under test. The variation of the resistance due to variation of incident reflected light on LDR causes variation in current to a local circuit of the LDR. But the disadvantage of the system is the current is non linear with respect to the amount of reflected light fall upon LDR.

The new developed technology is the solution for that problem.

For colour measurement, even in international level, no such instrument is present for lignocellulosic fibres. One instrument named Hunter is available to do similar type of testing, but that instrument is very costly. Moreover, the way of measurement needs an expert operator.

Similarly, for lustre measurement, no single instrument is available using which accurate measurement is possible, especially for jute and mesta fibre. Using this newly developed colour lustre meter we can measure both colour and lustre of jute and mesta fibre very accurately. The developed technologies are:

- The design and development of the handy colour range indicator meter has been completed in all respect. Testing & calibration has also been completed.
- The design & development of the Laboratory type Colour Lustre meter has also been completed within the due allotted time.

In handy type Colour Range Indicator meter, there are 4 LED lights, the three of which (Red, Yellow & Green) indicates the range of colour that might appear in test. The other LED indicates the battery level, i.e. the result will be correct if it glows.

In Laboratory type unit, the test sample is to be placed below the probe. Immediately it will indicate the colour value and lustre value in digital form in the display. The colour value will be shown with respect to the gray scale value and the lustre value will be shown as the ratio of Specular refection value divided by the Diffused refection value (S/D). The value of obtaining the value of S and D has been arranged in the probe itself using an array of light sensors.

Photographs of the instruments

Figure-QEI 16.1: Handy type Colour Range indicator for Jute

Figure-QEI 16.2: Laboratory type Colour & Lustre meter for Jute and Mesta fibre

Sample Results

Some of the results is given below which has been obtained from the tests of seven different fibres samples using the newly developed laboratory type Colour & Lustre meter. One fibre sample has been tested thrice in different parts.

Sample No		Colour	Luster
1	i	68	1.38
	ii	65	1.45
	iii	70	1.36
2	i	59	1.22
	ii	67	1.29
	iii	60	1.27
3	i	58	1.32
	ii	48	1.35
	iii	51	1.28
4	i	51	1.31
	ii	45	1.37
	iii	41	1.24
5	i	33	1.76
	ii	48	1.5
	iii	41	1.46
6	i	32	1.24
	ii	36	1.21
	iii	27	1.15
7	i	14	1.57
	ii	22	1.22
	iii	21	1.56

QEI-17: Laccase from Microbes for Value Addition in Jute

Dr Avijit Das & Dr Biplab Saha

Achievements

A bacterial and a fungal culture possessing laccase activity were isolated from rotten woods. The bacterial culture was been found have higher laccase activity than the fungal culture. The fungal culture showed very high cellulase activity than the bacterial culture. The bacterial colonies were white with a rough matte surface. Colony perimeters were irregular and represent the configuration of filiform boundary. Vegetative culture of the bacterial culture showed rod shaped cell which on spore formation became oval shaped. The fungal culture formed spherical sporangium which when matures dehisces oval shaped spores.

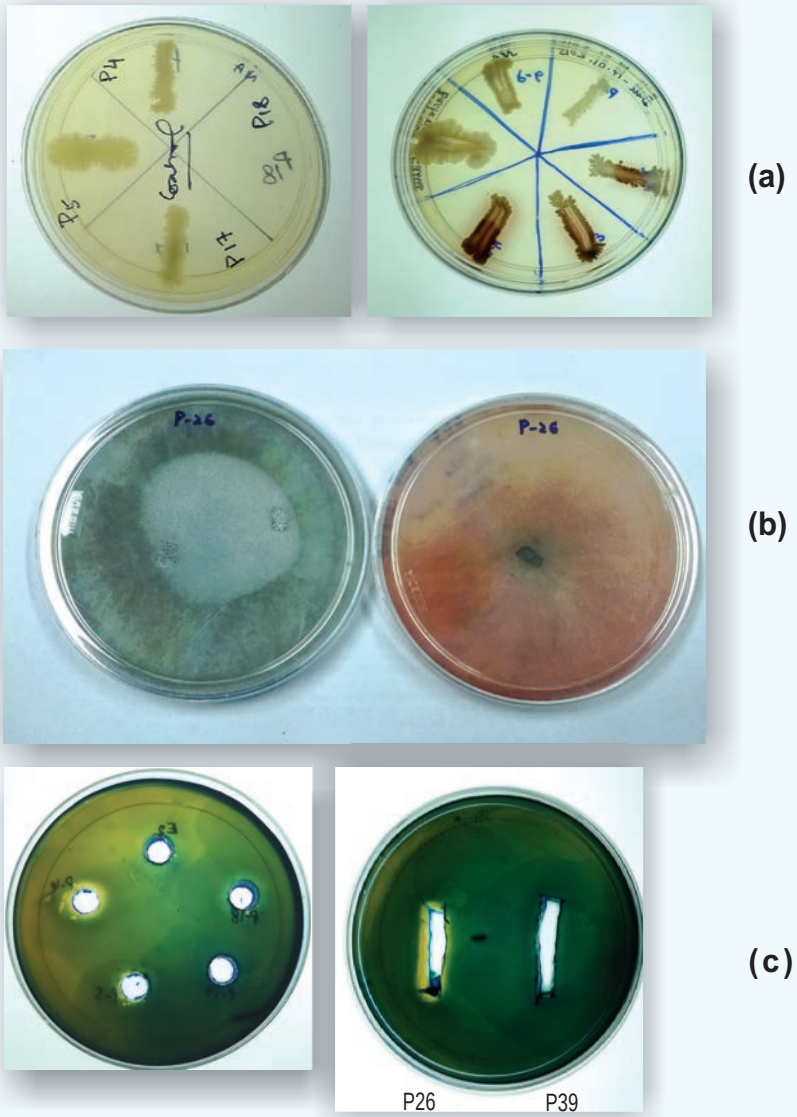


Figure-QEI 17.1: Laccase positive bacterial (a) and fungal (b) cultures. Lignin degradation test (c) on agar plate with culture extracts of laccase positive bacteria and fungi.

(B) Refinement of fungal Retting Technology of Jute

Achievements

1. Among the 4 fungal cultures used for retting F1 and S1 were found to be better in terms of enzyme activity (pectinase and xylanase).
2. Fibre quality of the 90 days old jute plants retted with three fungal cultures (F1, F2 and S1) yielded TDN2+50% to TDN3.
3. Smaller bundles (50 Kg) gave better retting than larger bundles (100 Kg & 150 Kg).

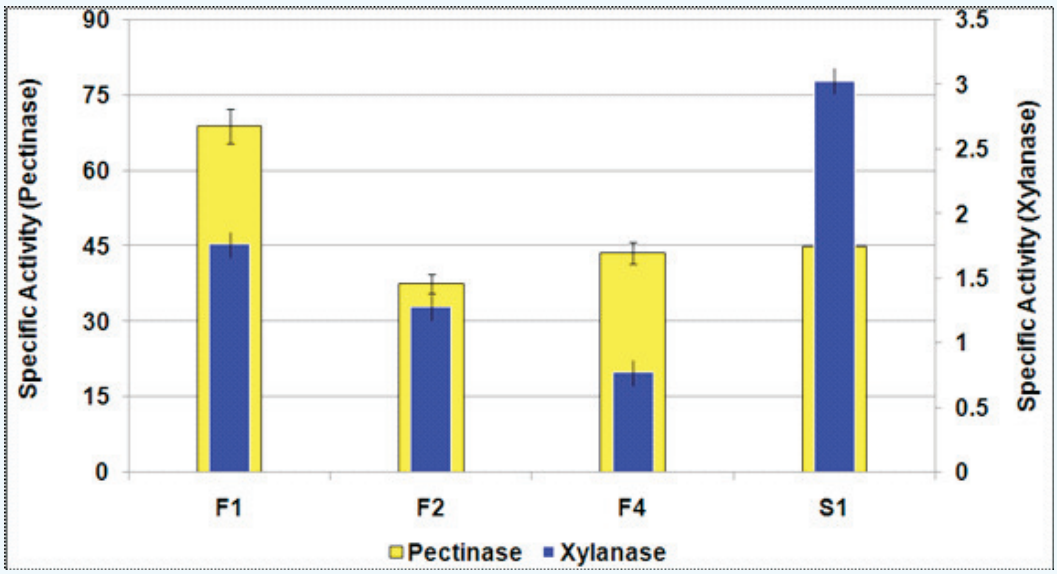


Figure-QEI 17.2: Pectinase and xylanase activities of fungal cultures used in retting of jute fibre.

Table-QEI 17.1: Grades of jute fibre samples retted with different cultures of fungi.

Parameters	Culture F1		Culture F2		Culture S1		Water Retting
	R1	R2	R1	R2	R1	R2	
Bundle Strength (g/tex)	Average	Average	Average	Average	Good	Average	Average
Fineness (tex)	Fine	Fine	Fine	Fine	Fine	Fine	Very Fine
Root Content (L, %)	>5	>8	>10	>10	>10	>5	>5
Defects (% by wt.)	1.0	1.5	1.0	1.5	1.5	1.5	1.5
Colour	Good	Average	Good	Good	Average	Good	Poor
Total Score	70	52	58	50	46	62	60
Sample Grade	TDN2+ 50%↑	TDN3+ 60%↑	TDN3+ 90%↑	TDN3+ 50%↑	TDN3+ 30%↑	TDN2	TDN2

Figure-QEI 17.3: Fungal retting of 90 days-old-jute plants at Ratanpur Village of Singoor, Hoogly.

4. **Development of "ready to use" fungal culture for retting.**

Cultures were grown in PD broth for 10 days. Spore count for each culture was taken with a haemocytometer and diluted accordingly to get equal spore count per unit volume. The spores were mixed with the storage matrix viz. kaolin alone and kaolin+wheat bran (1:1) and dried and stored at room temperature for six months. Kaolin alone was found to be better matrix than kaolin+wheat bran. Two combinations viz. 1.5:1 and 2: 1 (Kaolin:culture, w/w) were found to be better in terms of spore viability.

Table-QEI 17.2: Spore count of (a) with Kaolin and (b) with Kaolin + Wheat bran.

(a)

Fungal Culture	Matrix ratio	30 days	60 days	90 days	120 days	150 days
F1	1.5:1	19.12	17.74	5.11	0.74	0.42
	2:1	6.21	4.11	2.263	0.74	0.25
F2	1.5:1	52.69	23.66	19.72	17.69	12.77
	2:1	42.96	29.91	20.54	19.20	8.27
F4	1.5:1	3.07	2.74	2.39	2.38	1.73
	2:1	11.36	6.59	4.98	4.50	2.98
S1	1.5:1	22.79	8.68	6.83	5.86	5.51
	2:1	32.67	9.39	8.72	5.42	5.09

(b)

Fungal Culture	Matrix ratio	30 days	60 days	90 days	120 days	150 days
F1	1.5:1	8.28	6.28	0.61	0.56	0.27
	2:1	4.67	2.66	0.69	0.32	0.18
F2	1.5:1	26.51	10.28	9.37	7.81	5.17
	2:1	39.34	16.34	15.20	10.11	9.92
F4	1.5:1	1.99	1.37	1.13	0.93	0.35
	2:1	7.99	6.81	5.61	5.31	4.62
S1	1.5:1	4.91	4.79	3.31	2.81	2.01
	2:1	16.46	15.10	8.94	5.16	3.61

QEI-18: Comprehensive Mesta and Bimli Grading System

Dr S C Saha & Mr. T. K. Ghosh

The aim of this project is to develop a comprehensive Kenaf & Bimli grading system by which farmers' can do their own grading and in the same time bulk consumer will not be deprived. During this reported period samples were collected and only Kenaf samples were tested according to the existing BIS grading system. The Test results are given in a Table. With the following objectives the work is in process:

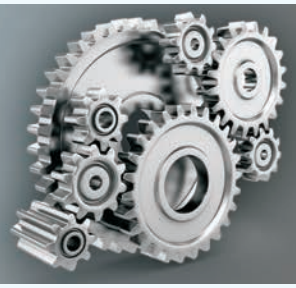
- Parameters should be minimum
- Score marks will be rearranged due to their importance for processing
- Reduction in number of grades will be done

Reduction in grades can create substantial price difference among the grades and the farmers' may be deprived. Precaution should be taken so that reduction in grades will not hamper the farmers.

Table-QEI 18.1 : Grading Table for Kenaf Fibre

Sl. No.	Root content (%)	Defects (%)	Tenacity (gm/tex)	Fineness (tex)	Colour	Bulk Density	BIS Grade
1	30	2.0	19.7	3.2	Average	Heavy	M-4 +50%↑
2	20	2.0	20.1	3.4	Average	Heavy	M-4+75%↑
3	30	2.0	21.4	3.2	F. Average	Heavy	M-4 +90%↑
4	40	2.0	19.8	3.6	F. Average	Heavy	M-5
5	40	2.0	18.3	3.6	F. Average	Heavy	M-5
6	20	2.0	22.6	3.0	Average	Heavy	M-3
7	20	2.0	20.4	3.4	F. Average	Medium	M-4+85%↑
8	20	2.0	22.1	3.6	F. Average	Heavy	M-3
9	30	2.0	19.1	3.6	F. Average	Heavy	M-4+50%↑
10	20	1.5	15.6	3.6	F. Average	Medium	M-4 +70%↑
11	20	2.0	19.4	3.2	F. Average	Heavy	M-4 +90%↑
12	20	2.0	17.6	3.4	F. Average	Heavy	M-4 +90%↑
13	12	2.0	20.6	3.4	F. Average	Heavy	M-3
14	12	2.0	21.2	3.6	F. Average	Heavy	M-3+25%↑
15	30	0.5	19.2	2.8	Good	Heavy	M-3+30%↑

Mechanical Processing Division



Priority areas of research

- Utilisation, value addition and process development of lesser known fibres i.e. sisal, linseed, banana, sun hemp, coconut fibre, etc.
- Development of instruments viz. modern cloth rigidity tester, coconut fibre strength tester and its grading system, unevenness and imperfection measurement by sensor combination or image processing
- Modification of fibre prior to spinning
- Development of diversified products
- Improved /online process control
- R & D for decentralized sector
- Eco-friendly process system development

Achievements

- The PALF fabric was found to have good dimensional stability, abrasion resistance, absorbency, natural lusture and crease recovery exploring the possibility for making green fashion fabrics with this agro-waste.
- An expert system has been developed to evaluate jute fabric defects percent
- Suitable needle punched nonwoven processing system has been developed and parameters have been optimized for sun hemp and banana fibres after softening of fibre and necessary modification of machine. Depending on the properties of needled fabric from sun hemp and banana probable uses have been proposed in insulation, mulching, filtration and packaging.
- Portable Coconut Fibre Strength Tester has been successfully developed.
- Water proof jute based carry bag has been developed for different industrial applications.
- Spinning process performance and yarn imperfections of Sulfated castor oil colloid treated jute fibre is comparable to conventional JBO emulsion treated fibre.

MP - 8: Development of PALF/ Silk-Ramie Blended Apparels

Sh. Seiko Jose & Dr. Gautam Basu

The use of textile grade fibre extracted from the Indian pineapple leaf is an underexplored area. Pineapple leaf fibre is fine, soft, and moderately strong and is much acceptable for textile fabric. An attempt has been made to extract and soften Indian pineapple leaf fibre from pineapple leaves by decortication and subsequent water retting. Fine yarn (38 tex) was spun in the suitable spinning system and the property performance was found to be suitable to make eco-sustainable novelty fabric. Fabric was developed by using cotton as warp yarn and pineapple leaf fibre based yarn as weft in a handloom. The developed fabric shows very good physical and mechanical properties, desired for apparels. This inferred that Indian pineapple leaf fibre may be successfully used to make eco-niche apparel quality fabric as well as novelty textiles.

A plain weave fabric was developed using 22 tex dyed cotton as warp yarn and 38 tex PALF as weft in a traditional handloom of 60 inch reed space with a 48^s reed count, maintaining mesh density 189 x 150 per dm and areal density (116 g/m^2).

Properties of PALF based fabric

Because of lack of suitable spinning system for pineapple leaf fibre, the yarn produced during our study was found to have slightly uneven and neppy. Interestingly the unevenness and neppiness gave a special fancy effect in fabric. It may be noted that weaving efficiency did not affect due to the use of PALF yarn. Table–MP 8.1 shows that though the breaking tenacity is nearly similar in both the directions, warp and weft, the tensile strain of the fabric in warp direction is almost 2.5 times greater than that of weft direction which may be attributed to high extensibility of cotton yarn. Initial modulus of the fabric in weft direction was found to be nearly 5 times greater than warp direction. This is mainly due to much higher modulus of PALF as compared to cotton. The high modulus of weft, which contains PALF yarn, indicates high dimensional stability and shape retention property of the fabric. Higher flexural rigidity in weft direction would give better fullness to the garment. It may be worth noting that since tilt of yarn in a fabric affects the bending modulus of a fabric every care was taken during weaving that no tilt was occurred in both the directions. Tear strength in warp direction 25% higher than that of weft direction. The wide difference of different physical property parameters, except breaking tenacity, in warp and weft direction may be due to the presence of high rigidity PALF as weft yarn, since the PALF is a lignocellulosic fibre and is stiffer than cotton. The crease recovery angle shows that this fabric is having much acceptable level of permanent creasing tendency in both directions. Since, both the fibres are highly hydrophilic in nature, wet ability of the fabric was also found to be almost similar in both directions which are apparent from wicking height values in the Table–MP 8.1.

The abrasion resistance was found to be notably high showing weight loss value, 3.35% even after 3700 cycle indicating its high durability. Wet shrinkage of fabric was found to be higher in weft direction than in warp direction. This may be due to the stress release of PALF yarn in weft direction after weaving, when the fabric was subjected to wetting. Since the cotton yarn, which already undergone wet processing during dyeing as well as there is no stress release in warp direction, the shrinkage in warp direction is comparatively lesser. The coefficient of friction between fabrics to metal was measured to assess the processibility of the fabric during mechanized wet processing machines. The values in both directions (warp way, 0.73, weft way, 0.81) indicate that the fabric is suitable for processing in mechanized system. Considering all the above properties including thickness (0.28 mm), it may be inferred that, PALF based fabric is much suitable for fashionable outer ware, upholstery and draperies.

Table–MP 8.1: Physical and Mechanical Properties of PALF Based Fabric

Parameter	Warp-way	Weft-way
Breaking tenacity (cN/tex)	3.7 (15)	3.9 (9)
Tensile strain at break (%)	13.0 (6)	4.9 (8)
Initial modulus (cN/tex)	10.2 (26)	57.6 (10)
Flexural rigidity (mg/cm)	540	3183
Tear strength (N)	354	260
Crease recovery degree	98.5	95.6
Water Wicking height (cm)	8.4	8.2
Shrinkage (%) in plain water	4.6	8.2
Coefficient of friction (fabric to fabric)	0.89	1.15
Coefficient of friction (fabric to metal)	0.73	0.81

Figure-MP8.1: Cotton/PALF fabric developed in handloom

Chief findings

- The weaving performance of PALF yarn was found to be much satisfactory in traditional handloom. High initial modulus of fabric indicates very good dimensional stability of the developed fabric.
- The abrasion resistance is notably high showing weight loss value, 3.35% even after 3700 cycle indicating its high durability. Water wicking property of PALF is nearly similar to cotton and high rate of absorbency of PALF shows its ability to absorb perspiration within a very short time.
- Crease recovery angle is nearly similar to that of commercial cotton. Thus, the work shows that pineapple leaf, an agro-waste can successfully be utilized for making green fashion fabrics.

MP-9: Development Of Suitable Expert System For Analysis Of Defects Of Jute Fabrics During Inspection

Sh. Sujai Das & Dr Surajit Sengupta

After completion of inspection table, real time febric defects detection software has been completed. This software is detecting the febric defects in real time of moving fabric on fabric inspection platform. It is display defect area and defect % in real time. For development of standard software, different type of fabric video has been captured at different speed of fabric and different heights. Initial Image processing has been done on single image. Segmentation of all defect areas from whole image has been done in single image using image processing technique. Then calculation has been done for the total image area, total all defective areas and calculate the percentage of defective area. Defect indication mark has been display at each centroid of defect area for clear view of fabric defects.

Figure-MP9.1: Inspection table and jute fabric image capture.

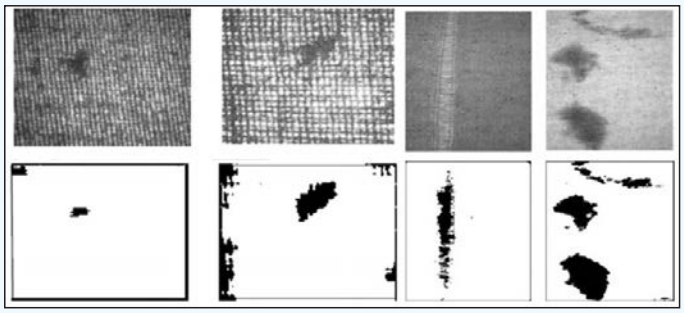


Figure-MP9.2: Defect area segmentation using image processing.

There are two type of indication red and blue indicator. Red indicator show thick area and blue indicator show thin area of fabric. Image processing has been done in all frame of video for real time defect detect and calculate defect percentage. This software has display the real time image of fabric on inspection table. This software has start and stop button for capture the video and analysis. Before starting the capture the vedio, minimum defect size adjustment to be needed using scroll bar. On the basis of minimum defect size adjustment, software has been ignored the small defect size.

After press the start button, software has been start the detect defect and calculate defect % of moving fabric on inspection table in real time. After press the stop button, captured length of fabric has been calculate on the basis of roller count which display on panel box. After press the graph button, software has been display defect concentration graph and defect point graph at the various lengths of fabric. Various trials have been done on different GSM fabric and different speed. Normal computer has been computing the defect in terms of percentage on speed of fabric movement about four meters per minute.

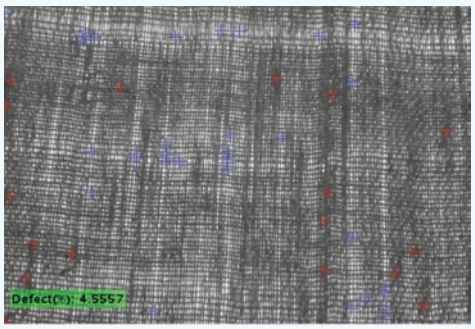


Figure-MP9.3: Software for real time defect detects and calculate defect %.

M P - 10: Development of Nonwoven fabrics from Banana and Sunhemp Fibres

Dr S. Sengupta, Dr S. Debnath & Sh. K. K. Banerjee

Fibre Properties

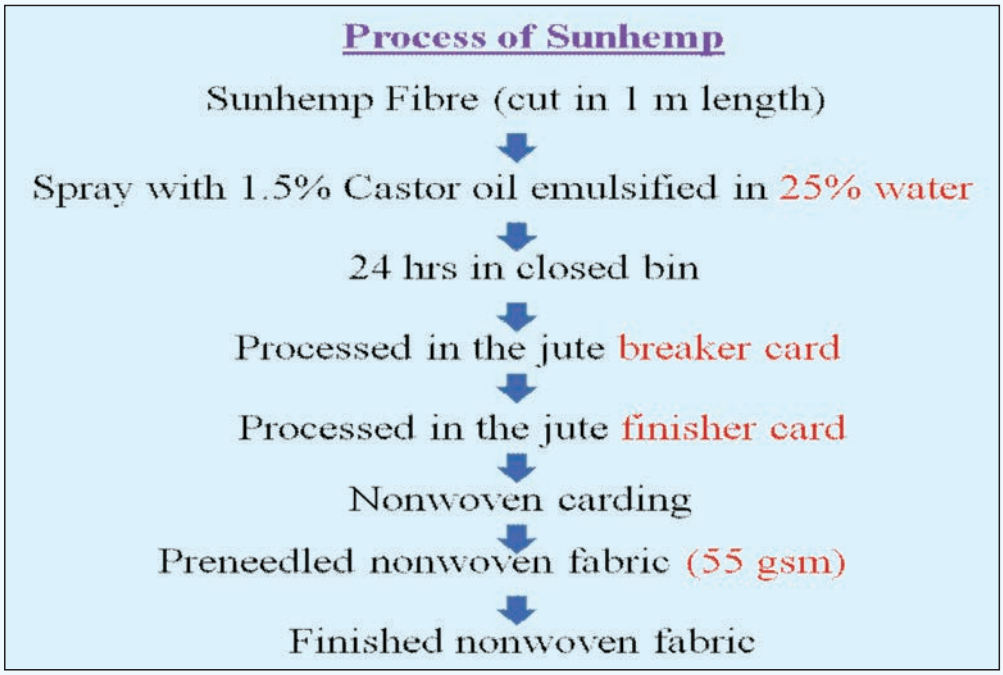
Random sampling has been done for testing of banana and sunhemp fibre. Fibre length, strength, fineness, elongation, work of rupture, initial modulus, rigidity have been tested using standard procedure to ascertain the collected fibre quality.

Process

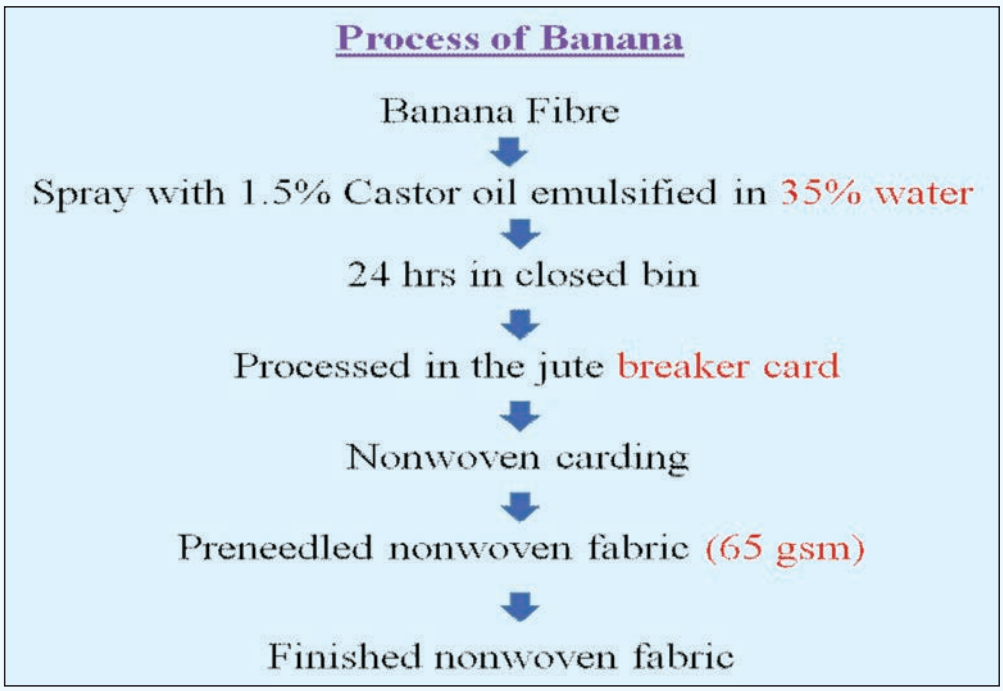
Literature survey has been carried out and found that no literature is available on needle punched nonwoven from these two fibres. A few literatures are available on fibre properties and yarn formation

Banana and Sunhemp (25 kg each) has been collected for processing.

Sunhemp reeds are sprayed with 1.5% castor oil emulsified in 30% water. The wet fibres are kept in a closed container (bin) for 24 hrs. Then removing from the bin, it is processed in the jute breaker card and finisher card to individualise the fibres. These fibres are fed to the conveyor of carding machine of nonwoven preparation and finally a pre-needled fabric has been made. This pre-needled fabric is stacked and needled in layers to get required g/m^2 fabric.



Banana fibres are sprayed with 1.5% Castor oil emulsified in 35% water. The wet fibres are kept in a closed container (bin) for 24 hrs. Then removing from the bin, it is processed in the jute breaker card to shorten and open the fibres. This fibres are fed to the conveyor of carding machine of nonwoven preparation and finally a pre-needled fabric has been made. This pre-needled fabric is stacked and needled in layers to get required g/m^2 fabric.



Process parameters in existing set up and available fibres

Table–MP 10.1: Process parameters of sunhemp and banana fibre with the effect of batching oil

	Sunhemp	Banana
Jute breaker card dropping*	16/9%	12/9.5%
Nonwoven card dropping*	18/4%	12/3%
Feed conveyor speed	0.23 m/min	0.26 m/min
Feed in card	500 g/m^2	600 g/m^2
Card doffer surface speed	15 .1 m/min	19.90 m/min
Cross lapper surface speed	15.4 m/min	20.2 m/min
Needling machine feed speed	0.75 m/min	0.9 m/min
Delivery speed	0.77 m/min	1.01 m/min
Punch density	160 p/cm^2	190 p/cm^2
Depth of needle penetration	12 mm	12 mm
Pre-needled fabric weight	55 g/m^2	65 g/m^2
Moisture content in feed material*	16/20 %	20/25 %
Batching oil %	1.5/2.5	1.5/2.0
Fabric areal cv%	21	12
*in two batching oil content		

During the process optimization, it was found that some mechanical modification is required for smooth and uninterrupted processing of natural fibres. It will be incorporated soon.

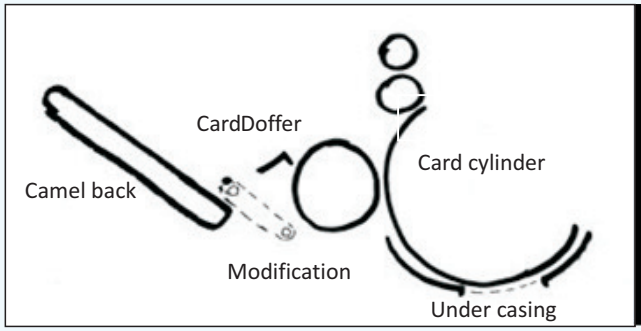
Mechanical modification in machine

1. Conveyor belt between doffer and cross-lapper
2. Perforated/non-perforated plate below card

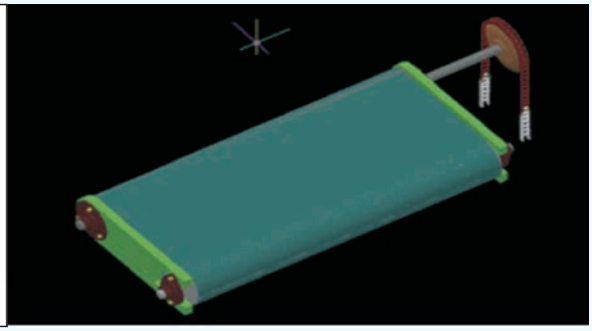
Modification required for
(i) smooth and uninterrupted processing , and
(ii) better uniformity, low card dropping and higher processing speed

Table–MP 10.2: System modification

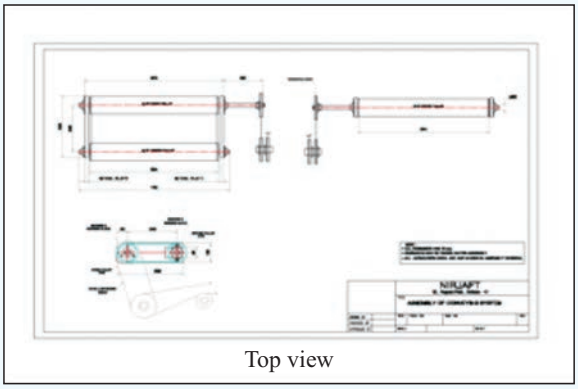
Modification required	Action taken	Effect
Conveyor belt between doffer and cross-lapper	Done	Reduced dropping Better CV% of fabric Better properties of fabric
Perforated/non-perforated plate below card	Not incorporated	Accumulation of fibre in the exit line Setting is critical May cause choking Increased CV% of fabric



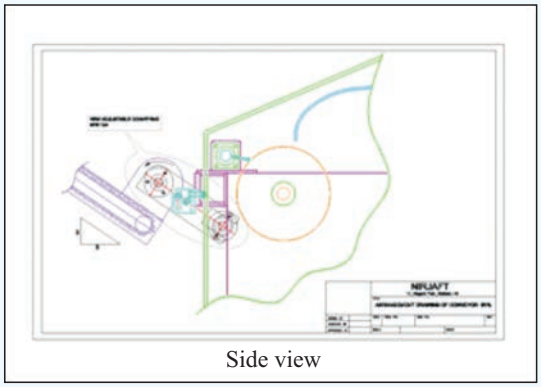
Schematic diagram of modification



Photograph of modification



Top view



Side view

Figure-MP10.1: Modification in carding delivery

After the modification, nonwoven card dropping and area density cv reduces significantly resulting in improvement in quality.

Table-MP 10.3: Improvement after modification

	Sunhemp	Banana
Nonwoven card dropping,	1%	1%
Fabric areal density cv%,	4.61	5.96

Pre-needled fabric has been prepared in Dilo loom with using 200 punches /cm2 and 12 mm depth of penetration.

Twenty eight numbers of cross laid needle punched nonwoven fabric samples out of sunhemp and banana fibres with different parameters have been prepared from 55/65 gsm pre-needled fabric using 200 punches/cm2 and 12 mm depth of penetration using 25 gauge needle.

Construction details of samples

Table–MP 10.4: Sample details

Sample no	Fibre used	Quantity	Nominal Area density, g/m^2	Thickness, mm	Actual Area density, g/m2
S1	Sunhemp	100%	300	3.97	312
S2		100%	600	4.00	598
S3		100%	900	4.87	891
S4	Sunhemp:Jute	50:50	300	3.43	299
S5		50:50	600	5.33	605
S6		50:50	900	6.61	898
S7	Sunhemp: PP	50:50	300	4.20	304
S8		50:50	600	5.81	613
S9		50:50	900	8.54	903
B10	Banana	100%	300	3.58	308
B11		100%	600	5.40	604
B12		100%	900	7.15	909
B13	Banana : Jute	50:50	300	4.28	297
B14		50:50	600	5.34	599
B15		50:50	900	7.65	899
B16	Banana: PP	50:50	300	3.49	302
B17		50:50	600	4.74	601
B18		50:50	900	6.88	908
SB 19	Sunhemp: Banana	75:25	600	5.83	591
SB20		50:50	600	5.41	602
SB21		25:75	600	5.55	597

Softening Treatment

Sunhemp and banana fibres were treated in for 15 mins

(1) boiled water,
(2) 1% nonionic detergent under boil,
(3) 1% NaOH Soln,
(4) 1% HCl solution
(5) 0.5% Silicone softener

By hand feeling it was found that 1% nonionic detergent under boil shows the improved fibre in both the cases compared to boiled water treatment. Detailed investigation shows that treatment with NaOH and HCl softens the fibre with reduction in strength. Furthermore, traces of chemicals present in this two cases may increase the strength deterioration due course. Treatment with silicone softener reduces the fibre to fibre friction and hence, difficult in processing. The fibre properties after 1% nonionic detergent under boil have been measured from breaker card sliver using standard procedure and reported.

For sunhemp, 1% nonionic detergent under boil reduces length by 2 mm, fineness by 0.3 tex and flexural modulus by 26 dynes/cm^2. For banana, 1% nonionic detergent under boil reduces length by 4 mm, fineness by 0.2 tex and flexural modulus by 6 dynes/cm^2.

Probable uses: Insulation fabric, Mulching Fabric, Filter fabric, Packaging.

M P - 11: Development of Portable Coconut Fibre Strength Tester

Dr. Gautam Basu, Sh. Chanchal Kundu, Sh. P Choudhury & Sh. L Patra

The aim of the work was to develop a user friendly low cost instrument for the benefit of the farmer and improvement of scientific grading system of coconut fibre. No such portable instrument is available for testing of coconut and other hard vegetable fibres for its tensile strength. The cost of the instrument is also very nominal with respect to other type of tensile testing instruments available in the market. The following development work has been done in the reported work.

- Weight of the whole instrument kept low, to make it portable suitable for outdoor use. Dimension of base and height of instrument was kept such that it should not vibrate during testing. Height of the instrument was calculated considering test length (50 mm), extensibility of fibre and accommodation of load cell. Precision in the fabrication was maintained up to 0.05 mm. Considering the location (coconut growing areas, mostly coastal belts) of use of the instrument, base plate, middle plate and columns were made from SS. Sufficient space between plates was maintained to dissipate the heat generated during working of the motor as well from electronic circuit.
- Since, coconut fibre is hard, gripping during tensile loading is a problem. It is tough to press within the jaw faces. Initially, rough metallic surface (serrated jaw faces) was tried and ultimately hide has been chosen for the jaw faces. Metal used for jaws- MS with high quality chromium plating. The capacity of the instrument has been kept at 980 N (10 kg). Test speed may be maintained as 50 mm/min or lower as per requirement.

- Dimension of the instrument is 320 mm (width) x 200 mm (depth) x 510 mm (height) and weight is approximately 16.0 kg which may further be reduced to a considerable extent using different materials.
- Memory unit is fixed in the machine. For ease of use, display unit is fixed in front of the instrument at an angle of 45° and calibrations have been done for load cell and for length using known calibrated weight and length scales. In addition, Computer interfacing with the machine has been done to record load, elongation, breaking time and breaking tenacity. Laboratory mode data can be generated in the MS Excel format in the computer and graph of load and elongation can be generated. Beauty of the work is that the instrument can be used without using any computer at the field.
- For operation of instrument, a single phase 230 V electrical connection is required.
- Result obtained in the developed tensile tester using coconut, sisal, and nylon fibres of different linear densities were compared with the result obtained from well established Instron universal tensile tester (costing about not less than Rs 35.00 lakh) and results are given in Table–MP 11.1. Data accuracy for the results were maintained at $\pm$ 0.005.

Table–MP 11.1: Comparison of tenacity and extension results with those of Instron tensile tester

Material	Tenacity (cN/tex)	CV (%)	Extension (%)	CV (%)
Developed instrument				
Coconut	14.42	78	22.26	34
Sisal	18.7	24	4.95	34
Nylon	25.3	4	54.46	24
Instron universal tensile tester				
Coconut	13.4	63	26.12	35
Sisal	21.42	25	4.04	26
Nylon	25.46	3	57.15	24

The Table–MP 11.1 shows that there is hardly any difference in tensile strength values, however, coefficient of variation percent values of corresponding parameters of developed instrument shows slightly higher as compared to Instron tensile tester which proves the high sensitiveness of the developed instrument. Marginal difference in extension values may be due to fibres won inherent difference between individuals.

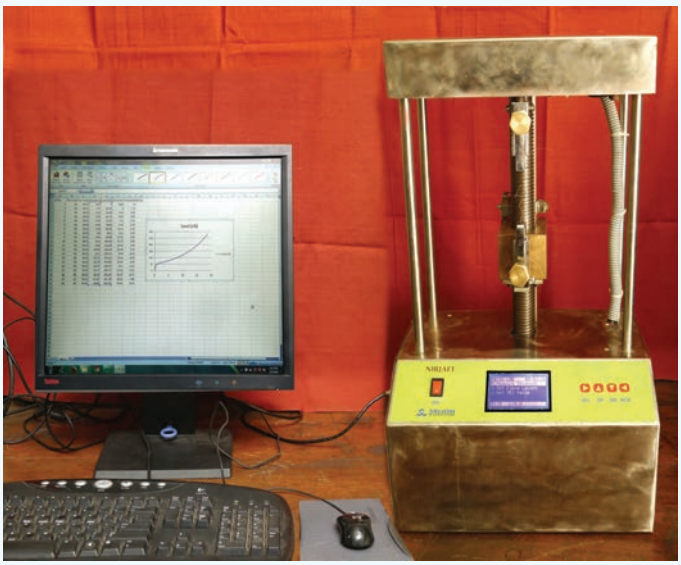


Figure-MP 11.1: Photograph of the developed coconut fibre strength fibre

Mp–12: Development of Coated and Laminated Products Based on Jute

Dr. Gautam Basu & Sh. Seiko Jose

The project was initiated with the objective for developing jute based flexible composite structures for water imperviousness, which could find application in areas, where water resistant/water proof materials like packaging materials, tents and sheds, floor mats, etc. Because of good flexibility natural rubber is preferred as a coating material. PVC coating on jute fabric was also performed for comparison purpose.

Progress

The herringbone structure of jute woven fabric was identified as the most suitable material for the coating. Initially, two types of coating were attempted. (1) coating of jute fabric with rubber and (2) coating of jute fabric with PVC.

In the initial stage of rubber coating, the coated fabric was found to be thick and heavy. In this context, a second attempt was carried out in order to reduce the thickness and weight of the coated fabric. Comparative properties of two coated fabrics are shown in the Table–MP 12.1.

Table–MP 12.1: Comparative evaluation of rubber coated fabric

Sl. no. of trial	Construction of jute fabric	Areal density of cloth (g/m^2)	Thickness after coating (mm)	Areal density of cloth after coating (g/m^2)	The cloth percentage (%)	The rubber percentage (%)
1	Herringbone	446	1.8	2423	22.55	77 .45
2	Herringbone	446	1.6	1400	46.75	53.25

From the Table–MP 12.1, it is inferred that the weight of the coated fabric during second coating was reduced considerably due to reduction in the rubber content. It was also observed that air and water permeability of both the coated fabric was nil. Thus based up on the above results, the coating 2 was considered as the optimum and the mechanical properties of the same was analysed and is listed in the Table–MP 12.2.

Table–MP 12.2: Mechanical properties of rubber coated jute fabric

Parameter	Tensile strain (%)	Breaking tenacity (cN/tex)	Initial modulus (N/mm^2)	Total energy (mJ)
Warp	5.2 (3)	2.1 (8)	48 (15)	4615 (12)
Weft	5.5 (4)	1.1 (4)	44 (14)	2355 (12)

Figure in the parenthesis shows the CV% of the corresponding value

A carrier bag was prepared using the above said fabric and is as shown in the Figure-MP 12.1. The bag was found to be water proof. In the Initial stage of development, slight water leakage was observed through the holes made by needle while stitching, but the problem was solved by pasting water repellent tape over it.

Figure-MP 12.1: Rubber coated jute bag (a)Outside view (b) Inside view

Figure-MP 12.2: PVC coated jute bag

In the second stage of development, the jute fabric was tried to coat with PVC, initially on one side, later on both sides. The both side coating gave much better water and air impermeability, though the weight is higher. A carrier bag was also made from the both side coated fabric and is shown in the Figure-MP 12.2.

