ISSN 0368-4636

Journal of the TEXTILE Association

VOL. 74 NO. 1 MAY - JUNE 2013

GO GREEN with SSP

Treat, Reuse & Conserve

SSP™ Since 1977

Zero Liquid Discharge Effluent Treatment Soulution for textile Dyeing Industries

SSP PVT LIMITED has come up with a Zero Liquid Discharge Effluent Treatment Solution for Textile Dyeing Industries, by which in the one hand the textile dyeing industry at large can treat the effluent consisting of dissolved solids, dye chemicals & reuse the same condensate water repeatedly for the dyeing process instead of pumping the water from the ground and on the other hand the salt used for dying can be reused & sold in the market after dyeing.

The basic thrust of the technology is to convert entire quantity of effluent to zero liquid level by separating water & salt using evaporation & separation technology.

- Zero Liquid Discharge System
- Highest Steam Economy
- Low Operating Cost
- Less Downtime for Maintenance
- Generation of Reusable Condensate Water
- Operator Friendly

SSP PVT LIMITED

AN ISO 9001:2008 CERTIFIED & ASME 'U' STAMP HOLDER

13 Milestone, Mathura Road
Faridabad - 121003, Haryana (INDIA)
Phone: +91-129-4183700 : Fax: +91-129-4183777
Email: info@ssp.co.in, marketing@ssp.co.in
Website: www.sspindia.com

TENCEL®

Lenzing AG, A-4860 Lenzing, Austria

The fiber brand for the botanic bed

TENCEL® is made from wood and is thus 100 % from Nature. TENCEL® can be used in lots of different ways in beds, starting with mattresses and mattress overlays, to bed covers and bed linens, through to lingerie. Thus a completely botanic bed becomes a reality.

Find out more at: www.lenzing.com/tencel-bed

INDIA OFFICE
Lenzing AG - India
1st Floor, Rajnarayan Towers
70, Race Course
Coimbatore - 641018 Tamilnadu. India
Phone : +91(0) 422 4292800
Fax : +91(0) 422 4292814
www.lenzing.com/tencel

LENZING
LEADING FIBER INNOVATION

Textechno
textile testing technology

Testing equipment for fibres, yarns, and fabrics

STATIMAT DS
automatic tensile-, evenness-, and count tester for yarns.

STATIMAT 4U
automatic tensile tester for high-tenacity yarns and monofilaments, with integrated yarn count measurement module **AUTOCOUNT**.

STATIMAT MEL+
automatic tensile tester for elastane yarns, elastic combination yarns, and elastic fabrics.

STATIMAT ME+
automatic tensile tester for yarns.

DYNAJET PLUS
weak-spot tester for spun yarns.

DYNAFIL ME
universal filament yarn tester, with automatic package changer models **SE** and **SM**.

TEXTURMAT ME+
automatic crimp contraction- and shrinkage tester for yarns.

COVAFIL+
capacitive evenness tester for filament yarns.

COMCOUNT
automatic yarn count measurement module.

ITEMAT+ TSI
automatic interlace and interlace stability tester.

FAVIMAT+ (AI)ROBOT2
automatic linear-density-, crimp-, and tensile tester for single fibres.

FAVIGRAPH
single-fibre linear-density- and tensile tester.

CSS
cotton classifying system.

FIBROTEST
fibre length- and strength tester.

MDTA3
Microdust-, Neps- and Trash Analyser and **NTDA-Module**.

QUICK SPIN UNIT
(QSU) Denkendorf single Rotor Quick spinning system.

Sole Agents in India: **M/s. World Traders MFG. Co.**
1413, Maker Chambers V, 13th Floor, Nariman Point, Mumbai 400 021;
Tel.: 91-22-2281 2743, 2284 3423, 2287 2935; Fax: 91-22-22872534;
E-Mail: info@wtmcindia.com;
Delhi Office: Ph. No. 91-11-24333256, 24334457;
Chennai: Ph. No. 91-44-24321547, 24338767;
Service Centre: Vashi Ph. No. 91-22-27892948;
Corporate Office: 710. Maker Chambers V, Nariman Point,
Mumbai 400 021; Tel. No.: 91-22-2283 3458 / 2283 3453 / 2283 3457;

NEW:

DRAPETEST
automatic drapability tester for technical- and non-crimp fabrics.

www.textechno.com

The Comfort of Competence

Settle back and relax – thanks to Rieter

Feel at ease and indulge in the comfort of truly tailored support. Our proficient personnel are at your service – from the very first meeting seamlessly through to operations of your spinning mill plant. Rest assured – Rieter provides all four spinning system technologies and will advise you with competence on the best investment in terms of economy and market impact. Benefit from our expert services and enjoy the comfort of partnership with Rieter.

