

Conference Report

International Conference on Natural Fibres (Theme: Jute and Allied Fibres)

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Three days International Conference on “Natural Fibres (Theme: Jute and Allied Fibres)” was organized by The Indian Natural Fibre Society, 12 Regent Park, Kolkata 700 040 in collaboration with National Institute of Research on Jute and Allied Fibre Technology (NIRJAFT), Kolkata; Central Research Institute for Jute & Allied Fibres (CRIJAF), Barrackpore; and National Jute Board (NJB), Kolkata during 1-3 August 2014 at Bhasa Bhavan, National Library and The Oberoi Grand Hotel, Kolkata. The conference was intended to bring researchers, educationists and industries of India and abroad working in the field of natural fibres specially on jute and allied fibres for mutual exchange of ideas, gathering knowledge of recent developments and future roadmap for researches. Invited foreign delegates from USA, UK, Thailand, Nigeria, South Africa and Bangladesh participated along with the eminent Indian delegates from different states. The conference was inaugurated by His Excellency Shri Pranab Mukherjee, The President of India, in presence of Shri Keshari Nath Tripathi, Governor of West Bengal; Dr S Ayappan, Director General, Indian Council of Agricultural Research & Secretary, DARE; Shri Firhad Hakim, Minister for Urban Development and Municipal Affairs, Govt. of WB; Dr Subrata Gupta, Jute Commissioner, Govt of India; Shri Raghavendra Gupta, Chairman, Indian Jute Mills Association; and Dr Debasis Nag, Director, NIRJAFT on dais at Bhasa Bhavan, National Library, Kolkata on 1 August 2014.

Dr Ayappan, DG, ICAR welcomed all the delegates and elaborated the importance of research on jute and allied fibres. Shri Hakim stressed upon the

issue of mandatory packaging act because 40 lakh families survive directly or indirectly on jute. In his inaugural lecture, The President of India emphasized the concerted effort by all stakeholders to develop the jute sector. He said that jute agriculture in general and post-harvest technology in particular need special attention in terms of technology support and extension activities. Improvement in fibre yield, and production of fine fibre with improved strength, colour and luster and devoid of defects that arise on account of faulty retting will ensure remunerative return to the jute farmers. The judicious development of appropriate process technologies is required to utilize immense potential of many natural fibres allied to jute like ramie, coir, sisal, banana and pineapple fibre in manufacturing useful products. He also mentioned the need of use of natural fibres in some areas of technical textiles, including geo-textiles and composites.

The technical discussions were held at the Oberoi Grand, Kolkata on 2nd and 3rd August 2014 in two parallel sessions, namely agriculture and technology. Here, only the fibres and textile related sessions are reported.

Technical Session 1 discussed on 'Quality Assessment and Improvement' where Dr D Sur, Ex-Deputy Director, Indian Jute Industries Research Association (IJIRA) and Dr P K Ganguly, Ex-Principal Scientist, NIRJAFT were Chairman and co-Chairman respectively. The session was started with the keynote lecture by Dr R Chattopadhyay, Head, Textile Technology Department, Indian Institute of Technology, Delhi on 'Natural Plant Fibres: A SWOT Analysis'. The strength of any natural fibre is its agro renewability, carbon sequestering behavior, biodegradability, low density, hygroscopic nature and

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known processing sequences. However, some of its strength like biodegradability, and hygroscopic natures are also its weakness along with others like low availability, dimensional instability and mechanical properties. The opportunities to these fibres are widened with the growing population of the world and also due to non-dependency on the petroleum based source. With this, he has pointed out that the threat to the natural fibre is its easy biodegradability and low self-life. Only the coconut fibre, which contains around 35% lignin is enough to sustain for a good period. The first paper was on 'Automatic Integrated Jute Grading Instrument' by Dr Gautam Roy & Dr. S. C. Saha of NIRJAFT. Jute fibres which are graded by hand and eye methods, now can be objectively graded by a sophisticated instrument using MATLAB software. For this, prototype has been prepared. The instruments can detect the colour, defects through the optical sensors using image processing unit. Dr S K Biswas of Dept of Jute & Fibre Technology (DJFT), Calcutta University, proposed the mathematical model of the variation of jute fibre length in sliver via gamma distribution function. He concluded that this distribution fits well depending on the methods of sampling and testing. Dr S C Saha *et al.* of NIRJAFT demonstrated User-friendly jute grading system. This paper suggests some amendments to the existing BIS system for grading of jute fibres. Modified grading system has been proposed to BIS with five grades and five parameters after consulting stake holders. Dr P Banerjee *et al.* of Central Research Institute of Jute & Allied Fibre (CRIJAF) studied same ramie variety from two agro-ecological region for its various properties pertaining to gum content, bundle tenacity, depending on the location of cultivation (temperature, soil, rainfall etc). It was concluded that, the gum content of ramie can be further reduced by proper soil management. Dr Aditi Kundu *et al.* of CRIJAF described the xylanase production by immobilized cells of *Bacillus pumilus*. It is incorporated for retting of jute and mesta. It was found that 5% alginate content, 72 h growth and 100 rpm shaking speed gave the maximum enzyme production. Dr L Ammayappan *et al.* of NIRJAFT optimised sodium hydroxide treatment of jute fibre for improved reinforcement of unsaturated polyester resin. One per cent of NaOH treatment at 50°C for 60 min with 1:10 MLR can be used to make moulds with USP resin.