Chief findings

- Fabric with different weave and composition has been developed for coating and it was found that the Herringbone structure is the most suitable construction for coating.
- Jute fabric was coated with rubber as well as PVC for the development of water proof carry bags
- The mechanical property of the coasted fabric shows marginal changes.
- The rubber/PVC coated jute fabric could find application in different industrial applications, where strength, weight and water imperviousness in needed.

MP-13: Development and Evaluation of Eco-Friendly Water Soluble Jute Conditioning Agent

Sh Seiko Jose

India is the largest producer of jute goods. During jute processing, a mineral oil known as Jute Batching Oil (JBO) is applied on jute fibre by making an emulsion with water and non ionic detergent. The presence of JBO makes the jute having kerosene odour and is reported as carcinogenic. Due to this, the demand on food products packed by jute bags in international market has been reduced. In this work, instead of JBO, sulfated castor oil was applied on jute fibre during processing, which is ecofriendly and water miscible. A comparison study was made with the performance of sulfated castor oil over jute batching oil in terms of physio chemical properties of oil, emulsion and yarn.

Particle size distribution in emulsion

The particle size analysis and zeta potential of the samples were carried out using Dynamic Light Scattering instrument (DLS, Zetasizer, model : Nano-ZS90) at 25°C.

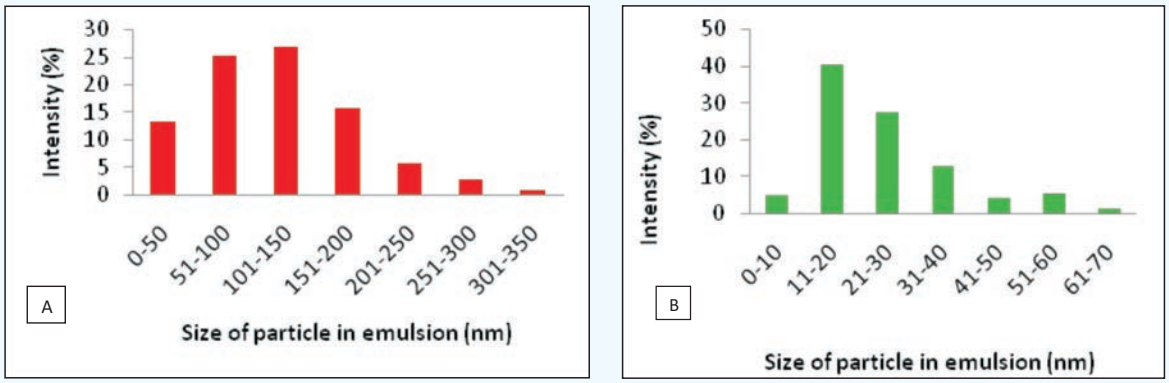


Figure-MP 13.1: ***Particle size distribution of (a) 2.5 % SCO (b) 2.5 % JBO***

Figure-MP 13.1 shows the particle size distribution of both SCO and JBO in water. Though the size of the particles of SCO colloids are higher, than that of JBO emulsion but particle size of colloids are in nano scale, indicating its ability to penetrate in to the intra fibre voids of jute. It is noteworthy that the particles size distribution of colloids is much wider that of JBO emulsion. The formation of smaller size particles of JBO in the emulsion is due to use of high vibrating energy caused much better atomization of oil droplets during emulsion formation.

Emulsion stability

Emulsion stability refers to the ability of an emulsion to resist changes in its properties over time. The stability of freshly prepared 2.5 % JBO and SCO emulsion after subjected to centrifugation for 5 minutes for 1000, 2500 and 5000 rpm is shown in Figure-MP13.2. It is apparent from the figure that, the SCO emulsion is processes superior stability in comparison with the same concentration of JBO emulsion under all experimental conditions. The stability of JBO emulsion was found to be gradually reduced as increase in the rotation and finally separated at 5000 rpm. Apparently the SCO emulsion was found to be unaffected under same experimental condition.

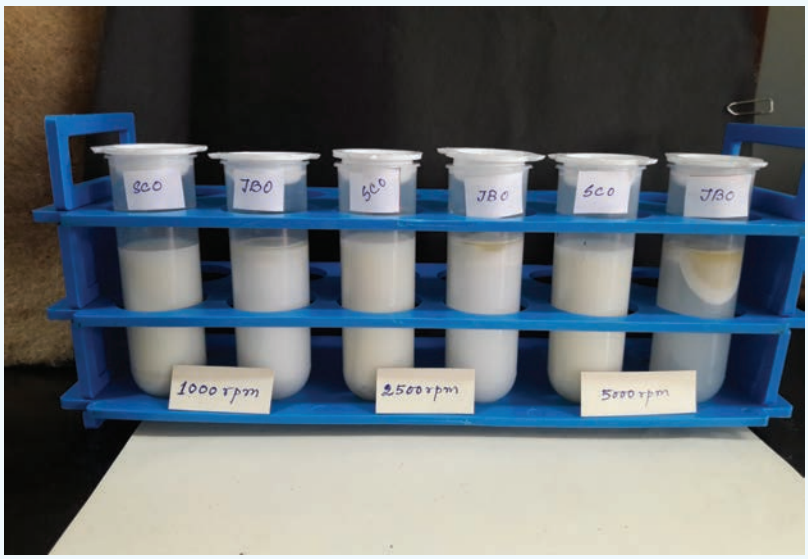


Figure-MP13.2: Stability of SCO and JBO emulsion

The stability of emulsion can also be expressed in terms of zeta potential. A potential exists between the particle surface and the dispersing liquid, which varies according to the distance from the particle surface, this potential at the slipping plane is called the Zeta potential. If the zeta potential value falls below a critical level, the colloid will aggregate due to attractive forces. The zeta potential of 2.5 % SCO emulsion (-45.1) was found to be more than 3 fold than that of corresponding JBO emulsion (-13.83). This is the reason for higher stability of SCO emulsion.

Processibility of jute fibre for making yarn with SCO

Three distinct parameters, viz., fibre wastage during processing, moisture regain in different stages and the yarn breakage rate were considered as the major criteria for analyzing the performance of SCO colloid and JBO emulsion during mechanical processing of jute fibre (Table–MP 13.1).

Table–MP 13.1: Comparative performance of JBO and SCO

Percentage of oil	2.5 % JBO	2.5 % SCO
Fibre waste during carding as droppings (%)	2.11	2.47
Breakages in spinning(spindle/hrs)	0.33	0.33
Breakages in rewinding	3	4
Moisture regain before spinning (%)	21.9	18.1
Moisture regain after spinning at yarn (%)	15.5	15.1
Breaking tenacity (cN/tex)	10.1 (16)	11.3 (16)
Breaking strain (%)	1.3	1.4
Initial Modulus (cN/tex)	635 (6)	675(7)
Specific work of rupture (mJ/tex.m)	0.63	0.76

Figures in the parenthesis shows cv% of the corresponding value

Physical and mechanical properties of jute yarn are given in Table–MP 13.1. The results shows the tensile strength and work of rupture of yarn made from 2.5 % colloid treated jute shows the most balanced and acceptable quality parameters as compared to emulsion treated fibre. The 2.5 % colloid treated jute fibre produced strongest yarn. Work of rupture of the same also shows the similar trend.

Table–MP 13.2: Yarn evenness data

Parameter	Um (%)	CVm (%)	Thin places/km (-50%)	Thick places/km (+50%)	Neps/km (+200%)	Hairiness
2.5 % JBO	19.5	25.03	690	745	170	8.96
2.5% SCO	18.36	23.69	625	700	70	10.23

Evaluation of evenness of a yarn is one of the key factors for assessing the subsequent process (weaving) performance and cloth appearance property. The table 2 shows, 2.5 % SCO colloid treated yarn reduced all the thread imperfection viz., thick places, thin places and neps. This shows that 2.5 % SCO treated fibres produces much even yarn than JBO treated fibres during spinning.

Chief findings

- Spinning process performance of SCO colloid treated jute fibre is much comparable to conventional JBO emulsion treated fibre.
- Yarn imperfections in terms of thick places, thin places and neps is shows much superior that that of JBO treated fibre may be due to balanced moisture and frictional properties.
- It may be concluded that 2.5 % Sulfated castor oil colloid gives much comparable and economic way of jute processing, it is sustainable and no costly equipment, arrangement of maintenance of sophisticated instruments is not required as well as labour cost will also be reduced drastically.

MP-14: Development of Yarn from Indian Flax for Technical Textile

Dr Sanjoy Debnath & Dr G Basu

Indian flax fibre of 24 kg has been collected from the Pratapgarh, Uttar Pradesh (Research station of ICAR-CRIJAF). The raw fibres in bundles received contains a huge amount of stick, which need to be removed prior to spinning processes. It has been observed that the broken plant sticks are adhering with the fibre strands which are not removed by normal shaking of the fibre strand. Hence a hackling process is required to remove the broken plan sticks from the fibres. With this intervention a manual hackling system has been designed and fabricated, since no such system was available in Institute. The hackling pin height, density tapper angle etc. had been optimized to suit efficient hackling process. The following photograph presents the design of the developed manual hackling system (Left) and manual hackling of the flax fibre using the developed hackling system (Right)

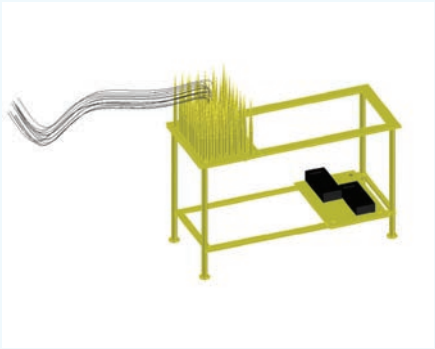


Figure-MP 14.1: Manual hackling system

Figure-MP 14.2: Hackling of the flax

Around 12 kg raw fibre has been hackled and three different qualities of fibres were obtained. The first hackled quality contains majority long and fine fibres with very less amount of broken stick. The subsequent hackling process, comparatively shorter fibre length obtained. The fineness of the raw fibres were measured at three different positions (root, middle and crop) to understand the variability of the fibre fineness. The fibre diameter has also been observed under projection microscope.

MP-15: Development of Low Area Density Jute Non-Woven Fabric for Carry Bags

Dr. Surajit Sengupta, Sh. Seiko Jose & Sh. K K Banerjee

After thorough survey, it can be said

(a) Two popular articles are available on warp knitted open fabric for carry bags.

(b) No scholarly literatures is available for carry bag from jute nonwoven.

(c) No literatures is available on low area density and well covered jute fabric except five literatures from NIRJAFT scientists. It will be the guide to perform the present study.

(d) Presently, GOI has also given emphasis to develop on eco-friendly carry bags instead of plastic bags.

(e) Lot of literatures are available on jute nonwoven, but those are basically needle punched nonwoven which are not suitable for carry bags depending on properties and limitation.

(f) A preliminary survey has been conducted in two markets of different locations and found a positive response from the stake-holders.

(g) The idea has been discussed with two jute mills. They have shown great interest.

Procurement of fibres and chemicals

(a) Jute fibre (25 Kg) of TD4 grade has been collected for the study.

(b) Chemicals (adhesive, HCl, NaOH, H_2O_2, Magnesium silicate, sodium silicate, soda ash, wetting agent) and required glasswares have been procured/collected.

(c) Lubricant for running the machine has been procured.

Chemical modification of fibre

Five kg of fibre has been scoured (300 g in a batch) and ready for processing.

Two Kg of fibre has been bleached with hydrogen per oxide (300 g in a batch) and ready for processing.

Preparation of cross laid pre-needled nonwoven fabric

Cross laid pre-needled fibre sheet (around 100 m) from 65g/m^2 has been prepared with 200 punches /cm^2, 14 mm needle penetration and 25 gauge needle.

Chemical & Bio chemical Processing Division

Priority areas of research

- Bio composites based on jute and other agro residues
- Eco-friendly pulping process suitable for small scale industry
- Low water textile finishing of jute fabric
- Application of biotechnology and nanotechnology in textile finishing and jute processing

Achievements

- ZnO nano-particle has been successfully prepared, characterised and applied on jute fabric for flame retardency.
- Better printing has been observed with natural dyes on bio scoured, bleached and double mordanted jute fabric.
- Sanitary napkins has been successfully developed from Jute Pulp.
- Activation of pre-treated jute stick biomass has been tried with H_3PO_4, KOH and NaOH.
- Electrical resisitivity of jute has been improved by PANI coating of jute fabric.
- Flame Retardancy has been improved by treating with Banana pseudostem sap (BPS) extracted from the banana stem.
- Colour yield and fastness properties are better in case of printing on double mordanted jute fabric using natural dyes.

CBP-7: Application of Enzymes for Making Pulp and Paper with Improved Characteristics Using Different Lignocellulosic Fibre

Dr Sambhu Nath Chattopadhyay

Handmade paper industry occupies a very important position in India and employs a large number of rural artisans. The beauty of handmade paper industry is that they can utilize a variety of raw material depending on the availability and can produce a wide range of products. Different lignocellulosic fibres are a good source of raw material which can be exploited to produce handmade paper which includes banana, sisal, pineapple, jute, etc. Paper making is a chemical and energy intensive process and biotechnological intervention may be useful. So, the project was undertaken with the objective of utilisation of biocatalysts to produce pulps with lower chemical and energy consumption using different lignocellulosic fibres and production of paper with improved optical and physical properties. Blending of pulps produced from lignocellulosic fibres was also carried out to produce different quality papers. Different lignocellulosic fibres like jute, sunnhemp, banana and pineapple fibres were procured and were cut into 2-4 cm pieces and used for bio-treatment and pulping. Three commercial enzymes, Texbio-M (Cellulase and hemicallulase based enzyme) & Texzyme –J (Xylanase based enzyme) were procured from M/s Tex Biosciences (P) Ltd, Chennai and Laccase 208 (lignin degrading enzyme) was procured from Enzyme India Pvt. Ltd., Chennai. These enzymes were used for biotreatment of these fibres. Sodium hydroxide, Sodium carbonate, sodium sulphite, acetic acid, sodium acetate, anthraquinone, methanol and non-ionic surfactant (Ultravon JU) were used as chemical auxiliaries. Biotreatment ,pulping , paper formation and evaluation of papers produced from different lignocellulosic fibres were carried out as follows.

Biotreatment

i)Cellulase-xylanase treatment : Lignocellulosic fibres were dipped in a solution containing cellulase-xylanase enzyme (2%, owf) using a material to liqueur ratio at 1:10, temperature - 50 °C, pH- 4 - 5.5 and treatment continued for 4 hours with constant stirring. After the treatment the content was boiled for one hour with 0.1% non-ionic detergent followed by washing.

(ii)Lacasse treatment: Lignocellulosic fibres were dipped in a solution containing laccase (1%, owf), Hydroxybenzo-triazole, HBT (1%, owf) using a material to liquour ratio at 1:10, temperature – 50 °C, pH- 4 - 5.5 and treatment continued for 4 hours with constant stirring. After the treatment the content was boiled for one hour with 0.1% non-ionic detergent followed by washing.

(iii)Sequential treatment of cellulase- xylanase followed by lacasse: Lignocellulosic fibres were first treated with cellulose- xylanase as in (i) followed by lacasse treatment as in (ii).

Pulping

Hot soda pulping: Controlled and enzymes treated fibres were boiled for three hours in open vessel using different caustic concentrations (2%, 4%, 8% , owf) using liquor ratio of 1:10. After the digestion, the pulps were washed thoroughly with running water.

Cold soda pulping : Control fibres was soaked in a 10% NaOH solution and enzyme treated fibres were soaked in a 4%,7% & 10% NaOH solution at 1:10 material to liquor ratio for 24 hrs. The material was washed free of alkali with running water.

High chemical ASAM pulping : Control and enzyme treated Lignocellulosic fibres were treated in a solution containing sodium hydroxide (5 %), sodium sulphite (20 %), Anthraquinone (0.1%) and methanol (15 %) using a liquor ratio of 1:12 for 3 hours at 160°C .The pulps were washed thoroughly after pulping.

Low chemical ASAM pulping : Control and enzyme treated Lignocellulosic fibres were treated in a solution containing sodium hydroxide (1.2%), sodium sulphite (5%), Anthraquinone (0.1%) and methanol (5%) using a liquor ratio of 1:12 for 3 hours at 160°C & 115°C. The pulps were washed thoroughly after pulping.

Beating

All the pulps were subjected to beating in laboratory scale valley type beater for different durations to produce pulp of 40° SR freeness.

Paper sheet formation

Paper sheets of 60 GSM were produced by using semi-automatic paper sheet Making Machine

Evaluation

Optical properties: The Whiteness Index in HUNTER scale, Yellowness Index in the ASTM D1925 scale and Brightness Index in TAPPI 452 scale of handmade paper produced by hot soda process and cold soda process was determined by Spectrascan-5100 computerised colour matching system using relevant software.

Physical properties: Tensile properties were evaluated by Tappi Test Method – T404 om-85, Bursting Index was determined by Tappi Test Method – T403 om-85, Tearing strength by Tappi Test Method – T414 om-88 and Folding endurance (Schopper type) was determined by Tappi Test Method – T423 om-89. Bundle strength and air flow fineness of fibre samples were determined following standard procedures.

Salient features of the papers produced from different fibres following biotechnological intervention

Jute fibre : Hot soda pulping of jute using 8% caustic soda produces paper with good optical and physical properties. But biotreatment of jute fibre using cellulose and xylanase enzyme followed by hot soda pulping using 50% chemical produces equivalent quality paper with 8% higher yield. Conventional cold soda pulping of jute produces paper with poor optical property and physical properties. Enzyme treatments of jute fibre using cellulose and xylanase followed by cold soda pulping using lower dose of chemical produces paper with improved optical and physical properties which are comparable to that produced by hot soda pulping process. ASAM pulping of jute fibre using high chemical concentration and temperature produces paper with good physical properties but their yield is as low as only 67%. Pretreatment of jute fibre with cellulose and xylanase enzyme and subsequent pulping using low chemical and high temperature produces paper having quality same as that produced by high temperature high chemical process but the

yield is as high as 82%. In all the cases biotreatment followed by pulping requires 25-30% less beating time in subsequent step to reach the required freeness level.

Pineapple fibre: Pineapple fibre produce paper with excellent optical and physical properties if indivisual treatment of cellulose-xylanase or laccase is done before hot soda pulping using 4% chemical. Sequential treatment of cellulose-xylanase followed by lacasse on pineapple fibre produce paper with excellent physical and optical properties if the biotreatment is done after soda pulping using 4% chemical. In case of biotreated samples, 25% less beating time is needed than the control samples to produce a particular freeness value of the pineapple pulp.

Banana fibre : Physical properties of the paper improve substantially if sequential bio treatment is carried out before ASAM pulping, particularly in case of low chemical process using banana fibres.

Sunnhemp fibre : Sequential biotreatment before or followed by low chemical ASAM pulping can produce paper comparable to that produced by high chemical ASAM pulping in case of sunnhemp fibre.

Salient features of the papers produced from blending of pulps produced from different fibres following biotechnological intervention

Biotreatment of different lignocellulosic fibres like jute, sunnhemp, banana and pineapple was done by sequential treatment of cellulose-xylanase followed by laccase. These fibres were pulped by low chemical low temperature (115^0C) ASAM process. Blending was done using pulps produced from two or three different fibres and papers were produced. It was found that for producing white and bright papers combination of jute, banana and pineapple in equal proportion produce good results while good physical properties are achieved if jute, sunnhemp and banana pulps are blended in equal amounts. Biotreatment before or followed by low chemical ASAM pulping can produce paper comparable to that produced by high chemical ASAM pulping in case of sunnhemp fibre. Low chemical ASAM pulp from sunnhemp fibre can produce paper with very good physical properties after mixing with 30% jute pulp

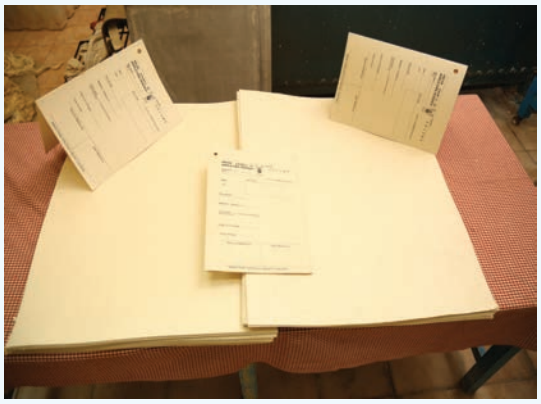
Conclusions

(i) Better yield of the pulp and improvement of quality of paper can be obtained using combination of enzyme treatment and chemical pulping using lower dose of chemical and at lower temperature in case of hot and cold soda pulping using jute fibres.

ii) In case of ASAM pulping, biotreatment before pulping results in better quality of paper with lower dose of chemicals and at lower temperature. Sequential biotreatment using cellulase-xylanase followed by laccasse is needed in case of jute, sun hemp & banana while individual treatment of cellulase-xylanase or laccasse is sufficient for pineapple.

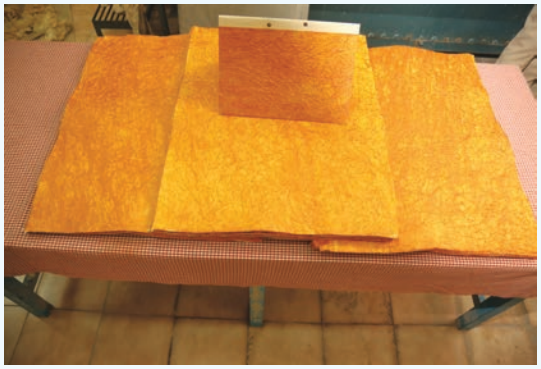
iii) Biotreated fibres require 25-30% less beating time in subsequent step to reach the required freeness level.

iv) Blending of jute, banana and pineapple pulp produce papers with good optical properties while blending of jute, sunnhemp and banana in equal proportion produced papers with very good physical properties.



File Cover

Bag from handmade paper



Decorative file cover from crack paper

Drawing paper

Figure-CBP 7.1: Uses of handmade paper

CBP-9: Functional Finishing of Jute Textile by Suitable Nanoparticles

Dr. L. Ammayappan & Dr. D. P. Ray

Flame Retardant Finishing of jute textile by Zinc Oxide Nanoparticle

ZnO nanoparticle preparation and effect of calcination

Zinc oxide has been identified as a suitable flame retardant nanoparticle. 0.12 M of sodium carbonate solution is slowly added to 0.1M of zinc nitrate hexahydrate in ten minutes followed by with continuous stirring for 60 minutes using with magnetic stirrer. After 60 minutes, zinc nitrate is converted into $Zn(OH)_2$ followed by ZnO. The nano ZnO sol was dried at 106°C for four hours followed by calcinated in muffle furnace at 300, 400, 500 & 600°C and the yield was ranged from 72 to 76%. It is noticed that crystallinity of ZnO nanoparticle is increased by an increase in calcination temperature.

Characterization of ZnO nanoparticle

ZnO nanoparticle sol was characterized by UV-Visible Spectroscopy & ZnO nanoparticle was characterised by transmission electron microscopy. UV-VIS spectroscopy of ZnO sol gave λ_{max} at

320 nm which confirmed the presence of zinc oxide. Calcinated ZnO nanoparticles show hexagonal shape with 28 to 100 nm particle size. SAED of the ZnO nanoparticle shows the bright spots indicating the high crystalline nature with symmetrical orientation of ZnO nanoparticles. It is inferred that ZnO nanoparticle has wurtzite structure and composed of tetrahedral coordinated O^{2-} and Zn^{2+} ions stacked alternately along the z-axis.

FTIR Spectra of calcinated ZnO nanoparticle

FTIR spectra of different calcinated ZnO nanoparticle shows the following peaks and they are confirm the formation wurtzite structure of ZnO. Peak at 1200–1500 cm^{-1} become shorter as the calcination temperature increases, suggesting that the purity of ZnO increases with increase in calcination temperature. Similarly the peak 3250cm^{-1} may be due to removal of the free water molecule present on the surface of the nanoparticles.

840-850 cm^{-1} = Zn-O bond vibration
3410 cm^{-1} = -OH band stretching on the surface of the nanoparticle
1640 cm^{-1} = Zn-O Stretching

Application of ZnO nanoparticle on jute fabric

Six different concentration of ZnO nano sol i.e. 0.05, 0.10, 0.25, 0.50, 1.0 & 2.0% (owf) were applied in exhaustion method with bleached jute fabric at 1:30 MLR in 80°C for 30 minutes with pH 8.0-8.5. Similarly bleached jute fabric was dipped in with ZnO nanosol by pad→dry→cure method i.e. immersing at 40°C for 30 minutes with pH 8.2, padded by 2 dip→2 nips with 95±5% expression, dried in an oven at 60°C for 30 minutes, cured at 130°C for 5 minutes followed by gradual cooling and drying at ambient condition. In another experiment, ZnO nanosol in 0.05, 0.10, 0.25, 0.50, 1.0 & 2.0% (owf) were dispersed in Wacker BS16 and the finishing formulation was applied by pad→dry→cure method. ZnO nanoparticle applied jute were characterised by SEM with EDX, pXRD, % add-on, FTIR and Limiting oxygen index.

Characterization of ZnO nanoparticle applied jute fiber

ZnO add-on (%) on jute fabric

Results inferred that increase in concentration of ZnO nanoparticle, increases its add-on on jute fiber and the amount of add-on is higher in paddrycure method (0.03 to 1.71%)than exhaustion method (0.03 to 1.17%).

FTIR spectra of ZnO nanoparticle applied jute fiber

FTIR spectra of control jute fiber show characteristics peak of absorbed moisture, hemi-cellulose, lignin and glycopyranse ring functional groups. In addition, the following peaks are confirmed the existence of ZnO nanoparticle on the surface of the jute fiber.

563 cm^{-1} = Zn-N bond vibration band
838 cm^{-1} = Zn-O bond vibration band
1740 cm^{-1} = >C=O stretching vibration of hemi-cellulose
1090 cm^{-1} = asymmetric stretching vibration of Zn–O–Zn bridging.

Limiting oxygen index (%) of ZnO nanoparticle applied jute fiber

Limiting oxygen index (LOI) is the minimum concentration of oxygen, expressed as a percentage that will support combustion of a fiber. It is measured by passing a mixture of oxygen

and nitrogen over a burning specimen, and reducing the oxygen level until a critical level is reached. Any finished textile fabric with LOI >28 termed as semi flame resistant and >35 termed as flame retardant material.

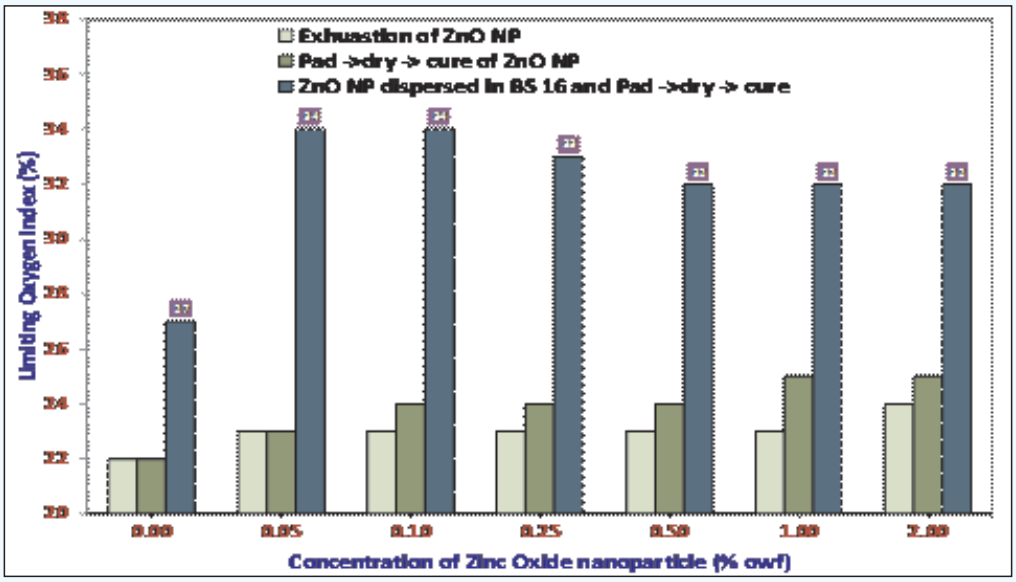


Figure-CBP 9.1: LOI Value of ZnO nanoparticle applied jute fabric

Limiting oxygen index of control, ZnO nanoparticle finished and ZnO nanoparticle dispersed in Wacker BS16 finished jute fibers were evaluated and given in the figure. Control jute fiber has less than 21 LOI and so it is easily flammable. Results inferred that ZnO nanoparticle did not impart flame retardant property to jute fabric (both exhaustion and pad→ dry→ cure method), however in presence of 2.5-5.0 gpl commercial flame retardant finishing chemical (Wacker BS16) , it improves the flame retardant property of jute fabric from 22 to 31-34.

Optimum ZnO nanoparticle based flame retardant repellent finish

It is concluded that the following processing could impart good flame retardant finish on jute textiles i.e. 1% ZnO nanoparticle dispersed in 5 gpl Wacker BS16 followed by application on 100% bleached twill jute fabric by pad (2 dip & 2 nip with 100% Expression)→dry (105°C/ 30 minutes)→ cure (150°C/3 minutes). This methodology gave LOI 34 (good flame retardant property), however it cannot be withstand up to two home launderings.

Cost economics of nanoparticle based functional finishing on jute textiles

Metal and metal oxide nanoparticle based functional finishing requires specifica attention for the preparation and application methodology. In order to assess the cost benefit, cost of the finishing was studied. It is found that application cost of functional finishing using the selective nano-particle like Ag, SiO_2 & ZnO are ranged from Rs. 24 to 394 per kg of the jute fabric in which silver and silica nanoparticle gave semi-durable functional finish however, ZnO nanoparticle shows poor washing durability. It is also suggested that nanoparticle based functional finishing can be preferred to apply to Jute/Cotton or Jute/Viscose blends for the development of home textiles.

Table-CBP 9.1: Cost economics of different nanoparticle based finishing on jute fabric

Functional Finishing	Finishing cost (Rs. Per Kg of fabric)	Fabric Cost (Rs. Per Kg)	Total Cost (Rs. Per Kg of fabric)
5 mM Silver nanoparticle colloidal exhaustion method ***(Anti-bacterial finish)***	394.1	45.5	439.6
10 gpl Silica nanoparticle followed by 100 gpl NUVA 2114 ***(Water repellent finish)***	177.6	50.5	228.1
10 gpl ZnO nanoparticle dispersed in 10 gpl Wacker BS-16 ***(Flame retardant finish)***	23.7	50.5	74.2

CBP-10: Eco-friendly Printing of Jute with Natural Dyes

Dr S. N. Chattopadhyay, Dr. N C Pan & Sh. A Khan

Pre-treatment of jute fabric

During the period under report grey jute fabric was treated with cellulase-xylanase enzyme combination (4% owf) in presence of non-ionic detergent and mild alkali at 60^0 C for 2 hrs, pH 7-9 followed by boiling for 30 min and souring using acetic acid. The bio sourced jute fabric was subsequently bleached by hot hydrogen peroxide bleaching process.

Weight loss during the process:

Scouring : 0.80-0.85 %

Bleaching : 07.7-08.0 %

Physical and optical properties of bio sourced bleached jute fabrics were evaluated and tabulated in Table-CBP 10.1 & Table-CBP 10.2.

Table-CBP 10.1: Physical properties

Sample	GSM	Tenacity		Bending length		Bending modules		Flexural rigidity	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
Grey	225	4.42	5.83	4.75	4.63	71.39	66.13	2411	2233
Bio sourced	262	3.56	4.60	3.55	3.51	24.59	23.77	1172	1132
Bleached	235	3.10	4.06	2.98	3.08	14.04	15.50	623	686

Table-CBP 10.2: Physical properties

	Whitenes index (HUNTER)	Yellowness index (ASTM -D 1925)	Brightness index (TAPPI 452)
Grey	44.75	55.31	15.49
Biosourced	39.44	49.99	12.63
Bleached	82.44	21.37	62.53

Evaluation of bioscoured-bleached jute fabric revealed that the fabric becomes white and soft accompanied by small reduction of tensile properties.

Extraction and characterisation of natural dyes

Natural dyes were extracted from manjistha, annatto, and ratanjot by aqueous method, filtered, dried in hot sand bath and dye powder was produced.

Yield of dyes are as follows:

Manjistha – 11.7%
Annato – 29.64%
Ratanjot – 24.9 %

Particle size of the extracted natural dyes were also evaluated using the instrument, Nano Particlesizer, Model :Zetasizer Nano ZS, Malvem,U.K. They are as follows:
Manjistha---> 560-860nm (93%), 64-89 nm (7%)
Annatto-----> 520-800 nm
Ratanjot-----> 480-810nm (91%), 61-89nm (9%)

FTIR study of the extracted natural dyes were done and the analysis of the results are as follows:

Manjistha : In the spectra the peak at 3252 cm^{-1} is attributed to the hydroxyl stretching of absorbed water and the absorption band at 3157 cm^{-1} is due to the phenolic eOH groups. aromatic C=C double bonds are seen at 1577 cm^{-1} The peaks at wide 1023 cm^{-1} corresponds to C-O stretching. The peaks detected at 2926 cm^{-1} and 2850 cm^{-1} are due to asymmetric C-H stretching in alkyl hydrocarbons. These peaks confirm the Anthraquinone nature of the dyes (mixture of manjustin & purpurin).

Annatto : The FTIR spectrum of annatto extract shows the following bands: at 3417cm^{-1} the -O-H stretching vibration is observed, at 2923 cm^{-1} and 2853 cm^{-1} the H-C-H bending vibration, at 1569 cm^{-1} the alkene C=C streching, at 1394 cm^{-1} the C–H bending of the methyl groups, at 1160 cm^{-1} the C=O streching, at 1035 cm^{-1} symmetric and asymmetric vibrations of the C–O–C ester group, at 1008 cm^{-1} asymmetric C-H bending, 963 cm^{-1} the methylene rocking vibration of *trans*-carotenoid, at 871 cm^{-1} the coupling of the C-O stretching vibrations, at 826 cm^{-1} the terminal methylene and at 722 cm^{-1} the methylene rocking vibration of *cis*-carotenoid. The main carotenoid found in annatto extract is bixin (80%). Small amounts of norbixin are also found. Bixin is responsible for the reddish-orange color of the annatto seeds and their extract.

Ratanjot : The IR spectrum showed a broad around 3263 cm^{-1} due to OH stretching, 1560 cm^{-1} and 1540 cm^{-1} (C=C vibrational bands of the naphthalene ring) and 1262 cm^{-1} (stretching C-O). These peaks indicates naphthoquinone nature of the dye (alkannan)

Ecofriendly chemical and bio mordanting

Biosourced bleached jute fabrics were biosourced using myrobolan extract by exhaustion method. A portion of these samples were further treated with ecofriendly chemical mordant potash alum. So three different samples were produced,

Bioscoured-bleached jute fabric (A)
Bioscoured-bleached-biomordanted jute fabric (B)
Bioscoured-bleached-double mordanted jute fabric (C)

Printing of bioscoured-bleached, single & double mordanted jute fabric

All these fabrics were printed by screen printing method using three different natural dyes extracted from annatto, ratanjot and manjistha. Guar gum was used as thickener, urea as hygroscopic agent. After printing, steaming was done for 30 min at 100^0C followed by soaping and washing.All these samples were evaluated for colour yield and fastness properties and tabulated in Table-CBP 10.3**.**

Table-CBP 10.3: Color yield and fastness properties of different printed jute fabrics using natural dyes

Sample	Dye	K/S	WF	Rubbing Fastness	
				Dry	Wet
A	Manjistha	5.48	2	5	4 - 5
	Annatto	3.94	2	4	3 - 4
	Ratanjot	3.36	2	4	4 - 5
B	Manjistha	11.14	2 - 3	4 - 5	3 - 4
	Annatto	10.3	2 - 3	5	4
	Ratanjot	7.09	2 - 3	4 - 5	3 - 4
C	Manjistha	17.5 0	3 - 4	5	4
	Annatto	14.76	3	5	4 - 5
	Ratanjot	15.73	3	4 - 5	4

Evaluation of results indicate that the double mordanted fabric produce the best effect with respect to colour yield and fastness properties in case of all the natural dyes.

Printing of biosourced bleached jute fabric using dhanicha gum (extracted from dhanicha seeds)

In order to evaluate the performance of dhaincha gum as thickener to be used in printing, scoured-bleached jute fabric was printed with natural dyes extracted from manjistha. Printing was carried out following substantive printing method.

Table-CBP 10.4: Comparison of printing by dhanicha and guar gum using manjistha as dye

Thickener	K/S	L	a	b	Wash fastness	Rubbing Fastness	
						Dry	Wet
Dhanicha	2.84	51.65	13.39	12.36	2 - 3	4	3 - 4
Guar gum	5.48	41.37	15.01	12.38	2	5	4 - 5
Guar gum+dhanicha (50/50)	4.35	45.01	14.13	12.56	2 - 3	4	4

It is found that the jute fabric printed with dhaincha gum as thickener produces poor colour yield and fastness properties but when dhaincha gum is mixed with guar gum then the performance improved.

Conclusion

- Bioscouring and bleaching makes the jute fabric white, bright and soft, which is suitable for printing.
- Particle sizes of natural dyes are found to be in the range of 400-800 nm.
- Colour yield and fastness properties are better in case of printing on double mordanted jute fabric.
- Performance of dhaincha as thickener produces the poor printing performance with respect to colour yield and fastness properties.

Dye extracted from Manjistha **Dye extracted from Ratanjot** **Dye extracted from Annatto**

Figure-CBP 10.1: Natural Colour printing

CBP-11: Development of Jute Pulp for Making Tissue Paper and Sanitary Napkins

Dr S N Chattopadhyay, Dr R K Ghosh & Sh. S Bhowmick

Jute fibre consists of 60% α-cellulose which can be used to replace wood pulp and save our forests. We know that about 68% of our rural women cannot afford sanitary napkins available in the market. Eastern India emerges as the region where the state of feminine hygiene is significantly poorer. Taking these factors into consideration it was thought that jute pulp cellulose can very well replace the imported and costly wood pulp. A sanitary napkin basically comprises of three layers; top layer, absorbent layer and barrier sheet. The absorbent layer is the key component of the napkin (cellulose pulp) and the extent to which this layer is able to absorb and retain the fluid determines the efficiency of the napkin.

Jute fibre was cut into small lengths (1-2 inches) and pulping was carried out by different combinations of chemical and temperature as follows:

A) High chemical, high temperature ASAM pulping
B) Pulping with caustic, sulphite&Anthraquinone at 160° C
C) Pulping with caustic, sulphite at 160° C
D) Pulping with caustic, sulphite& Methanol at 160° C
E) Pulping with caustic, sulphite&Anthraquinone by open cooking
F) Low chemical ASAM pulping at 115°C

All these pulps were bleached by hydrogen peroxide bleaching process. The yield of the pulps were evaluated at every steps along with optical properties of bleached pulp which are tabulated in Table-CBP 11.1.

Table-CBP 11.1: Effect of different pulping methods on yield and optical properties.

Sample	Yield (%)	Whiteness index	Yellowness index	Brightness index	K/S value
A	57.20	88.27	11.28	68.71	0.09
B	57.95	85.79	12.78	69.90	0.10
C	60.8	81.19	16.58	61.40	0.18
D	61.8	80.09	17.58	60.40	0.19
E	**80.75**	**82.42**	**25.23**	**61.07**	**0.28**
F	**71.44**	**79.43**	**23.83**	**57.23**	**0.31**

The diameters of the fibres were evaluated under microscope, they are as follows:

greyfibre - 0.11mm
pulped fibre - 0.08mm
bleached pulp fibre - 0.06mm

As the diameter of the fibre decreases, surface area of the bleached pulp fibre increases,this is needed for better absorption and retention of fluid.The disintegration of pulp was carried out in the laboratory which separates the individual fibres in the pulp and volume increases. This

material is then mixed with super absorbent polymer (SAP) in mass mixture. The super absorbent pulp produced in the laboratory was taken to two NGO at Howrah, where sanitary napkins were produced

- Sampriti Mahila Mahasangha, Amta, Howrah
- Nari-O-Sishu Kalyan Kendra, Panchla, Howrah

Sanitary napkins were prepared following the steps as mentioned below:

i) Weighing of 10gm samples

ii) Preparation of mat of 20cm x 7.5cm x 1.5cm.

iii) Compacting the mass using 100 kg/cm^2 pressure.

iv) U.V. treatment of the sample

v) Evaluation of absorption and retention property of fluid by BIS test (IS:5405-1981) method.

The comparative study of products produced from NGO-1, NGO-2, two multinational product and six experimental samples has been carried out and tabulated in Table-CBP 11.2.

Table-CBP 11.2. : Comparative study of different sanitary napkins

Sample	Amount of SAP added (%)	Quantity of testing liquid added (ml)	Area absorbed by Sanitary Napkin (after 2 min)	Area absorbed by Sanitary Napkin (after putting 1 kg wt for 1 min)	Feeling of upper surface by hand
A	2	15	4.5cm × 5 cm	5cm × 5.5 cm	Very good
B	2	30	6 cm × 6.5 cm	6.5cm × 8 cm	Good
C	2	30	6 cm × 6.5 cm	6.5cm × 8.5 cm	Moderate
D	2	30	6 cm × 7.5 cm	7 cm × 8.5 cm	Good
E	2	30	6.5 cm × 8 cm	7 cm × 10.5 cm	Good
F	2	30	7 cm × 10 cm	7 cm × 11 cm	Good
NGO-1	Unknown	30	7 cm × 8 cm	7 cm × 11 cm	Moderate
NGO-2	Unknown	30	6 cm × 7 cm	6 cm × 7.5 cm	Good
Carefree	Unknown	30	6.5 cm × 8 cm	7 cm × 9 cm	Moderate
Stayfree	Unknown	30	-	-	Very bad

From the table it is clear that the all the samples produced from the jute pulp performs well and better than that obtained from commercial samples. The study of pH of the pulps after mixing with SAP is an important parameters and which should be within 7-7.5. All the samples have been evaluated and have been tabulated in Table-CBP 11.3. It is found that the ph values of all the samples lie between 7 to 7.5.

Table-CBP 11.3: Determination of pH of Jute based sanitary napkin as per IS: 1390- 1983 procedure

Sample Code	pH paper (Merck, India)	Online pH meter (Eutech Instruments, Singapore)	Dipping electrode based pH meter (Mettler Toledo, USA)
A	7	6.96	7.38
B	7	7.07	7.21
C	7.5	7.61	7.58
D	7	7.00	7.03
E	**7.5**	**7.46**	**7.12**
F	**7.5**	**7.45**	**7.46**
NGO -1	7	7.01	7.32
NGO -2	7	6.68	6.72
Carefree	7	7.08	7.01
Stayfree	7	7.21	7.58

Large number of samples has been prepared and distributed to end users in two locations

i) Howrah – semi urban area
ii) Purulia – Tribal dominated areas.
iii) Questionnaire has also been prepared and distributed with sanitary napkin sample pack.

Conclusions

i) Pulps produced by Low Chemical ASAM process produce very white pulp after bleaching. The yield of the pulp and performance of the product is good.
ii) Pulping by open digestion following alkaline sulphite - anthraquinone process also produces good yield and white pulp after bleaching. The performance of the product produced from this pulp is also good.

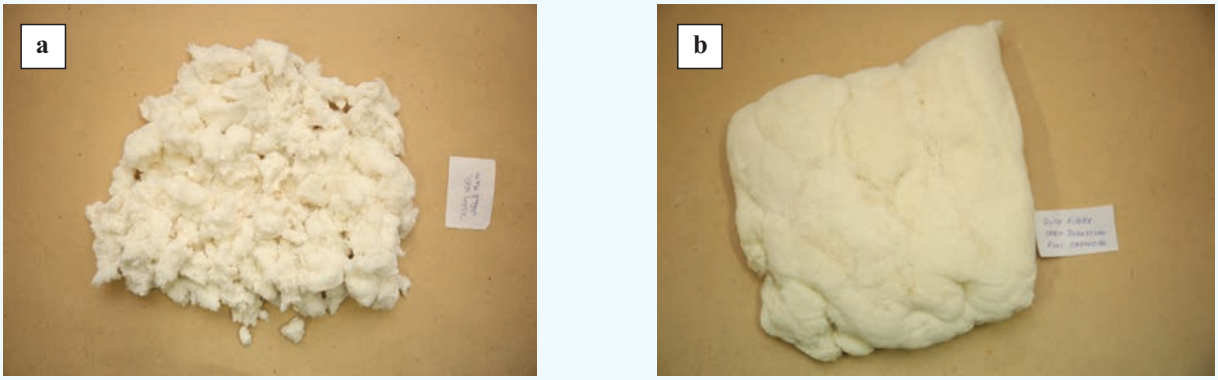


Figure CBP 11.1: (a) Jute pulp and (b) Disintegrated jute pulp

Testing of Sanitary Napkin

Sanitary Napkins from Jute Pulp

Field trial on 15.03.2016

Field trial on 21.03.2016

Figure-CBP 11.2: Sanitary Napkin & its trial

CBP-12: Preparation of Activated Carbon from Jute Stick by Chemical Activation

Dr. R. K. Ghosh & Dr D. P. Ray

The global demand for activated carbon is expected to rise 10.3% annually through 2016 to 1.9 million metric tons. Due the expanding nature of the global activated carbon market, the source of raw material has gained severe attention. The conventional raw material for activated carbon is wood, however, global concern of deforestation and environmental sustainability has severely affected the wood industry and the availability of wood is facing a serious challenge. In search of a new source of activated carbon, for the first time, jute stick biomass (JSB) has been explored in the present project.

Pre-treatment of jute stick biomass:

JSB was pre-treated with chemical activating agents namely, H_3PO_4, KOH, NaOH & HCl. The ratio of biomass to chemical agent varied from1:2 to 1:0.01 for 24 h at ambient temperature of 30±2 ^{o}C& RH of 75-80%. Modification of biomass after treatments was investigated with FTIR analysis (Figure-CBP 12.1).

The FTIR analysis shows several peaks, indicating presence of various functional groups in jute stick biomass (JSB). The broad characteristic peak around 3340 cm^{-1} coupled with a weak peak

at 604 cm^{-1} typically correspond to the O–H stretching vibration of free hydroxyl groups of cellulose and lignin and the out-of-plane deformation of O–H, respectively. The bands around 2918 cm^{-1} are due to the stretching vibration of C–H bond in methylene ($–CH_2$) and methyl ($–CH_3$) groups. The peaks at 1375, 1328 and 1238 cm^{-1} indicate the in-plane symmetric deformation vibration of $–CH_3$ in lignin, the in-plane bending vibrations of O-H or stretching of C-O in cellulose, and the asymmetric stretching of =C–O–C attached with aryl groups in lignin. The peak at 1616 cm^{-1} corresponds to vibration of C=O and C=C. A very weak peak observed at 895 cm^{-1} could be associated with the in-plane bending vibrations of C–H or out-of-plane deformation mode of C–H and O–H in pyranoid rings involved in cellulose. A strong band at around 1025 cm^{-1} corresponding to C–O–C stretching vibration confirms the cellulose and lignin structures of JS. The FTIR spectrum indicates the lignocellulosic nature of JS coupled with various polar

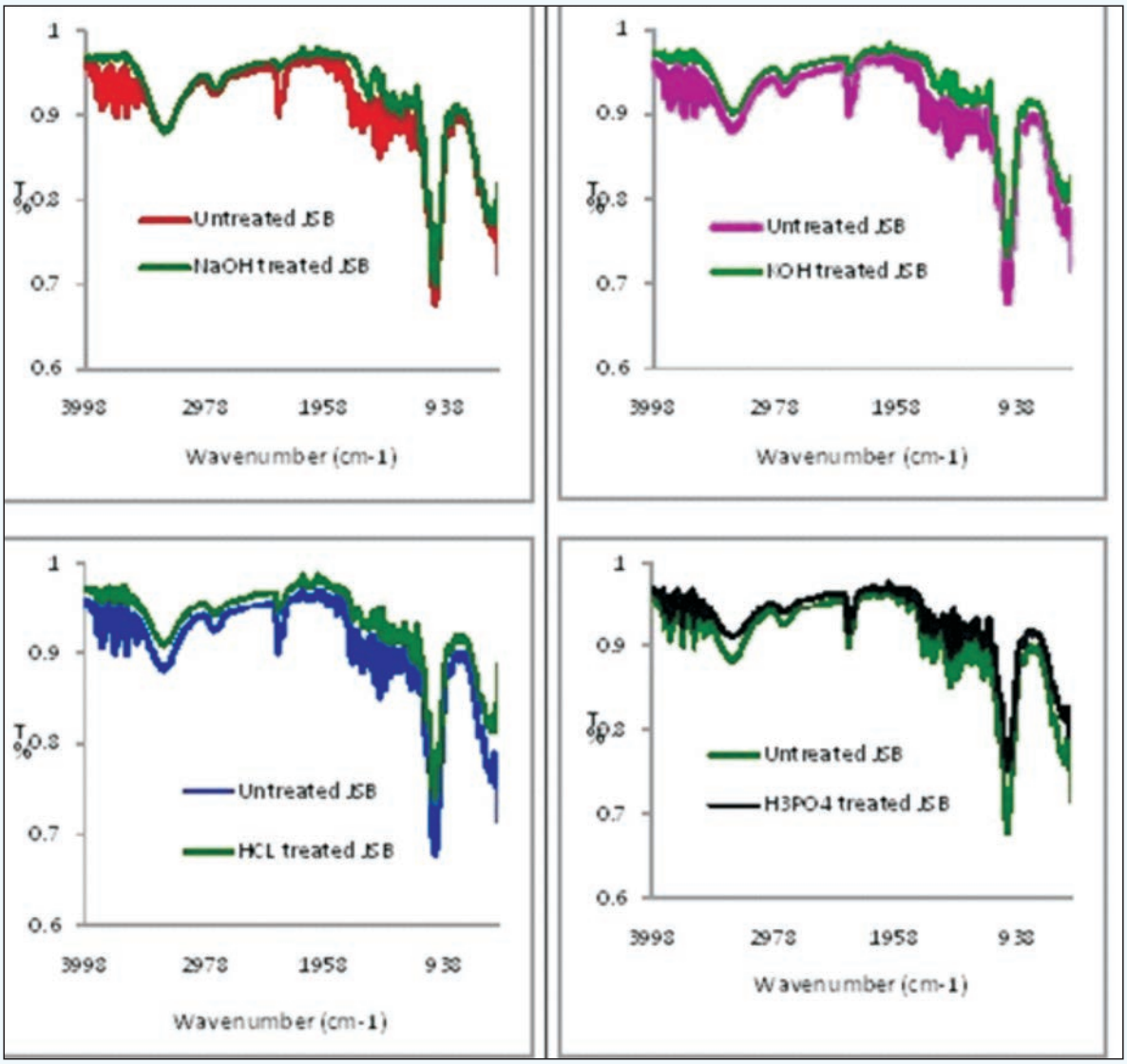


Figure-CBP 12.1: FTIR Analysis

functional groups. Chemical modification with H_3PO_4, HCl, NaOH & KOH resulted in shift and change in % transmittance of these respective peaks, indicating changes due to chemical modification.

Physical observations of JSB after treatments:

Most significant change in colour was observed for H_3PO_4 treatments above the biomass to chemical ratio of 5:1 and samples became pitch black in colour.

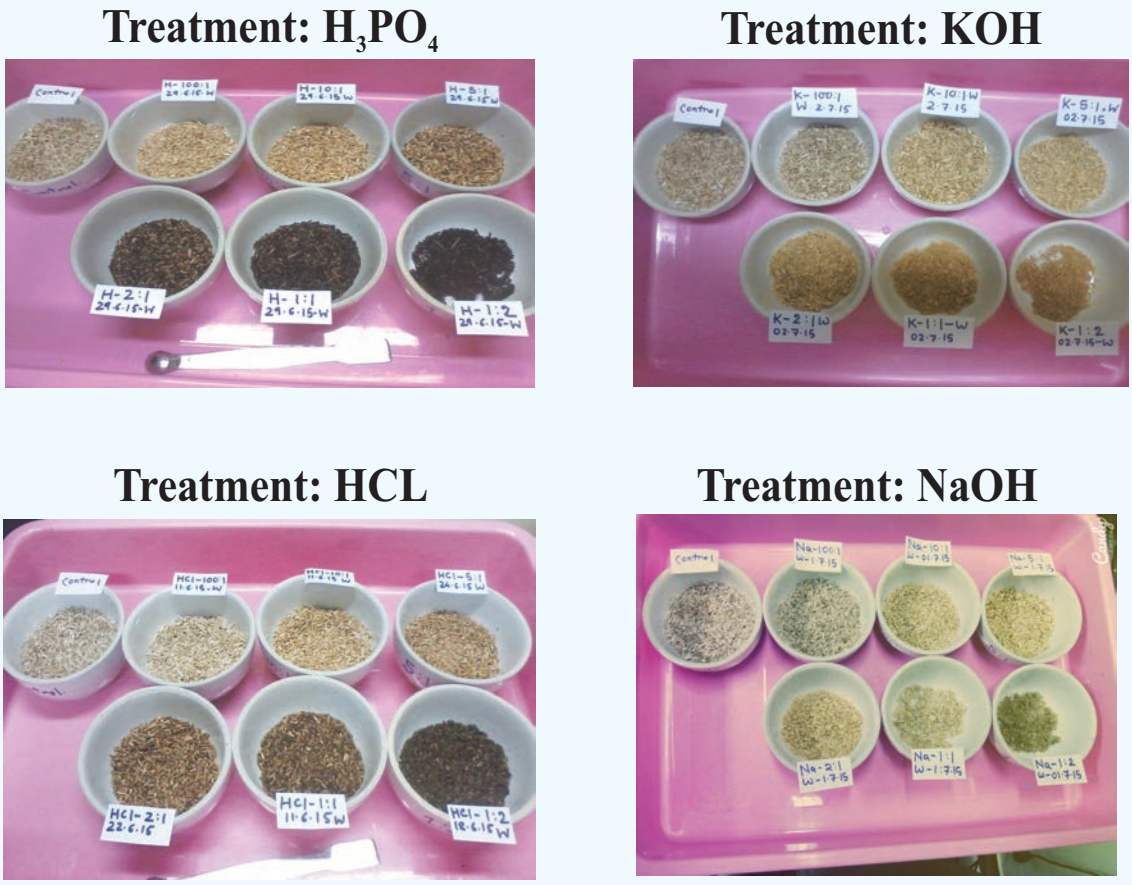


Figure-CBP 12.2: Physical observation of treated JSB before activation

The nature of chemical modification was also investigated by means of methylene blue (MB) and acid red (AR) removal. The MB removal order was H_3PO_4 (93%)≥ HCl (92.1%)> KOH (90.6%)= NaOH (89.8%) >JSB (85.1%). However, major change in biomass was observed by AR removal testing. The order of AR removal was JSB (41.2%) > KOH (16.2%) > H_3PO_4(9.3%) >HCl (3.2%).

Activation of JSB with different treatments: The chemically modified JSB was subjected to 1 h combustion at 450 °C under atmospheric and inert (N_2) condition in a muffle furnace. The product was washed with water till the pH attains neutrality (6.9-7.2), then oven dried at 105 °C for 5h and stored for further use (Figure-CBP 12.3).

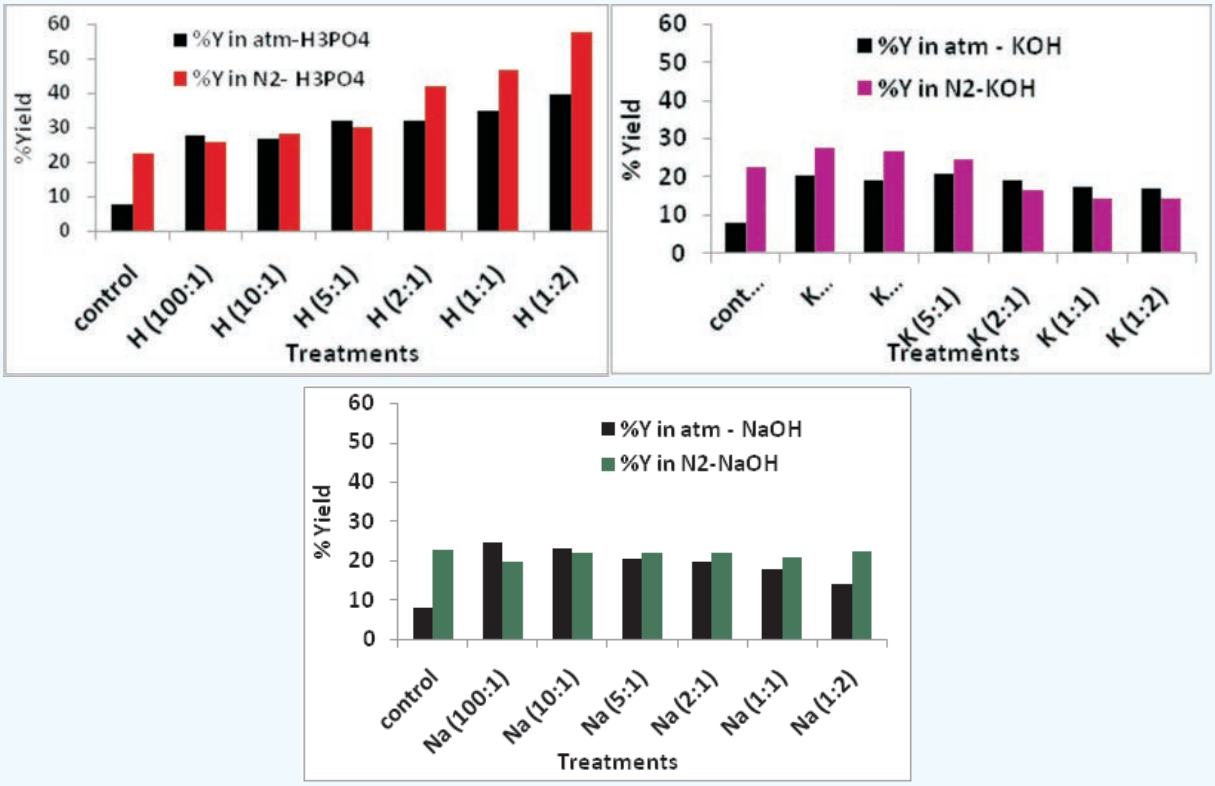


Figure-CBP 12.3: Yield of activated C from various treatments of JSB

Activation of H_3PO_4 treated JSB:

Under atmospheric condition, %C yield varied from 7% (in control) to 39.6%. The %C Yield increased with an increase in the amount of H_3PO_4. The data analysis revealed that the yield increased from 28% to 47% with increase in the amount of chemical agent from 100:1 to 2:1, and there after it decreased to 39.6% with further increase in the amount of chemical agent upto 1:2. The data analysis revealed that H_3PO_4 activation in O_2 decreased the loss of biomass from 92% to 60% which indirectly indicated higher trapping rate of C from loss by adding chemical agent even in atmospheric combustion. Whereas, under inert condition, %C yield of varied from 22-57% with respect to the biomass (dry wt basis). %C yield increased (up to 57%) with the increase in the addition of H_3PO_4 with respect to control. Maximum yield (57%) was obtained at 1:2 ratio of activation. The data analysis revealed that H_3PO_4 activation decreased the loss of biomass from 77% to 42 % which indirectly indicated higher trapping rate of C from loss by adding chemical agent.

Activation of KOH treated JSB:

Under atmospheric condition, addition of chemical agents (from 100:1 to 2:1) increased the %C yield and maximum yield of 23.8% was observed at 2:1 and then the yield decreased with further increase in the amount of chemical agent. The data analysis revealed that KOH activation in O_2 decreased the loss of biomass from 92% (control) to 79% (100:1 ratio) which indirectly indicated higher trapping rate of C from loss. Whereas, under inert condition, The C yield of varied from 14-28% with respect to the biomass (dry wt basis). Addition of chemical agents increased the %C yield to 27.7% at 100:1 and then the yield decreased with further increase in the

amount of chemical agent. The data analysis revealed that KOH activation in N_2 decreased the loss of biomass from 78% (control) to 72% (at 100:1 ratio) which indirectly indicated higher trapping rate of C from loss.

Activation of NaOH treated JSB:

Under atmospheric condition, C yield of varied from 13.9-24% with respect to the control (7.93%). Maximum yield was observed at low ratio of chemical activating agent to biomass. Whereas, under inert condition, The C yield of varied from 19.5-23% with respect to the biomass (dry wt basis). Addition of chemical agents (from 100:1 to 2:1) did not show significant effect on the %C yield over the control.

CBP-13: Jute Based Conductive Polymer Composite for Electromagnetic Shielding

Dr L Ammayappan & Dr Gautam Roy

A potential route to develop electronic textiles is through the application of conducting polymers like polyaniline. Aniline Black is famous for imparting greenish black colour on cotton textiles in ancient times and after invention of conductive polymer, polyaniline got important. Polyaniline (PANI) is developed from aniline i.e. amino benzene ($C_6H_5NH_2$). Aniline is dissolved in an acid to form aniline salt ($C_6H_5NH_3^+$) and it is oxidized with an oxidizing agent like ammonium persulphate. The polyaniline has a complex structure i.e. Leuco emeraldine (colourless/ $(C_6H_4NH)_n$); Emeraldine base or salt (green or blue/ $([C_6H_4NH]_2[C_6H_4N]_2)_n$) and Pernigraniline base or salt (Blue or violet/ $(C_6H_4N)_n$). The conductivity of polyaniline depends on its oxidation state and degree of protonation. The role of polyaniline on different pretreated jute fabric was studied.

Pretreatment of jute fabric

Jute fabric of 275 & 400 GSM was procured from the local market of Kolkata and pretreated with 3% (owf) Non-ionic detergent/ 50°C/ 1:50 MLR/ 60 minutes; 3% (owf) Sodium hydroxide /90°C/ 1:50 MLR/ 60 minutes & 3% (owf) Hydrogen peroxide /90°C/ 1:50 MLR/ 60 minutes. The pretreated jute fabrics were evalauted for their properties like FTIR spectra, whiteness index and weight loss. The weight loss due to NID Treatment, NaOH based scouring & H_2O_2 bleaching were 2.5, 4.6 & 6.1% respectively and the whitenss of the jute fabric is improved after H_2O_2 bleaching only. FTIR spectra of different pretrated jute fibres were given in the figure and it inferred that peaks responsible for carboxylic acid and ester groups at 1240 & 1736cm^{-1} are disappeared / reduced in comparison with NID treated jute fibre due to partial removal of hemicellulose.

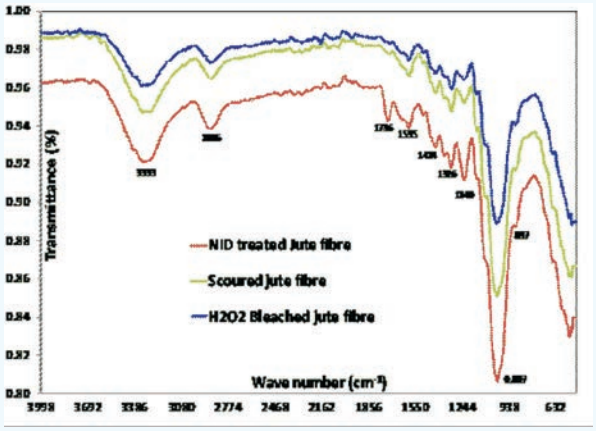


Figure-CBP 13.1: FTIR Analysis

In-situ polymerisation of polyaniline on jute

Coating of polyaniline on jute fabrics (275GSM plain weave) was carried by chemical oxidative polymerization process. 100mM of aniline was dissolved in 100mM of hydrochloric acid (HCl) solution and kept at 5°C. Subsequently the pre-dried sample was placed in the bath and kept it for 60 minutes at 5°C. In another bath 100mM ammonium persulphate (APS) was dissolved in 100mM of HCl. After exhaustion of aniline, the APS solution was gradually added to the aniline solution to polymerize the aniline and kept it for 60 minutes at 5°C . Then the PANI coated sample was then rinsed with dilute HCl solution to remove un-reacted monomer.

Electrical resisitivity of PANI coated jute fabric

Polyaniline coated jute fabric with different concentrations (100,250 & 1000 mM) were characterised for surface electrical reisitance by multimeter(Ohm.cm), FTIR spectra and K/S Value in a computer colour matching spectrophotometer. It is noticed that polyaniline was coated on the surface of jute fibre and formed green colour due to the formation of emeraldine salt. FTIR spectra confirmed the formation of PANI with respective peaks at 1600, 1490 & 1250cm^{-1}. Bleached jute fabric shown 166-188 MOhm & 1000 mM PANI coated jute fabric shown 1.68-2.44 k.Ohm electrical resistivity. Electrical conductivity of jute fibre might be due to formation of a partially cross-linked network of PANI and it shorten the inter-chain distance and facilitate inter-chain transition of charge carriers. It is also inferred that the electrical conductivity of jute fabric is increased with increase in aniline concentration and similarly removal of impurities was also increased the conductivity of jute fabric.

Table-CBP 13.1: Electrical resistivity of jute fabric

Sample	Average surface resistivity (Ohm.cm)	Average K/S value
Bleached Jute fabric	188.1 x 10^6	0.32
100 mM PANI coated Jute fabric	82.4 x 10^3	23.25
250 mM PANI coated Jute fabric	11.3 x 10^3	33.90
1000 mM PANI coated Jute fabric	2.5 x 10^3	37.83

CBP-14: Modification of Yak Fibre for Making It Suitable for Yarn Production in Jute Spinning System

Dr. Kartick K. Samanta, Dr A. N. Roy, Sh. K. Patra & Sh. Kousik Mitra

The yak (*Poephagus grunniens*), the lifeline of highlanders, is a unique bovine species. In India, it plays a major role in the economy of the tribal population living in the difficult terrains in the foothills of Himalayas. The products and services provided by the yak include: meat, milk, and wool and leather for clothing, blankets, bags, implements, rugs, and tents. As far as the fibre is concern, yak is an exotic specialty rare animal fibre in the world. Yak hair, a specialty luxury animal fibre, is mainly produced by the China and Mongolia. The fibre is available in three different colours and fineness, namely fine/down, coarser/guard, and middle type fibres. The yak fleece contains large quantity of coarse hair fibre that is quite thick and stiff, and hence does not utilized for high value end application including textile. Coarser grade yak fibre was chemically modified for making it suitable for jute/yak fibres blended yarn production.

Physical properties: As yak is an animal fibre, it contains lots of vegetable matters, hence there was a scouring loss of about 4.1 %. It was found that untreated sample has a moisture regain value of 15.6% and it improved marginally to 16.5% after scouring and bleaching as shown in the Table-CBP 14.1. Untreated sample (as received) has linear density of 9.3 tex and there was no change upon scouring. However, the linear density was found to reduce in successive bleaching due to the presence of alkali in bleaching solution. As a result of this, linear density changed from 9.3 to 8.0 tex, in the untreated to treated sample, respectively. The strength of the fibre is also found to reduce marginally due to chemical treatment. Fibre length was measured manually and the reported data are average of 25 readings. Fibre length reduced from 18.5 cm to 11.2 cm in the untreated to treated samples, respectively.

Table-CBP 14.1: Mechanical properties of untreated and treated yak fibres

Different samples	Fibre length [cm]	Linear density [Tex]	Breaking load [N]	Tenacity [cN/tex]	Initial modulus [cN/tex]	Elongation [%]	Moisture regain [%]
Untreated (Unwashed) yak fibre	18.8	9.3	0.97	10.4	428	25	-
Untreated (Washed) yak fibre	18.5	9.4	0.79	8.4	326	27	15.6
Treated yak fibre	11.2	8.0	0.65	8.0	408	-	-
Jute fibre (Finisher Card)	9-15	2-5	-	35-50	500-600	1-2	13

It was seen that untreated (as-procured i.e. raw fibre) has very low surface co-efficient of friction value of 0.28 resulting surface very much smooth and slippery. This is possibly presence of lipid film (polysaccharide) attributed to low surface frictional value. However, after scouring with mild alkali and soap solution there was no noticeable improvement in frictional value. It was interesting to observe that after modification, the co-efficient of friction value was as high as 0.351. This is one of the important desirable requirement for spinning of proteinous hair fibre with lingo-cellulose jute fibre, which has higher co-efficient of friction of 0.45 and 0.39, respectively in the parallel and perpendicular direction for the *Corchorus olitorius* variety.

Untreated and bleached samples were observed under scanning electron microscope at a magnification of 1000X. It was observed that like other hair fibres, yak hair (fibre) possesses scale on the surface as shown in Figure-CBP 14.1. On the other hand in the bleached sample, the scale seems to be slightly smoother, however, all the scale are easily visible at higher magnification. Therefore, it can be concluded that the yak fibres were bleached to get desired co-efficient of friction without any major detrimental effect on the surface features. The change in fibre morphology has appeared possibly due to adverse interaction of dilute sodium hydroxide and sodium bi-carbonate alkali with yak protein. The diameter of the coarser grade yak fibre is about 50-100 µ considering top to bottom of the fibres.

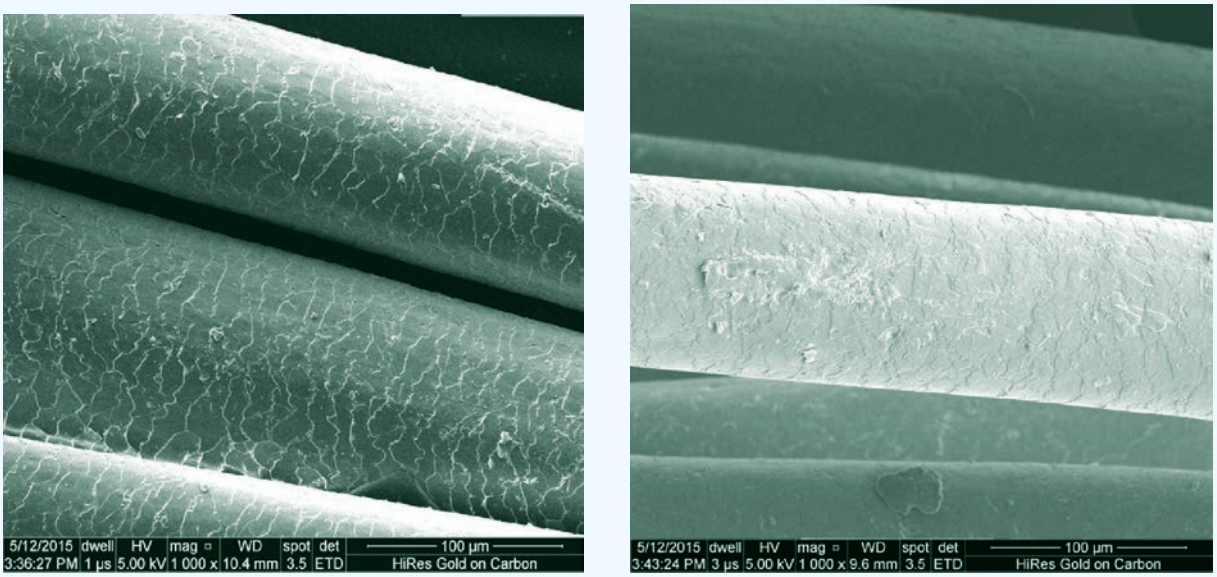


Figure-CBP 14.1: Scanning electron micrograph surface images of the untreated and treated yak fibres.

Colour and chemical parameters: Majority (68.5%) of yak fibre is available with natural black colour. The inherent black colour of yak hair/fibre appears due to presence of melanin that is present in the form two pigments, namely eumelanin and phaeomelanin. Untreated (control) yak fibre has black colour and after modification with hydrogen peroxide (H_2O_2) in alkaline medium, it colour changed to deep yellowish brown (golden) colour that is very similar to colour of raw jute fibre as shown in Figure-CBP 14.2. Due to lowest of reflectance value comes from the unmodified black sample, it shows lowest L* value and highest *K/S* value of 24.3. However, sample after bleaching with H_2O_2, the whiteness/brightness value profoundly increased to 34.8, resulting corresponding decrease in *K/S* value.

Figure-CBP 14.2: Picture of the untreated and treated yak fibres, and jute fibre

CBP-15: Sustainable Flame Retardant Finishing of Jute and Jute-Cotton Fabrics Using Plant Extracts

Dr. Kartick K. Samanta, Dr. S. N. Chattopadhyay & Sh. K. Patra

Among the various functional finishing of textiles, the flame retardant finishing is important as it directly related to human health and hazards. Cellulosic, ligno-cellulosic and protein based natural fibres, like jute, cotton, flax, ramie, silk and wool are mostly used in apparels and home-furnishing applications. Indeed for apparel production, cotton fibre is mostly preferred due to its advantages of soft feel and good moisture regain. Cotton being a cellulosic fibre with a low limiting oxygen index (LOI) of 18, it catches flame readily and burns vigorously in an open atmosphere that makes difficult to extinguish. The textile with an LOI of $\leqslant$ 21 catches flame readily and burns rapidly in an open atmosphere. The samples with an LOI of $\geqslant$ 21 to $\leqslant$ 27 also catch flame, however, burn quite reduced rate in an open atmosphere. On the other hand, the sample with an LOI of $\geqslant$ 27 is generally considered to be a flame retardant textile. The situation is slightly better for the ligno-cellulosic textiles as compared to cellulosic cotton textile. Jute possesses the LOI value of approximately 21 thus, making better choice for packaging of agricultural crops and food products, and upholstery and home furnishing applications. Apart from the sacking and hessian, diversified jute products like wall covering, carpets, furnishing materials and such on are now considered up-coming items that need to be designed with flame retardant formulation for their potential application as decorative and diversified products. The mechanism of imparting flame retardant finishing to textiles is related to the combustion process of a fibre or fabric in contact with the flame. It makes a difference between the untreated and flame retardant treated textiles in terms of limiting oxygen index (LOI), heat required for combustion, burning rate, rate of heat release, formation of flammable and non-flammable gases, char and tar. In the past, significant efforts have been made for improving flame retardant property of jute textiles using various inorganic salts and commercially available synthetic chemicals, like sodium potassium tartrate (Rochell salt), borax-boric acid combination, phosphorous-nitrogenous combination, di-ammonium phosphate-urea, thio-urea, silicate compound and such on. In the last few years, efforts have also been made on utilization of agro-residues and other plant molecules for flame retardant finishing of cellulosic and ligno-cellulosic textiles. In this regard, applications of banana pseudostem sap (BPS) for flame retardant finishing of jute fabrics

is worth mentioning due to their advantages of being environmentally friendly, cost-effective, and sustainable materials produced from the renewable source. It is also an eco-friendly natural by-product obtained during the extraction of fibres from the banana pseudostem.

Jute fabric was scoured with non-ionic soap and alkali solution. Thereafter, it was bleached with hydrogen peroxide. Banana pseudostem sap (BPS) was extracted from the banana stem using padding mangle. Its colour was light grey (ash) and after keeping sometime in open atmosphere, the colour changed to dark ash. Density of banana pseudostem sap (BPS) was measured to be 1.012 g/cc and it also contains 4.5% solid ingredient. Banana pseudostem sap (BPS) was applied in the unbleached without mordanted and pre-mordanted fabrics. After application, the fabric was not catching flame and its limiting oxygen index (LOI) value was found to improve significantly from 22 in the untreated sample to 30 and 34 to in the only BPS treated, and mordanted and BPS treated samples, respectively. Similar result was also observed, when the BPS was applied in bleached jute fabric as shown in Figure-CBP 15.1. Energy dispersive X-ray (EDX) elemental analysis showed the presence of different metal constituents, such as magnesium (Mg), silicone (Si), phosphorus (P), iron (Fe), sodium (Na), calcium (Ca) and potassium (K). The very presence of these metals either in the form oxides or metal salts might have helped in improving thermal stability of jute fabric.

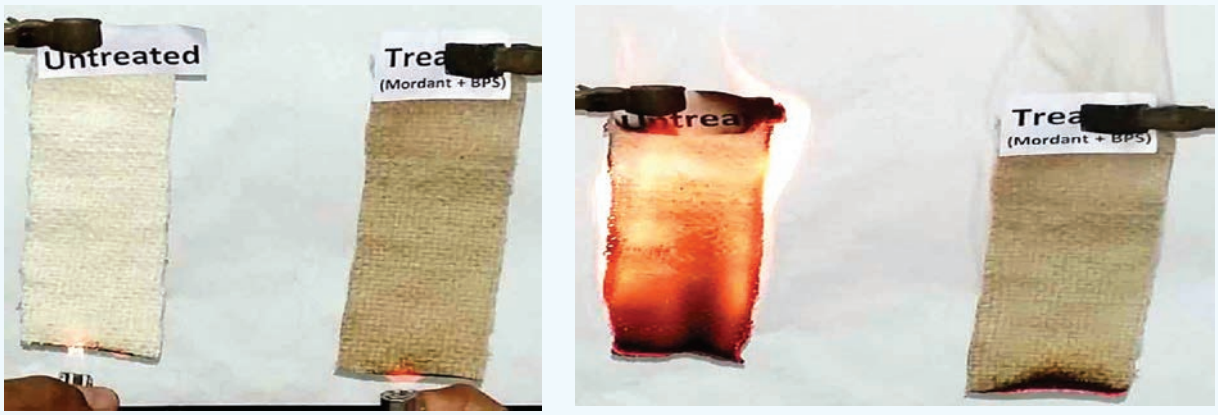


Figure-CBP 15.1: Untreated and BPS treated jute fabrics in contact of flame

Table-CBP 15.1: Thermal properties of untreated and treated jute fabrics

Different parameters	Washed fabric	Only BPS treated	Mordant + BPS treated
LOI	22	30	34
Burning with flame time (s)	62	0	0
Burning rate (cm/s)	2.7 cm/s	0.133 cm/s	0.123 cm/s
Burning with afterglow time (s)	0	1275	1360
Total burning time (s)	62 + 0	0 + 1275	0 + 1360

It can be seen from the Table CBP15.1 that an untreated sample of 17 × 5 cm^2 burnt completely within 62 s in open atmosphere, where as both the BPS treated samples did not burn with flame. In contrast, they were found to burn slowly with afterglow only. The burning with afterglow rate was as slow as 0.133 cm/s as compared to 2.7 cm/s noted in untreated sample. It can also be noted that the total burning time was only 62 s in the untreated sample and it improved significantly to 1275 s and 1360 s in the only BPS treated and mordanted followed by BPS treated samples. Table-CBP 15.2 shows the mechanical properties of the untreated and BPS treated samples. In the treated sample, breaking load was little lower than the untreated samples. However, the extension, strain, and tenacity values remain in close proximity to the untreated sample.

Table-CBP 15.2: Mechanical properties of untreated and treated jute fabrics

Different samples	Max. Load [N]	Extension [mm]	Strain [%]	Tenacity [cN/tex]	Total energy [mJ]	Ini. Modulus [cN/tex]	Break. Modulus [cN/tex]
Bleached untreated fabric	538	10.7	14.2	3.97	1024	3.71	27.8
Mordant + BPS treated	474	8.87	11.8	3.44	851	2.90	29.5

Transfer of Technology Division

Priority areas of research

- Design development and dissemination of jute based decorative fabric.
- Studies on techno-economic constraints and opportunity of jute diversified products manufacturing.
- Training through established institutions under HRD scheme sanctioned by Development Commissioner (Handicrafts), Ministry of Textiles, Government of India.

Achievements

- Fabric with jacquard design has been developed in handloom from jute and matt stick which can be used shopping bag, file folders, table mat and prayer mat.
- Demonstrated successfully the newly developed power ribboner for extraction of ribbons/barks from jute/mesta plants at five different places covering three jute growing districts namely Hooghly, North 24 Parganas and Nadia of West Bengal.

TOT-7: Studies on Techno-Economic Constraints and Opportunity of Jute Diversified Products Manufacturing

Dr S B Roy

Jute Diversified Products

Jute export constitutes a low proportion of the value of world trade, but its cultivation along with processing is labour-intensive and therefore provides a livelihood and an important source of food security for many farmers and their families in India. Jute Diversified Products (JDP), such as hand & shopping bags, geo-textiles, floor coverings, wall hanging, decorative fabrics and other gift items are manufactured in relatively small quantities. However, their share in the value of total exports is on the rise day by day due to environmental apprehension. Globalization has opened up enormous numbers of new markets along with enormous numbers of new competitors for jute diversified product manufacturers.

Production and commercialization of value added jute products created additional employment opportunities and assisted in alleviating poverty in India especially in the eastern part of the India. Production of diversified jute products increased through medium and small sector entrepreneurs, NGOs, SHGs, WSHGs and individual manufacturers.

Export performance of JDP

Contribution of JDP export to the all jute goods export from India during the period 2000-01 to 2013-14 is increased from 14 per cent to 23 per cent ranging from Rs. 131.15 crores to 483.74 crores in monetary terms. India's total jute goods exports were Rs.931.71 crores and Rs. 2121.95 crores during the same period. There is about 33.42 per cent increase in JDP export value during 2013-14 as compared to 2012-13.

On examination, the relative performance of Jute Diversified Products (JDP) export in total jute products export observed during last decade increased significantly. A closer look at the Indian diversified jute exports showed a very worthy trend. The share of diversified jute exports in total jute exports in the year 2013-14 was 23 per cent. It is important to note here that export value of jute goods was significantly higher than jute diversified products throughout the time period.

Export of jute diversified products in financial year 2013-14 was Rs. 483.74 crores, which was a notable rise by 268.84 per cent rise in value terms over the corresponding figures of financial year 2000-01 in India. It needs to be pointed out here that the composition of JDP export base has continued to remain same with slight changes in their contributions. India's export basket is concentrated in only about five traditional jute products including yarn and five JDPs.