In presence of Chairman Dr P Majumdar, former Head, Government College of Engineering & Textile Technology (GCETT), Serampore and co-Chairman Dr S Bhattacharya, In charge, GCETT, Serampore, in the technical Session 2 on 'Mechanical Processing & Technical Textiles', the keynote address was delivered by Dr R D Anandjiwala, Material Science & Manufacturing, CSIR, South Africa. He elaborately discussed on 'The Role of Natural Fibres in Technical Applications'. Different lingo-cellulosic fibres due to their comparatively lower density are comparable with synthetics in terms of their various mechanical properties such as tensile strength and toughness for technical textile applications. In composite applications, the reduction of fibres fineness, i.e. nano-celluloses, enhances the fibre loading, which leads to successful development of many parts of automobiles. However, the newer biodegradable polymers, such as PLA are serious threats to the natural fibre. Hence, the disadvantageous properties of natural fibres need to be improved to sustain its application in technical textiles. Dr M Uddin of Bangladesh Jute Research Institute (BJRI) studied the chemical modification of jute fibres using factorial designs of experiment to get improved spinning properties. The method leads to better handle properties, colour and extension. So, these treated fibres can be blended with other fibres like cotton for developing different high value-added products. Dr K K Goswami of Indian Institute of Handloom Technology elaborated the quality of the Indian wool vis-à-vis New Zealand wool. Raw wool production from Indian sheep is less than a kg as against New Zealand wool which is about 5 kg. Extraction of wool from the sheep and processing for making various export quality apparel, carpets, body warmers were described. Dr A N Roy *et al.* of NIRJAFT depicted the processing of banana fibre in jute spinning system and also product development. It has been found that jute-banana yarn with more than 50% banana fibre do not achieve reasonable strength. However, 100% banana fibre yarn could be spun in jute spinning system up to 446 tex with reasonable strength and other property parameters. Dr Anindita Sengupta *et al.* of Indian Institute of Engineering Science & Technology (IEST), Shibpur has developed a system for the determination of the yarn parameters like yarn diameter, diameter variation, thin places, thick places, hairiness, etc. using image processing technique. Dr S K Ghosh *et al.* of DJFT described the

development of bituminized jute fabric for application in the road constructions. Dr Sunil Kumar Sett *et al.* of DJFT prepared yarn from giant nettle fibre (*Girardinia diversifolia*), available in the Himalayan region. It has been spun after degumming using jute spinning technique. It will be useful to support the decentralized sector. Dr Atin Chaudhuri *et al.* of DJFT assessed strength, breaking extension, initial modulus, specific work of rupture, unevenness and packing coefficients of Dref-III spun yarns using Box and Behnken design of experiments. Dr S K Chakrabarti of IJIRA has proposed energy efficient green sizing technology for jute yarn. A green sizing material has been made by modifying Tapioca starch. It enhances the tensile strength, quality ratio, abrasion resistance & extension percentage and reduces 25.5% energy consumption, 80% BOD, 70-75% COD level. Dr Surajit Sengupta *et al.* of NIRJAFT reported the design and development of computerized instrument for testing bending behaviour of semi-rigid technical textiles. Dr Sanjoy Debnath *et al.* of NIRJAFT has optimised the tensile properties of bio-composite, reinforced by 2/2 twill jute fabric. Dr Biplab Saha of NIRJAFT evaluated the nonwoven mulch fabric with respect to soil and crop parameters in various horticultural production systems of West Bengal.