Table-TOT 7.1: Export of Jute from India: JDPs Vs Total Jute Goods

Rs. In Crores

Year	Jute Goods Export								
	JDPs						Total JDPs	Total Jute Goods	Share of JDPs
	Floor Covering	Shopping Bag/ Hand Bag	Blanket	Decorative Fabrics	Gift Articles	Wall Hanging			
2000-01	66.31	54.53	0.43	4.21	--	5.67	131.15	931.71	14%
2001-02	76.63	39.97	0.77	2.52	--	6.38	126.27	613.32	21%
2002-03	124.18	60.98	2.82	2.81	5.44	6.93	203.16	913.32	22%
2003-04	104.37	106.57	8.20	1.30	2.24	0.59	223.27	1051.88	21%
2004-05	155.75	80.87	10.94	3.88	1.68	0.64	253.76	1146.90	22%
2005-06	213.39	88.00	6.24	2.29	2.16	0.46	312.54	1186.24	26%
2006-07	167.57	70.31	15.01	2.19	0.97	0.42	256.47	1055.16	24%
2007-08	182.59	112.28	0.68	1.68	1.11	0.22	298.56	1178.49	25%
2008-09	124.24	165.68	2.37	1.72	0.40	0.11	292.16	1216.16	24%
2009-10	126.89	98.13	1.77	2.15	1.76	0.12	229.06	859.46	27%
2010-11	134.24	126.42	0.76	2.86	2.29	3.00	268.80	1854.15	14%
2011-12	142.01	163.66	0.07	8.61	1.46	4.10	319.84	2094.96	15%
2012-13	178.99	169.69	0.24	7.25	6.17	0.21	362.55	1951.08	19%
2013-14	216.09	244.80	0.14	18.44	3.83	0.57	483.74	2121.95	23%

Source: Directorate General of Commercial Intelligence and Statistics (DGCI&S), Kolkata, under the Ministry of Commerce, Government of India

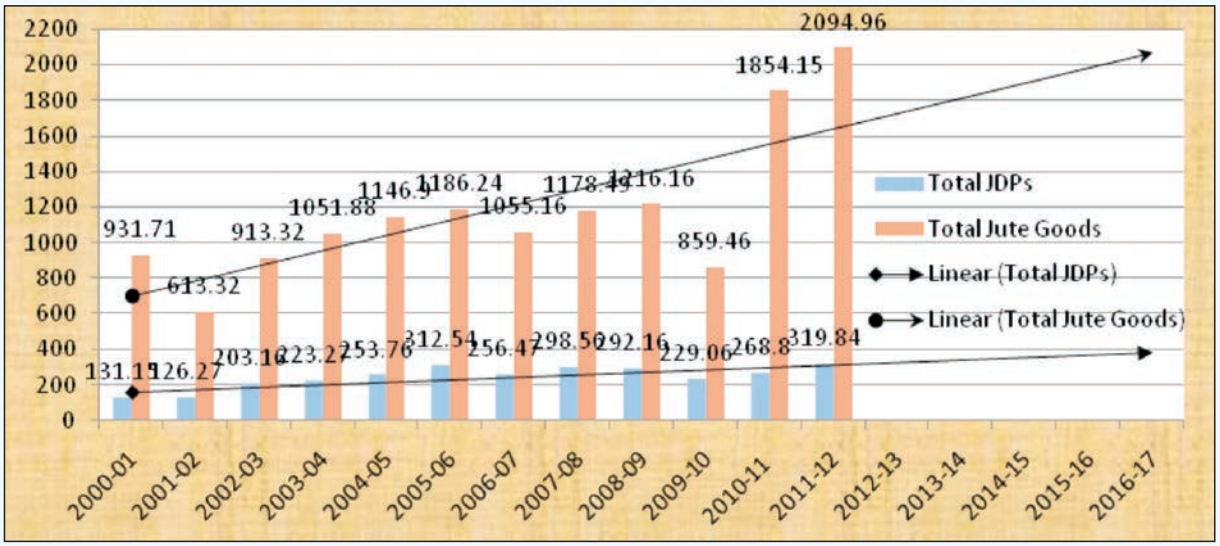


Figure-TOT 7.1: Export of jute goods

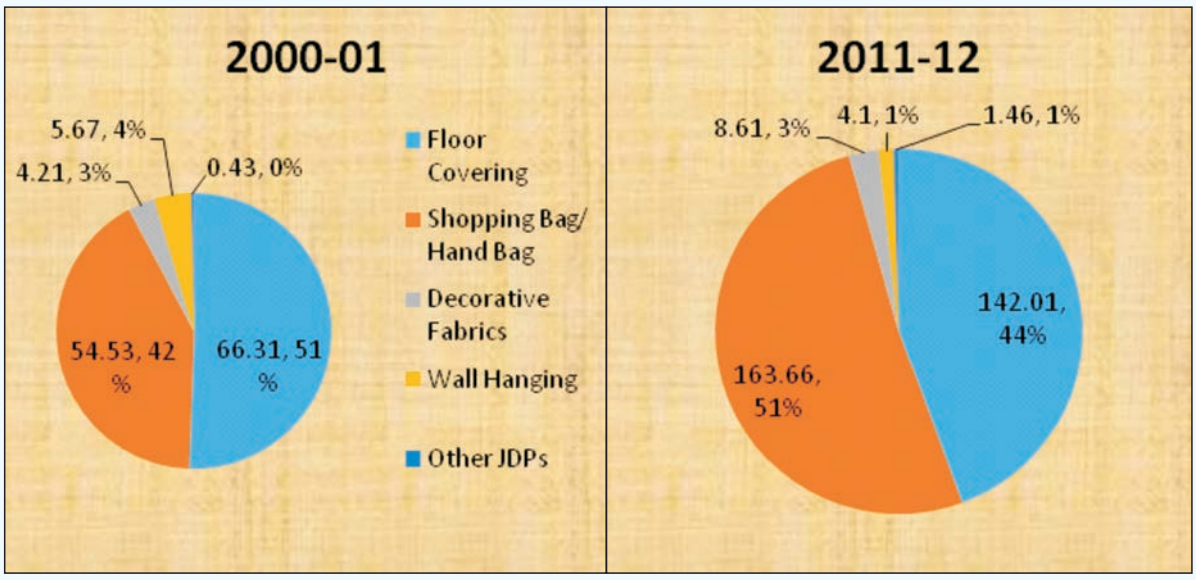


Figure-TOT 7.2: Share of JDPs Export Items

Figure-TOT 7.2 indicates that, contribution of jute shopping bag/ hand bag has increased from 42 per cent in 2000-01 to 51 per cent in 2011-12 while share of floor covering declined from 51 per cent to 44 per cent during the same period.

TOT-8: Design, Development and Dissemination of Jute Based Decorative Fabric

Dr. A. N. Roy, Dr. Samir Baran Roy & Sh. Kaushik Mitra

Fabric with jacquard design could be successfully developed in handloom from jute and matt stick. Shopping bag, file folders, table mat and prayer mat was developed from jute-matstick fabric. The cost of the bags ranges between Rs. 120/= to Rs. 150/=. Load bearing capacity is around 10Kg. Jute % in all these products are not less than 60%. Developed ten product specific designs to be woven in handloom for ladies fancy garments and for designs for JDP like slipper and bags. Out of these designs, four designs were converted into handloom fabrics for jute based slippers and bags. Area density ranges between 350 to400 GSM. Cost of these handloom fabrics were between Rs. 90 to 110 / sq. mt. Jute content in all these fabrics are 75 to 80%. Six designs were converted into handloom fabric for fancy garments. Jute content in these fabrics ranged between 50 to 70 % . Repeated washing (3 wash) do not show any appriciable shrinkage (0.5 to 1%). Some of these garments were developed with the help ATDC, Kolkata students, who used high speed stitching machines without any problem of yarn pull from fabric. Powerloom fabric with and without jacquard design could be produced using jute yarn weft. Six designs suitable for weaving in power loom were developed. From these designs, developed four light weight fabric with 2/40s cotton warp and 4 lb jute weft in powerloom without jacquard and two design with jacquard (80s cotton, 2.5lb jute yarn). Production rate could be achieved upto 150 ppm. Weight of these fabric is as low as 160 GSM with jute content of approximately 70%. Cost of these fabrics are around Rs 120/ sq. mt. for ordinary design and Rs 120/ sq. mt. for jacquard design. Developed 4 life style products (Mens Kurta, Jacket, Slipper and decorative bag) from power loom fabric.

Figure-TOT 8.1: Jute based decorative fabrics

TOT-9: Comparative Evaluation of Ribboner Developed by NIRJAFT

Dr. V. B. Shambhu, Dr. L. K. Nayak, Sh. S. Das and Sh. P. Sanyal

Jute and mesta are the two important natural fibre crops in India next to cotton and both crop fibres are used in textile and related industries. Conventionally fibres of these crops are extracted by laborious manual process from the bark or bast of the plants after retting the harvested whole plants. Retting is the most important parameter contributing largely to the quality of the fibre. Cost as well as energy analysis shows that fibre extraction is the second most resource consuming unit operation of the whole process.

Evaluated energy requirement for the extraction of ribbons/barks from the jute plants for different developed ribboners available at NIRJAFT like NIRJAFT manual ribboner, CRIJAF Bast Fibre Extractor NIRJAFT first generation power ribboner and newly developed NIRJAFT Power Ribboner. Energy requirement of NIRJAFT first generation power ribboner couldn't be evaluated due to frequent stoppage of the machine. Because it was found that wrapping of peeled ribbon on and around the fluted rollers was started from the time the first/ second plant was fed and the rollers were completely wrapped with peeled ribbons within few minutes of operation. Energy Requirement for Ribbons/bark Peeling from the different ribboners viz. NIRJAFT Manual, CRIJAF Bast fibre extractor and newly developed Power ribboner was found to be 5919.45, 16275.28 and 3389.25 MJ/ha respectively.

Power Ribboner was successfully demonstrated for extraction of ribbons/barks from jute & mesta plants at five different places covering three jute growing districts namely Hooghly, north 24 Parganas and Nadia of West Bengal. The ribbons obtained from the ribboner were retted in a tank holding it in vertical position with the help of bamboo or bamboo grid. This vertical steeping method of ribbons retting required low volume of water as well as less space compared to conventional method. It was observed that retting period for ribbons reduced to 6-8 days as compared to 14-17 days for conventional retting of whole jute plants. This is due to the reason that the contact surface area of ribbons/ barks with that of water and microbial becomes more than double. It was found that quality of fibre obtained from ribbon retting was better in colour, strength, fineness and upgraded as compared to conventional whole plants retting.

Chief findings

- Energy Requirement for Ribbons/bark Peeling from the different ribboners viz. NIRJAFT Manual, CRIJAF Bast fibre extractor and newly developed Power ribboner was found to be 5919.45, 16275.28 and 3389.25 MJ/ha respectively.
- Demonstrated newly developed power ribboner for extraction of ribbons/barks from jute/mesta plants at five different places covering three jute growing districts namely Hooghly, north 24 Parganas and Nadia of West Bengal in collaboration with KVKs, JCI and Govt. of West Bengal.

Figure-TOT 9.1: On Farm Demonstration of Power Ribboner

TOT-10: Developing and Undertaking of Extension Services for Effective Dissemination of Institute Technologies

Dr. S. B. Roy, Dr. Avijit Das, Dr. L. K. Nayak, Dr. D. P. Ray, Dr. V. B. Shambhu & Sh. Kousik Mitra

The Division of Transfer of Technology assumes its established responsibility as dissemination of proven technologies in jute and allied fibres processing and popularizing the benefits of venturing into natural fibre business to the jute sector stake holders across the country. Besides technology dissemination, the department undertakes research programs on Techno-Economic Feasibility of jute Industries, Baseline Surveys for Project Implementation, Product Promotion and Market Forecasts and Case Studies on Socio-Economic Impacts of Jute Business Ventures. The department facilitates R&D - Industry tie-ups, public-private partnerships, and entrepreneurial group development and village adoption programs for farmers, rural youth and Self Help Groups in the areas of jute processing. The department also promotes specialized programs like EDPs through capacity building under institute HRD scheme and Agribusiness Management programs to preferred target groups in the form of Agribusiness Incubation Centre and facilitating prospective entrepreneurs through Pilot Plant. Furthermore, the department coordinates with other departments of ICAR-NIRJAFT in offering consultancies and turn-key projects for establishment of new jute based industries and up gradation of the existing ones.

Self-Sponsored Training Programme on 'Advance Jute Handicrafts' from January 18 to 30, 2016.

Externally funded Training Programme on 'Training in skill development on jute handicrafts and jute fabric bag' under Natural Fibre Mission with the aegis of Special BRGF Fund. Granted Amount: Rs. 10,83,500.00. No. of training: Jute Bag - 02 and Handicrafts - 02.

Exhibitions:

- Participated and exhibited the Institute R&D outputs in the "*Jute materials exhibition-cum-sale*" programme at Jamshedpur, Jharkhand organized by *Ashar Aalo Maa Saroda Cancer Help Line* (*An NGO*) of Jamshedpur at Sonari community centre, Jamshedpur, Jharkhand on October 05 & 06, 2015.
- Participated in the "*5th Agro Protech-2015*" to exhibit its R& D products which was organized by Indian Chambers of Commerce at Milan Mela Ground, Kolkata during November 19-21, 2015.
- Participated in the exhibition & showcased the institute R&D technologies/products to the farmers in "*Scientists–Dairy industry partner's interface meet*" organized byERS-NDRI, Kalyaniat Kalyani, West Bengal on December 12, 2015.

Demonstrations:

- Demonstration of *Banana & Pineapple leaf fibre extractors* to a group of twenty five (25) farmers from Pakur, Jharkhand during their visit to institute under training programme on "*Improved production technologies of jute & allied fibres*" on January 07, 2016.

Evaluation of fibre samples from fungal retting for quality parameters.

- Fibre samples of 90, 120 and 150 days old jute plants retted with F1 and F2 fungal cultures were evaluated for fibre quality.
- Following parameters attributed to the fibre quality:

  (a) plants bundles were partially inundated in the field due to flood,

  (b) uneven retting due to large bundle size and of course

  (c) crop age.

Use of new fungal cultures in jute/ramie degumming

Ninety days old jute plants were treated with a new fungal culture in 1:20 ratio and allowed to ret under ambient condition. Retting was complete in 14 days and the resulted fibre had TDN3 grade.

External Sponsored Project

Achivements

- Effect of alkali, hydrogen per oxide and biological degradation of bio-composites have been studied.
- Operation manual, operation demonstration DVD, folder and installation CD of developed fabric stiffness tester have been done and distributed to stakeholders.
- Automatic Fibre Strength Tester, Digital Fineness Tester, Digital Colour Lustre Meter for ramie fibre have been developed.
- The process of pre-treatment i.e. bio-scouring and bleaching of banana fibre has been standardized.
- Schematic drawing of a new pineapple leaf fibre extractor and flax fibre extractor were made and the machines are under construction.

AINP 1.01 Activity: Quality Evaluation of Jute and Allied Fibres under Various Agricultural Trials

Dr. S. C. Saha, Sh A. Ghosh, Sh T. Ghosh & Sh A. Sarkar

Jute, Mesta, Flax & Sunnhemp fibre samples grown under different agronomical conditions at CRIJAF and participating research centres were received under this network project. The total number of samples tested 490 in 2015-16. Strength, fineness, root content, defects percentage, colour and bulk density values and grading of jute, kenaf, roselle and sunnhemp fibre samples were carried out for the following projects of different entries is given below:

Table-AINP1.01.1: Testing of Samples

Entries	No of samples tested
Capsularis jute	80
Olitorius jute	142
Roselle (Bimli)	123
Kenaf	78
Sunnhemp	32
Ramie	05
Flax	30
Total	**490**

The crop wise brief results are given below:

Tossa Jute

IET Biomass: Root content varied from 5 to 15%, defects 1 to >2%, tenacity was weak in nature and very fine. Grade varied from TD-4 to TD-5.

***IET*:** Root content 5-20%, defects, 1 to >2%, tenacity ranged from average to fair average and samples were of very fine category. Grade varied from TD-3 to TD-5 and above.

***AVT-I*:** Fibre fineness was very fine to fine category. Tenacity values were mediocre. Grade varied from TD-4 to TD-6 and above.

***AVT-II*:** Root content varied between 8 to 20%, defects from 1 to 2%, tenacity values were average and fineness was very fine in nature. Grade varied from TD-3 to TD-5 and above

White Jute

***IET*:** Tenacity values of the samples were weak except two entries and fineness were very fine. Grade varied from W-3 to W-6. BCCC-6 entry exhibited grade W-3.

***AVT-I*:** High root content observed in Kalyani samples and low in Barrackpore samples. Grade varied from W-3 to W-5 category.

***AVT-II*:** Tenacity values were weak to average in nature. Fibre samples showed very fine to fine in appearance. Grade varied from W-4 to W-5.

Roselle

***IET*:** Root content varied from 18 to 25% with high defects. Tenacity was weak to average. Samples were very fine. Fibre grades were B-3 and above.

***AVT-1*:** Root content varied from 10 to 25% with maximum defects, samples were very fine. Tenacity values were weak to fairly good. Grades were B-3 and above.

***AVT-11*:** All the samples were very fine in nature. Tenacity values of the samples were weak to fairly good category. Grades were B-3 and above.

Kenaf

***IET*:** Root content 12 to 20%, defects 1 to 2%, samples were very fine except AMC108 and JRHC-3 entry. Tenacity varied from good to very good. Grades were M-3 to M-4.

***AVT-1*:** Fibre samples were of very fine to fine category. Tenacity varied from average to fairly good and grades were M-3 to M-4.

***AVT-11*:** Root content 12% for all the samples. Tenacity was average to fairly good. Samples rated as very fine to fine. Grade varied from M-3 to M-4.

Sunnhemp

IET: Strength for all the samples received from Barrackpore was average in nature.

***AVT-1*:** Strength for all the samples received from Barrackpore was weak in nature.

IDP/IND/2010/19: Design & Development of Computerized Instrument for Testing Bending Behaviour of Semi-rigid Fabrics with Special Reference to Technical Textiles

Dr. S. Sengupta, Dr. S. Debnath & Dr. A. Sengupta*

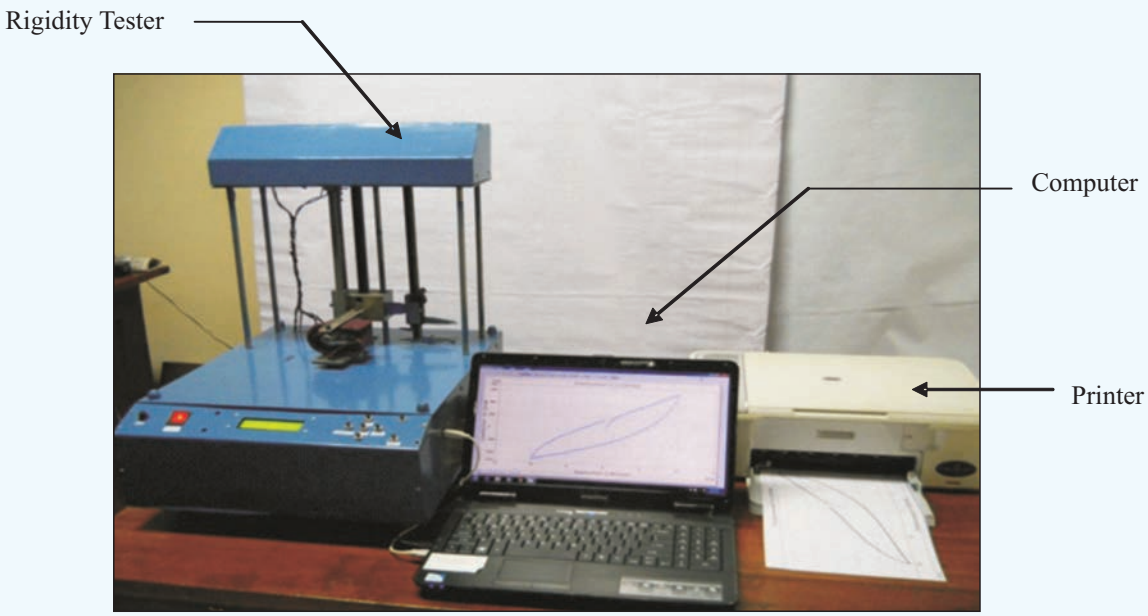
**IIEST, Shibpur, Howrah*

The final prototype of computerized instrument was developed using bending of fabric loop principle either in tensile mode or in compressional mode. This instrument can report the complete information of rigidity of semi-rigid technical textiles i.e. bending stress, bending deflection, bending cycles, bending hysteresis, bending relaxation, bending load-deflection curve etc. No such instrument is available. It can be calibrated very easily. It can be used for wide spectrum of fabric and also can be extended for ropes. Ten various technical textiles have been tested successfully using this instrument.

Following jobs have been done in reporting period.

1. Refinements and fabrication in gripping zone and deflection recording zone for final stage of instrument has been done
2. Fine modifications of developed software has been done considering better representation and user friendliness
3. Final painting, name plate preparation & fitting, transparent cover preparation and fitting (for cleanliness of m/c and reduction the effect of air circulation), naming of switches etc has been completed successfully.
4. Preparation of instrument working manual with parts description (hard and soft copy), Preparation of installation CD, Preparation of leaflet and brochure, Preparation of operation and demonstration video.
5. The replaceable jaws have been fabricated suitable for testing ropes. It has been modified from the existing jaws.

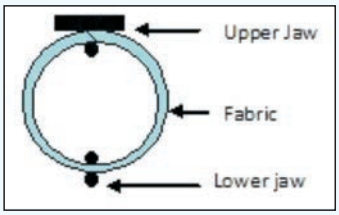
6. Three separate memorandum of understanding have been signed with IIEST, Shibpur; Text (style) India and Joy Maa Tara Enterprise to promote the technology.
7. The leaflet has been distributed to 4 teaching/research institutes, 3 promotional bodies and 29 industries.

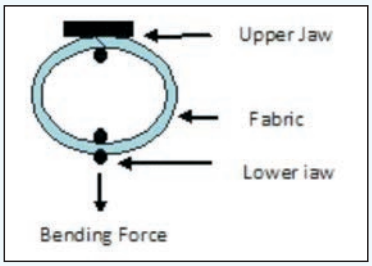


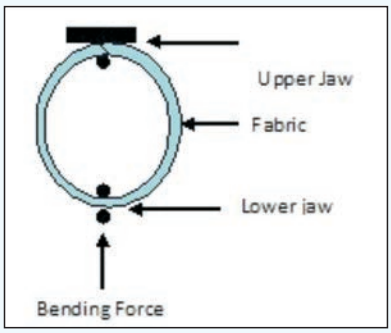
Complete Set-up of Rigidity Tester

This tester is suitable for almost all types of textile fabrics having wide range of rigidity value from thin apparel to thick laminated nonwoven including semi- rigid coated fabrics. The dynamic rigidity will express the idea of drapability and creasing behaviour simultaneously. Cords or ropes can also be tested with the slight modification of jaws.

Modified hanging loop technique has been adopted to develop the new instrument. A rectangular fabric strip is initially clamped in the upper position of a vertical loop keeping one end above another. The lower end of the loop is also clamped. When the upper clamp moves up and down (well before stretching of fabric), the load on the lower clamp will be changed depending on rigidity of the fabric. The load value for a particular deflection will be converted to bending stress. This load will be measured by load cell. The deflection of upper jaw will be measured by deflection counter. Deflection counter contains a sensor and a wheel mounted on the rotatable & reversible lead screw which is responsible for up and down movement of the clamp. The sensor measures the number of change of teeth due to rotation, which will be converted to length/deflection using screw-pitch. The change of load (loading and unloading) is plotted against deflection. Other parameters will be calculated by software.

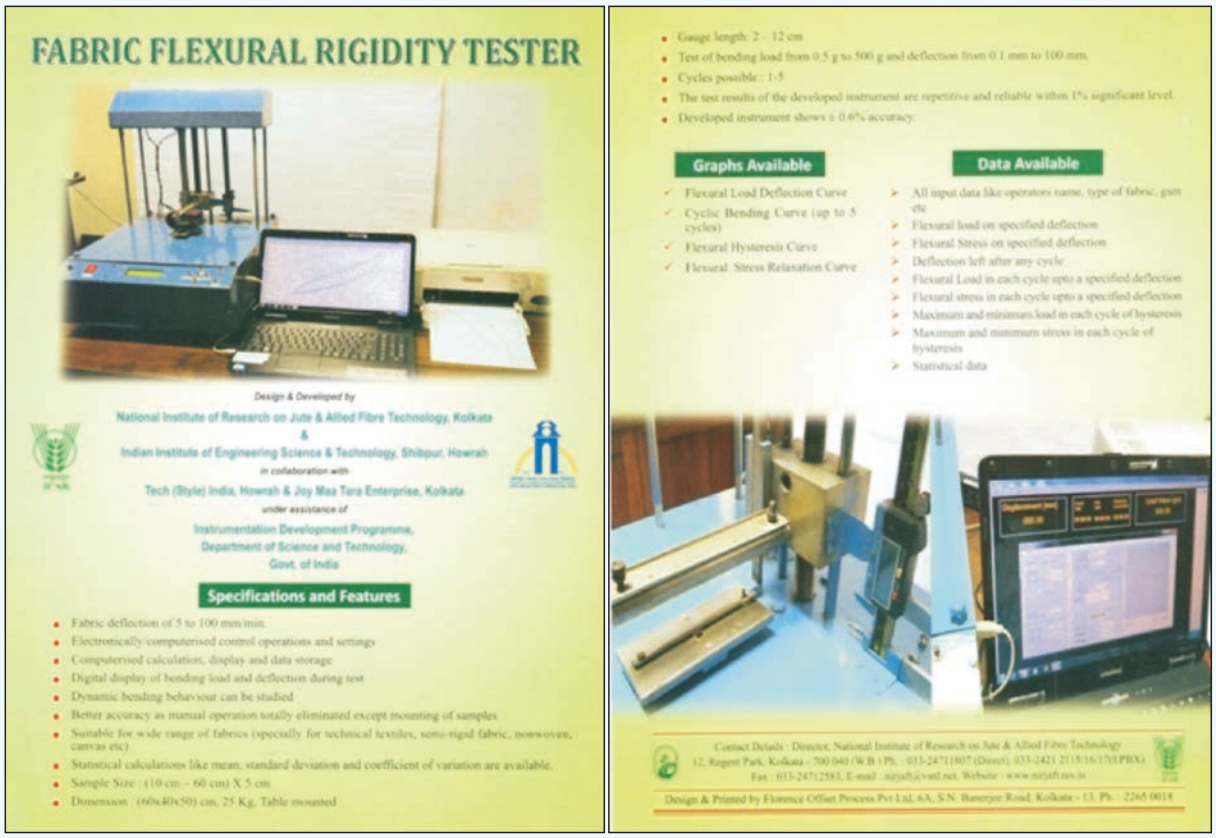






Technical Data

(i) Motorised movement of jaw causes fabric deflection in selected speed 5 to 100 mm/min
(ii) Electronically/computerised control operations and settings
(iii) Computerised calculation, display and data storage
(iv) Digital display of bending load and deflection during test
(v) Dynamic bending behaviour can be studied
(vi) Better accuracy as manual operation totally eliminated except mounting of samples
(vii) Suitable for wide range of fabrics (specially for technical textiles, semi-rigid fabric, nonwoven, canvas etc)
(viii) Suitable for ropes also
(ix) Output data and graphs as (a) bending stress in specified deflection, (b) bending load-deflection curve, (c) cyclic bending graph, (d) Bending resilience, (e) Bending stress relaxation, (f) deflection left after any cycle.
(x) Statistical calculations like mean, median, mode, Standard deviation and coefficient of variation are available.
(xi) Sample Size : (10 cm – 60 cm) X 5 cm (tentative)
(xii) Gauge length: 2 – 12 cm (tentative)
(xiii) It can test of bending load from 0.5 g to 500 g and deflection from 0.1 mm to 100 mm.
(xiv) Cycles possible : 1-5
(xv) The test results of the developed instrument are repetitive and reliable as repeated tests of same sample show variation within 1% significant level.
(xvi) Developed instrument shows ± 0.6% accuracy.



Fq3029: Jute Based Bio-composites for Industry

Dr. L. Ammayappan, Dr. S. Debnath, Dr. D. P. Ray & Dr. R. K. Ghosh

Effect of alkali treatment and coupling agent

Jute fabric was treated with 3% NaOH (owf) and then oven dried for 2 hrs at 110^{0}C. NaOH treated jute fabric was treated with 0.5%, 1%, and 1.5% in w/v as well as w/w basis of CA-18 in acetone solution and cured at 110^{0}C for 2 hr. Biocomposites were prepared from alkali treated and CA-18 treated jute fabrics by hand laying method. It was found that the tensile strength, flexural modulus & ILSS of the biocomposites prepared from the coupling agent treated fabrics gave an increase of 26%, 80% and 20% respectively when compared with the biocomposites prepared from untreated jute fabrics. It was also observed that nearly 123% increase in fiber loading of the coupling agent (w/v) treated biocomposites (51.3%) in comparison to the untreated composites (23%).

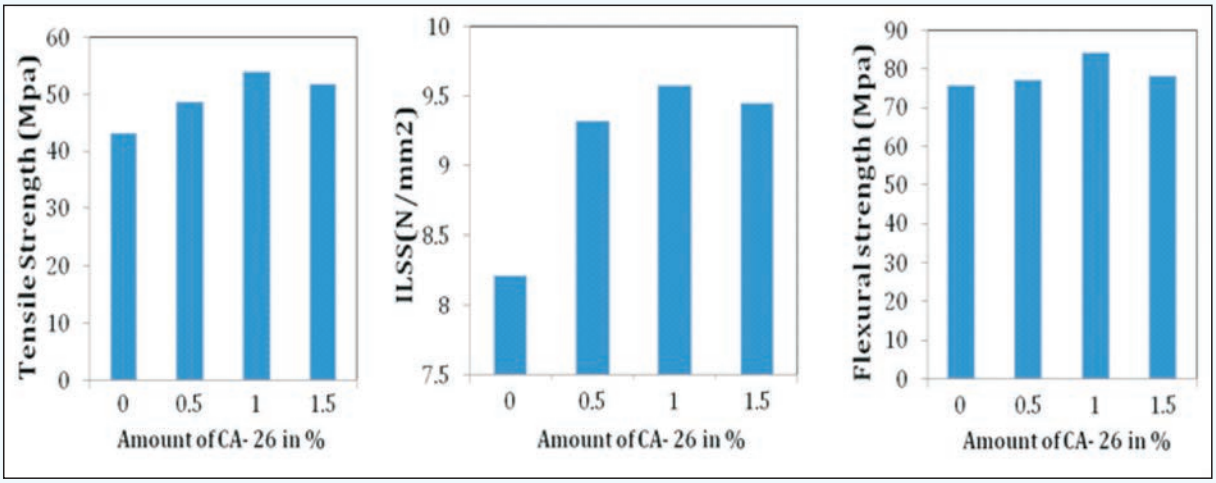


Figure-FQ3029.1:Mechanical property of CA-26 treated jute based biocomposites

Effect of H_2O_2 treatment and coupling agent

Plain jute fabrics and twill jute fabrics were bleached with H_2O_2 (30% v/v) in four different concentration 1, 2, 3 & 4% (owf). Bleached samples were treated with 1% and 1.5% (on W/V basis) of CA-18 in acetone solution by exhaustion method followed by drying and curing at 130°C for 1 hr. The tensile properties of the oxidized jute treated with CA-18 showed comparatively an increase of strength by 20-25% when compared with bleached fabrics. Biocomposites were prepared from twill bleached & CA-18 treated fabric and tested for their mechanical properties. Result shown that biocomposites prepared from 4% bleaching + 1% of CA-18 treated jute fabric gave good results in all the cases. Moreover there is an increase in the value of tensile strength (35%), flexural modulus (71%), ILSS (51%) and IPS (71%) of the twill bleached fabric composites in comparison to that of the bleached composites.

Biological degradation study of biocomposites

Selective biocomposite samples (0%, 0.5%, 1%, 1.5% of CA-18 treated Jute based biocomposites) were buried into 6-12 inches deep soil as per standard. Buried samples were taken out after a period of 15, 30, 45, 60 days respectively and were tested for their change in mechanical property. It is observed from the table that the controlled samples (0% CA-18) degraded gradually, whereas the CA-18 treated samples were quiet stable in terms of degradation. It is concluded that 4% hydrogen peroxide bleaching followed by 1% CA-18 treated jute fabric shown better mechanical properties than untreated jute based biocomposites.

NFBSFARA: FQ-3030: Understanding Genetics and Biosynthesis of Gum in Ramie (*Boehmeria nivea L. Gaud*) for Developing Low-gum-genotypes

Dr. P. Satya [*] ***& Dr. D. P. Ray***
[*]*ICAR-CRIJAF, Barrackpore*

The major hindrance faced during Ramie (*Boehmeria nivea* (L.) Gaud.*)* fibre extraction is its high gum content. The challenge was accepted in the Project sponsored by ICAR in its NASF Scheme. The key objective of the project was to identify the major components in gummy substance in

ramie and to have some idea in its biosynthetic pathway. In this project, the gummy substance has been characterized with proper characterization ramie pectin and hemicelluloses. In this project, the distribution pattern of ramie gum has also been elucidated. The Gum characterization have been carried out in different lines having high, medium, low gum to differentiate in the biosynthetic process.

Characterization of components of gummy substances

Ramie gum is mainly composed of hemicelluloses and pectin. The fat, wax, ash, lignin and other hot water soluble constitute the minor components of ramie gum.

Extraction of pectin

The ramie gum is mainly composed of pectin and hemicelluloses. Pectin content was estimated by boiling the decorticated and defatted fibre with 0.50% ammonium oxalate solution in the liquor ratio of 1:50. The pectin was separated from the liquor in form of calcium pectate by using 10% calcium chloride.

Pectin is a major constituent in ramie gum. Pectin is the methylated ester of polygalacturonic acid. The association of pectin chains leads to the formation of the three dimensional networks that is to gel formation. The highest concentrations of pectin are found in the middle lamella of cell wall, with a gradual decrease as one passes through the primary wall toward the plasma membrane. Chemical analysis revealed that decorticated fibres of ramie the pectin content varies around 2.0 to 5.0% whereas, in ramie plant the pectin content varies from 15 to 25%. In the following table the pectin content of different ramie lines have been enumerated. The ramie progeny R-1411 found to be lesser pectin containing whereas the R-50 line was found to be rich in pertinacious materials.

Table- NFBSFARA: FQ-3030.1: Pectin content in ramie progenies

Ramie progenies	Gum content (%)	Pectin (%) on dry weight basis
R-1411	23.16	15.21
Progeny of R-1411	22.17	16.60
RH 1	26.52	20.32
R 1428	25.31	20.74
R-1438	27.35	17.22
R 1417	22.86	21.22
R 50	27.74	23.43

Extraction of hemicelluloses

The holocellulose, alpha cellulose and hemicelluloses were estimated gravimetrically by standard TAAPI methods.

To isolate the hemicellulosic part, the decorticated ramie fibre was treated with 1% hot sodium hydroxide solution in the liquor ratio of 1:50 and the filtrate was neutralized with 1% acetic acid solution. It was then subjected to rotary vacuum evaporator to concentrate the liquor below 60^0C temperature. The hemicelluloses were separated from the concentrated liquor by precipitating it with ethanol. The gum was then dried in vacuum oven at 40^0C temperature.

Acid hydrolysis of the oven dried gum sample was performed using 77% sulphuric. The hydrolysate was neutralized with barium hydroxide and barium carbonate and filtered with Whatmann No. 1 Filter paper prior to HPLC analysis. 20µl of sample was required for the analysis.

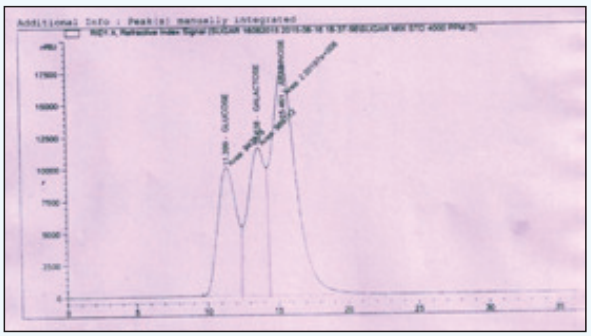
Identification of hemicellulosic components by HPLC

For the identification of ramie gum components, the gum samples extracted from plants were dried and were subjected to acidic hydrolysis for further fractionation. The hydrolysate were neutralized and concentrated further for analysis in HPLC. The HPLC (Dionex UHPLC Ultimate 3000) analysis of sugar of ramie revealed the presence of D-galactose, D-galacturonic acid, D-galacturonic methyl ester, glucose, mannose, arabans and xylans. The samples were compared with the standard sugars using amino column and RI detector at room temperature. The standard solution of sugars was prepared in ppm level for qualitative and quantitative analysis of ramie gum. The sugar solutions were prepared in acetonitrile-water matrix. The mobile phase used for analysis was acetonitrile: water in a ratio of 30:70 (0.2% TEA).

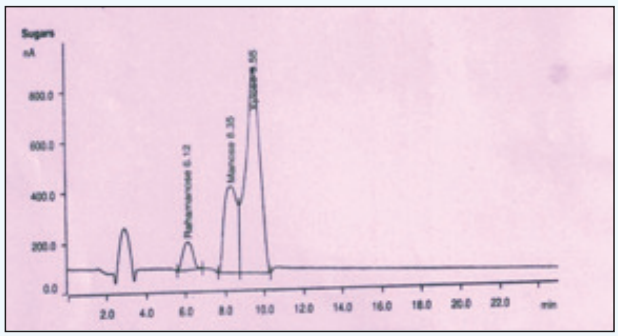
Figure- NFBSFARA: FQ-3030.1: Hemicellulose from ramie

Monosaccharide components of ramie plant

HPLC analysis was performed to detect the presence of sugars in ramie plant with reference to the standards. The mobile phase was acetonitrile and water with a flow rate of 1ml/min and 8MPa pressure. RI detector was used to detect the individual sugar molecules. Glucose, galactose, arabinose, rhamnose, mannose and xylose were the major sugar molecules identified in the plant.



HPLC chromatogram showing glucose, galactose and arabinose



HPLC chromatogram showing rhamnose, mannose and xylose

Figure- NFBSFARA: FQ-3030.2: HPLC chromatogram

Table- NFBSFARA: FQ-3030.2: Sugar components in the hydrolysates of ramie hemicelluloses

Sugar constituents	Relative abundance of sugar constituents (%)		
	1% NaOH	2% NaOH	5% NaOH
D-Mannose	13.28	12.5	15.75
D-Xylose	13.20	15.2	8.9
D-Glucose	35.20	30.16	40.12
D-Galactose	25.84	20.16	27.45
L-Arabinose	5.20	12.25	2.5
L-Rhamnose	9.46	9.35	5.2
Hemicellulose yield in raw ramie	2.80	3.26	3.12
G/M	2.65	2.41	2.54

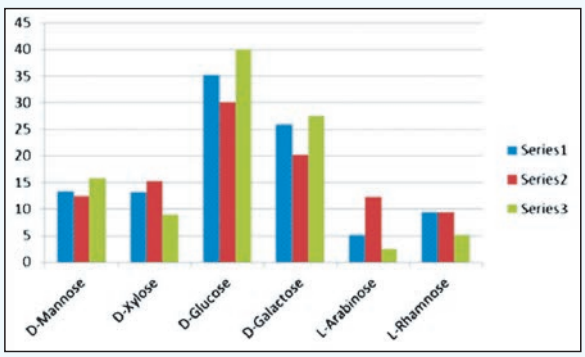


Figure- NFBSFARA: FQ-3030.3: Relative abundance of sugar constituents at 1, 2, 5% alkali treated fraction

Distribution of gum in different parts of ramie plant

To observe that the distribution of gum was not equal within the whole plant., the plant was divided into three portions, viz., top, middle and bottom portion and gum content of each part was estimated. It was found that the twig portion of the plant contains maximum gum followed by the middle and bottom portion. The part-wise gum variation of whole ramie plant is shown in the following Table- NFBSFARA: FQ-3030.3.

Table- NFBSFARA: FQ-3030.3: Distribution of gum in different parts of ramie plant on dry weight basis

Gum content (%)	R -67 -34	R -1411	R -1415
Twig	58.92	39.88	45.25
Middle part	55.25	36.78	43.57
Bottom part	51.77	31.02	41.07

Gum characterization in different lines having high, medium, low gum – two from each category

Different varieties of ramie lines were carefully analyzed in the laboratory in three replications. The gum content of nine ramie lines were determined and according to their gum content the plants were designated as high gum content, low gum content and intermediate gum content. As high gum content of Indian variety of ramie is the major hindrance to use the fibre in a large scale, identification of low-gum-genotypes were utmost important. Table- NFBSFARA: FQ-3030.4 shows the classification of ramie lines according to their gum content.

Table- NFBSFARA: FQ-3030.4: Gum and pectin content in ramie in different ramie strata

Ramie line	Gum content (%)	Hemicellulose (%)	Pectin content (%)	Bundle strength (g/tex)	Gravimetric fineness (tex)
High gum content					
R-67-34	26.15	9.25	4.45	21.10	0.70
Hakhui	25.82	8.62	4.02	18.38	0.67
R-1418	24.86	8.05	3.92	21.19	0.65
Low gum content					
R-1411	22.15	7.09	3.67	24.12	0.68
R-1419	26.15	7.07	3.49	21.87	0.55
R-1424	25.82	7.62	3.65	24.55	0.60
Intermediate gum content					
R-1415	23.86	7.60	3.77	23.56	0.62
R-67-51	24.10	7.95	3.78	24.34	0.71
R-1427	23.78	7.62	3.05	20.57	0.65

Wild species characterization

Ten numbers of wild relatives of ramie were collected from North-Eastern and Northern Himalayan Ranges. The plants were subjected to gum extraction by conventional means to find the variation in gum formation in wild and cultivated lines. The wild ramie lines contained higher amount of gum than cultivated lines. Generally the gum in the wild species was around 21-33% while the cultivated lines contained 20-27% gum content.

Table- NFBSFARA: FQ-3030.5: Gum content in the wild types of ramie fibre

Ramie Lines	Gum Content (%)	Pectin (%)	Hemicelluloses (%)	Bundle tenacity (g/tex)	Fineness (tex)
W-1	33.24	6.21	9.87	15.20	0.90
W-2	29.74	5.36	9.02	17.90	0.87
W-3	30.25	5.89	8.82	19.50	1.01
W-4	32.21	6.43	9.17	18.40	1.00
W-5	25.74	4.56	8.63	19.69	0.76
W-6	21.58	4.88	9.52	20.54	0.86
W-7	27.31	4.72	8.71	18.91	0.92
W-8	23.81	5.01	9.34	19.70	0.84

Chief findings

- Optimization degumming methodology
- Gum profiling of all available ramie lines available in India
- FT-IR based degumming protocol development
- Isolation of pectin and estimation of galacturonic acid in pectin component of ramie genotypes
- Chemical profiling of Ramie gum in high gum and low gum lines
- Component analysis of hemicellulose and gum
- HPLC based gum characterization technique
- Study on Variation in gum formation in cultivated and wild species

NASF/ME-5016: Investigation of Effect of Structure of Jute and Allied Fibre Products on Its Sound Insulation Property

Dr. Gautam Bose, Dr. Surajit Sengupta, Dr. Sanjoy Debnath, Dr. Kartick K. Samanta & Sh. Seiko Jose

The project is under taken with the following objectives-

i) Understanding of science of acoustical and non-acoustical properties of jute and allied fibers in relation to its fine structure.

ii) Study the effect of engineered fibrous structure(s) on frequency dependent sound propagation.

iii) Effect of surface modification of natural fibre on sound insulation.

iv) Study the effect of temperature, heat tolerance and climatic condition on acoustic behaviour.

During the reporting period one Impedance Tube and one Reverberation Chamber has been procured by co-investigating institute GCETTS. Another co-investigating institute, IIEST, Shibpur procured an Acousto Ultrasonic Signal Generator. One Capillary Porometer and Flammability tester is under procurement by NIRJAFT. One RA and three SRFs have joined.

Literature review on fine structure, properties and acoustic behaviour of Jute and allied fibres has mostly been completed. The following activities have been carried out:

1. For studying fine structure i) Cross-section of Jute & Sisal fibre by optical microscopy ii) SEM of raw jute & Sisal fibre iii) FTIR of Jute & Sisal fibre have been carried out.

Cross sectional view of Jute and allied fibres (sisal) shows multi-cellular structure containing lumen filled with air. The porous structure acts as a discontinuous media and reduces the energy of the propagating sound wave and hence may suitable to be used as sound insulator.

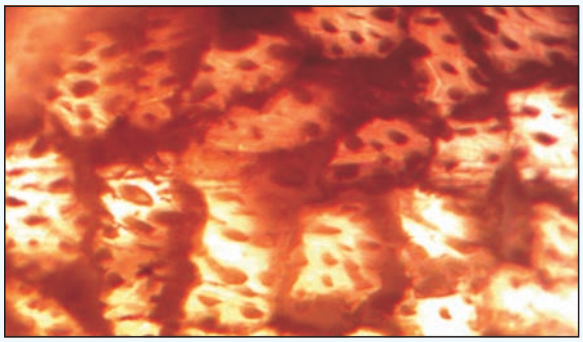


Figure- NASF/ME-5016.1:
Cross Section of Raw Jute

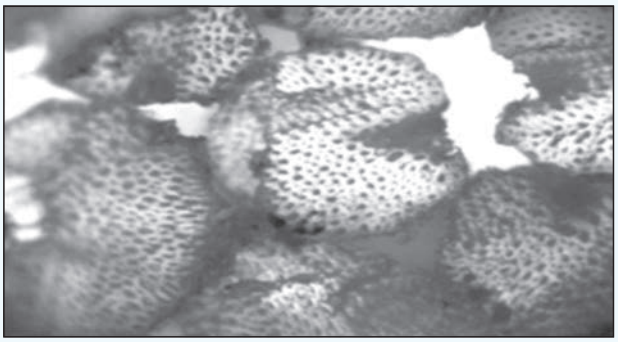


Figure- NASF/ME-5016.2:
Cross Section of Raw Sisal

SEM shows the surface morphology of Jute and sisal, which is having irregular serrations, nodes, internodes and surface impurities. The irregular shape may responsible for surface frictional loss at the time of propagation of sound energy.

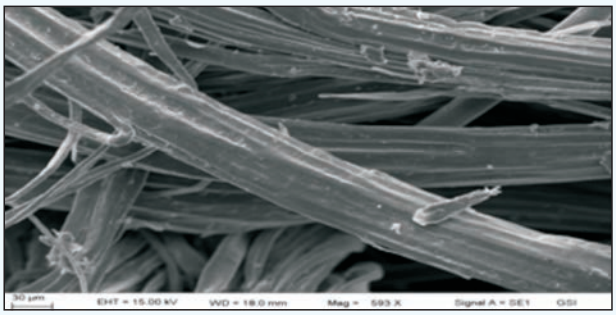


Figure- NASF/ME-5016.3:
SEM of longitudinal raw Jute

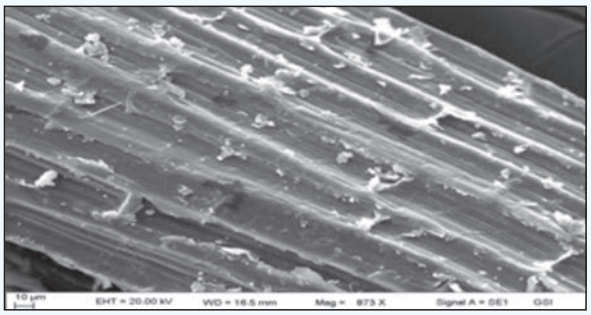


Figure- NASF/ME-5016.4:
SEM of longitudinal raw Sisal

FTIR reveals many reactive groups present in jute and allied fibres making them a very good platform for suitable chemical modification aimed at enhancing their sound insulation property.

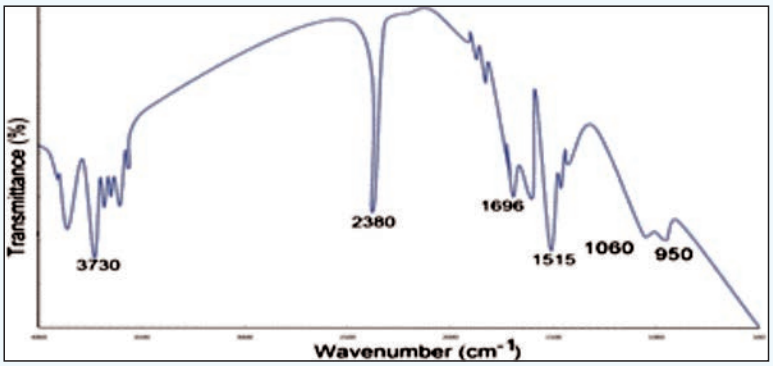


Figure- NASF/ME-5016.5: FTIR of Raw Sisal

2. Different woven and nonwoven jute fabrics are manufactured and/or selected based on I) rate of production II) mechanical property and III) sound insulation property (tested on facility available with GCETTS for transmission loss) for production of Jute based composite.

CRP/ NIRJAFT 1: Development of Machinery for Extraction of Fibre from Sisal, Flax and Pineapple Leaf

Dr L K Nayak, Dr. V.B. Shambhu & Dr. Sanjoy Debnath

During the period under report, the reviews on the on the existing pineapple leaf fibre extractor and flax fibre extractor (*in terms of capacity, principle & operation) and* the process parameters involved there in were explored. Schematic drawing of a new pineapple leaf fibre extractor and flax fibre extractor were given in Figure-CRP/ NIRJAFT 1.1 & Figure-CRP/ NIRJAFT 1.2 respectively.

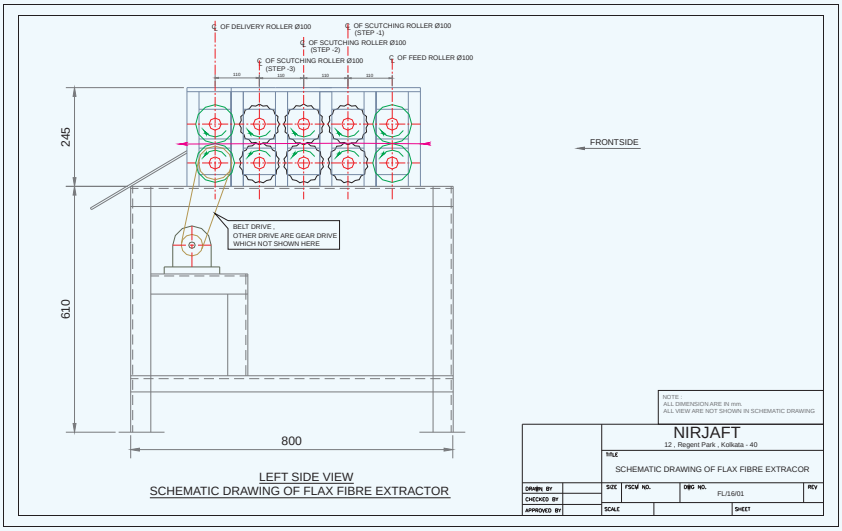


Figure-CRP/ NIRJAFT 1.1: Schematic drawing of flax fibre extractor

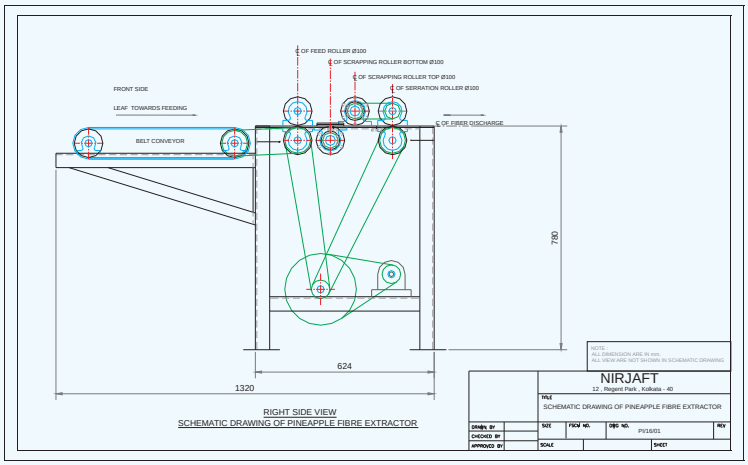


Figure-CRP/ NIRJAFT 1.2: Schematic drawing of pineapple leaf fibre extractor

CRP/NIRJAFT 2: Development of Grading System and Instruments for Jute and Allied Fibres

Dr Gautam Roy & Dr S. C. Saha

Beside Jute, there are other important natural fibres available like Sunnhemp, Sisal,Flax and Ramie which can be used in many applications and products. At present, there is no specific grading system available for Sunnhemp, Sisal, Flax and Ramie fibres.Different countries adopt different types of grading system for Sunnhemp, Sisal, flax and Ramie.There are no such instruments and methodologies available for such allied fibres till date. Being the leading research institute and having all sorts of credentials inthe research of jute and allied fibres, NIRJAFT can undertake the research activities of allied fibres in grading and instrument development domain.

The Main Objectives are:

I. To Standardize the Methods of Grading of Ramie, Sunnhemp, Sisal and Flax fibres.

ii. To Develop New Instruments to Measure there Grading Parameters

Salient Achievements

Grading Part

- Grading parameters (strength, fineness, colour, length, defects & softness) of ramie fibre has been finalised
- Score marks and Grading table of ramie fibre has been prepared
- Sunhemp fibre collected
- Grading parameters (length, strength, fineness, colour & defects) of sunnhemp fibre has been identified

Table-CRP/ NIRJAFT 2.1: Scores

TENTATIVE RAMIE GRADING SCORE DEVELOPED

Grade	Special (100)	Grade-1 (75)	Grade-2 (50)	Grade-3 (30)

Parameters	Fibre Length (20)	Strength (25)	Fineness (15)	Colour (10)	Softness / Gum content (20	Defects (10)

Length	Excellent	Very Good	Good (10)	Average
	>120 cm (20)	>90 -120 cm(15)	>60-90 cm	<60 cm (5)

Strength	High	Medium	Average	Weak
	25	18	13	7

Fineness	Very Fine	Fine	Coarse
	15	10	5

Colour	Good	F. Average	Average
	10	7	3

Defects	High	Medium	Average
	10	7	5

Softness	V. Soft	Soft	Hard	V. Hard
	20	15	10	5

TENTATIVE MARKS OF RAMIE GRADING TABLE

Grade	Fibre Length	Strength	Fineness	Softness	Colour	Defects	Score
Special	20	25	15	20	10	10	100
R-1	15	18	10	15	10	07	75
R-2	10	13	05	10	07	05	50
R-3	05	07	05	05	03	05	30

Table-CRP/ NIRJAFT 2.2: Ramie grading

Instrument Developed for Ramie fibre

- Automatic Fibre Strength Tester
- Digital Fineness Tester
- Digital Colour Lustre Meter

Automatic Fibre Strength Tester | Digital Fineness Tester | Digital Colour Lustre Meter

Figure-CRP/ NIRJAFT 2.1 : Photographs of the instrument Developed for ramie

CRP/NIRJAFT 3: Eco-Friendly Chemical Processing of Ligno-Cellulosic Fibres for the Preparation of Home Textiles

Dr S N Chattopadhyay, Dr N C Pan, Dr AN Roy & Dr Kartick K Samanta

During the period under report jute and banana fibre samples were procured and they were characterized for optical and physical properties.

Table-CRP/ NIRJAFT 3.1: Optical properties of banana and jute fibres

Fibre	K/S value	Reflectance (%)	Whiteness Index (HUNTER)	Yellowness Index (ASTM D 1925)	Brightness Index (TAPPI 452)
Banana	1.69	19.22	53.80	44.87	23.56
Jute	2.22	15.91	50.39	52.27	19.91

It is clear from the table that banana fibres are whiter and brighter than jute fibre which is of golden colour.

The fineness of both the fibres was evaluated in tex value and the diameter were also measured by microscope. The bundle tenacity of the fibres was also evaluated. All the values are tabulated in Table-CRP/ NIRJAFT 3.2.

Table-CRP/ NIRJAFT 3.2: Fineness and tenacity of banana and jute fibres

Fibre	Bundle tenacity (gm/tex)	Fibre fineness (tex)	Diameter (mm)
Banana	24.42	8.3	0.16-0.18
Jute	27.15	3.4	0.11

Banana fibres are found to be coarser than jute and their bundle tenacity is similar in nature. The diameter of the fibres are shown in fig-1,2,3. The chemical composition of both the fibres were evaluated and tabulated in Table-CRP/ NIRJAFT 3.3.

Table-CRP/ NIRJAFT 3.3: Chemical composition of banana and jute fibres

Fibre	α-cellulose (%)	Hemicellulose (%)	Lignin (%)
Banana	60.70	26.12	8.7
Jute	61.10	18.80	13.2

The α-cellulose content of both the fibres is similar but lignin content is more in case of jute.

FTIR study of raw, bio-scoured and bleached banana fibres were carried out. Analysis of spectra shows strong peaks at 2952, 2898, 1369, 1024 and 895 cm^{-1} confirms the cellulose and lignin structure of banana fibre indicating lignocellulosic fibre. Absence of peak at 610 cm^{-1} in case of bio-scoured banana fibre correspond to the O-H stretching vibration of free hydroxyl groups of cellulose and lignin confirming removal of small amount of cellulose and lignin parts from the fibre due to enzymolysis. Absence of peaks at 1728 & 1641 cm^{-1} and decrease in peak intensity at 1369, 1324 & 1239 cm^{-1} indicates removal of lignin and hemicelluloses fractions in both the bleached samples.

Evaluation of diameter of untreated jute and banana fibres by Nikon stereomicroscope, Model – SMZ18

Banana fibre 80X microscopic view middle part (0.18 mm)

Banana fibre 80X microscopic view top part (0.16 mm)

Jute fibre 80X microscopic view (0.11 mm)

Figure-CRP/ NIRJAFT 3.1: Stereomicroscope photo

Bio-scouring of banana fibres were carried out using cellulase –xylanase enzyme and then bleached by hot hydrogen peroxide bleaching process. Another batch of raw banana fibres was subjected to only bleaching treatment. The standardized recipes are as follows:

Table-CRP/ NIRJAFT 3.4: Recipe

Bio-scouring of banana fibre (A)		Bleaching of bio-scoured banana fibre (B)		Bleaching of raw banana fibre (C)	
Enzyme, Texbio M	2% (owf)	Hydrogen peroxide (30%)	20 ml/L	Hydrogen peroxide (30%)	20 ml/L
		Tri sodium phosphate	5 g/L	Tri sodium phosphate	5 g/L
Enzyme, Texzyme J	2% (owf)	Sodium hydroxide	1 g/L	Sodium hydroxide	1 g/L
Sodium carbonate	0.5 g/L	Sodium silicate	10 g/L	Sodium silicate	10 g/L
Ultravon JU	2 g/L	Ultravon JU	2 g/L	Ultravon JU	2 g/L
Temperature	60°C	Temperature	80 -85°C	Temperature	80 - 85°C
Time	120 min	Time	120 min	Time	120 min
pH	8-9	pH	10-11	pH	10-11

All the fibre samples like bio-scoured (A), bio-scoured-bleached (B) and only bleached(C) fibres were evaluated for optical and physical properties which are tabulated in Table-CRP/ NIRJAFT 3.4 and Table-CRP/ NIRJAFT 3.5.

Table-CRP/ NIRJAFT 3.5: Optical properties of banana fibres

Sample	Whiteness Index (HUNTER)	Yellowness Index (ASTM D 1925)	Brightness Index (TAPPI 452)	K/S value	L	a	b
Control	53.80	44.87	23.56	1.69	63.22	4.43	11.35
A	58.45	41.76	28.77	1.32	69.24	3.88	17.28
B	81.32	28.95	60.38	0.60	89.33	-3.01	17.84
C	78.94	30.68	56.16	0.65	87.52	-2.83	18.54

Table-CRP/ NIRJAFT 3.6: Physical properties of banana fibre

Sample	Bundle tenacity (gm/tex)	Fibre fineness (tex)	Diameter (mm)	Weight loss (%)
Control	24.42	8.3	0.16-0.18	-
A	20.40	6.8	0.15	6.20
B	18.30	6.0	0.14	10.04
C	19.40	6.2	0.15	14.70

Analysis of the tables revealed that wet processing of banana fibres accompanied by loss of weight with improvement of fineness, whiteness, brightness. Cumulative loss of weight of banana fibre during bioscouring –bleaching is more than that produced by only bleaching. There is about 20% reduction of tenacity of the banana fibre after the treatment compared to control. Raw jute and banana fibres have been blended in three different proportions like 75:25,50:50 and 25:75 and yarn of 8 jute count have been produced .Evaluation of these yarns are on progress. Similarly bleached jute and banana fibres will be blended in different proportions and yarn will be produced.

Conclusions

a) Banana fibres have been procured in bulk and length of the fibres varies from 3.5 to 5.5 ft.

b) Both the banana and jute fibres have been characterized. The banana fibres are found to be coarser, whiter, and brighter and contain low lignin. On the other hand jute fibre is golden yellow in colour and contains more lignin but it is finer than banana fibre.

c) The process of pretreatment and bleaching of banana fibre has been standardized. The fibres become finer, whiter and brighter after the treatment with about 20% loss in tenacity.

d) There is about 14-16% weight loss during pretreatment of the banana fibres. FTIR study of banana fibres at different stages of processing reveals that during bio-scouring due to enzymolysis small amount of cellulose and lignin is removed. Bleaching process removes substantial amount of hemicelluloses and lignin.

e) Raw jute and banana fibres have been blended in different proportions like 75:25, 50:50 and 25: 75 and 8 lb jute count yarn have been produced.

f) Pretreated jute and banana fibres have been produced for blending in different proportions to make yarns.

Figure-CRP/ NIRJAFT 3.2: Grey, bio scoured & bleached banana fibre

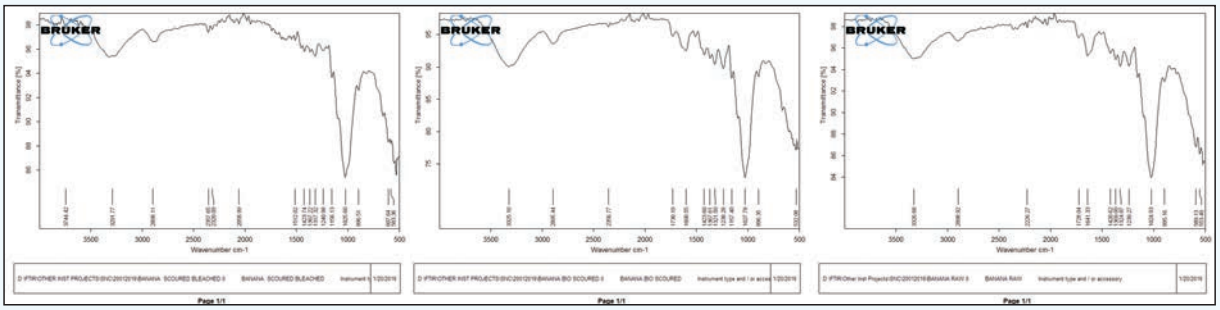


Figure-CRP/ NIRJAFT 3.3: FTIR of raw banana fibre

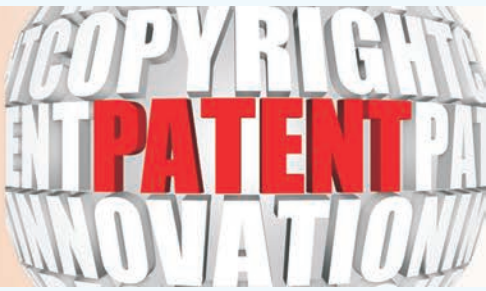
Figure-CRP/ NIRJAFT 3.4: FTIR of bio-scoured banan fibre

Figure-CRP/ NIRJAFT 3.5: FTIR of bleach banana fibre

Figure-CRP/ NIRJAFT 3.6: Banana-jute blended yarns

Figure-CRP/ NIRJAFT 3.7: Bio scoured–bleached banana fibres for conversion into yarns

Patent



- Ammayappan L, Ganguly P K, Nag D, Debnath S, Ray D P, Ghosh R K, Dasgupta S, and Chakraborty S, A process for coating metal nanoparticles on surface of jute fibre/ textiles for enhancing functionality of jute fibre/fabric and Jute-polymer resin biocomposite sheet obtained thereof, E-filed no 1262/KOL/2015, dated Dec 09, 2015.
- Ammayappan L, Ganguly P K, Nag D, Debnath S, Ray D P, Ghosh R K, Dasgupta S, and Chakraborty S, A process for surface modification of jute fibre/fabric for improved interfacial adhesion characteristics and biocomposites obtained thereof, E-filed no. 1348/KOL/2015, dated Dec 30, 2015.

Results-Framework Document (RFD)
for
National Institute of Research on Jute & Allied Fibre Technology
(2014 –2015)

Section 1: Vision, Mission, Objectives and Functions

Vision:

To uphold the cause of jute and allied fibres in favour of farmers, trade and industry keeping in view the prevalent global scenario and bring back the glory of the golden fibre with socio-economic uplift.

Mission:

To utilize jute and allied fibres in wide and diverse areas by exploiting the intrinsic and advantageous properties of the fibres and converting the demerits whatsoever into merits by application of scientific tools through development of technologies, products and processes for the benefit of farmers and industries of both large and small scales.

Objectives:

1. Technological support for quality improvement and assurance of jute, mesta and other allied fibres.
2. Development of technologies for diversified uses of plant fibres, by-products & industrial wastes, transfer of technology and capacity building.

Functions:

- Working on jute as well as allied fibres and their agro and industrial residues
- Post harvest aspects and development of products out of jute as well as from allied fibres
- Research and development (R & D) activities on both woven and non-woven products to be used as domestic goods, disposable bags, floor coverings, geo-textiles, agro-textiles, other technical textiles and composites
- To deal with the problems of both large and small scale industries, organized and decentralized sectors and the farming community
- To function in close collaboration with industries and entrepreneurs on one hand and academic institutions on the other

Section 2: Inter se priorities among Key Objectives, Success Indicators and Targets

Sl. No.	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target/Criteria Value				
							Excellent	Very good	Good	Fair	Poor
							100%	90%	80%	70%	60%
1.	Technological support for quality improvement and assurance of jute, mesta and other allied fibres	**3 2**	Technology support to jute breeders, industries & jute export houses	Breeder and commercial samples (fibre, yarn, fabric etc.) tested for quality evaluation	Number	**28**	408	340	272	204	136
			To fabricate grading aid instruments for farmers, industries and stake holders	New equipment fabricated for supply to stake holders	Number	**4**	7	6	5	4	3
2.	Development of technologies for diversified uses of plant fibres, by-products & industrial wastes, transfer of technology and capacity building	**4 8**	Development of new product/ machinery / instrument / technology	New product/ machine/instrument/ technology developed	Number	**29**	6	5	4	3	2
			Up-gradation/refinement of instruments/technology	Number of Instruments/Techno-logy refined/ upgraded under different project	Number	**4**	1	1	1	1	1
			Entrepreneurship development and training	Programmes organised	Number	**15**	**8**	15	12	9	6
3.	Publication/Documentation	**5**	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	Number	**3**	6	5	4	3	2
			Timely publication of the Institute Annual Report (2013 -2014)	Annual Report published	Date	**2**	30.06.14	02.07.14	04.07.14	07.07.14	09.07.14
4.	Fiscal resource management	**2**	Utilization of released plan fund	Plan fund utilized	%	**2**	98	96	94	92	90
5.	Efficient Functioning of the RFD System	**3**	Timely submission of Draft RFD (2014-2015) for Approval	On-time submission	Date	**2**	May 15, 2014	May 16, 2014	May 19, 2014	May 20, 2014	May 21, 2014
			Timely submission of Results for RFD (2013-14)	On-time submission	Date	**1**	May 01, 2014	May 02, 2014	May 05, 2014	May 06, 2014	May 07, 2014
6.	Enhanced Transparency /Improved S ervice delivery of Ministry/ Department	**3**	Rating from Independent Audit of implementation of Citizens'/ Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	**2**	100	95	90	85	80
			Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	**1**	100	95	90	85	80

Sl. No.	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target/Criteria Value				
							Excellent	Very good	Good	Fair	Poor
							100%	90%	80%	70%	60%
7.	Administrative Reforms	**7**	Update organizational strategy to align with revised priorities	Date	Date	**2**	Nov 01, 2014	Nov 02, 2014	Nov 03, 2014	Nov 04, 2014	Nov 05, 2014
			Implementation of agreed milestones of approved	% of implementation	%	**1**	100	90	80	70	60
			Mitigating Strategies for Reduction of potential risk of corruption (MSC)								
			Implementation of agreed milestones for ISO 9001	% Implementation	%	**2**	100	95	90	85	80
			Implementation of agreed milestones of approved Innovation Action Plans (IAPs)	% Implementation	%	**2**	100	90	80	70	60

Section 3: Trend Values of the Success Indicators

Sl. No.	Objectives	Actions	Success Indicators	Unit	Actual Value for FY12/13	Actual Value for FY13/14	Target Value for FY14/15	Projected Value for FY15/16	Projected Value for FY16/17
1.	Technological support for quality improvement and assurance of jute, mesta and other allied fibres	Technology support to jute breeders, industries & jute export houses	Breeder and commercial samples (fibre, yarn, fabric etc.) tested for quality evaluation	Number	310	382	340	370	405
		To fabricate grading aid instruments for farmers, industries and stakeholders	New equipment fabricated for supply to stake holders	Number	4	7	6	6	7
2.	Development of technologies for diversified uses of plant fibres, by -products & industrial wastes, transfer of technology and capacity building	Development of new product/ machinery / instrument / technology	New product/ machine/instrument/ technology developed	Number	4	6	5	6	7
		Up-gradation/refinement of instruments/technology	Number of Instruments/technology refined/ upgraded under different projects	Number	##	##	Jan, 15, 2015	Jan, 15, 2016	Jan, 15, 2017
		Entrepreneurship development and training	Programmes organised	Number	13	14	15	15	17
3.	Publication/Documentation	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	Number	##	##	6	7	7
		Timely publication of the Institute Annual Report (2013-2014)	Annual Report published	Date	-	-	July 02 2014	-	-
4.	Fiscal resource management	Utilization of released plan fund	Plan fund utilized	%	99.73	99.78	96.00	98.00	98.00

Sl. No.	Objectives	Actions	Success Indicators	Unit	Actual Value for FY12/13	Actual Value for FY13/14	Target Value for FY14/15	Projected Value for FY15/16	Projected Value for FY16/17
5.	Efficient Functioning of the RFD System	Timely submission of Draft RFD (2014 -2015) for approval	On-time submission	Date	-	-	May16, 2014	-	-
		Timely submission of Results for RFD (2013 -2014)	On-time submission	Date	-	-	May 02, 2014	-	-
6.	Enhanced Transparency /Improved Service delivery of Ministry/ Department	Rating from Independent Audit of implementation of Citizens'/ Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	-	-	95	-	-
		Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	-	-	95	-	-
7.	Administrative Reforms	Update organizational strategy to align with revised priorities	Date	Date	-	-	Nov 02, 2014	-	-
		Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	% of implementation	%	-	-	90	-	-
		Implementation of agreed milestones for ISO 9001	% Implementation	%	-	-	95	-	-
		Implementation of agreed milestones of approved Innovation Action Plans (IAPs)	% Implementation	%	-	-	90	-	-

Success Indicators added this year onwards

SECTION 4(a): Acronyms

S.No	Acronym	Description
1.	R & D	Research and Development
2.	NIRJAFT	National Institute of Research on Jute & Allied Fibre Technology
3.	EDP	Entrepreneurship Development Programme
4.	CRIJAF	Central Research Institute for Jute and Allied Fibres
5.	JCI	Jute Corporation of India
6.	NABARD	National Bank for Agriculture and Rural Development
7.	NGO	Non Government Organization

Section 4(b): Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No.	Success indicator	Description	Definition	Measurement	General Comments
1	Breeder and commercial samples (fibre, yarn, fabric etc.) tested for quality evaluation	Quality evaluation of jute and allied fibres under various agricultural trials under "All India Network Research Project on Jute & Allied Fibres" finally aims to select varieties and treatments which produce fibres of good quality and also have good yield for variety release and treatment recommendation to the farmers. Commercial samples received from industries and export houses are also tested	Evaluation of physical and chemical parameters of fibre, yarn, fabric, composites, paper etc. for quality assessment	Number of samples	All the tests/evaluations are done as per the requirement of stakeholders following standard methods
2	New equipment fabricated for supply to stake holders	Jute grading instruments viz. Strength tester, fineness tester, colour and lustre meter, bulk density tester, yarn hairiness counter, thermal insulation tester etc. developed by NIRJAFT are fabricated against supply order	Instruments for determination of strength, fineness, colour, bulk density, hairiness, thermal insulation value etc. of fibre and fibrous structures (yarns, fabrics etc.)	Number of Equipments/ Instruments fabricated	Instruments developed at NIRJAFT are fabricated and supplied against order
3	New product/ machine/instrument/ technology / Technology developed	Technology/process development for new products from jute/allied fibres and their blends with fibres of natural and man-made origin using cutting edge technologies e.g., nano and bio technology, compact spinning etc. Designing of suitable textile structures for biocomposite geo/agro textile applications; machinery and instrument development for better process control	To diversify application of jute and allied fibres in value added applications and improvement of existing product range in terms of quality and production efficiency; upgradation of machineries and instrumentations for process control leading to superior products at higher efficiency	Number of technologies	To utilize jute and allied fibres in wide and diverse areas by exploiting the intrinsic and advantageous properties of the fibres and converting the demerits whatsoever into merits by application of scientific tools through development of technologies, products and processes for the benefit of farmers, artisans and industries of both large and small scales
4	Number of Instruments/ Technology refined / upgraded under different project	Institute has developed many instruments viz. Fibre Bundle Strength Tester, Fibre Fineness Tester, Moisture Metre, Jute Ribboner and these instruments are upgraded by interfacing with computers Institute has also developed many technologies in the field of jute & allied fibres. These technologies are refined/modified after certain duration	NIRJAFT instruments are upgraded for determination of different quality parameters of fibres NIRJAFT technologies are refined for preparation of quality products	Number of instruments & technologies upgraded or refined	NIRJAFT has upgraded/ refined number of instruments/technologies
5.	Programmes organised	Frontline demonstration, field and industrial trial, training programmes, workshops, talk delivered, seminars, EDP	To commercialize the technologies, entrepreneurship development and to promote public-private partnership; it is envisaged to make awareness through training, demonstration, entrepreneurship development programme	Number of programme organised	These programmes are based on different technologies developed at the institute and are conducted for transferring technologies

SECTION 5:

Specific performance requirements from other departments that are critical for delivering ageed results

Location Type	State	Organisation Type	Organisation Name	Relevant Success Indicator	What is your requirement from this organisation	Justification for this requirement	Please quantify your requirement from this Organisation	What happens if your requirement is not met?
Urban	Delhi	Govt.	Department of science and technology	New product/ machine/instrument/ technology developed	Project sponsorship	Broadening of our research areas	Two R&D projects	Have to search for alternative sponsors
Urban	West Bengal	Govt.	Development Commissioner for Handicrafts	Programmes organised	Programme sponsorship and identification of trainees	For identification of proper/appropriate participants	Sponsorship of eight (8) programmes per year	To search for alternate organisations

SECTION 6:

Outcome / Impact of activities of Department / Ministry

Sl. No.	Outcome/impact	Jointly responsible for influence this outcome impact with the following organization(s) department(s)/Ministry(ies)	Success indicator(s)	Unit	2012-13	2013-14	2014-15	2015-16	2016-17
1	Scientific grading of jute fibre	Ministry of textiles, Jute industry, CRIJAF, JCI	Share of total jute fibre produced which is graded scientifically	%	4	4	5	5	5
2	Alternative products for jute /other industries	Jute industry, National Jute Board Cottage and small scale industry.	Enhancement of production of jute crop based diversified products	%	2	2	2.2	2.4	2.4
3	Human resource development	Ministry of Textiles, NABARD, NGOs	Skilled manpower developed	Number	110	200	300	400	500

Target setting

Success Indicators	Past achievements of the success indicators					Average	Projected value of the success indicator for 2014-15 as per the approved RFD 2013-14
	V 2009-10	IV 2010-11	III 2011-12	II 2012-13	I 2013-14		
Breeder and commercial samples (fibre, yarn, fabric etc.) tested for quality evaluation	225	216	344	200	200	237	340
New equipment fabricated for supply to stake holders	17	5	4	4	4	7	6
New product/ machine/instrument/ technology developed	4	6	4	5	6	5	5
Instruments/technology refined/ upgraded	2	2	4	5	6	4	1
Programmes organised	7	19	20	10	10	13	15

Classification of the success indicator according to its category

Sl No	Success Indicator	Input	Activity	Internal Output	External Output	Outcome	Measures Qualitative Aspects
1.	Breeder and commercial samples (fibre, yarn, fabric etc.) tested for quality evaluation	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
2.	New equipment fabricated for supply to stake holders	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
3.	New product/ machine/instrument/ technology developed	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
4.	Instruments/technology refined/upgraded	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
5.	Programmes organised	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

Performance Evaluation Report of RFD 2014-15

Sl. No.	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target / Criteria Value					Consolidated Achievements	Performance		Percentage achievements against Target values of 90% Col.*	Reasons for short - falls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
1	Technological support for quality improve-ment and assurance of jute, mesta and other allied fibres.	**32**	Technology support to jute breeders, industries & Jute Export houses	Breeder and Commercial samples (fibre, yarn, fabric etc.) tested for quality evaluation	Number	**28**	408	340	272	204	136	**415**	**100**	**28.0**	**122.0**	More number of jute & allied fibre samples were received and tested against the estimated one from different centres of AINP & other agencies
			To fabricate grading aid instruments for farmers, industries and stake holders	New equipment fabricated for supply to stake holders	Number	**4**	7	6	5	4	3	**6**	**90**	**3.60**	**100.0**	-
2	Development of technologies for diversified uses of plant fibres, by products & industrial wastes, transfer of technology and capacity building	**48**	Development of new product/ machinery / instrument / technology	New product/ machine/instrument/ technology / Technology up gradation	Number	**29**	6	5	4	3	2	**6**	**100**	**9.00**	**120.0**	Achieved 100% (as per Excellent column)
			Up-gradation/ refinement of instruments/technology	Instruments/Technology refined/upgraded	Date	**4**	Jan 01, 2015	Jan 15, 2015	Feb 01, 2015	Feb 15, 2015	Mar 01, 2015	**June, 2014**	**100**	**4.00**	**100.0**	-
			Entrepreneurship Development and Training	Programmes organised	Number	**15**	18	15	12	9	6	**22**	**100**	**15.00**	**146.7**	Some externally funded training programme were sponsored to our Institute which were beyond the scheduled

3	Publication/Documentation	**5**	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	Number	**3**	6	5	4	3	2	**6**	**100**	**3.00**	**120.0**	Prior to receiving the necessary circular from RFD Co-ordination Unit, as a Co-author, one published research paper has already been reported in monthly RFD programme
			Timely publication of the Institute Annual Report (2013-14)	Annual Report published	Date	**2**	30.06. 2014	02.07. 2014	04.07. 2014	07.07. 2014	09.07. 2014	**30.06. 2014**	**100**	**2.00**	**-**	-
4	Fiscal resource management	**2**	Utilization of released plan fund	Plan fund utilized	%	**2**	98	96	94	92	90	**99.91**	**100**	**2.00**	**-**	-
5	Efficient Functioning of the RFD System	**3**	Timely submission of Draft RFD (2014-15) for approval	On-time submission	Date	**2**	May 15, 2014	May 16, 2014	May 19, 2014	May 20, 2014	May 21, 2014	**0**	**0**	**0**	**-**	-
			Timely submission of Results for RFD (2013-14)	On-time submission	Date	**1**	May 01, 2014	May 02, 2014	May 05, 2014	May 06, 2014	May 07, 2014	**April 21, 2014**	**100**	**1.00**	**-**	-
6	Enhanced Transparency /Improved Service delivery of Ministry/Department	**3**	Rating from Independent Audit of implementation of Citizens'/Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	**2**	100	95	90	85	80	**100**	**100**	**2.00**	**-**	-
			Independent Audit of implementation of Grievance Redress Management (GRM) System	Degree of success in implementing GRM	%	**1**	100	95	90	85	80	**100**	**100**	**1.00**	**-**	-

7	Administrative Reforms	7	Update organi - zational strategy to align with revised priorities	Date	Date	2	Nov 01, 2014	Nov 02, 2014	Nov 03, 2014	Nov 04, 2014	Nov 05, 2014	**Oct 27, 2014**	**100**	**2.00**	-	-
			Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	% of implementation	%	**1**	100	90	80	70	60	**100**	**100**	**1.00**	-	-
			Implementation of agreed milestones for ISO 9001	% of implementation	%	**2**	100	95	90	85	80	**100**	**100**	**2.00**	-	-
			Implementation of agreed milestones of approved Innovation Action Plans (IAPs)	% of implementation	%	**2**	100	90	80	70	60	**70**	**70**	**1.40**	-	-
													Total Composite Score:		**97.00**	

Percent of achievable Targets = Consolidated Achievements/Targets under 90% column *100 **Rating : Excellent**

ANNEXURE-I

Actual Scientific Staff in position in the Institute and their research articles publications published in International and National Journals having NAAS rating 6.00 or more during April 1, 2014-March 31, 2015

Name of the Division: AGRICULTURAL ENGINEERING

Name of the Institute: ICAR – National Institute of Research on Jute & Allied Fibre Technology

S. No.	Category of Scientific Staff	Actual Scientific Staff in position (Nos.)	Research articles publications as first/ corresponding author (Nos.)	Publication productivity* (Number of research articles publications divided by number of Scientists)
1	Principal Scientist	11	02	0.18
2	Senior Scientist	06	01	0.17
3	Scientist	05	03	0.60
Total		**22**	**06**	**0.27**

RESEARCH & DEVELOPMENT PROGRAMME 2015-2016

Quality Evaluation & Improvement Division

1.	**Project No.**	**QEI-13**
	Title	***Design and Development of a Commercial Extractor for PALF***
	Principal Investigator	Dr L K Nayak, Sr Scientist
	Associate	Dr Avijit Das, Pr Scientist
	Date of start	October 2012
	Date of completion	March 2014 + extn upto March, 2015 + Extended upto March, 2016
	Specified objectives	i. Design and development of a commercial decorticator for PALF ii. Optimization of retting parameters to obtain best quality of fibre
2.	**Project No.**	**QEI-15**
	Title	***Performance Analysis of Crop Specific Agrotextiles***
	Principal Investigator	Dr B Saha, Pr Scientist
	Associate	Dr S Debnath, Sr Scientist Dr S B Roy, Pr Scientist Dr Debabrata Das, Sr Technical Officer
	Date of start	October 2013
	Date of completion	September 2016
	Specified objectives	i. Development of suitable agro-textile materials ii. Study of suitability of different agro-textile materials for specific crops iii. Study of techno-economic feasibility of different crop-specific agro-textiles
3.	**Project No.**	**QEI-17**
	Title	***Laccase from Microbes for Value Addition in Jute***
	Principal Investigator	Dr Avijit Das, Pr Scientist
	Associate(s)	Dr Biplab Saha, Pr Scientist
	Date of start	October 2015
	Date of completion	September 2018
	Specified objectives	i. Characterization of laccase producing bacterial isolate ii. Optimization of growth conditions for laccase production from the bacteria isolate iii. Characterization of laccase from bacterial isolate iv. Optimization of bio-bleaching technique with laccase enzyme from the bacterial isolate

4.	**Project No.**	**QEI-18**
	Title	***Comprehensive Mesta and Bimli Grading System***
	Principal Investigator	Dr S C Saha, Sr Scientist
	Associate	Shri T K Ghosh, Technical Officer
	Date of start	October 2015
	Date of completion	September 2017
	Specified objectives	i. To introduce an easy mesta and bimli grading scheme for the benefits of farmers and end users

Mechanical Processing Division

5.	**Project No.**	**MP-8**
	Title	***Development of PALF-Silk-Ramie Blended Apparels***
	Principal Investigator	Shri Seiko Jose, Scientist
	Associate	Dr Gautam Basu, Pr Scientist & Head, M P Div
	Date of start	April 2013
	Date of completion	March 2016
	Specified objectives	i. To study the blend compositions and fibre properties to be blended and mechanical processing parameters for development of PALF-Silk-Ramie blended yarns ii. Development of suitable woven and knitted fabrics with different shades and functional finish for product development from natural fibres
6.	**Project No.**	**MP-9**
	Title	***Development of Suitable Expert System for Analysis of Defects of Jute Fabrics during Inspection***
	Principal Investigator	Shri Sujai Das, Scientist
	Associate(s)	Dr S Sengupta, Pr Scientist
	Date of start	May 2012
	Date of completion	March 2015 + Extended upto March, 2016
	Specified objectives	I. To capture the image sample and to make image database ii. To develop the algorithm for identify the texture using artificial intelligence iii. To train and validation of developed model iv. To develop software for decision support
7.	**Project No.**	**MP-10**
	Title	***Development of Nonwoven Fabrics from Banana and Sunhemp Fibres***
	Principal Investigator	Dr S Sengupta, Pr Scientist
	Associate(s)	Dr S Debnath, Sr Scientist Shri Kamal Kr Banerjee, Tech Officer
	Date of start	April 2014

	Date of completion	March 2016
	Specified objectives	i. To explore the possibility of production and uses of nonoven fabrics from long vegetable and under exploited fibres like banana and sunnhemp
8.	**Project No.**	**MP - 11**
	Title	***Development of Portable Coconut Fibre Strength Tester***
	Principal Investigator	Dr Gautam Basu, Pr Scientist & Head, MP Division
	Associate(s)	Shri C Kundu - TO Shri P Chowdhary - TO Shri L M Patro - ACTO
	Date of start	April 2014
	Date of completion	March 2016
	Specified objectives	i. Development of portable type coconut fibre strength tester ii. Optimization testing parameters iii. Digitization and computerization of the system
9.	**Project No.**	**MP - 12**
	Title	***Development of Coated and Laminated Products Based on Jute***
	Principal Investigator	Dr Gautam Basu, Pr Scientist & Head, MP Division
	Associate(s)	Shri Seiko Jose, Scientist
	Date of start	April 2014
	Date of completion	March 2016
	Specified objectives	i. To develop jute based flexible composite structures for water imperviousness ii. To design and develop water resistant/ water proof flexible products
10.	**Project No.**	**MP - 13**
	Title	***Development and Evaluation of Eco-Friendly Water Miscible Jute Conditioning Agent***
	Principal Investigator	Shri. Seiko Jose, Scientist
	Associate(s)	
	Date of start	April 2014
	Date of completion	March 2016
	Specified objectives	i. Development of eco-friendly water soluble jute conditioning agent ii. Study the spinning performance of the developed jute conditioning agent in comparison with conventional JBO
11.	**Project No.**	**MP - 14**
	Title	***Development of Yarn from Indian Flax for Technica Textile***
	Principal Investigator	Dr Sanjoy Debnath, Sr Scientist
	Associate(s)	Dr Gautam Basu, Pr Scientist
	Date of start	October, 2015
	Date of completion	September, 2017
	Specified objectives	i. To study the major textile related fibre properties of Indian flax fibre ii. To develop flax and flax-based yarns