The 3rd Session on 'Chemical Processing and Composites' was chaired by Dr B C Mitra, Former Director, NIRJAFT and co-Chaired by Dr D Chakrabarty, Professor, Rajabazar Science College, Calcutta University. The keynote address was delivered by Dr Subhas Chandra Ghosh, Natalie Chipot Eastern Michigan University, USA on 'Evolution of Smart Textiles for Possible Applications of Lignocellulosic Fibers'. He discussed about the phase change textiles, aroma textiles and optical sensors based textiles. The phase change textiles are obtained by application of micro-encapsulated PEG of 600 Mw on cotton and a vegetable oil based polyol (PCM) on jute. Aroma textiles are developed using β -cyclodextrin inserted molecular structure to hold the different aroma molecules in its porous structure. The optical sensor is incorporated into the woven fabric for military applications, monitoring weather, medical textiles, etc. Dr A K Roy *et al.* of NIRJAFT described the prospects and opportunities of jute based medium density fibre (MDF) board. His study shows MDF board made up of jute fibre and stick in the ratio of 25:75 is found to be the best in properties. Dr D Ghosh *et al.* of CSIR-IIP, Dehradun illustrated

the feasibility study of production of industrial spirit from jute fibre. Reasonable quantity of bio fuel is obtained by saccharification of biomass and conversion of sugar monomer into ethanol from variety of biomass, i.e. jute fibre, stick, bagasse, etc. at a reasonable cost. Dr Adwaita Konar and Dr A K Samanta of DJFT proposed the standardisation of extraction, purification and process variables of application of natural dyes on textiles with assured reproducibility and acceptable fastness. Dr Debasis Das *et al.* of DJFT studied the breathable waterproof coating for jute with compound based on natural rubber latex. The treatment conditions were standardized to make waterproof jute fabric without restricting the flow of air. Dr S N Chattopadhyay and Dr A K Roy of NIRJAFT showed that the bio treatment of jute fibre produces the better quality handmade paper followed by eco-friendly pulping. Dr K K Samanta *et al.* of Central Research Institute of Cotton Technology (CIRCOT) suggested hydrophobic finishing of cotton textile using atmospheric pressure plasma. This paper was awarded as best paper among the presentations of technology section. Dr D P Roy *et al.* of NIRJAFT studied the effect of chemical compatibilizers (prepared using an acid and an alcohol at a ratio 1.1:1) which is found to have better tensile strength & flexural strength, and higher fibre content than their control jute fibre reinforced unsaturated polyester resin composites. Dr N C Pan *et al.* of NIRJAFT developed the particle board from cassava stalk using bio-adhesive chitosan/soya protein. Dr R K Ghosh *et al.* of NIRJAFT stated the chemical modification of jute stick biomass for waste-water treatment. The finding shows that the jute stick modified with HNO₃ and EDA can able to remove both acid and cationic dye at above 85%. Ms Mallika Datta *et al.* of GCETT, Serampore used coconut fibre for making composites by compression moulding method. The result shows that the coconut fibre based moulds has better mechanical properties than the jute and jute-coconut blended composites due to better dispersion of the fibre. Dr S K Pandey *et al.* of Indian Institute of Natural Resins & Gums, Numkum studied twill woven jute fabric and lac/modified lac based bio-composites for Industry. Ms Swati Dasgupta *et al.* of NIRJAFT described the chemical modification of jute fabric with alkaline peroxide and its effect on reinforcement of unsaturated polyester resin. Results inferred that peroxide treatment increases flexural strength of the

treated jute than the untreated one. Dr Arup Mondal of Rajabazar Science College, Calcutta University explained the mechanical, thermal, morphological and barrier properties of nano composites based on poly(vinyl alcohol) and nanocellulose from sugarcane bagasse.

In the 4th Session, marketing, diversifications and related issues were discussed under the chairmanship of Dr S Sreenivasan, Former Director, CIRCOT, Mumbai and co Chairmanship of Mr N Sengupta, Secretary, NJB. Dr U Mukim of Thailand delivered the case studies for using natural fibre as polymer reinforcement. He suggested that high performance engineered woods can be manufactured out of natural resources/biomass/agricultural residues through standard research methods as per the requirement in different applications areas. Mr Sujai Das of NIRJAFT discussed about the computerised jute production information system. Dr Sujaya Das (Dewanjee) *et al.* of NIRJAFT discussed about trade related intellectual property rights (TRIPS) and its history. Dr Rina Naiya (Basak) of NIRJAFT explained the case study of information seeking behaviour of research workers in the field of jute and allied fibre in West Bengal. The need of online information was established. Dr F H Rahman *et al.* of Zonal Project Directorate, Salt Lake discussed the entrepreneurship development through preparation of jute diversified products and efficient marketing using KVK. Mr I J Sharma of Gloster Jute Mill suggested the value addition by organic jute cultivation which is the way to have sustainable growth in future.