12.	**Project No.**	**MP - 15**
	Title	***Development of Low Area Density Jute Non-Woven Fabric for Carry Bags***
	Principal Investigator	Dr Surajit Sengupta, Pr Scientist
	Associate(s)	Shri Seiko Jose, Scientist Shri Kamal Kr Banerjee, Tech Officer
	Date of start	October, 2015
	Date of completion	September, 2018
	Specified objectives	i. To develop well covered low gsm jute nonwoven fabric ii. To impart functional properties in the fabric iii. Performance study as carry bags and cost calculation

Chemical & Biochemical Processing Division

13.	**Project No.**	**CBP - 10**
	Title	***Eco-friendly Printing of Jute with Natural Dyes***
	Principal Investigator	Dr S N Chattopadhyay, Pr Scientist
	Associate	Dr Nimai Chandra Pan, Pr Scientist & Head (Acting), C & BP Division Shri Amalesh Khan, Technical Officer
	Date of start	April 2014
	Date of completion	March 2017
	Specified objectives	i. Development of printed jute fabrics by natural dyes using substantive and pigment printing method with improved fastness characteristics
14.	**Project No.**	**CBP - 11**
	Title	***Development of Jute Pulp for Making Tissue Paper and Sanitary Napkins***
	Principal Investigator	Dr S N Chattopadhyay, Pr Scientist
	Associate	Dr R K Ghosh, Scientist
	Date of start	April 2014
	Date of completion	March 2017
	Specified objectives	i. To isolate jute pulp from jute fibre and to develop tissue paper for value addition of jute ii. To utilize jute cellulose as an alternative to wood cellulose based absorbent layer in sanitary napkin
15.	**Project No.**	**CBP - 12**
	Title	***Preparation of Activated Carbon from Jute Stick by Chemical Activation***
	Principal Investigator	Dr R K Ghosh, Scientist
	Associate	Dr D P Ray, Sr Scientist
	Date of start	April 2015
	Date of completion	March 2018
	Specified objectives	i. Preparation of activated carbon from jute stick by chemical (phosphoric acid) activation ii. Characterization of activated carbon iii. Application of activated carbon to treat water contaminated with dyes and pesticides

16.	**Project No.**	**CBP - 13**
	Title	***Jute Based Conductive Polymer Composite for Electromagnetic Shielding***
	Principal Investigator	Dr L Ammyappan, Sr Scientist
	Associate	Dr Gautam Roy, Pr Scientist & Head, QEI Division
	Date of start	October, 2015
	Date of completion	September, 2017
	Specified objectives	i. To develop conductive polymer composite from jute-polyaniline polymer ii. To characterize the jute-polyaniline (PANI) composites iii. To study the electromagnetic shielding property of Jute-PANI composite
17.	**Project No.**	**CBP - 14**
	Title	***Modification of Yak Fibre for Making it Suitable for Yarn Production in Jute Spinning System***
	Principal Investigator	Dr K K Samanta, Scientist
	Associate	Dr A N Roy, Pr Scientist & Head, TOT Division Shri Karunamoy Patra, Tech Officer Shri Kaushik Mitra, Tech Officer
	Date of start	October, 2015
	Date of completion	September, 2018
	Specified objectives	i. Modification of coarser grade yak fibre for making it suitable for yarn production in jute spinning system ii. Dyeing of yak and jute fibres for the development of jute/yak fibres blended fancy yarn for diversified end applications iii. Optimization of spinning parameters for the production of jute/raw yak fibres, jute/washed yak fibres, jute/ chemically modified and jute/coloured yak fibres yarns iv. Development of jute/yak fibres blended woven fabrics
18.	**Project No.**	**CBP - 15**
	Title	***Sustainable Flame Retardant Finishing of Jute and Jute-Cotton Fabrics Using Plant Extracts***
	Principal Investigator	Dr K K Samanta, Scientist
	Associate	Dr S N Chattopadhyay, Pr Scientist Shri Karunamoy Patra, Tech Officer
	Date of start	October, 2015
	Date of completion	September, 2017
	Specified objectives	i. Utilization of by-products during extraction of banana fibre and other agro-residue for making fire retardant jute and jute-cotton union textiles ii. Evaluation and characterization of by-products (banana pseudo-stem sap) and identification of factors responsible for imparting fire retardancy property in jute and jute-cotton union textiles

Transfer of Technology Division

19.	**Project No.**	**TOT-8**
	Title	***Design, Development and Dissemination of Jute Based Decorative Fabric***
	Principal Investigator	Dr A N Roy, Pr Scientist & Head, TOT Div.
	Associate(s)	Dr S B Roy, Pr Scientist Shri Kaushik Mitra, Technical Officer
	Date of start	April 2014
	Date of completion	March 2017
	Specified objectives	i. Identification/generation of suitable product specific designs ii. Development of jute based decorative fabric as per the design and product development iii. Dissemination of the developed designs
20.	**Project No.**	**TOT-9**
	Title	***Comparative Evaluation of Ribboner Developed by NIRJAFT***
	Principal Investigator	Dr V B Sambhu, Sr Scientist
	Associate(s)	Dr L K Nayak, Sr Scientist Shri Sujai Das, Scientist (SS) Er P Sanyal, Sr Tech Officer
	Date of start	April 2014
	Date of completion	March 2016
	Specified objectives	i. To evaluate the performance of developed ribboners on the basis of peeling capacity (plants/min) ii. Energy requirement and its analysis for developed ribboner iii. Improvement based on the performance evaluation
21.	**Project No.**	**TOT-10**
	Title	***Developing and Undertaking of Extension Services for Effective Dissemination of Institute Technologies***
	Principal Investigator	Dr S B Roy, Pr Scientist & In-Charge, PME Cell
	Associate(s)	Dr Avijit Das, Pr Scientist Dr L K Nayak, Sr Scientist Dr D P Ray, Sr Scientist Dr V B Shambhu, Sr Scientist Shri Kausik Mitra, Tech Officer
	Date of start	October, 2015
	Date of completion	September, 2018
	Specified objectives	i. Capacity building and empowerment of stake holders ii. Front line demonstration of ICAR-NIRJAFT's developed technologies and multimedia information creation iii. Collaboration with organizations engaged in promotion of jute & allied fibres

Sponsored / Contact Research

22.	**Project No**	**NFBSFARA-FQ-3030**
	Title	***Understanding Genetics and Biosynthesis of Gum in Ramie (Boehmeria nivea L. Gaud.) for Developing Low-Gum Genotypes***

	Sponsored by	National Fund for Basic, Strategic and Frontier Application Research in Agriculture(NFBSFARA), ICAR
	Lead Centre	CRIJAF, ICAR, Barrackpore P.I. : Dr Pratik Satya, Sr Scientist
	Cooperating Centre	NIRJAFT, Kolkata P.I. : Dr D P Ray, Sr Scientist
	Duration	4 years
	Date of start	June 2012 (upto May 2016)
	Objective(s)	i. To characterise components of gum in ramie ii. To study the genetics of gum content in ramie
23.	**Project No**	**National Agricultural Science Fund (NASF)**
	Title	***Investigation of Effect of Structure of Jute & Allied Fibre Products on Sound Insulation Property***
	Sponsored by	NASF, ICAR
	Lead Centre	ICAR-NIRJAFT P.I.:Dr Gautam Basu, Pr Scientist Co- P.I.: Dr Surajit Sengupta, Pr Scientist Co- P.I.: Dr Sanjoy Debnath, Sr Scientist Co- P.I.:Dr Kartick K. Samanta, Scientist Co- P.I.: Shri Seiko Jose, Scientist
	Cooperating Centre	i. Government College of Engineering and Textile Technology, Serampore, Government of West Bengal, 12 William Carey Road, Serampore, Hooghly - 712201, West Bengal P.I.: Ms. Mallika Datta, Assistant Professor GCETTS, Serampore, W.B. ii. Indian Institute of Engineering Science and Technology, Shibpur, Botanic Garden, Howrah - 711103, West Bengal P. I.: Dr. Sampad Mukherjee, Associate Professor, Department of Physics, IIEST, Shibpur
	Duration	Three Years
	Date of start	July, 2015
	Date of Completion	June, 2018
	Objective(s)	i. Understanding of science of acoustical and non-acoustical properties of jute and allied fibres assembly in relation to its structure. ii. Study the effect of engineered fibrous structure(s) on frequency dependent sound propagation iii. Effect of surface modification of natural fibre on sound insulation. iv. Study the effect of temperature, heat tolerance and climatic condition on acoustic behaviour
24.	**Project No**	**CRP-NIRJAFT-01**
	Title	***Development of Machinery for Extraction of Fibre from Sisal, Flax and Pineapple Leaf***
	Sponsored by	CRP-Project, ICAR
	Lead Centre	ICAR-NIRJAFT P. I.: Dr L K Nayak, Sr Scientist Co- P. I.: Dr V B Shambhu, Sr Scientist Dr S Debnath, Sr Scientist

	Duration	Two Years
	Date of start	August, 2015
	Date of completion	March, 2017
	Objective(s)	i. Design, development and demonstration of high capacity extractors for pineapple leaf, sisal and flax fibre
25.	**Project No**	**CRP-NIRJAFT-02**
	Title	***Development of Grading System and Instruments for Jute and Allied Fibres***
	Sponsored by	CRP-Project, ICAR
	Lead Centre	ICAR-NIRJAFT P. I.: Dr Gautam Roy, Pr Scientist Co-P.I.: Dr S C Saha, Sr Scientist
	Duration	Two Years
	Date of start	August, 2015
	Date of Completion	March, 2017
	Objective(s)	i. To develop standardize methods of grading of Sisal, Sunnhemp, Flax and Ramie fibres ii. To develop new electronic instruments to measure their grading parameters
26.	**Project No**	**CRP-NIRJAFT-03**
	Title	***Eco-Friendly Chemical Processing of Ligno-Cellulosic Fibres for the Preparation of Home Textiles***
	Sponsored by	CRP-Project, ICAR
	Lead Centre	ICAR-NIRJAFT P.I.: Dr Sambhu Nath Chattopadhyay, Pr Scientist Co-P.I.: Dr N C Pan, Pr Scientist Co-P.I.: Dr A N Roy, Pr Scientist Co-P.I.: Dr K K Samanta, Scientist
	Duration	Two Years
	Date of start	August, 2015
	Date of Completion	March, 2017
	Objective(s)	i. Development of ecofriendly preparatory processing technology for jute and banana fibres and their blends ii. Colouration of home textiles by innovative dyeing and printing process using natural and reactive dyes for development of attractive shades iii. Imparting functional properties to lignocellulosic textiles using ecofriendly chemicals for fire resistance, UV-resistance, etc with improved handle properties iv. Development of contemporary fashion home textiles like curtains, upholstery, appliances cover, etc

The following activities will be carried out as adhoc work:

1. **Refinement of Fungal Retting Technology of Jute and Determination of Relative Economy Fungal Retting Technology Vis-a-Vis Conventional Process**
   By Dr Avijit Das, Pr Scientist
   From: 01-10-2015 to 31-03-2016
2. **Development of Technology for Extraction and Characterization of Nano-Cellulose from Jute Waste**
   Dr D P Ray, Sr Scientist
   From: 01-10-2015 to 31-03-2016
3. **Improvement of Durability of Jute-based Geo-textile**
   Shri Seiko Jose, Scientist
   From: 01-10-2015 to 31-03-2016
4. **Development of Interliner/Garment Stiffener/Filler from Sunhemp and Banana Nonwoven**
   Dr. Surajit Sengupta, Pr. Scientist
   From: 01-10-2015 to 31-03-2016
5. **Aroma Finishing on Jute Textiles**
   Dr. N. C. Pan, Pr. Scientist
   From : 01-10-2015 to 31-03-2016
6. **Development of Ligno-Cellulose Fibre Based Bio-composites**
   Dr. L. Ammayappan, Sr. Scientist
   From : 01-10-2015 to 31-03-2016

SUMMARY OF R & D PROGRAMME FOR THE YEAR 2015 -16

Continuing projects for 2015-16	Projects granted for extension (extended period)	Projects completed/ terminated in 2014-15 & 2015-16	New projects approved for 2015-16 (from October, 2015 onwards)
QEI-15	*QEI-13 (up to March, 2016.)*	*QEI-4 (on 31.03.15)*	*CBP-13 (October, 15)*
MP-8	*MP-9 (up to March, 2016.)*	*QEI-8 (on 31.03.15)*	*CBP-14 (October, 15)*
MP-10		*QEI-12 (on 31.03.15)*	*CBP-15 (October, 15)*
MP-11		*CBP-8 (on 31.03.15)*	*QEI-17 (October, 15)*
MP-12		*NJB/MM IV/6.2 (on 31.03.15)*	*QEI-18 (October, 15)*
MP-13		*QEI- 16(on 30.09.15)*	*MP-14 (October, 15)*
CBP-10		*CBP-7(on 30.09.15)*	*MP-15 (October, 15)*
CBP-11		*CBP-9(on 30.09.15)*	*TOT-10 (October, 15)*
CBP 12		*TOT 7(on 30.09.15)*	*NASF (July, 15)*
TOT-8		*DST-1- IDP/IND/2010 /19(on 30.09.15)*	*CRP-NIRJAFT-01 (Aug, 15)*
TOT-9		*DST-2-IDP/IND/2010 /19 (on 30.04.15)*	*CRP-NIRJAFT-02 (Aug, 15)*
NFBSFARA FQ 3030		*NFBSFARA FQ 3029 (on 31.05.15)*	*CRP-NIRJAFT-03 (Aug, 15)*
New approved adhoc projects: 6			

Institute Activity

3rd C.R. Nodder Memorial Lecture

The 3rd C. R. Nodder Memorial Lecture was held in the memory of institute's first Director, Late C. R. Noddar on October 03, 2015 at NIRJAFT auditorium. Dr. D. Nag, Director welcomed the gathering and briefly presented the life sketch of Late C. R. Nodder. Prof. (Dr.) Swapan Kumar Datta, Pro-Vice-Chancellor, Visva Bharati and Former DDG (Crop Science), ICAR presided over the function. In his presidential address, he briefly described the scientific contribution of Shri C. R. Nodder in jute fibre science and technology. He talked about application of genomics for production of jute fibres with desired properties. Successively, Dr. S. N. Chattopadhyay, Principal Scientist of ICAR-NIRJAFT introduced the Chief Guest i.e. Prof.(Dr.) Mangesh. D. Teli, Professor,

Fibre & Textile Processing Department, Institute of Chemical Technology, Mumbai. He presented the memorial lecture on "Glimpses of R&D Experience in Fibres and Chemical Processing of Textiles". He mainly discussed the advancement in different textile fibres as well as chemical processing technology in the recent years. He discussed in detail about antimicrobial, aroma finishing and crease resistant finishing using non-formaldehyde chemicals. His work on oil absorption by different fibres for oil spillage management in sea during oil transport and high absorbent cotton was interesting. He also talked about bamboo fibre which is mainly regenerated in nature. Dr. Kartick K. Samanta, Scientist, ICAR- NIRJAFT presented the vote of thanks. There was large gathering from different jute and textile teaching and research institutes and other jute related organisations including industries. Ex-employees of NIRJAFT were also present in that occasion.

78th Foundation Day

78th Foundation day of ICAR-National Institute of Research on Jute and Allied Fibre Technology was organized on January 4, 2016 at NIRJAFT auditorium. The programme was presided over by Dr. B.C. Mitra, Ex Director, NIRJAFT and Ex-RAC Chairman. The programme was started with the ICAR theme song

followed by lightening of lamp to mark the inauguration of the programme. Dr. D. Nag, Director, NIRJAFT welcomed all the delegates, Ex-NIRJAFT employees and staffs of the institute who attended the programme. Dr. Nag during his welcome address described about the institute's achievements and events for the last one year. Then a small video show regarding felicitation of Dr. S.B. Bandyopadhyay, Ex-Director, NIRJAFT on his 100th birth anniversary held on December 13, 2015 was presented before the audience. Dr. B. C. Mitra during his presidential address briefly described the achievements of the institute for the last 78 years and under the leadership of different directors of NIRJAFT. Foundation day lecture was given by Dr. B.S. Bisht, Ex-Vice Chancellor of G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand and presently Director, Birla Institute of Applied Sciences, Bhimtal, Uttarakhand. He presented the history and development of different natural fibres including cotton, jute and other lignocellulosic fibres. In his lecture, he unearthed the potential and scope of utilization of natural fibres based on advance research and development.

5th P.B. Sarkar Memorial Lecture

5th Dr. P.B. Sarkar Memorial lecture was organised on January 4, 2016. Before the lecture, Dr. N. C. Pan, Head, Chemical and Bio-chemical Processing Div. provided the life sketch of Late Dr. P. B. Sarkar who was the second Director of the institute and incidentally the first Director in independent India. The programme was presided over by Dr. B.C. Mitra, Ex Director, NIRJAFT and Ex-RAC Chairman. (Prof.) D. Chattopadhyay, Vice-Chancellor, Amity University, Kolkata and Ex-Pro-Vice Chancellor (Academic affairs), University of Calcutta presented 5th Dr. P.B. Sarkar memorial lecture on the topic "Smart Materials and Chemical Industries". In his presentation, he mainly described about application of nanotechnology in different industries particularly with reference to Fibre Technology. He told that nanotechnology can be applied in smart textiles, military apparels, functional finishing of textiles and several other application areas. He mentioned that during application of nano-chemicals, study of nano-toxicity should also be done so that the product is safe for use. He also mentioned that size of the nano-pesticides is the main factor for evaluation of nano-toxicity. The programme ended with a hearty vote of thanks to the dignitaries.

Celebration of 100th Birthday of Former Director

The 100th Birthday of Dr Sasanka Bhusan Bandopadhyay, Former Director (1968-75) of the then Jute Technological Research Laboratories was celebrated by the present and past staff members of NIRJAFT on December 13. On that day, a team lead by Dr Debasis Nag, Present Director visited Dr Bandopadhyay's house to felicitate him ceremoniously. He was felicitated by Dhuti, Uttariya and a Citation. A 'Book of Works by Dr S B Bandopadhyay' which is the collection of his

published works was published by NIRJAFT and inaugurated in this occasion.. The whole programme has been captured by a video and that has been played in the NIRJAFT Auditorium for other staff members and well wishers. The staff members of NIRJAFT has been remembered his leadership in research and development by discussing about the investigations and contributions of Dr Bandopadhyay in that ceremony.

Brain Storming Seminar

ICAR-National Research Institute on Jute & Allied Fibre Technology, Kolkata organized a brain storming lecture at ICAR-NIRJAFT, Kolkata on May 7, 2015. The programme was chaired by Dr. Subrata Gupta, IAS, Jute Commissioner, Ministry of Textiles, Govt. of India. Shri Subha Kirti Mazumder, Director General, Indian Jute Mills Association and former Jute Commissioner delivered a lecture on "An industry in search of its lost legacy" on the basis of past facts, recent trends with a touch of the literary glimpses of history. Important issues regarding relaxation on Jute Packaging Materials Act and its impact on jute industry, competitive export in national and international market, quality jute products for diversified sector, R&D for increasing efficiency in jute mills, modernization of jute mills etc. were discussed. About 75 participants from different organizations like Indian Jute Mills Association, National Jute Board, Jute Commissioner Office, ICAR-NIRJAFT and Jute Industries participated in this brain storming session.

Another brainstorming lecture was organized by National Research Institute on Jute & Allied Fibre Technology, Kolkata on "Regeneration and Introspection with Changing Environment" at ICAR-NIRJAFT, Kolkata on August 22, 2015. Sh. Sudhir Bhargava, Director, M/S Agroman Systems Private Ltd., Mumbai & Hon'ble Member of Governing Body of ICAR delivered the lecture on said topic emphasizing the impending need for augmenting agricultural productivity considering Hon'ble Prime Minister's slogans 'farmers first' and 'lab to field'. He expressed concern that the average agriculture sector growth over the last few years has remained around 4.7%. It appears that the Indian agriculture, being at the cross-roads, is currently facing both unprecedented challenges and unparalleled opportunities. The impact of trade liberalization on agriculture and the global climate change are new challenges. At the same time, new opportunities are emerging for Indian agriculture. Commercialization of agriculture, diversification towards high-value commodities and integration with the global markets are the new opportunities. PPP is the most effective mechanism for translating the potential of technology into products that will help in enhancing agricultural productivity and improving the economic condition of farming community. While a number of successful partnerships have emerged during the last few years, more needs to be done to build new partnerships and strengthen the existing ones. In his 2 hours long interaction with more than 80 scientists and researchers representing different ICAR institutes and Regional Research Stations of other institutes located in West Bengal, he discussed in details other important issues like commercialization and transfer of technologies, competitive research, collaborative research projects etc. He also mentioned that institutes should rethink over their

present mandates and must incorporate necessary improvements considering the changing environment and future challenges.

The Innovation Cell of institute organised a brainstorming session with a seminar delivered by Dr. D. Sanyal of D. S. Marketing Services, Kolkata on "Soilless plant substrate made from nonwoven felt of jute waste (caddies) along with nutrients" on January 12, 2016. In his lecture, a new concept of soilless agriculture using jute waste nonwoven and controlled nutrients has been delivered. He was presented different trials on various crops. The concept has been discussed with a lot of enthusiasm by the audience.

Visit of Chairman, ASRB

Dr. Gurbachan Singh, Chairman, Agricultural Scientists Recruitment Board (ASRB) visited ICAR-National Institute of Research on Jute & Allied Fibre Technology, Kolkata on June 26, 2015. He addressed the scientists, Technical officers and the administrative staff on recruitment policy of Agricultural Research Service (ARS). He also urged the scientists to give the feedback of newly prepared score card. He admires the cleanliness of institute premises including garden and expressed that it is the preeminent institute in the eastern zone. Dr. Singh informed that there is a strong consensus to make ASRB transparent, strong and efficient. Dr. D. Nag, Director, ICAR-NIRJAFT appraised Dr. Singh about the institute's research activities as well as the shortage of scientific cadre strength. Hon'ble Chairman promised to look into the matter with the assurance of taking necessary action to improve the scientific strength.

Visit of Union Minister

Dr. Sanjeev Kumar Balyan, Hon'ble Union Minister of State for Agriculture and Food Processing Industries visited ICAR-National Institute of Research on Jute & Allied Fibre Technology, Kolkata on June 29, 2015 and addressed a gathering of Directors and In-Charges of different institutes in and around Kolkata i.e., ICAR- National Institute of Research on Jute and Allied Fibre Technology, Kolkata; ICAR- Central Inland Fisheries Research Institute, Barrackpore, West Bengal; ICAR-National Dairy Research Institute, RRS, Kalyani, West Bengal; ICAR- Zonal Project Directorate (Zone-II), Kolkata; ICAR- Central Institute of Fishery Education, RRS, Kolkata; ICAR- NRC Mithun, Nagaland; ICAR-National Bureau of Soil Survey & Land Use Planning, Regional Institute, Kolkata; ICAR- Central Institute of Brackish Water Aquaculture, RRS, Kakdwip, West Bengal;, ICAR- Central Institute of Freshwater Aquaculture, RRS, Rahara, West Bengal; ICAR- Indian Veterinary Research Institute, RRS, Kolkata. All the Scientists, Technical and Administrative Staffs of ICAR-NIRJAFT were also present. Dr. Balyan took an account of the research priorities, achievement, scope of work a nd constraints (if any) from each of the Institutes individually. Dr. Balyan in his

address mentioned the need for more proactive research and for that the mandate of each institute should be relooked to provide better quality service to the farmers for achieving more productivity using minimum resources rather than generation of scientific knowledge only. He mentioned that time is changing, so development of machinery or technology must suit the requirements of the farmers. So, Scientists should do more work for the benefit of farmers. The Hon'ble Minister complemented Director, NIRJAFT for creation of proper environment in office premises and nice beautification of the garden. Dr. Debasis Nag, Director, NIRJAFT, honoured Dr. Balyan with a jacket made of jute handloom designed and developed in the institute as well as a photo frame made of jute stick particle board. At the end Shri Rajiv Lal, CAO, NIRJAFT proposed hearty vote of thanks in honour of Dr. Balyan and other dignitaries.

Vigilance Awareness Campaign

NIRJAFT has observed Vigilance Awareness Week from October 26 to October 31, 2015. On October 27 an oath taking ceremony was held in presence of Dr. G. Roy, Vigilance Officer of NIRJAFT. During this period, debate and essay writing competition on anti-corruption was organised among the staff members of NIRJAFT and also the school students of the locality.

In the closing ceremony of weeklong Vigilance Awareness Campaign on October 31, Sh. Altamas Kabir, The Hon'ble Former Chief Justice of India, was the Chief Guest and in his address to the institute employees, school students and their teachers and guardians stated how corruption is creating hindrance in the overall development of our planet, specially our country and how proper vigilance can overcome these problems. Basically corruption is trying to take an undue advantage which corrupts the system. There are four prime parameters needed in a corruption free society - Sensitivity, Sincerity, Commitment and Integrity. He urged the students, the future of our country, to become vigilant from the early age by building strong moral character and always dream for a corruption free India so that the nation can achieve glorious progress in the years to come.

Dr. Debasis Nag, Director, ICAR-NIRJAFT, in his welcome address, gave a brief account of Mr. Kabir's educational background and chronology of his illustrious professional career. Sh Kabir also handed over the prizes to the winners of different competitions. The programme ended with a hearty vote of thanks delivered by Dr. Gautam Basu, Head, Mechanical Processing Division.

Workshop on library management

One day workshop on "Role of Information Technology in Library Management in Digital Era" was organised at NIRJAFT on Dec 22, 2015. The programme was started with the ICAR theme song. Dr. D. Nag, Director, NIRJAFT welcomed all the dignitaries including librarians from different ICAR and CSIR institutes around Kolkata. He stressed upon the importance of holding such events particularly networking of different libraries for sharing text and digital resources. Dr. Swati Bhattacharya, Librarian, Indian Institute of Management, Kolkata presided over the inaugural function. In her address, she emphasised on the digital library management system for easy management of library as well as better service to the reader. Shri Rabishankar Giri, Assistant Librarian, Presidency University, Kolkata presented the keynote lecture. He talked about a model library with different e-resources and e-consortia for use in research and academics on mutual sharing basis so that wider access to different resources can be made by a large group of readers.

The inaugural session was followed by a technical session Chaired by Dr. N.C. Ghosh, Librarian, CSIR-Indian Institute of Chemical Biology, Kolkata. Four presentations in this session are (i) Evolution of library, (ii) Remote Access Software, EZ-proxy (iii) D SPACE and (iv) RFID library security system. All these presentation were very informative to the audience and evoked a lot of enthusiasm. Dr. Ghosh shared his rich library experiences during the briefing of the session. The programme ended with a vote of thanks to all the dignitaries, invited guests and institute scientists and staffs for their overwhelming response.

Institute Management Committee (IMC) Meeting

The 67th Institute Management Committee meeting was held on August 28, 2015 at NIRJAFT under the Chairmanship of Dr. D. Nag, Director of the Institute. The meeting was attended by the members, viz, Dr Souti Mukherjee, Dean & Faculty of Ag Engg, BCKV, Mohanpur, Nadia, West Bengal; Sri Lal Mohon Roy, Jute Technologist & Ex faculty, IJT, Kolkata; Sri Pushpendu Chattopadhyay, Jute industry representative, Dr. Indramani Mishra, Professor (Ag. Engg.), IARI, New Delhi; Dr. Niranjan Prasad, PS & Head of Division, ICAR-IINRG, Ranchi; Dr. S B Mitra, PS & Head of Division, ICAR-CRIJAF, Barrackpore, Kolkata, Dr. Goutam Bose, PS & Head of Division, ICAR-NIRJAFT, Kolkata, Ms. Aanasua Majumder, Assistant Finance & Accounts Officer, ICAR-NIRJAFT, Kolkata and Sri Rajeev Lal, Chief Administrative Officer, ICAR-NIRJAFT, Kolkata. The Chairman, IMC, welcomed all members to the meeting. The Member Secretary presented the proceedings of the 66th IMC meeting and Action Taken Report for recommendation. In the meeting, the following items were discussed: proposal for items under works, condemnation of old vehicles, installation of solar power plant, constitution of Institute Grievance Committee etc. At the end, Dr. L. Ammayappan, Sr. Scientist, Chemical & Bio-chemical Processing Division made a presentation on "Jute based Bio-composites". IMC members also discussed with Sri S. Sardar, Member, IJSC, Smt. Rita Sarkar, Secretary, Women Cell, Sri R.D. Sharma, Assistant Director (OL) and I/C, Hindi cell regarding their facilities and grievances.

Institute Technology Management Committee (ITMC) Meeting

The meeting of Institute Technology Management Committee was held on September 24, 2015; December 21 2015 and January 21, 2016. The meeting was chaired by Dr. D. Nag, Chairman of ITMC and Director, NIRJAFT. Mainly the patent related matters, commercialisation of intellectual properties and technology valuation was discussed. Reconstruction of the ITMC has been proposed and approved.

Institute Research Committee (IRC) meeting

The XII-7 IRC meeting was held on April 6, 2015 under the chairmanship of Dr D Nag, Director, NIRJAFT in presence of Prof P K Das, Former Professor, Department of Genetics & Plant Breeding, Bidhan Chandra Krishi Viswavidyalaya Dr P K Ganguly, Former Pr Scientist, C & BP Division and In-Charge, PME Cell. Twenty one on-going and eleven adhoc projects were discussed, recommendations of RAC and suggestions of experts has been incorporated in future programmes of those projects.

The XII-8 IRC meeting was held on September 26, 2015 under the chairmanship of Dr D Nag, Director, NIRJAFT in presence of Prof Rintu Banerjee, IIT, Kharagpur and Prof Sadhan Chandra Roy, Department of Jute and Fibre Technology, Calcutta University. Eleven numbers of adhoc projects, eight numbers of new adhoc projects and one full project have been discussed in details and modifications were suggested by experts.

The XII-9 IRC meeting was held on February 9-10, 2016 under the chairmanship of Dr D Nag, Director, NIRJAFT in presence of Prof Rintu Banerjee, IIT, Kharagpur; Prof Sadhan Chandra Roy, Department of Jute and Fibre Technology, Calcutta University; Prof Debabrata Chakrabarty, Former Head, Deptt. of Polymer Science and Technology, Science College, Rajabazar, University of Calcutta and Dr Bidyuit Kr Mukherjee, Former Deputy Director, IJIRA, Kolkata. Twenty two members were present in the meeting.. Four completed, twenty one on-going and nine adhoc projects were discussed, suggestions of experts and recommendations of IRC has been incorporated in future programme of those projects.

Research Advisory Committee (RAC) meeting

The XXV Research Advisory Committee Meeting was held under the chairmanship of Dr. S. Sreenivasan, Former Director of CIRCOT, Mumbai on March 29-30, 2016. The meeting was attended by the members, viz. Dr. S. N, Jha, ADG (PE), ICAR; Dr. D. Sur, Former Deputy Director, IJIRA, Kolkata, Dr. S. C. Roy, Former Head, Department of Jute and Fibre Technology, Calcutta University, Dr. S. K Chandra, Chief Exicutive (Works) & Director, Hooghly Infrastructure Private Ltd and Chairman, Technical Development division, IJMA , Shri. P. Chatterjee, Representative of Jute Industry. All Heads of the Divisions, Scientists, Technical Officers also attended the meeting as invitees.

The Chairman opined that consolidated and comprehensive effort has to be made in promotion of natural fibres since the consumption is declining in spite of its good attributes. ADG suggested that there should be a special brain storming between scientists and RAC members to crystallize the future roadmap to face the the forthcoming challenges. The Action Taken Report was presented by Dr S N Chattopadhyay, Member Secretary. The Progress Report of divisional activities and the ongoing R&D projects, Statistical data on jute & Allied Fibres and implementation of QRT Recommendations were presented by respective Head of the Divisions. As ADG suggested, a brain storming session was also held to identify researchable issues that could be taken in near future. At the end, Director expressed the need of strengthening the number of manpower of this institute and RAC strongly recommended that issue and suggested to provide textile scientists in the entry level to face the future challenges of natural fibres provided by the manmade fibres.

Independence Day Celebration

NIRJAFT celebrated The Independence Day on August 15, 2015 at the office premises organised by the security staffs. Dr. D. Nag, Director of the institute hoisted the flag in presence of all staff members of the institute. In his speech, he wished all a happy independence day and reminded the sacrifices of freedom fighters for achieving this moment of glory. This celebration was closed with the National Song sung by all the staffs.

Republic Day Celebration

NIRJAFT celebrated The Republic Day on January 26, 2016 at the office premises organised by the security staffs. Dr. G. Roy, Officiating Director of the institute hoisted the flag in presence of all staff members of the institute. In his speech, he encouraged the audience to work to prosper India, our motherland. This celebration was closed with the National Song sung by all the staffs.

Programmes by NIRJAFT recreation club

- A pre-independence day was celebrated in the institute auditorium on August 14, 2015 evening. Staffs of NIRJAFT and their family members were present and performed patriotic songs and poems.

- Annual function of recreation club was celebrated on June 15 with NIRJAFT staff members and their families at Tapan Theater, Kolkata. In this occasion, a souvenir has been published. The audience was overwhelmed in songs sung by the artists. A drama "Mitheybadi" was acted by famous actor Mr Paran Bandopadhyay and his group. Everybody enjoyed that play. At the end, Director felicitated Mr Paran Bandopadhyay with flower bouquet and a memento from NIRJAFT product.
- Raksha Bandhan Utsab was celebrated in the NIRJAFT premises. Donation for flood victims were collected and handed over to Bharat Sebasram Sangha.
- A cultural function at institute auditorium by the staff members to celebrate 'Vijaya Sammilani' on Nov 09.
- A family picnic of staffs at Wonderland Park, Chandannagar on Jan 10.
- Inaugurated a wall magazine named 'Anubikshan' by Dr. B.S. Bisht on Jan 04.

Viswakarma Puja

Viswakarma Puja was celebrated at NIRJAFT on Sept 18. All the employees of NIRJAFT, their family members, friends, fellows, contractual staffs and workers have participated actively in the celebration.

Swachh Bharat Abhiyan



Institute staffs including Director are actively participating periodically in Swachh Bharat Abhiyan (National Sanitation Campaign) launched by Govt. of India with the following activity: Cleaning and sweeping of offices, corridors and premises, white washing/painting, weeding out of old records, disposing of old and obsolete furniture and junk material to keep the institute clean. The activity has been extended to the students of nearby school, The Future Foundation.

Mera Gaon Mera Gaurav

NIRJAFT is also actively engaged in the following activities under 'Mera Gaon Mera Gaurav' campaign launched by Govt. of India

Date	Adopted/ Visited
June 03	Village Damorgacha, PO. Inchura, Block. Balagarh, Dist. Hooghly
June 03	Village Tentia, PO. Inchura, Block Balagarh, Dist. Hooghly
June 06	Village Tentia, Gram panchayat Kalirhat, Block Krishnagar-I, Dist. Nadia
July 16	Village Naskarpur, Block Tarakeswar, dist Hooghly
July 16	Village Phulia Para, Panchyat Belgharia - I, Dist. Nadia, West Bengal
July 22	Village Damorgacha, P.O., Inchura, Block-Balagarh, Dist. Hooghly, West Bengal
Sept 09	Village Ichapur, Block Gobardanga, Dist. 24 Pgs. (N) and demonstrated the jute ribboner machine on the same day to 40 farmers

The Director, ICAR-NIRJAFT in consultation with Programme Coordinator of different KVKs has identified 25 villages belonging to five districts viz., Howrah, Hooghly, Nadia, North 24 Pgs. and South 24 Pgs. Each village has been allotted to a scientist of institute for adoption and to carry out activities like conducting lecture/ meetings/demonstrations smoothly. Dr. S. Debnath. Senior Scientist has been given responsibility as Nodal Officer for execution of the programme.

Date	Adopted/ Visited	Farmers'Attendance
Nov, 11	Visited five adopted villages of Nadia district and interacted with farmers on different aspects of jute & allied fibres	Twenty five progressive farmers
Dec, 28	Visited village Babpur, Barasat, 24 Parganas (North) and delivered lectures on "Dry retting of jute", "Grading of jute fibre", "Application of jute in diversified applications" and "Chemical retting of jute"	Fifty farmers from nearby villages
Feb, 08	Visited Howrah KVK and delivered lectures on "Extraction of banana fibre and value-added products therefrom" and "Application of agrotextile in value added horticultural crops", respectively.	Twenty four progressive farmers of Jinghra village, Howrah.

Front Line Demonstration of Jute Retting

Front linedemonstration of ICAR-NIRJAFT developed power ribboner for extraction of ribbons/barks from jute/mesta plants were satisfactorily conductedat five different places covering three jute growing districts of West Bengal in collaboration with KVKs, JCI and govt. of West Bengal (Table 1).About260 jute/mesta growing farmers were actively participated during deliberation of a lecture and they themselves have operated the machine for extraction of ribbons from green jute/ mesta plant. They have taken keen interest in operation of machine. Their queries on ribboning capacity, fibre quality, cost of machine, labour requirement, power consumption, weight of the machine etc. were answered by the concern scientist satisfactorily.

Table 1: Front line Demonstration place

Sl. No.	Date of Demonstration	Village	Block	District	No. of Participants
1.	July 16	Naskarpur	Tarakeswar	Hooghly	50
2.	July 22	Damorgacha	Balagarh	Hooghly	60
3.	Aug 14	Jalsuka	Nakasipara	Nadia	50
4.	Aug 20	Champadanga DPC	Tarakeswar	Hooghly	60
5.	Sept 09	Ichapur	Gobordanga	24 Parganas (N)	40

Twenty front line demonstrations (FLD) were conducted on Accelerated Jute Retting Technology with farmers' participation under the National Food Security Mission, 2015-16, to assess the performance of the technology. Jute Corporation of India, Govt. of India collaborated in organizing the FLD programmes which were conducted as per the specified guidelines and carried out under the direct supervision of scientist from NIRJAFT during the month of July-September, 2015 at West Bengal, Odisha, bihar, Tripura.

In each FLD programme, about 0.1 hectare crop area was selected of which a part of the crop amounting to about 2-3 quintals was retted after harvesting by NIRJAFT Improved Retting Technology while the other half crop was retted by conventional technique immersing in water for comparison. the whole jute plants were used for retting in retting tank. The retting process was conducted in open ditch, cemented tanks and road side nullah. The plants were arranged in tank in reverse direction and soaked in water using 0.05% of the retting accelerator formulated and supplied to the farmers by NIRJAFT for accelerated and improved retting. As per the recent reports retting was completed in 8-12 days.The major achievement of programme was to gather the number of community under the single umbrella whom the technology was demonstrated.

The farmers, around 1000 in numbers, were selected by JCI who are mainly jute growers or associated with jute. Many of them were very keen to accept this technology. All the programmes were covered by the local and national Newspapers and television reporters.

Sl. No.	Performed with the help of	Name of DPC	Date of Demonstration
1.	Krishnanagar Region, West Bengal	Farmers field at Krishanagar	July 29
2.	KVK, Hooghly	Dhobapara, Hooghly	August 26
3.	KVK, Hooghly	Dyamargachha, Hooghly	August 26
4.	Sheoraphuli DPC	Kulia, Howrah	September 01
5.	Sheoraphuli DPC	Bakshi, Howrah	September 01
6.	Bethuadahari Regional office	Jompukur, Nadia	September 04
7.	Debagram DPC	Dingel, Nadia	September 04
8.	Cuttack Region,	Marshaghai	September 09
9.	Odisha	Kendupatna	September 10
10.		Patharpara	September 10
11.		Dhanmandal	September 11
12.	Purnea Region, Bihar	Kishanganj	September 14
13.		Simulbari	September 14
14.		Bahadurganj	September 15
15.		Thakurganj	September 15
16.	Agartala Region,	Udaipur	September 21
17.	Tripura	Jamjuri	September 22
18.		Ranirbazar	September 23
19.		Taidu -Ompi	September 23


दैनिक जागरण

जूट के रंग को निखरेगा सोनाली साथी

Jai Kisan Jai Vigyan

NIRJAFT organized a Farmers-Scientist interface meeting at the village Babpur under Barasat-1 block of North 24 Parganas, West Bengal on Dec 28, 2015 under the campaign 'Jai Kisan Jai Vigyan'. Dr. Avijit Das, Dr. Sanjoy Debnath, Dr. Deb Prasad Ray, and Dr. Subhas Chandra Saha discussed on prospects of fungal retting, alternate uses of jute and jute sticks, accelerated retting and jute grading respectively. About 40 villagers from Babpur, Mathurapur, Ariala, Bodai, Durlavpur and Hansia participated in the interface meeting. They were made aware of various recent developments in the scientific frontiers of natural fibres and how ICAR-NIRJAFT can help in providing training on various aspects at the village level. The programme ended with vote of thanks to the local organizers.

Memorandum of Understanding (MOU) signed

Name of the Company	Understanding
ICAR -National Institute of Research on Jute & Allied Fibre Technology (NIRJAFT), Kolkata and **Indian Institute of Engineering Science & Technology** (IIEST), Shibpur, Howrah with **M/s Tech (Style) India**, Howrah	Commercialization, manufacturing and sale of 'Computerised Fabric Bending Behaviour Tester'
ICAR -National Institute of Research on Jute & Allied Fibre Technology (NIRJAFT), Kolkata and **Indian Institute of Engineering Science & Technology** (IIEST), Shibpur, Howrah with **M/s Joy Maa Tara Enterprise**, Sodepur, Kolkata	Commercialization, manufacturing and sale of 'Computerised Fabric Bending Behaviour Tester'
Indian Institute of Engineering Science & Technology (IIEST), Shibpur, Howrah and **ICAR -National Institute of Research on Jute & Allied Fibre Technology** (NIRJAFT), Kolkata with **M/s Tech (Style) India**, Howrah	Commercialization, manufacturing and sale of 'Yarn Characterization Unit'

Appreciation of NIRJAFT product

On September 1, 2015, the foundation stone of Patsan Bhawan was innagurated by Shri Santosh Kumar Gangwar, Hon'ble Union Minister of State (Textiles), along with the Jute Common Facility Centre (CFC) Scheme and Workshop for Women Self Help Groups, at Rabindra Tirtha, New Town, Rajarhat, Kolkata. ICAR-NIRJAFT was showcased different jute based products in the events and that has been covered by different national and regional newspapers . Dr D Nag, Director has activily participated .