Dr H S Sen, Former Director, CRIJAF and Dr K K Satapathy, Former Director, NIRJAFT were the Chairman and co-Chairman respectively for the 5th Session entitled 'Fibre Extraction'. Dr Shyamal Banik of NIRJAFT discussed a new ecofriendly technology of water saving retting i.e. fungal dry retting of jute. In this process, green jute stalks are treated with a special pectinolytic fungus which is then spread in a very less amount of water and wrapped with a polythene sheet for 7 days to develop those fungus which loosen the fibre mass from the non fibrous part of the stalk and helps easy extraction. Dr B Majumdar of CRIJAF described the prospect and impact on quality jute fibre production in stagnant water with user friendly microbial formulation. This is cost effective and reduces the retting duration by 6-7 days. These microbes not

only ret the fibres but also cleans the contamination of retting liquor so that the same liquor can be used for multiple retting. Dr Gautam Bose *et al.* of NIRJAFT explained the user-friendly chemical retting of coconut fibre to improve properties. It also reduces the retting time from 10 months to 3 hours. Dr L K Nayak *et al.* of NIRJAFT demonstrated the design and development of an efficient banana fibre extractor for better spinnable fibres. Dr V B Shambhu *et al.* of NIRJAFT described the design modifications and development of NIRJAFT power ribboner for jute & mesta with reduced cost and energy involvement. Pig hair fibres were studied by Dr N H Mohan *et al.* of National Research Centre on Pig, Guwahati for its morphology, tensile and other properties to explore its potentiality for manufacturing the diversified products.

Eleven posters were presented on the challenges of jute, chemical retting of jute ribbons, potassium permanganate treated jute for bio-composites, analysis of ramie gum components, extraction of pineapple leaf, thermal characteristics of pig hair fibre, effect of saccharum spontaneum filler on green composite, dyeing of silk by plasma treatment, ecofriendly biocomposites, R&D of bast fibre, stress analysis of jute composite by finite element method. Out of these posters, the one on 'Effect of pre-treatment of jute fabric with potassium permanganate on the jute polyester based bio-composites' by Ms Debashmita Mondal *et al.* of NIRJAFT was awarded the best prize according to the decision by the jury.

The valedictory session was chaired by Mr N Sengupta, Secretary, NJB and cochaired by Dr N Gopalakrishnan, Assistant Director General, ICAR. In this Session, the recommendations proposed by chairman and co-chairman of different technical sessions were finalised. These recommendations which will be the roadway for future researchers are:

(i) Session—Quality Assessment and Improvement

- User friendly grading system should be commercialized for the better opportunity of mills as well as farmers.
- Grading systems are to be developed for allied fibres
- Improved and user friendly testing equipments are required to assess fibre qualities
- For getting better textile quality of long vegetable fibres, better agricultural practices, better extraction procedure and physical/chemical modification are required.

(ii) Session— Mechanical Processing and Technical Textiles

- User friendly and need based instrumentation/ machinery development are required.
- Ramie, banana and nettle fibres have an enormous potential for manufacturing quality products. So, attempts should be taken for growth of those fibre production and utilization.
- Fabric development is required for seed bed protection, crop protecting nets, shed-net, fruit-net, agricultural mulch, soil stabilization, soil moisture and temperature control.
- Natural fibre based nonwoven has to be developed for technical textile applications.
- Allied and under exploited fibres are to be used in different product preparation.

(iii) Session— Chemical Processing and Composites

- Efforts should be made to develop green technology for the production of value-added diversified products from lignocellulosic fibres
- Efforts should be made to develop application method for producing different functional finishing, i.e. water repellent, fire retardant, UV protected, Anti-microbial and wrinkle resistance of fabric made from lignocellulosic fibres.
- Efforts should be made for the improvement in compatibility and adhesion between lignocellulosic fibres and synthetic polymers to be used for making bio-composites by using both thermoset and thermoplastic resins through physical/chemical modification of fibre surface and development of coating/coupling agents.

- Efforts should be made for the development of green composites based on lignocellulosic fibres, agro-residues and bio-degradable polymers based on natural resources suitable for specific applications.
- Plasma treatment and nanotechnology are new fields. It should be exploited properly.
- Low cost and high cellulose containing natural fibres or biomass may be used effectively in high grade paper or medium density fibre board. Biotreatment may be given to the fibre for better product.

(iv) Session— Marketing, Diversification and Related Issues

- Efforts should be made to develop the entrepreneurship.
- Efforts should be made to build-up learning and capacity building through training.
- Research is required for suitable diversification of jute and allied fibres

(v) Session— Fibre Extraction

- Efforts should be made to increase the production capacity of the ribboner machine so that the technology is acceptable to the farmer.
- Efforts should be made to develop the easy retting process by using bio-physical technique.
- Efforts should be made to develop the water-less retting of jute and allied fibre by identifying the plant specific.
- Efforts should be made to develop suitable technology for extraction of allied fibres