Participation in Exhibition

ICAR-NIRJAFT participated & displayed various developed products in an Agricultural exhibition organized by ICAR at Piprakothi, Motihari, Bihar on August 20-21, 2015. Dr. S. Ayyappan , DG, ICAR & Secretary, DARE visited all the stall & encouraged

them. Great interest was shown by the visitors about the NIRJAFT's products in the exhibition stall.

ICAR-NIRJAFT participated in the Annual Fair & Festival ***"Aspiration-2015"*** organized by Sri Aurobindo Institute of Culture, at 3, Regent Park, Kolkata-40 during December 11-20, 2015 to exhibit Institute R&D outputs.

ICAR-NIRJAFT participated in the "Kissan Sammelan-cum-Technology Week" organized by Howrah KVK, BCKV at Jagatballavpur, Howrah during December 19-21, 2015 to exhibit Institute R&D outputs.

ICAR-NIRJAFT participated in the Exhibition held during the One Day National Seminar on "Jute Diversified Products" held at Rabindratirtha, Rajarhat, Kolkata on February 19, 2016 organized by National Jute Board.

Official Language Implementation Committee (OLIC) Meeting

Two OLIC meeting for the quarter ending of June and Sept., 2014 was held on June 22 and Sept. 08 under the chairmanship of Dr. D. Nag, Director, NIRJAFT. In first meeting, the main discussion was to increase the original correspondence in Hindi for achieving the required target and Annual Programme 2015-16. The the nomination in Hindi Typing training was mainly discussed in the second meeting.

The meeting of Official Language Implementation Committee was held on Dec. 22 and March, 26 for the quarter ending of December, 2015 and March, 2016 respectively under the Chairmanship of Dr. D. Nag, Director, NIRJAFT. The main discussion was to increase the original correspondence in Hindi for achieving the required target given in Annual Programme 2015-16.

Hindi Fortnight Celebration

Hindi Fortnight Celebration was organised in the institute from September 16 - 30, 2015. Extempore, debate and recitation competitions were organized for the staffs of the institute during this period. The closing ceremony was held on September 30, 2015 under the chairmanship of Dr. D. Nag, Director, NIRJAFT. Dr A K Singh, Director, ICAR-Agricultural Technology Application Research Institute, Kolkata graced the occasion as Chief Guest. Dr Singh in his key note address suggested to perform the official paperwork in our national language. He also appreciated the enthusiasm of the staff members for participating in different competitions during Hindi Fortnight Celebration. Director expressed the interest to publish a book with the writings of staffs of different writing competitions. Dr. D. Nag in his presidential address expressed that working in bilingual form viz Hindi-English is not only the duty of Hindi Section but also it is a constitutional responsibility of each employee that they should render their official works originally in Hindi to the maximum extent.

Presentation in Seminar Conferance/Workshop/Meeting

- Banerjee P and Ray D. P., *Opportunities in Ramie Cultivation for Sustaining Rural Livelihood,* National Seminar on Resource Based Inclusive Agriculture & Rural Development: Opportunities & Challenges organized by Faculty Centre for Integrated Rural Development and Management (IRDM), Ramakrishna Mission Vivekananda University (RKMVU) on January 15-16, 2016.
- Naiya R, Chattopadhyay S N, Ghosh T S, *Evolution of library,* Workshop entitled "Role of information technology in library management in digital era organized by ICAR-NIRJAFT on Dec 22, 2015.
- Debnath Sanjoy, *Diversified use of jute & Mesta* under the scheme National Food Security Mission – Commercial Crops – Jute Based Cropping System during 2015 – 2016 at Office of the Deputy Director of Agriculture (Admn.), Government of West Bengal, P.O. Noapara, District North 24 Parganas on March 18, 2016.
- Kumar Shailesh, Jha S.K., Shamna A. and Shambhu V. B. *Transfer of Technology in Jute Cultivation: An Experience of West Bengal.* International Extension Education Conference (IEEC)-2016 on "*Education Research & Services",* held at *Department* of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University (BHU), Varanasi, Uttar Pradesh during January 27-30, 2016.
- Nag Debasis, *Application and usability of Agro-textiles* at Geotextiles and Agrotextiles in North-East, organised by Indian Chamber of Commerce, Kohima, Nagaland, Sept 04, 2015.
- Nag Debasis, *Cost economisation and choice of materials for JDP*, National Seminar on "Jute Diversified Products" organised by National Jute Board, Kolkata on Feb 19, 2016.
- Nag Debasis, *Engineering the technologies of cotton, jute and other fibre processing,* Workshop on "Making engineering scientists' contribution more meaningful to stakeholders and the nation" organised by Agricultural Engineering Division of ICAR, NASC Complex, New Delhi on April 13-14, 2015.
- Nag Debasis, *Innovations in jute technology, relevant for diversified products,* Industrial Innovation for Entrepreneurs, Farmers & Academicians organised by NIT, Nagpur on Feb 4-6, 2016.
- Nayak L.K. and Roy A.N., *Strengthening National Food Security: Role of ICAR-NIRJAFT in training stake holders in jute & allied fibre sector*, International Extension Education Conference (IEEC) – 2016 on "Education, Research & Services" organised by Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University (BHU) at Varanasi, Uttar Pradesh on January 27-30, 2016.
- Ray D P, *Phyto-chemicals from Jute seed: A Biorational approach*, Invited speech in 11th National Symposium on Dynamics of Crop Protection: Challenges in Agri-horticultural Ecosystems Facing Climate Change Society for Plant Protection Sciences (SPPS), Udaipur, Rajasthan on April 23-25, 2015.
- Ray D P, Sen D and Banerjee P, *Quality Evaluation of Fibre Properties of Banana Grown in North-East Himalayan*, National Seminar on Sustaining Hill Agriculture in Changing

Climate (SHACC) organized by Indian Association of Hill Farming and ICAR Research Complex for NEH Region, Agartala, Tripura on December 5-7, 2015.

- Roy A.N, *Modification of coarse yak fibre for blending with jute fibre in jute spinning system*, 4th Interface meeting on "Holistic Approaches to sustain livelihood of Yak Rearing through scientific intervention in India" organized by ICAR-NRC –YAK, Dirang during March 3-5, 2016.
- Sengupta Surajit, presented *Development of fabric bending tester for technical textiles* in the Meeting of Expert Advisory Group of DST-IDP at CSIR- Central Glass & Ceramic Research Institute (CGCRI), Kolkata on May 30, 2015.
- Samanta Kartick K., Invited Talk on *Water-free Sustainable Textile Processing using Atmospheric Pressure Cold Plasma*, in 30th National Symposium on Plasma Science and Technology (PLASMA 2015) organised by Saha Institute of Nuclear Physics, Kolkata, India, on December 1-4, 2015.
- Sengupta A, Sengupta Surajit & K Das Bhattacharya, *Development of an efficient staple yarn characterization unit with multi sensor fusion and field Programmable gate array (FPGA) based data reduction card,* Meeting of Expert Advisory Group of DST-IDP organised by CSIR- Central Glass & Ceramic Research Institute (CGCRI), Kolkata on May 30, 2015.
- Sengupta Surajit, Debnath Sanjoy & Sengupta A, *Design & development of computerized instrument for testing bending behaviour of semi-rigid fabrics with special reference to technical textiles*, Meeting of Expert Advisory Group of DST-IDP organised by CSIR-Central Glass & Ceramic Research Institute (CGCRI), Kolkata on May 30, 2015.
- Shambhu, V. B, Nayak, L. K. and Das Sujoi. *Improved Technology for Extraction of Ribbons/Barks fromJute & Mesta Plants.* Presented in the 50th Annual Convention of ISAE and Symposium on Agricultural Engineering in Nation Building: Contributions and Challenges organised by College of Agricultural Engineering and Technology (CAET), Orissa University of Agriculture and Technology (OUAT), Bhubaneswar, Odisha during January 19-21, 2016.
- Shambhu, V. B., *Operation maintenance and repair of power tiller* on farmers' training programme of "*Maintenance and repair of farm machineries"* under TSP at ICAR-CRIJAF, Barrackpore on January 28, 2016.
- Das Avijit, *Improved retting technologies of jute,* in State level Officers' Training at DDA, Maldah organised by the Department of Agriculture, Govt. of WB on Feb 25-26, 2016.
- Saha S C, *Jute and mesta fibre grading*, under the scheme of National Food Security Mission - Commercial Crops - Jute based Cropping System at Office of the Deputy Director of Agriculture (Admn), Govt of WB on March 18, 2016.
- Nayak L K, Extraction and utilisation of banana fibre, in the training programme on Fibre extraction from banana pseudostem organised by ICAR Research Complex for NRH Region, Tripura on March 01, 2016.

Publication

Research Paper

- Ammayappan L, Debnath Sanjoy, Ray D P, Ghosh R K, Dasgupta S, Mondal D, Chakraborty S, Islam S & Musthafa I, Optimization of sodium hydroxide treatment for improved reinforcement with unsaturated polyester resin. *Indian Journal of Natural Fibres,* 1(2)(2015)233-244.
- Ammayappan L, Debnath Sanjoy, Sengupta Surajit, Effect of softness finishing on performance properties of jute blended fabric. *Indian Journal of Natural Fibres*, 2 (2), January (2016) 1.
- Ammayappan L, Lee J S, Jeyakodi Moses J and Ashok Senthil K, Comparison of biopolymer finishing with functional finishing on wool fibre, *Indian Journal of Fibre and Textile Research*, 40(4)(2015) 447-452.
- Ammayappan L., Jeyakodi Moses, J and Ashok Senthil K, Handle properties of wool/cotton union fabric finished with different finishing chemicals, *Indian Journal of Natural Fibres*, 2 (1) (2015) 7-19.
- Ammayappan, L. and Shakyawar D.B., Dyeing of Carpet Woolen Yarn using Natural Dye from Cochineal, *Journal of Natural Fibers*, 13(1) (2015)42 – 53.
- Banerjee P, Ray D P, Satya P, Debnath S, Ghosh R K, Mustafa I and Biswas P K, Gum based Screening and Characterization of Ramie (Boehmeria nivea. L Gaud.) for Textile Application, *Indian Journal of Natural Fibres* 2 (1) (2015)35-39.
- Banerjee Pradipta, Ray D.P., Debnath Sanjoy and Biswas P.K. 'Quality Attributes of North-East Himalayan Soil for Cultivation of Ramie (Boehmerianivea L. Gaudich.)', *International Journal of Agriculture, Environment and Biotechnology*, 8(4)(2015) 879-884.
- Banerjee Pradipta, Ray, D.P., Satya Pratik, Debnath Sanjoy, Mondal D, Saha S C and Biswas P K 'Evaluation of ramie fibre quality: A review', *International Journal of Bioresource Science*, 2 (1), April (2015) 65-69.
- Basak S, Samanta Kartick K, Chattopadhyay S K, and Narkar R, Thermally stable cellulosic paper made using banana speudostem sap, a wasted by-product, *Cellulose*, 22(4)May (2015) 2767-2776.
- Basu Gautam, Mishra Leena, Jose Seiko & Samanta A K, Accelerated retting cum softening of coconut fibre, *Industrial Crops and Products,* 77(2015)66–73.

- Chakraborty S., Weindorf D.C., Paul S., Ghosh B., Li B., Ali N., Ghosh R.K., Ray D.P. & Majumdar K. Diffuse reflectance spectroscopy for monitoring lead in landfill agricultural soils of India, *Geoderma Regional* , 5 (2015)77–85.
- Chattopadhyay S N, Pan N C, Roy A K & Khan A, Sustainable coloration of jute fabric using natural dyes with improved color yield and functional properties, *AATCC Journal of Research,* 2(2) (2015) 28-36.
- Chaudhary S K, Bhattacharya T K and Shambhu V B, Parametric standardization of catalyst removal from transesterified palm oil through wash water, *Agricultural Mechanization in Asia, Africa and Latin America (AMA),* 46(3) (2015) 53-56.
- Chauhan S, Roy A K, Sharma A K & Chattopadhyay S N, Enzymes for making tissue paper of archival use from jute, *Inpaper International*, 18(1) (2015) 97-101.
- Das Sujai, Ammayappan, L., Nayak, L.K., & Sen Utpal, Decision Support System for Jute Diversified Product, *International Research Journal of Engineering and Technology*, 2 (9)(2015)615-619
- Debnath Sanjoy, SenguptaSurajit Nag Debasis, 'Advancement of Jute Nonwoven in Agriculture'*, Annual Technical Volume of Textile Engineering Division Board*, Institution of Engineers (India), 1(February) (2016). 5-12.
- Ghosh R. K., Ray D. P. & Reddy D.D. Biomarkers: A tool for monitoring pesticide pollution, *International Journal of Bioresource Science*, 1(1)(2015)37-41.
- Ghosh R. K., Ray D. P., Chakraborty S., Majumdar K. & Reddy D.D. Pesticides in environment and their management strategies, *International Journal of Bioresource Science,* 2(1) (2015), 47-54.
- Gotmare V D, Samanta Kartick K, Patil V, Basak S & Chattopdhayay S K, Surface Modification of Cotton Textile using Low-Temperature Plasma, *International Journal of Bioresource Science,* 2 (1) (2015) 37-45.
- Khan Z.S., Girame R., Utture S.C., Ghosh R.K. & Banerjee K., Rapid and sensitive multiresidue analysis of pesticides in tobacco using low pressure and traditional gas chromatography tandem mass spectrometry. *Journal of Chromatography*, Part A, 41(8)(2015) 228-232.
- Mishra L, Basu Gautam & Samanta A K, Structure and property of Indian coconut fibre, *Annual Technical Volume Textile Engineering Div Board,* Institution of Engineers (India), 1 (2016) 50-56
- Mitra K, Rana JP, Naskar B and Ray D P, Relationship between Early Blight Disease Severity and Uptake of NPK by Potato Under Diverse Fertility Gradient of Soil, *International Journal of Bioresource Science*, 2(2) (2015) 129-137.
- Mondal D, Ray D P, Ammayappan L, Ghosh R K, Banerjee P & Chakraborty D, Pre-Treatment Processes of Jute Fibre for Preparation of Biocomposites, *International Journal of Bioresource Science*, 2 (l) (2015)7-14.
- Mondal D., Ray D.P., Ammayappan L., Ghosh R.K. & Debnath S. Coupling Agents for Natural Fibre and Polymer Reinforced Biocomposites, *Indian Journal of Natural Fibres* 2 (1) (2015) 97-105
- Naiya R, Chattopadhyay S N & Ghosh T S, Centralised information dissemination system among the jute and allied fibre research institutes of West Bengal: A proposal, *Indian Journal of Agricultural Library and Information Services*, 30(2), (2014) 32-36
- Nayak L K & Samuel D V K, Process optimization of instant pigeon-pea dal using sodium

chloride (NaCl) pretreatment, *Agricultural Science Digest*, 35 (2) (2015) 126-129

- Pan N C, Chattopadhyay S N & Roy A K, Application of biotechnology in the coloration of jute fabric using bis-triazinyl type of reactive dyes, *Indian Journal of Fibre & Textile Research*, 40(4)(2015) 414-418.
- Pan N C, Chattopadhyay S N & Roy A K, Development of particle board from cassava stalk using bio-adhesives, *Indian Journal of Natural Fibres*, 2(1), July, (2015) 79-84.
- Panda BB, Sharma SG, Mohapatra PK and Das Avijit, Iron homeostasis in tropical indica rice (Oryza sativa L.) cultivars having contrasting grain iron concentration, *Journal of Plant Biochemistry and Biotechnology,* Feb 22, (2016) pp: 1-10 (DOI 10.1007/s13562-016-0350-1).
- Panda P, Chakraborty S., Ray D P, Mahato B, Pramanik B, Choudhury A, Solubilization of Tricalcium Phosphate and Production of IAA by Phosphate Solubilizing Bacteria Isolated from Tea Rhizosphere Soil, *Economic Affairs,* 60(4) (2015) 803-807.
- Paul S, Chakraborty S, Ali M N and Ray D P, Arsenic distribution in environment and its bioremediation, *International Journal of Agriculture, Environment and Biotechnology*, 8(1) (2015) 189-204.
- Ray D P, Banerjee P and Nag Debasis, Improvement of Jute Retting Processes in India in the Context of Water Scarce Situation, *International Journal of Bioresource Science*, 2(2) (2015)101-110
- Ray D.P., Banerjee P., Ghosh R.K. & Nag Debasis. Accelerated Retting of Jute for Economic Fibre Yield, *Economic Affairs,* 60(4) (2015) 693-697
- Roy A N, Basu Gautam & Pan N C, Processing of banana fibre in jute spinning system and product development, *Indian Journal of Natural Fibres*, 1(2), January, 2015, 185-193.
- Samanta Kartick K, Patil P G, Saxena S, Arputharaj A, Basak S & Gayatri T N, Value Added Nano-finishing of Cotton Textile using Water-free Plasma Technology, *Cotton Research Journal*, 7(1) (2015) 83-92.
- Sen Utpal, Roy S B., Das Sujoi., and Nayak, L.K.. Extending Agricultural Advancements to Rural Bengal: Tools & Techniques, *International Research Journal of Engineering and Technology*, 3(1) (2015)283-290.
- Sengupta A & Sengupta Surajit, Workshop report in institute industry workshop on newly developed fabric flexural rigidity tester, yarn characterization unit and fabric electrical insulator tester for technical textiles, *Indian Journal of Fibre & Textile Research*, 40 (2) (2015) 220-221.
- Sengupta Surajit & Bose Gautam, 'Preparation of Jute Yarn and Fabric -a Traditional System and its Developments', *Annual Technical Volume of Textile Engineering Division Board*, Institution of Engineers (India), 1, February (2016) 42-48.
- Sengupta Surajit, Debnath Sanjoy, 'Jute Based Textiles in Modified Cotton Handloom', *Annual Technical Volume of Textile Engineering Division Board*, Institution of Engineers (India), 1(February)(2016) 38-41.
- Sengupta Surajit, Debnath Sanjoy, Sengupta Anindita, Fabric bending behaviour testing instrument for technical textiles, *Measurement* (Elsevier) Online published on March 2016. doi:10.1016/j.measurement.2016.03.030.
- Shambhu V. B. & Bhattachary, T. K., Production of biodiesel from *Jatropha curcas* L. oil having high free fatty acids content. *Agricultural Mechanization in Asia, Africa and Latin America*, 46(4)(2015)63-66.
- Srivastava S and Ray D P, Natural gum resources in India and their Commercial importance,

International Journal of Bioresource Science, 2(2) (2015)151-155.

- Teli M D, Pandit Pintu & Samanta Kartick K, Application of Atmospheric Pressure Plasma Technology on Textile, *Journal of the Textile Association*, March-April (2015) 422-427.
- Teli M D, Samanta Kartick K, Pandit Pintu, Basak S & Chattopadhyay S K, Low-temperature dyeing of silk fabric using atmospheric pressure helium/nitrogen plasma, *Fibres and Polymers*, 16(11) (2015) 2375-2383.
- Teli M D, Samanta Kartick K, Pandit Pintu, Basak S & Gayatri T N, Hydrophobic Silk Fabric using Atmospheric Pressure Plasma, *International Journal of Bioresource Science*, 2 (1) (2015) 15-19.

Seminar paper

- Chattopadhyay S N, Pan N C & Roy A K, *Fast colour natural dyed jute fabric with multi functional properties,* Proceeding of All India Seminar on 'Appropriate technologies of farm mechanization for marginal and small farmers', organized by Agricultural Engineering Division, The Institution of Engineers (India) on 8-9th August, 2014, 46-53 published in May, 2015
- Das Sujai., K.K. Mahanta, *Irrigation system using wireless system network*, proceeding of All India seminar on appropriate technology of mechanization for marginal and small farmer. organized by Agricultural Engineering Division, The Institution of Engineers (India) on 8-9th August, 2014, 59-63, published in May, 2015
- Pandit P, Teli M.D., & Samanta K K., *Optimization of Plasma Modification for Low Temperature Dyeing of Silk Fabric*, Invited Talk in Fourth International Conference on Natural Polymers, Bio-Polymers, Bio-Materials, their Composites, Nano-composites, Blends, IPNs, Polyelectrolytes and Gels: Macro to Nano Scales (ICNP–2015), 10-12th April, 2015, Kerala, India.
- Samanta Kartick K, Saxena S, Basak S, Arputharaj A & Gayatri T N, *Water-free Sustainable Textile Processing using Atmospheric Pressure Cold Plasma*, in the book of papers, 30th National Symposium on Plasma Science and Technology (PLASMA 2015), Saha Institute of Nuclear Physics, Kolkata on December 1-4, 2015.
- Samanta Kartick K, Teli M D, Pandit Pintu & Basak S, *Low Temperature Eco-friendly Dyeing of Silk Fabric using Plasma Technology*, National Seminar on Indian Handloom Textiles in the Context of Globalization, June 27-28, 2015, Visva-Bharati, West Bengal, India.
- Nayak L K and Jha S N, *Evaluation of jute nonwoven cooling pads in evaporatively cooled storage structure*, Proceedings of The All India Seminar on Appropriate technologies on farm mechanisation for marginal and small farmers organised by Agricultural Engineering Division, The Institution of Engineers (India), published on May 2015, 54-58.
- Nayak L K and Shambhu V B, *Potential and prospects of jute stick as raw materialfor biomass energy*, Proceedings of The All India Seminar on Appropriate technologies on farm mechanisation for marginal and small farmers organised by Agricultural Engineering Division, The Institution of Engineers (India), published on May 2015, 77-79.
- Shambhu V B and Nayak L K, *Energy requirement in cultivation of jute crop in West Bengal*, Proceedings of The All India Seminar on Appropriate technologies on farm mechanisation for marginal and small farmers organised by Agricultural Engineering Division, The Institution of Engineers (India), published on May 2015, 70-76.

- Shambhu V B, *A simple and low cost drill for sowing of jute seeds*, Proceedings of The All India Seminar on Appropriate technologies on farm mechanisation for marginal and small farmers organised by Agricultural Engineering Division, The Institution of Engineers (India), published on May 2015, 14-18.
- Roy Gautam and Saha S C, *An automated microprocessor based integrated jute grading instrument,* Proceedings of The All India Seminar on Appropriate technologies on farm mechanisation for marginal and small farmers organised by Agricultural Engineering Division, The Institution of Engineers (India), published on May 2015, 42-45.

Book Chapter

- Ammayappan L. and Jose Seiko, Functional Aspects, Eco-testing, and Environmental Impact of Natural Dyes, *Handbook of Sustainable Apparel Production*, Ed. S.S.Muthu, CRC Press, USA, 2015, pp.333-350
- Ammayappan, L., Jose, Seiko, Arputha Raj, A.,. Sustainable Production Processes in Textile Dyeing, *Green Fashion*, Vol.I, Eds: S. S. Muthu and M.A.Gardetti, Springer Singapore, 2015, pp. 185-216.
- Debnath Sanjoy Chapter 4: Natural Fibres for Sustainable Development in Fashion Industry. Book Title, 'Sustainable Fibres for Fashion Industry', Part of the series 'Environmental Footprints and Eco-design of Products and Processes', In: Muthu S S and Gardetti M A (eds). Springer Science+Business Media Singapore, ISBN 978-981-10-0522-0, DOI 10.1007/978-981-10-0522-0_4. available in internet from 24th March, 2016.
- Debnath Sanjoy, 'Pineapple leaf fibre–A sustainable luxury and industrial textiles'. Book Title: *Handbook of Sustainable Luxury Textiles and Fashion, Environmental Footprints and Eco-design*',Eds. Gardetti M A and Muthu S S. Springer Science+Business Media Singapore, 2016, pp. 35-49. DOI 10.1007/978-981-287-742-0_3
- Debnath Sanjoy, Chapter 1: Unexplored vegetable fibre in green fashion. Book Title, 'Green Fashion' Part of the series 'Environmental Footprints and Eco-design of Products and Processes', In: Muthu S S and Gardetti M A (Eds). Springer Science+Business Media Singapore, January 2016, pp. 1-19. Print ISBN 978-981-10-0244-1, Online ISBN 978-981-10-0245-8, DOI 10.1007/978-981-10-0245-8_1.
- Debnath Sanjoy, Chapter 12: 'Design, Development, Characterization, and Application of Jute-based Needle-Punched Nonwoven', Book title 'Non-woven Fabrics', In: Han-Young Jeon, Publisher: InTech, pp. 277-295. ISBN: 978-953-51-4586-8, DOI: 10.5772/61705. Available online from 24th March, 2016.
- Debnath Sanjoy, Chapter 5: 'Design and Development of Jute-Based Apparels', Book title: 'Handbook of Sustainable Apparel Production', Ed. Subramanian SenthilkannanMuthu, CRC Press, Taylor & Francis Group, USA, April 2015, ISBN 978-1-4822-9937-3, pp. 97-111.
- Debnath Sanjoy, Design and Development of Jute-Based Apparels, in *Handbook of Sustainable Apparel Production*, Ed. S S Muthu, CRC Press, USA, 2015, 97-111
- Debnath Sanjoy, Great Potential of Stinging Nettle for Sustainable Textile and Fashion, in *Handbook of Sustainable Luxury Textiles and Fashion*, Eds. M.A. Gardetti and S.S. Muthu, Springer Book publication, Singapore, 2015, 43-57.
- Samanta Kartick K, Basak S & Chattopadhyay S K, Recycled Fibrous and Non-fibrous Biomass for Value Added Textile and Non-textile Applications, in *Environmental*

Implication of Recycling and Recycled Products, *Ed.* S.S. Muthu, Springer Book Publication, Singapore, 2015, 167-212.

- Samanta Kartick K, Basak S & Chattopadhyay S K, Speciality Chemical Finishes for Sustainable Luxurious Textiles, in *Handbook of Sustainable Luxury Textiles and Fashion*, Ed. M. A. Gardetti and S.S. Muthu, Springer Book Publication, Singapore, 2015, 145-184.
- Samanta Kartick K, Basak S, Chattopadhyay S K & Gayatri T N, Water-Free Plasma Processing and Finishing of Apparel Textiles, in *Hand Book of Sustainable Apparel Production*, Ed. S. S. Muthu, CRC Press, USA, 2015, 3-37
- Samanta Kartick K., Basak S., and Chattopadhyay S. K., Book Chapter 3 on "Sustainable Flame-Retardant Finishing of Textiles: Advancement in Technology", CRC Press (Taylor and Francis), Hand Book of Sustainable Apparel Production (*Ed.* S.S. Muthu), 2015, pp. 51-75.
- Samanta Kartick K., Basak S., and Chattopadhyay S. K., Book Chapter 6 on "Sustainable UV Protective Apparel Textile", CRC Press (Taylor and Francis), Hand Book of Sustainable Apparel Production (*Ed.* S.S. Muthu), 2015, pp. 113-137.

Book

- Ray D P, Saha S C, Roy G & Nag D, *Jute Retting*, New Delhi Publishers, New Delhi, 2015, 120 p, ISBN: 978-93-85503-30-6.
- Roy, A.N. and Nayak, L.K , *Extraction, Processing & Diversification of Jute & Allied Fibres*, published by ICAR-NIRJAFT, August, 2015, 290p
- Sur D, Kundu S K, Das B K and Saha S C, Investigations on Science and Technology of Jute and Allied Fibres, collection of important research works by Dr S B Bandopadhyay published in the occation of 100th birthday of Dr Bandopadhyay, January, 2016, ICAR-NIRJAFT, 110p

Technical Bulletin/Manual/ Report/Leaflet/ brochure

- Chattopadhyay S N, Technical Bulletin on Handmade paper from jute - Published by ICAR-NIRJAFT
- ICAR-NIRJAFT Annual Report, 2014-15 .
- ICAR-NIRJAFT news, Oct, 2014 - March, 2015 .
- ICAR-NIRJAFT News,April- Sept, 2015.
- Pan N C, Technical Bulletin on Chemical processing of ramie fibre - Published by ICAR-NIRJAFT
- Pan N C, Technical Bulletin on Prospect of jute stick as a raw material for the development of particle board - Published by ICAR-NIRJAFT
- Ray D P, Saha S and Sarkar A, Accelerated Retting of Whole jute plant, ICAR-NIRJAFT Publication, English, August, 2015
- Ray D P, Saha S and Sarkar A, Jute ka twarit saran (Accelerated Retting of Jute), ICAR-NIRJAFT Publication, Hindi, July, 2015.
- Ray D P, Saha S and Sarkar A, Pater Twarito Pachan Paddhati (Chemical Retting of Jute), ICAR-NIRJAFT Publication, Bengali, August, 2015.

- Ray DP, Saha SC, Banik S and Roy Gautam, Advanced Technologies for Jute Retting, ICAR-NIRJAFT Publication, English, July, 2015.
- Roy, A. N. & Nayak, L. K. Training Manual of the National Level Training on "Production and retting technology of Jute/Mesta/Ramie/Sun-hemp including other related aspects" sponsored by National Food Security Mission (NFSM), Commercial Crops, Department of Agriculture & Co-operation, Ministry of Agriculture, Govt. of India during August - Sept, 2015.
- Sengupta A., Sengupta Surajit and Bhattacharyya K, Final report of DST project entitled Development of an efficient staple yarn characterization unit with multi sensor fusion and field Programmable gate array (FPGA) based data reduction card (IDP/IND/2010/25)
- Sengupta Surajit, Debnath Sanjoy & Sengupta A. Final report of DST project entitled 'Design & development of computerized instrument for testing bending behaviour of semi-rigid fabrics with special reference to technical textiles' (IDP/IND/2010/19)

Popular Article/ Technical Article

- Roy A. N. and Samanta Kartick K., "Modification of coarser yak fibre for blending with jute fibre in jute spinning system", published in *the book of papers of Fourth Interface Meeting on Holistic approaches to sustain livelihood of yak rearers through scientific intervention in India*, March 2016, pp. 61-76, Published by ICAR-National Research Centre on Yak, Arunachal Pradesh
- Das Robin, Mishra L, Mustfa Izhar & Basu Gautam, Indian pinapple leaf fibre, *Souvenir of Annual Re-union of Institute of Jute Technology* , Kolkata, India, 26st January, 2016, 63- 69.
- Das Sujai., Ahirwar, K. L. "*Joot Se Aarthik Vikas Ki Apaar Sanbhawnaen Aur Samasyaen*" (Hindi) in *Neelanjali Magazine*, 6(2015)34-40.
- Nayak, L.K., Mohan, N.H. and Shambhu, V.B. *Bamboo fibre: A boon to textile industry*, *COMSOMATH: Computer Science, Social Science and Mathematics,* 18 (1) (2015) 39-41.
- Pan N C, Chattopadhyay S N & Parta K, A cost efficient and ecofriendly option for making particle board, *Textile Asia*, 46 (4), May, 2015, 27-28.

Seminar/Conference/Workshop/ Training/Meeting Attended

Programme	Organised by	Date	Name
Meeting of Board of Studies	J D Birla Institute (Department of Textile Science, Clothing & Fashion Studies) under Jadavpur University	April 0 6	Gautam Basu
CACP Meeting	Ministry of Agriculture, Govt. of India at Krishi Bhawan	April 07	Debasis Nag S C Saha
Engineering Workshop on "Making Engineering Scientists' contribution more meaningful to stake holder and the nation"	Division of Agril. Engineering, ICAR at Lecture Hall, NASC Complex, New Delhi	April 13	Deba sis Nag
11th National Symposium on "Dynamics of Crop Protection: Challenges in Agri-horticultural Eco systems Facing Climate Change"	Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan	April 23 -25	D P Ray
Jute-Coordination Committee (JCC) Meeting	National Jute Board, Kolkata	May 08	Debasis Nag
Lecture on " Green Technology" delivered by Dr S R Moulick and Dr P K Chaudhury, Asstt Prof, Dept of Silpa Sadan, Textile Section, Visva Bharati, Shanti Niketan	Textile Engineering Division, The Institution of Engineers (India), Kolkata	May 08	All Scientists & Technical Officers
First Taskforce Meeting 2015-16 of Agri & Food Processing	The Bengal Club, Kolkata	May 13	Debasis Nag

Programme	Organised by	Date	Name
Weekly Technical Lecture on 'Transmigration of mineral oil hydrocarbons from jute bags to packed food items'	IJIRA, Kolkata	May 13	G. B asu , Seiko Jose
Directors' and Vice Chancellors' conference	NAAS Complex, New Delhi	May 15-16	Debasis Nag
Technical lecture entitled "Natural dyes : sources, chemistry and application in textiles" delivered by Shri R Chakraborty, Scientist	IJIRA, Kolkata	May 20	N C Pan S N Chattopadhyay
Meeting with NJMC Officials	National Jute Board Office, Kolkata	May 20	Debasis Nag
16th Prof Hemchandra Dasgupta Memorial Lecture on "India's successful Mars Mission" delivered by Dr Debiprasad Duary, Director (Research & Academic) M P Birla Institute of Fundamental Research and M P Birla Planetorium, Kolkata	Mechanical Engineering Division, The Institution of Engineers (India)	May 20	S N Chattopadhyay
ICAR Regional Committee III Meeting	Agartala, Tripura	May 22-23	Debasis Nag
Zone II KVK Workshop	ICAR-CIFRI, Barrackpore	May 26-27	Debasis Nag
Fourth annual review workshop of NFBSFARA funded research projects	NASF, ICAR, New Delhi	May 28-29	L Ammayappan D P Roy
Technical lecture on "Nanofinishing of jute with titania"	IJIRA, Kolkata	May 29	Kartick K. Samanta
World Water Day Celebration, theme "Rain water harvesting"	Agricultural Engineering Division, The Institution of Engineers (India), Kolkata	May 29	All Scientists & Technical Officers

Programme	Organised by	Date	Name
International conference on Emerging Global Business opportunities for Entrepreneurs	Vijayawada	May 29-30	Seiko Jose
Meeting of Expert Advisory Group of DST-IDP	CSIR-Central Glass & Ceramic Research Institute (CGCRI), Kolkata	May 30	Surajit Sengupta
Lecture in connection with "World Environment Day 2015"on "Seven billion dreams, one planet, consume with care"	Environmental Engineering Division, The Institution of Engineers (India), Kolkata	June 05	S N Chattopadhyay
A meeting for the "Formulation of comprehensive guidelines for the new R & D Schemes"	Jute Commissioner's Office	June 15-16	Gautam Basu
2nd Jute Coordination Committee Meeting	Jute Commissioner's Office	June 19	Debasis Nag
Review Meeting of the project NFBSFARA/FQ-3030	CRIJAF, Kolkata	June19	D.P.Ray
Invitation lecture delivered by Dr A Das Rabindranath, Central Coir Research Institute, Kerala and by Shri G Mukhopadhyay, IJIRA	IJIRA, Kolkata	June 24	Debasis Nag
West Bengal Veterinary Council Seminar delivered by Dr Sanjeev Baliyan, Ministry of State for Agriculture and Food Processing Industries, Govt. of India	Kolkata	June 29	Debasis Nag
Lecture meeting on "Recent advances in rolling technology" by Dr. Siddhartha Ray, Professor & Dean, Heritage Inst. of Technology and Former Director, National Institute of Technical Teachers' Training and Research, Kolkata	Production Engineering Division of West Bengal State Centre, The Institution of Engineers (India). Kolkata.	July 03	L.K. Nayak V. B. Shambhu, Sanjoy Debnath

Programme	Organised by	Date	Name
Open House with Shri Pravir Kumar, IAS, Director General of Foreign Trade, Ministry of Commerce & Industry, Govt. of India	Confederation of Indian Industry (CII) at The Park, Kolkata	July 03	Debasis Nag
Awareness Workshop on JGT	Salt Lake City, Kolkata	July 17	Debasis Nag
Eastern Zonal Task Force Meeting of CII	ITC Virginia House, Kolkata	July 22	Debasis Nag
Directors' and Vice Chancellors' Conference	Patna, Bihar	July 25-26	Debasis Nag
Seminar on "Disaster Management against Biological and Chemical Terrorism"	The Institution of Engineers (India), Kolkata	July 25	S N Chattopadhyay, Kartick K. Samanta
Attended the Contact Classes of Post Graduate Diploma in Technology Management in Agriculture (PGDTMA)	NAARM, Hyderabad & University of Hyderabad	August 8-14	D.P.Ray
3rd Coordination Committee Meeting	Jute Commissioners Office at NJB Conference Hall, Kolkata	August 22	Surajit Sengupta
Meeting of the Members of Indian Society of Agricultural Engineers (ISAE)-Kolkata Chapters	ISAE - Kolkata Chapter at ICAR-NIRJAFT, Kolkata.	August 29	Debasis Nag, L.K. Naya, V.B. k Shambhu
Foundation Stone laying programme of Patsan Bhawan and Display Centre by Shri Santosh Kumar Gangwar, Union Minister of State for Textiles, Govt. of India	Newtown, Kolkata	September 01	Debasis Nag
The seminar on Geo-textile/Agro-textile	Kohima, Nagaland	September 04	Debasis Nag
Meeting with Mr Themcho Tunyi, Ex-Home Minister and Speaker of Nagaland	ICAR-National Research Centre for Mithun, Medziphema, Nagaland	September 05	Debasis Nag

Programme	Organised by	Date	Name
Technical workshop cum exhibition on "Applications of jute Geotextiles	Hotel Polo Towers, Shillong, Meghalaya	September 11	Gautam Basu
48th Engineers Day Lecture on "Engineering Challenges for Knowledge Era"	West Bengal State Centre, The Institution of Engineers (India), Kolkata	September 15	S N Chattopadhyay, N C Pan, Sanjoy Debnath
Mid-term review meeting, ICAR Regional Committee II	ICAR- CIFRI, Barrackpore	September 19	Debasis Nag
Seminar on "Ready to use Steel in Construction	Civil Engg. Division, West Bengal State Centre, The Institution of Engineers (India), 8 Gokhale Road, Kolkata 700 020.	September 23	Sanjoy Debnath
18th Meeting of Geosynthetics Sectional Committee (TX 30) and 7th Meeting of Industrial Fabrics Sectional Committee (TX 30) BIS	BIS at BTRA, Mumbai	September 29	Gautam Basu
15th Prof. N. Majumdar Memorial Oration	Environmental Engg. Divisional Committee, West Bengal State Centre, The Institution of Engineers (India), Kolkata	September 30	Sanjoy Debnath
Inaugural function of "Jute materials exhibition-cum-sale"	Ashar Aalo Maa Saroda Cancer Help Line (An NGO), Jamshedpur, Jharkhand	October 05	L.K. Nayak, S.B. Roy
Lecture Meeting on "Total Quality Management"	Production Engg. Divisional Committee, West Bengal State Centre, The Institution of Engineers (India) Kolkata	October 9	Sanjoy Debnath
Krishi Unnayan Mela-2015	Confederation of Indian Industry (CII), Eastern Region in association with Department of Agriculture, Government of West Bengal at Burdwan, West Bengal	October 8-10	Debasis Nag, Alok Nath Roy, Sujai Das

Programme	Organised by	Date	Name
Meeting with Project Implementation Unit of CRP on Natural Fibres.	Project Implementation Unit, CRP on Natural Fibres at ICAR CIRCOT, Mumbai.	October 14	L.K. Nayak
Special Task force meeting on User -friendly jute grading system	ICAR-NIRJAFT	October 17	Debasis Nag, S C Saha, Gautam Roy, Gautam Basu, D. P Ray, U Sen, A Sarkar
Technical Assessment Committee's meting	ICAR-CRIJAF, Barrackpore	October 17	V B Sambhu
Workshop on "Developing road map for lower gangetic plain areas"	ICAR-CIFRI, Barrackpore	October 31	S B Roy
Interactive meeting with DDG (AE), ICAR	ICAR-ATARI, Kolkata	November 01	D Nag, S Debnath
12th International Exhibition and technical conference on "Pulp, Paper and allied industries" on the theme "Indian pulp & paper industries - INNOVATIONS : need of the hour"	Conference Auditorium, Pragati Maidan, New Delhi	November 4	S N Chattopadhyay
Golden Jubilee inaugural function of College of Agricultural Engineering & Technology (CAET), OUAT, Bhubaneswar, Odisha.	College of Agricultural Engineering & Technology (CAET), OUAT, Bhubaneswar, Odisha.	November 02	L.K. Nayak
Seminar on "Irrigation system for small farmers" at NIRJAFT, Kolkata	Agricultural Engg. Divisional Committee, West Bengal State Centre, The Institution of Engineers (India), 8 Gokhale Road, Kolkata 700 020	November 07	All scientists and technical officers
Meeting with the In-Charge, Scientists and Technical Staffs of ICAR-CRIJAF, Sisal Research Centre, Bamra, Odisha	In-Charge, ICAR-CRIJAF, Sisal Research Centre, Bamra, Odisha	November 09	L. K. Nayak Sanjoy Debnath

Programme	Organised by	Date	Name
Meeting with Managing Director, M/S AKRITI, A leading manufacturer and supplier of agricultural machineries in the state of Odisha.	M/S AKRITI, Bamra, Odisha	November 10	L.K. Nayak Sanjoy Debnath
Taylor & Francis interactive digital library event on "Evolving librarian : trends, challenges, new environment & partnerships"	Taylor & Francis Group, Kolkata	Nov 19	S N Chattopadhyay
Panel discussions on "Food processing industry-Adding value to Agri-Horti & Food Products"	Indian Chambers of Commerce (ICC) in collaboration with the Ministry of Food Processing Industries, Government of India. Hotel ITC Sonar, Kolkata	November 20	L.K. Nayak S.B. Roy
Seminar on "Chemical Engineering and biotechnology process intensification through innovative computation"	Chemical Engineering Division, IE(I)	November 21	S N Chattopadhyay
Workshop on "Occupational Mapping and Functional Analysis of all categories work force employed in the jute industry"	DJFT, University of Calcutta for National Standardisation of jobwise / stage wise workers training models by an industry-institute interaction	November 24	S N Chattopadhyay
Vigilance Review Meeting	Agartala, Tripura	November 27	Gautam Roy
30th National Symposium on Plasma Science and Technology (PLASMA 2015)	Saha Institute of Nuclear Physics, Kolkata,	December 01-04	K Samanta Kartick
Attended the Contact Classes & Examination of Post Graduate Diploma in Technology Management in Agriculture (PGDTMA)	NAARM, Hyderabad & University of Hyderabad	December 5-14	D P Ray

Programme	Organised by	Date	Name
National Seminar on "Irrigation system for small farmers"	Agricultural Engineering Division, The Institution of Engineers (India), Kolkata	December 07	All scientists and Technical Officers
Interface Meet of Scientists & Dairy industry partners on "Commercialization of Dairying through production and traditional processing".	ERS, ICAR-NDRI, Kalyani, Nadia, West Bengal	December 12	L.K. Nayak
Meeting with In- charge, ICAR Research Complex for NEH Region Tripura Centre	ICAR Research Complex for NEH Region Tripura Centre, Lembucherra, Tripura.	December 17	L.K. Nayak
Workshop on "Unified messaging & web hosting solution"	IASRI at CIFRI, Barrackpore	December 18	Sujoi Das K G Nath
Inaugural function of "Kisan Sammelan & Technology Week"	Krishi Vigyan Kendra (KVK), Jagatballavpur, Howrah	December 19	L.K. Nayak
Interaction meet-cum-workshop of National Agricultural Innovation Fund (NAIF)	NASC Complex, New Delhi	December 23	A N Roy
47th meeting on Official Language at Bhasha Bhawan, National Library, Kolkata	Kolkata Town Official Language Implementation Committee, Zone-8	December 16	R.D. Sharma
CAS meeting	ASRB, New Delhi	December 18	Debasis Nag
Board meeting at Udyog Bhavan, New Delhi	National Jute Board (NJB)	December 29	Debasis Nag
Meeting of Project Approval Committee (PAC)	Udyog Bhawan, New Delhi	December 30	R K Ghosh
Training on Garment Manufacturing from jute-yak fibre blended fabric	NRC Yak, Dirang, Auranachal Pradesh Under NEH (North East Hill) Component of ICAR-NIRJAFT	January 07	A N Roy, Sanjoy Debnath

Programme	Organised by	Date	Name
Bengal Global Business Summit 2016	Govt of WB	January 8-9	Kartick K. Samanta
50th Annual Convention of ISAE and Symposium on Agricultural Engineering in Nation Building: Contributions and Challenges	College of Agricultural Engineering and Technology (CAET), Orissa University of Agriculture and Technology (OUAT)	January 19-21	V B Sambhu, L K Nayak
Meeting with Ms Choten D Lama, IAR, State Mission Director & Chief Executive Officer, ANANDADHARA for Field Trial of Sanitary Napkins	West Bengal State Rural Livelihood Mission, Salt Lake , Kolkata	January 25	S N Chattopadhyay
Interna tional Extension Education Conference (IEEC) -2016 on *Education, Research & Services*	Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University (BHU) at Varanasi, Uttar Pradesh	January 27-30	L K Nayak
Review Meeting on CRP on Natural Fibres	Project Implementation Unit, CRP on Natural Fibres, ICAR-CIRCOT, Mumbai.	January 30	L.K. Nayak. Gautam Roy, S.N. Chattopadhyay
12th Annual Group Meeting of AINP	BCKV, Kalyani	February 3-4	Debasis Nag, S C Saha, A Sarkar
Seminar on "*Food processing conclave: Make in Bengal* " at Hotel ITC Sonar, Kolkata	Confederation of Indian Industry (CII).	February 05	L.K. Nayak
Annual Review Meeting of Ongoing Projects under NASF	NASC Complex, New Delhi	February 9-12	D.P.Ray
Meeting with Ms Kristin Kagetse, Chief Executive Officer, SATHI, Ahmedabad, Gujarat	ICAR-NIRJAFT, Kolkata	February 05	S N Chattopadhyay, N C Pan

Programme	Organised by	Date	Name
National Seminar on "Jute Diversified Products (JDPs)"	National Jute Board in Kolkata at Rabindra Tirtha, New Town	February 19	Debasis Nag, A N Roy, N C Pan, S B Sanjoy Roy, Debnath, L Ammayappan, L K Nayak Kartick K, Samanta, R K Ghosh,
Technological Conference on "Trends in Textiles & Garments"	The Textile Association (India) West Bengal unit at NIFT, Kolkata	February 20	Kartick K. Samanta N C Pan, S N Chattopadhyay
Annual Review Workshop of CRPs on natural Fibres	SMD-Engineering at ICAR-CIAE, Bhopal	March 09-11	L.K. Nayak, Gautam Roy, S N Chattopadhyay
19th meeting of Geo-synthetics sectional committee (TX 30) and 8th meeting of Industrial Fabrics sectional meeting (TX 33)	BIS at BTRA, Mumbai	March 17	Kartick K. Samanta
Sensitization Workshop on 'Agri -Business Incubation'	ICAR-National Academy of Agricultural Research Management, Rajendranagar, Hyderabad, Telangana, India	March 21-22	Sanjoy Debnath

Training and Capacity Building

Participation in Training

Training	Organised by	Duration	Name of staffs
Production & Retting Technology of Jute/Mesta/Ramie/Sunhemp Including Other Related Aspects	ICAR-NIRJAFT, Kolkata, sponsored by National Food Security Mission (NFSM), Commercial Crops, Ministry of Agriculture, Govt. of India	August 4-6	Dr Kartick K. Samanta
'DST-Lockheed Martin India Innovation Growth Programme 2015' on Technology Commercialization and Entrepreneurship Workshop	STANFORD Graduate School of Business at Goa.	April 12-17	Dr Kartick K. Samanta
Production & Retting Technology of Jute/Mesta/Ramie/Sunnhemp including other related aspects	ICAR-NIRJAFT, Kolkata, sponsored by National Food Security Mission (NFSM), Commercial Crops, Ministry of A griculture, Govt. of India	August 25-27	Biman Das, Sudipta Bhowmik, Karunamoy Patra
Production & Retting Technology of Jute/Mesta/Ramie/Sunhemp Including Other Related Aspects	ICAR-NIRJAFT, Kolkata, sponsored by National Food Security Mission (NFSM), Commercial Crops, Ministry of Agriculture, Govt. of India	September 08-10	Dr Debabrata Das, Kausik Manna, Chanchal Kundu, Subir Kundu, Tarun Kr Kundu, Kamal Banerjee, Izahar Mustafa,
HRD Workshop for Jute Industry	DJFT, Calcutta University, Kolkata	July 28	Dr Debasis Nag
The two days Workshop on "KRISHI" i.e. Knowledge Based Resource Information System Hubs for Innovation in Agriculture	ICAR NAAS Complex, New Delhi	August 4-5	Dr S B Roy

Training Organised

Program	Collaboration with/ Sponsored by	Venue	Duration	Participants
Short term (1 month) training programme on "Jute Chappal"	Development Commissioner (Handicrafts), Ministry of Textiles, Govt. of India	ICAR NIRJAFT, Kolkata	April 1-30	10
Long term training programme (3 Month) on "Jute Handicrafts"	Development Commissioner (Handicrafts), Ministry of Textiles, Govt. of India	ICAR NIRJAFT, Kolkata	Completed on April 30	10
Training programme on "Jute Handbag/Shopping bag"	Self sponsored	ICAR NIRJAFT, Kolkata	June 15-27	22 (10 male & 12 female) belonging to 04 SC; 01 ST; 01 OBC and 16 General
National Level Training programme on "Production and retting technology of Jute/Mesta/Ramie/Sun -hemp including other related aspects"	National Food Security Mission (NFSM), Commercial Crops, Department of Agriculture & Co-operation,Ministry of Agriculture, Govt. of India	ICAR-NIRJAFT, Kolkata	August 4-6, August 25-27, and September 8-10	75 from Odisha, AP, WB, Bihar and UP
Training programme on "Jute Handicraft & Jewellery"	Self sponsored	ICAR NIRJAFT, Kolkata	Sept 14-30	24 (08 male & 16 female) belonging to 6 SC, 1 ST, 17 General
National Training on New Jute Grading System	Jute Corporation of India	ICAR - NIRJAFT, Kolkata	November 16-17 November 18-19 November 20-21	45 from different JCI offices of WB, Odisha, Assam, Bihar and Tripura.
Training Programmes on 'Advance Jute Handicraft".	Self-Sponsored	ICAR - NIRJAFT, Kolkata	January 18-30	21 entrepreneurs (10 male, 11 female)

Program	Collaboration with/ Sponsored by	Venue	Duration	Participants
Farmers meet under "Mera Gaon Mera Gaurav" programme at Damorgacha village, PO: Inchura, Block: Balagarh, Dist: Hooghly, West Bengal.	-	ICAR - NIRJAFT, Kolkata	June 03	29
			July 22	24
Farmers' Interface Meeting at Babpur near Barasat, under "Jai Kisan Jai Vigyan"	-	ICAR - NIRJAFT, Kolkata	Dec 29	40 villagers from Babpur, Mathurapur, Ariala, Bodai, Durlavpur and Hansia
Training programme on "Development of garments from jute/yak fibre blended fabric"	ICAR-National Research Centre on Yak, Dirang, Arunanchal Pradesh	ICAR - National Research Centre on Yak,Dirang, Arunanchal Pradesh	January 7-11	-
Technology Demonstration-cum-Training Programme on "Fibre Extraction from Banana Pseudo-stem"	ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra, Tripura	ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra, Tripura	March 01	Eighteen
"Training in Skill development on Jute Diversified products" Four training programmes (Jute Handicrafts-2 and Jute fabric Bags-2)	Funded under "Natural Fibre Mission with the Aegis of Special BRGF Fund" in association with Office of The General Manager, Districts Industries Centre, Dakshin Dinajpur, Balurghat, West Bengal	ICAR-NIRJAFT, Kolkata	March 01-31	20 participants in each programme (Total 80)
Workshop on "Role of Information Technology in Library Management in Digital Era"	-	ICAR-NIRJAFT, Kolkata	Dec 22	All scientists and technical officers

Program	Collaboration with/ Sponsored by	Venue	Duration	Participants
Workshop on Official Language hindi	Hindi Teaching scheme, Department of Official Language, Ministry of Home Affairs, Government of India	ICAR-NIRJAFT, Kolkata	May 23	22 staff members
			Dec. 19	28 staff members
Workshop on Noting and Drafting	Hindi Teaching scheme, Department of Official Language, Ministry of Home Affairs, Government of India	ICAR-NIRJAFT, Kolkata	Sept 21	24 staff members
			February 20	21 staff members
Training on Hindi Language	Central Hindi Training Institute, Department of Official language, Ministry of Home Affairs.	ICAR-NIRJAFT, Kolkata	June 09-July 06 (Praveen), July 07-27 (Pragya)	11 staff members

HRD Fund Allocated & Utilization

Fund Allocated : ₹ 1,50,000/-

Fund Utilization : ₹ 1,48,927/-




In House Seminar

Date	Speaker	Designation	Topic
April 04	Shri K. G. Nath	Senior Technical Assistant, PME Cell	Office automation using Oracle.
April 24	Dr. L. Ammayappan	Senior Scientist, CBP Division	A Novel Eco-Friendly Pre-treatment to Enhance the Interfacial adhesion of Jute textiles for the Preparation of Bio-Composite sheet
June 06	Mrs. Leena Mishra	Technical Assistant, MP Div.	Microencapsulation of Disperse Dyes for Coloration of Polyester
June 18	Mr. Seiko Jose	Scientist, MP Div.	Technology Transfer in Jute and Allied Fibres
July 03	Dr.Sanjoy Debnath	Senior Scientist , MP Div.	Sustainable development of Northern disadvantaged districts of West Bengal
July 17	Mr. Pradipta Banerjee	Senior Research Fellow, QEI Div.	Studies on the variation of fibre quality of ramie grown in two different soil regimes
July 31	Dr. Utpal Sen	Chief Technical Officer, PME Cell	Influence of soil properties on plant fibre quality
August 07	Dr. S.B. Roy	Principal Scientist, TOT Div.	KRISHI-Knowledge Based Resources Information Systems Hub for Innovations in Agriculture
August 13	Dr. Debasis Nag	Director	An overview on Performance evaluation of RFD of DARE/ICAR, RC's and RSC's
Sept 04	Mr. Rajeev Lal	Chief Administrative Officer	Financial Management and Budgeting in Government/ICAR
Sept 11	Mr. Sujai Das	Scientist (SS), TOT Div.	Machine Vision and Tracking
Sept 18	Mrs. Ruby Das	Technical Assistant, QEI Div.	High density Lipoprotein in Female Population
Oct 09	Dr. D.P.Ray	Sr. Scientist, QEI Div.	Phytochemicals from Jute Seed: A Biorational Approach

Date	Speaker	Designation	Topic
Oct 10	Dr. G.Roy	Head, QEI Div.	Quality Management Systems Using ISO 9001:2008 & ISO 9001:2015
Nov 06	Mr. T.S. Ghosh	Technical Assistant, Library	Library Automation in ICAR-NIRJAFT
Nov 20	Dr. U. Sen	Chief Technical Officer, PME Cell	Towards a modern soil testing approach: Soil health cards and tailored prescription
Nov 11	Shri. G. Sardar	Technical Assistant, QEI Div.	Model based controller designing for first-order time delay (FOPDT) process
Dec 04	Dr.S.N.Chattopadhyay	Principal Scientist, CBP Div.	Overview of PAPEREX-2015
Dec 11	Dr. B. Saha	Principal Scientist, QEI Div.	Soil Health: Key to Sustainable Agriculture
Jan 01	Dr. K.K. Samanta	Scientist, CBP Div.	An overview of PLASMA 2015
Jan 08	Shri. Rabin Das	Technical Assistant, MP Div.	Study on the potentiality of sugarcane fibre as an oil absorbent
Jan 15	Dr. V.B.Shambhu	Sr Scientist, TOT Div.	Improved Technology for Extraction of Ribbons/Barks from Jute & Mesta Plants
Jan 21	Dr. L.Ammayappan	Sr Scientist, CBP Div.	Value Chain on Jute: Seed to Market
Jan 29	Dr. G. Basu	Head, MP Div.	Testing of Geo-textiles and some related arguments
Feb 08	Dr. D. Nag	Director	Future Training Program of ICAR-NIRJAFT
Feb 11	Dr. G. Roy	Head, QEI Div.	Digital Colour Lustre Meter
March 04	Dr. R. Naiya	I/C, Library	An overview on Strengthening and Sustainability of E-Granth
March 11	Dr. S.C.Saha	Sr Scientist, QEI Div.	Digital Colour & Lustre Meter for Lignocellulosic Fibres
March 19	Dr. S.C.Saha	Sr Scientist, QEI Div.	Agricultural Research Management

Awards & Recognition

Dr Debasis Nag, Director

- Chairman, Agricultural Engineering Division of West Bengal State Centre, The Institution of Engineers (India).
- Member, Jute Co-ordination Committee, Ministry of Textiles, Govt of India.
- Chairman, Indian Society of Agricultural Engineers (ISAE) - Kolkata Chapters.
- Member, National Jute Board, Ministry of Textiles, GoI.
- Member, Executive Council, Bidhan Chandra Krishi Viswavidyalyaya (BCKV), Nadia, WB.
- Member, Faculty Council of Agricultural Engineering, BCKV, Nadia, WB.
- Member, State Level Advisory Board (SLAB), Deptt of MSME and Textiles, Govt. of WB.
- Member, Taskforce of Agriculture & Food Processing, Confederation of Indian Industry, East Zone (CII-EZ)
- Member, Variety Release Committee, All India Network Project on Jute & Allied Fibres, ICAR.
- Member, Research Advisory Committee of CRIJAF, Barracpure.
- Member, Standing Advisory Committee, Sasys Shyamala KVK, 24-Pgns (S), WB.
- President, The Indian Natural Fibre Society (TINFS)
- Member, Monitoring Committee, ARYA, ATARI, Zone II, Kolkata.
- Member, Incentive Scheme on Agriculture of Plants and Machinary, Jute Commissioner's Office, Ministry of Textiles, Govt. of India.

Dr Gautam Basu, Principal Scientist and Head, M P Division

- Acted as a Member of Board of Studies for the postgraduate programme in Technical Textiles of the University of Calcutta, India.
- Acted as the Member (on behalf NIRJAFT) of the
  - (i) Jute and Jute Products Sectional Committee (TX 03) of BIS
  - (ii) Cordage Sectional Committee (TX 09) of Textile Division of BIS
  - (iii) Technical Textiles Sectional Committee (TX 30 & TX 33) of Textile Division of BIS
  - (iv) Acted as External examiner of the M. Tech (Technical Textiles) course of the University of Kolkata.
  - (v) Acted as a member of Management Committee of NIRJAFT

Dr N C Pan, Principal Scientist and Acting Head, CBP Division

- Research paper reviewer, Indian Journal of Fibre & Textile Research (CSIR)
- Acted as Member of Selection Committee for Selection of Technical Assistant (T-III, Laboratory Technician)
- Acted as Chairman of DPC for the Post of Assistant Administrative Officer

- Acted as Chairman of DPC for the Post of Young Professional-II
- Acted as Nodal Officer for conducting NIRD Post Graduate Diploma in Rural Development Management Admission Test at NIRJAFT, Kolkata.
- Acted as External Examiner of M Tech in Textile Technology (Technical Textiles) at Department of Jute & Fibre Technology, University of Calcutta.

Dr S N Chattopadhyay, Principal Scientist

- Acted as External Examiner of MTech in Textile Technology (Technical Textiles) at Department of Jute & Fibre Technology, University of Calcutta.
- Acted as a Chairman of the selection committee for selection of staffs of NIRJAFT for participation in ICAR Eastern Zonal Tournament at Bareli, UP
- Acted as research paper reviewer, Indian Journal of Fibre & Textile Research (CSIR), ACS Sustainable Chemistry & Engineering (USA)
- Nominated as a member of Institute Management Committee of ICAR- Indian Institute of Natural Resins nd gums, Ranchi, Jharkhand and ICAR-Centralt Institute of Research on Cotton Technology, Mumbai.

Dr Surajit Sengupta, Principal Scientist and Incharge, DDM Section

- Acted as a member of examiners/paper setter/moderator of B tech course on Jute & Fibre Technology of Calcutta University.
- Acted as a member of examiners/moderator of M tech course on Technical Textiles of Calcutta University.
- Acted as the reviewer of Indian J fiber and Textile Research, J of Scientific and Industrial Research. Institute of Engineers (I), Bio-Resources, Textile Research Journal, Journal of Industrial Textiles.
- Acted as Supervisor of one Ph D student.

Dr Avijit Das, Principal Scientist

- A high protein rice cultivar (CR Dhan 310) has been released by CVRC, New Delhi

Dr Sanjoy Debnath, Senior Scientist

- Acted as Convenor of Textile Engineering Divisional Sub-Committee for the Session 2015-2016 of The Institution of Engineers (India), Kolkata.
- Acted as Convenor of lectures on "Green Technology in Textiles" by Dr. Sankar Roy Moulick, Associate Professor and Dr. Prabir Choudhry, Associate Professor of Viswabharati, Santineketan, West Bengal at R.N. Mukherjee Hall, West Bengal State Centre, The Institution of Engineers (India), Kolkata. on May 08, 2015.
- Acted as reviewer of Journal of Industrial Textiles, Indian Journal of Fibre& Textiles Research, Fibers and Polymers Journal, Textile Research Journal

Dr Debprasad Roy, Senior Scientist

- Received SPPS Fellow Award at 11th National Symposium of SPPS at Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan on April 23, 2015
- Acted as Councillor of the Society of Plant Protection Sciences, Division of Nematology, IARI, LBS Centre, New Delhi
- Acted as Dissertation Supervisor of 3 Ph D students
- Acted as an External Examiner M.Sc. (Ag.) Hons. Students of Visva-Bharati University.

- Admitted the life membership of the Society for Polymer Science (India) Pune, India.
- Acted as Executive Editor of Indian Journal of Natural Fibres
- Associated Chief Editor of International Journal of Agriculture, Environment and Biotechnology
- Acted as Chief Editor of International Journal of Bioresource Science
- Acted as Mukhya Sampadak of the Bengali Magazine *Krishi Samachar*

Dr L Ammayappan, Senior Scientist

- Acted as an external examiner for the Ph.D viva voce examination under Anna University, Chennai, Tamilnadu (January 2016)
- Acted as peer reviewer for Textile Research Journal, Journal of Industrial Textiles, Fibers and Polymers, Indian Journal of Fiber & Textile Research, Textiles and Clothing Sustainability, Asian Journal of Textiles.
- Regional Editor of the international journals "Asian Journal of Textiles" and "Journal of Applied Science"
- Editorial board member for the journal Indian Journal of Natural Fibers, International Journal of Scientific and Engineering Research and Journal of Bioresource Engineering and Technology, International Journal of Green Chemistry.

Dr. L.K. Nayak, Senior Scientist

- Convenor, Agricultural Engineering Divisional Subcommittee, West Bengal State Centre, The Institution of Engineers (India) .
- Elected as Fellow of The Institution of Engineers, India (IEI).
- Convenor of seminar on "Irrigation Systems for Small Farmers" organized by Agricultural Engineering Division of West Bengal State Centre, The Institution of Engineers (India) on November 07, 2015.
- Received the Distinguished Service Certificate Award-2015 from Indian Society of Agricultural Engineers (ISAE).
- Acted as Co-Chairman in a session with the theme "Innovative methods and Effectiveness of teaching in extension education" during the International Extension Education Conference (IEEC) – 2016 organized by Institute of Agricultural Sciences, Banaras Hindu University (BHU), Varanasi on January 28, 2016.

- Received the Best paper (oral) presentation award for presenting a paper entitled "Strengthening National Food Security: Role of ICAR-NIRJAFT in training stake holders in Jute & Allied fibre sector" in the International Extension Education Conference (IEEC)–2016 organized by Institute of Agricultural Sciences, Banaras Hindu University (BHU), Varanasi during January 27-30, 2016.
- Acted as Member, Editoroial Board of the e-News Letter of ISAE-Kolkata Chapter
- Acted as Paper setter-cum-External examiner for the 3rd year B. F. Sc students of the College of Fisheries, Central Agricultural University

- Acted as Subject matter expert in the Inaugural function of "Kisan Sammelan & Technology Week" organized by Howrah Krishi Vigyan Kendra (KVK) at Jagatballavpur, Howrah on December 19, 2015.

Dr V B Sambhu, Senior Scientist

- Acted as Paper setter and examiner of Central Agricultural University, Imphal, Manipur and Central Agricultural University, Ranipool, Gangtok.

Dr Subhas Chandra Saha

- Acted as an Editorial Board Member of The International Journal of Bioresource and Krishi Samachar

Dr. Kartick K. Samanta, Scientist

- Selected as one of the top 50 Innovator in 2015 in DST-Lockheed Martin "India Innovation Growth Programme" for the promising technology on "Water-free Sustainable Colouration and Functionalization of White and Dyed Textiles, and Garments".
- Acted as an external examiner of B Tech and M Tech in Technical Textiles of the University of Calcutta, India
- Acted as an external examiner of pre-synopsis Ph D seminar at VJTI, Mumbai.
- Acted as the reviewer of Journal of Applied Polymer Science (Wiley), Textiles and Clothing Sustainability (Springer), Fibres and Polymers (Springer), Journal of the Institution of Engineers (India): Series E (Springer), Journal of Industrial Textiles (Sage)
- Acted as Editorial Board Member of International Journal of Bioresources Science and Indian Journal of Natural Fibres

Dr R K Ghosh, Scientist

- Acting as a reviewer of Journal of Hazardous Materials, Pesticide Research Journal.
- Acting as an editorial board member of the International Journal of Bioresource Science, Krishi Samachar (in Bengali).

Research Support System

Design, Development and Maintenance Section

The objective of this section:

(i) to assist in design and development of machinery/ prototype, equipment, instruments etc.

(ii) customary maintenance of machines and instruments;

(iii) Maintain civil & electrical infrastructure of institute;

(iv) new infrastructure building activities;

(v) Vehicle maintenance and operation.

The following important works has been carried out during 2015-16.

a) Preventive and breakdown maintenance of machines, instruments, infrastructure, car, air conditioners etc.

b) Coordinated and monitored all forms of civil, electrical, mechanical works, sanitation and plumbing services.

c) Monitored institute vehicle movement and maintenance.

d) Provided others support services like watch and ward and fire fighting.

e) Planning, coordinating & execution of major infrastructure development works of the Institute through external agencies like CPWD

f) The Master Plan/ Building Plan of all buildings of the institute was prepared and sent to Council in required format.

g) Renovation of the Institute Record room with installation of the Optimizer

h) Recycling of waste in the form of Bio Compost

i) Briquetting machine and Gassifier Plant were cleaned and serviced for R&D work

j) refilling of fire extinguishers etc.

k) Regularization of institute land records was initiated by contacting State Land Record Department and Kolkata Municipal Corporation officials.

l) Running of Briquetting machine and Gassifier Plant were cleaned and serviced for R&D work.

m) Fabricated and assembled different jute grading instruments like Fibre Strength Tester, Air Flow Fineness Tester, Colour & Lustre Metre & Bulk Density Metre.

n) Coconut fibre strength tester has been designed and developed.

o) The Farmers Hostel is also maintained and monitored.

Priority setting, Monitoring & Evaluation (PME) Cell

PME cell acts as a nodal centre for administration, coordination, monitoring and evaluation of R&D activities of the institute. Under the supervision of Director, PME cell participates in various research planning and resource allocation mechanism, inviting peer reviews from experts

and keeping documents of institute's projects, human resource developments in frontier areas of research and decentralization of management functions and powers. Direction of research is obtained from SFC documents, QRT recommendations and RAC meetings which are in unison with institute mandate. PME cell organizes all these meetings and finally progress of the projects are critically evaluated by holding IRC meetings under the chairmanship of Director, NIRJAFT. Institutional seminars are regularly organized by PME cell where scientists and technologists present their research papers for obtaining approvals from competent authorities for subsequent presentation in national or international events after critical evaluation. Eminent scientists are also invited to talk in the current and prospective frontier areas of research. All the information received by the institute regarding career advancements, capacity development and R&D activities from ICAR and other national or international organization are percolated to the scientists, technical officers or other staff of the institute through PME cell. All the necessary steps are taken to nominate scientists and other staffs of the institute for different events around the globe. PME cell delivers the R&D reports as well as replies to numerous queries sought by the ICAR HQ and Parliament as and when required. Activities of Institute Technology Management Units in now converged into the PME Cell to manage the innovations, showcase the intellectual assets and pursue matters related to IP Management and transfer/ commercialization of technologies and services.

Quality Assurance (QA) Section

This section deals with evaluation of fibre quality and grading of jute and allied fibres. It is associated with CRIJAF in All India Network Project (AINP) for jute and mesta. The section coordinates the system for acquiring and maintenance of ISO certification of the institute. Quality Assurance Section is working under Quality Evaluation & Improvement Division. Basically this section deals with fibre properties and grading of jute & mesta fibre and doing regular physical tests as a part of many research projects initiated in NIRJAFT, CRIJAF and other organizations including All India Network Project (AINP). The institute is having very good infrastructure for short training programme on jute grading. Theoretical and practical training on grading methods are provided on demand basis. This training course is conducted to acquaint marketing personnel and other peoples from different organizations and agencies with the BIS specifications on raw jute grading. The section is doing quality evaluation of fibres from different breeding, agronomical and quality trials on jute, mesta, sunnhemp, flax and ramie fibre under All India Network Project (AINP) headed by CRIJAF. These trials were conducted for commercial recommendation with a view to select varieties which produced fibres of good quality and high yield. Recently the section has developed a new user-friendly jute grading system and it is with BIS for recommendation.

Different jute grading instruments like Fibre Bundle Strength Tester, Air-flow Fineness tester, Colour & Lustre Meter and Bulk Density Meter which were developed by the institute are calibrated by the section for supplying these instruments to the different organizations and jute

mills as per order received.

The section has also taken up ad-hoc research project on Development of Ramie fibre grading system to find out the easy grading system and process. The system of testing of jute, mesta samples received from outside agencies on payment basis has been done regularly. A good number of outside parties have been availing of the testing facilities of this section. This financial year the section earned as revenue of Rs. 2.37 lakhs.

Library

It acts as a centre of repository for scientific and technological information of jute & allied fibres including other ancillary disciplines by maintaining a large number of books, journals, reports, reprints, pamphlets. the library has developed suitable infrastructure for computerized operation.

The following activities have been carried out in addition to during this year,

a) NIRJAFT library has been made accessible by the members via on line system from anywhere through internet.

b) A database on Jute & Allied Fibres has been updated to store information.

c) A collection of abstracts on 'Jute & Allied Fibres', Vol. 2, No. 1 & 2 has been published.

d) The library section has developed a model database on CDS/ISIS of UNESCO over Common Communication Format (CCF) with necessary modifications.

e) Digitisation of library is under progress. Rare, old and valuable books (169 numbers) were digitized and make accessible in the On-line Public Access Catalogue (OPAC).

f) Organised a workshop on “Role of Information Technology in Library Management in Digital Era”

g) Preservation of old but valuable library documents (7253 numbers of pages) have been done using “Tissue paper lamination technique”.

h) Installed EZ proxy soft ware to facilitate remote on-line access to e-resources by users of ICAR-NIRJAFT library.

i) Purchase of books and journals

Distinguished Visitors

Date	Eminent visitors
May 07	Sh. Subha Kirti Mazumder, IAS, DG, IJMA & Former Jute Commissioner
May 07	Dr. Subrata Gupta, IAS, Jute Commissioner, Ministry of Textiles, Govt. of India.
May 15	Mr. Samir Kr Biswas, IAS, Development Commissioner (Handicrafts) and Mr M Pravakaran, Deputy Director (Handicrafts), Incharge, Eastern Region.
June 11	Mr S K Chanda, Chief Executive (Works) & Director, Hooghly Infrastructure Pvt. Ltd and Chairman, Technical Development Division, IJMA.
June 26	Dr. Gurbachan Singh, Chairman, Agricultural Scientists Recruitment Board (ASRB)
June 29	Dr. Sanjeev Kumar Balyan, Hon'ble Union Minister of State for Agriculture and Food Processing Industries
July 10	Mr. Ajoy Todi, Managing Director, Ladlow Jute & Specialties Ltd.
July 14	Shri Arvind Kumar M., IAS, Secretary, National Jute Board, MoT, GoI
July 27	Dr. P B Jhala, Research Advisor, National Institute of Design, Ahmadabad
August 04	Dr. K. Manoharan, Director, Directorate of Jute Development, Ministry of Agriculture, GoI.
August 04	Dr. P.K. Das, Ex-Professor, Bidhan Chandra KrishiViswavidyalaya, West Bengal
August 04	Dr. S.K. Biswas, Ex-Director, Directorate of Jute Development, GoI
August 22	Sh. Sudhir Bhargava, Director, M/S Agroman Systems Private Ltd., Mumbai & Hon'ble Member of Governing Body of ICAR
August 25	Prof. Debasis Majumdar Honourable Vice Chancellor, Uttarbanga Krishi Viswavidyalaya, Coochbehar
October 03	Prof. (Dr.) Swapan Kumar Datta, Pro-Vice-Chancellor, Visva Bharati and Former DDG (Crop Science), ICAR
October 03	Prof.(Dr.) Mangesh. D. Teli, Professor, Fibre & Textile Processing Department, Institute of Chemical Technology, Mumba
October 31	Sh. Altamas Kabir, The Hon'ble Former Chief Justice of India
December 14	Prof. Matthew Prasad, Vice-Chancellor, Uttarakhand University of Horticulture and Forestry, Bharsar

Date	Eminent visitors
December 22	Dr. Swati Bhattacharya, Librarian, Indian Institute of Management, Kolkata
December 22	Shri Rabishankar Giri, Assistant Librarian, Presidency University, Kolkata
December 22	Dr. N.C. Ghosh, Librarian, CSIR-Indian Institute of Chemical Biology, Kolkata
December 16	Botany Students, Netaji Nagar Woman's College, Kolkata
December 23	Dr. R.T Patil, Ex Director ,CIPHET,ICAR
January 0 4	Dr. B.C. Mitra, Ex Director, NIRJAFT and Ex-RAC Chairman.
January 04	Dr. B.S. Bisht, Ex-Vice Chancellor of G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand
January 04	(Prof.) D. Chattopadhyay, Vice-Chancellor, Amity University, Kolkata and Ex-Pro-Vice Chancellor (Academic affairs), University of Calcutta
March 30	Dr. S. N, Jha, ADG (PE), ICAR


DILO

Personnel

Dr. Debasis Nag	**M. Tech., Ph.D., FIE(I)**	**Director**
Quality Evaluation & Improvement Division		
Dr. Gautam Roy	MEE, Ph.D.	Principal Scientist & Head, Vigilance Officer
Dr. Biplab Saha	M.Sc., Ph.D.	Principal Scientist
Dr. Avijit Das		M.Sc., Ph.D.Principal Scientist
Dr. Deb Prasad Roy	M.Sc., Ph.D.	Senior Scientist
Dr. Subhas Ch. Saha	M.Sc., Ph.D.	Senior Scientist
Sh. Kulwant Dahiya	M.Tech.	Scientist
Sh. Arindom Ghosh	B.Sc.	Senior Technical Officer (Retd on March 31)
Sh. Tapas Kr. Ghosh	B.Sc.	Technical Officer
Chemical & Bio-Chemical Division		
Dr. Nimai Chandra Pan	M.Tech., Ph.D., FIE(I), FTA	Principal Scientist & Head (Acting) Officer I/C Administration
Dr. Sambhu Nath Chattopadhyay	M.Tech., Ph.D., FIE(I), FTA	Principal Scientist
Dr. Lakshmanan Ammayappan		M.Sc., Ph.D.Senior Scientist
Dr. Rakesh Kr. Ghosh	Msc., Ph.D.	Scientist
Dr. Kartick Kr. Samanta	M.Tech., Ph D	Scientist
Sh. Karunamoy Patra	H.S., Dip. in Elec. Engg.	Technical Officer
Sh. Amalesh Khan	B.Sc.	Technical Officer
Sh. Pradip Talukdar	S.F.	Technical Officer (Retd. on April 30)
Sh. Basudev Chakraborty	H.S., ITI	Technical Officer
Mechanical Processing Division		
Dr. Gautam Basu	M.Tech., Ph.D.(Tech.), FIE(I), PFDJT	Principal Scientist, Head (Acting)
Dr. Surajit Sengupta	M.Tech., Ph.D. (Tech), FIE(I), C. Engg., PGDFM	Principal Scientist & Incharge, Design Development and Maintenance Section
Dr. Sanjoy Debnath	M.Tech., Ph.D., FIE(I)	Senior Scientist
Mr. Seiko Jose	M.Sc.	Scientist (Transferred to CSWRI on December 03)
Sh. Kamal Kr. Banerjee	Madhyamik	Technical Officer

Transfer of Technology Division

Dr. Alok Nath Roy	M.Tech., Ph.D.	Principal Scientist & Head
Dr. Samir Baran Roy	M.Sc., Ph.D.	Principal Scientist & I/C, PME Cell
Dr. Laxmi Kant Nayek	M.Tech., Ph.D.	Senior Scientist
Dr. Vidya Bhushan Sambhu	M.Tech., Ph.D.	Senior Scientist
Sh. Sujai Das	M.Sc. (Computer Sc.)	Scientist (Senior Scale)
Sh. Koushik Mitra	B.A.	Technical Officer

Design Development & Maintenance Section

Dr. Surajit Sengupta	M.Tech., Ph.D. (Tech) FIE(I), C. Engg., PGDFM	Principal Scientist & Incharge
Sh. Prosenjit Sanyal	B.Sc. (Agril. Engg. & Tech.)	Assistant Chief Technical Officer
Sh. Lilamoy Patra	H.S., Dip. in Elec. Engg.	Assistant Chief Technical Officer
Sh. Prabin Chowdhury	S.F., ITI	Technical Officer (Retd. on Dec 31)
Sh. Chanchal Kundu	H.S., Dip in Mechanical Engg.	Technical Officer
Sh. Kartick Chandra Majumder	ITI	Technical Officer (Retd. on Dec 31)

Prioritization, Monitoring and Evaluation Cell

Dr. Samir Baran Roy	M.Sc., Ph.D.	Principal Scientist & Incharge
Dr. Utpal Sen	M.Sc., Ph.D.	Chief Technical Officer
Smt. P. R. Ghatak	B.Sc.	Asstt. Chief Technical Officer (Joined on Sept 20)
Dr. Debabrata Das	M.Sc., Ph.D.	Senior Technical Officer

Library

Dr.(Smt). Rina Naiya	B.Sc., B.Lib., Ph.D.	Senior Technical Officer & Incharge
Sh. Srikumar Chowdhuri	H.S.	Technical Officer

Administration

Sh. Rajeev Lal	B. Sc. (Hons)	Chief Administrative Officer
Sh. Brindavan Kabi	B.Com.	D.D.O. & A.A.O. (Adm. II) (Retd. on April 30)
Mrs. Anasua Majumder	M.Sc.	Asstt. Finance & Accounts Officer
Late P. K. Purkayastha	P.U.	A.A.O. (Adm. I) (Expired on March 29)
Sh. Swapan Kr. Sinha	B.Com.	A.A.O. (Adm. II)
Sh. Sanatan Sardar	B. A.	A.A.O. (Adm. III)
Smt. Jayashree Nath	B. A.	A.A.O. (Adm. I)
Sh. Balaram Chatterjee	B.Com.	PS to Director

Hindi Cell

Sh. Ram Dayal Sharma	M.A. (Hindi), DHT, PGDT	Asstt. Director (OL) & Incharge
Sh. K. L. Ahirwar	M.A.	Senior Technical Officer

Financial

A. The budget provision and actual utilization under Plan, Non Plan, NAIP & Plan Schemes during 2015-16.

(Amount in Rs)

Sl. No.	Name of Heads	Opening Balance	Fund Received	Actual Utilization	Closing Balance
1.	Non Plan	5352689	143000000	139016636	**3983364**
2.	Plan	286857	32000000	26411869	**5588131**
3.	NAIP Projects	-330779	0	0	**(-)330779**
4.	Plan Schemes (ITMU & ZTMC,ABI)	231072	5988000.00	4223789	**685283**

B. Sub-head wise budget provision and actual utilization under Institute Plan and Non Plan Schemes during 2015-16.

(Amount in Rs)

Sl. No.	Sub-Head	Plan		Non Plan	
		Budget Provision	Actual Utilization	Budget Provision	Actual Utilization
	A) Revenue Expenditure				
1.	Establishment Expenses	NIL	NIL	94048000	94920237
2.	Pension & Other Retirement Benefits	NIL	NIL	39600000	32499825
3.	Travelling Allowances	1000000	972522	600000	337447
4.	Research & Operational Expenses	6000000	4936163	1400000	948945
5.	Administrative Expenses	13450000	11714016	10500000	8507052
6.	Miscellaneous Expenses	4750000	2071501	1452000	1188330
	Total of A	**25200000**	**19694202**	**53552000**	**43481599**
	B) Capital Expenditure				
1.	Equipment	4600000	4544187	500000	485971
2.	Works				
3.	Library Books & Journals	700000	694800		
4.	Vehicles				
5.	Furniture & Fixture	750000	740323	200000	195616
6.	Information Technology	450000	443628		
7.	**NEH**	**300000**	**294729**		
	Total of B	**6500000**	**6422938**	**700000**	**681587**
	Total (A+B)	**32000000**	**26411869**	**148300000**	**139083423**

BALANCE SHEET AS ON 31ST MARCH, 2016

Corpus/Capital Fund & Liabilities	Schedule	Current Year	Previous Year
Capital Fund	1	183569778	179034291
Reserves	2	0	16564192
Earmarked/Endowment Fund	3	0	3036551
Current Liabilities & Provisions	4	37691479	19695839
Total		**221261257**	**218330873**
Assets			
Fixed Assets	5	181107944	193462458
Investments-Earmarked/Endowment Funds	6	0	0
Current Assets, Loans & Advances	7	40153313	24868415
Total		**221261257**	**218330873**

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2016

(Amount in Rupees)

A. Income	Schedule	Current Year	Previous Year
Income from Sales/Service	8	1380822	1220409
Grants in aid/subsidies	9	162105969	151570352
Fees/Subscriptions	10	0	0
Income from Investments	11	0	0
Income from Royalty, Publications	12	0	0
Interest earned	13	169226	264171
Other Income	14	1464445	1709431
Prior Period Income	15	0	0
Total (A)		**165120462**	**154764363**
B. Expenditure			
Establishment expenses	16	126949192	114485433
Research & Operational Expenses	17	8586858	6942595
Administrative expenses	18	21840116	24279239
Grants and subsidies	19	0	0
Miscellaneous expenses	20	3259831	5959993
Depreciation	5	17459583	9317367
Prior period expenditure	21	0	0
Total (B)		**178095580**	**160984627**
Balance being surplus/(Deficit) carried to corpus/Capital Fund		**-12975118**	**-6220264**

ABSTRACT OF 'OTHER RECEIPTS' FOR THE YEAR 2015-16

(Amount in Rupees)

S.NO	HEAD OF ACCOUNT	AMOUNT
1	Sale of farm produce	476922.00
2	Sale of vehicle, other machine tools	2000.00
3	Licence fee	64857.00
4	Interest earned on loans & advances	595994.00
5	Analytical and testing fee	414100.00
6	Application fee from candidates	111300.00
7	Receipts from services rendered	391500.00
8	Interest earned on short term deposits	45356.00
9	Income generated from Internal Resource Generation Schemes	
	a) Training	95950.00
	b)Sale of Doc.	350.00
10	Recoveries of Loans & Advances(including the refund of S-Advance)	1107188.00
11	Miscellaneous Receipts	1288288.00
12	Revenue Receipts of NAIP	0.00
	TOTAL : OTHER RECEIPTS	**4593805.00**

ICAR - National Institute of Research on Jute & Allied Fibre Technology

12, Regent Park, Kolkata - 700 040
West Bengal, India
Dial + 91 33 2471-1807 (Director), + 91 33 2421-2115/6/7(EPBX)
Fax 91-33-2471 2583
email nirjaft@vsnl.net, director@nirjaft.res.in
website www.nirjaft.res.in