E 80 Comber

The E 80 comber meets the highest standards in terms of productivity, quality and economy together with a high degree of flexibility. The effective production performance of the E 80 comber in combination with the fully automated ROBOlap lap piecing system is 2 tonnes/day. The lead in combing technology has been extended further through C•A•P•D^{Q} (Computer Aided Process Development). With outstanding fiber selection and optimal machine running behavior, the comber achieves superior quality values with maximum economy. The mill-proven ROBOlap fully automated lap changing and piecing system is a unique feature and still sets the standard for modern combing operations.

www.rieter.com

RIETER

Spin Superior with super tex

In a short span of just over a decade, SUPER TEX with its team of foreign trained & highly qualified professionals clubbed with advanced technology has created cots & aprons suitable for high speed & modern spinning machines. SUPER TEX products ***spins superior*** with all kinds of spinning machines, giving excellent & consistent yarn results with longer life. SUPER TEX is a name to be reckoned with both in the Indian & International markets.

SUPER TEX

COTS & APRONS

SUPER TEX INDUSTRIES

143, Udyog Bhavan, Sonawala Road, Goregaon (E), Mumbai - 400 063. (India)
Tel: 2686 1015 / 16 / 17 Fax: 91-22-2686 1018 / 2840 7480
E-mail: supertex@vsnl.net, jugalk@bom5.vsnl.net.in
Website: www.supertexcots-aprons.com

FACTORY: 362 / 9, Ganesh Industrial Estate, Kachigam, Daman - 396210

South Gujarat Chapter

11th International & 69th All India Textile Conference

Conference Theme

Indian Textiles - Global Prospects and Perceptions

20th & 21st December, 2013

at

The Gateway Hotel, Athwalines, Surat

Host

The Textile Association (India) – South Gujarat Chapter

For more information, please visit

www.taisurat.org

Complete Laboratory Solutions for Dyestuff and Textile Industries

COLOR MEASUREMENT

SS 6200 Spectrophotometer

SS 5100A Spectrophotometer

SS 5145 Spectrophotometer

EN 471 Compliant

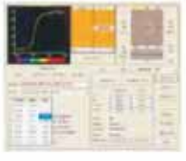
Spectro Guide Gloss

Portable Spectrophotometer

Scan-o-Lite

Visual Inspection Cabinets & Luminaires

Color Matching Software



X 5 On-line Color Measurement

Premier Colorscan

www.premiercolorscan.com

UV-2000F ULTRAVIOLET TRANSMITTANCE ANALYZER

labsphere

www.labsphere.com

WEATHERING TESTERS

Xenon Light Fastness Testers

Q-Sun Xe2

Rotating Drum

Q-Sun Xe3

Flat Bed

UV Tester

Q-UV

UV Chamber

Q-LAB

www.q-lab.com

TEXTILE TESTING

Moisture Management Tester

- Launder-Ometer.
- PnuBurst - Bursting Strength Tester
- Digital Elmendorf Tear Tester.
- Perspiration Tester
- QuickWash Fabric Testing System.
- Flammability Testers.
- Tinius Olsen Universal Tensile Tester.
- ICI Pilling and Snagging Tester
- Martindale Abrasion Tester
- Crockmeter
- Fabric Yield Package System
- Random Tumble Pilling Tester
- Sweating Guarded Hot Plate
- Universal Wear Tester
- Air Permeability tester
- Wascator Washer Extractor.

Fabric Touch Tester

Complete range of testing consumables for textile testing.

SDL ATLAS

www.sdlatlas.com

Premier Colorscan®

Premier Colorscan Instruments Pvt. Ltd.
EL-130, Electronic Zone, M.I.D.C., Mahape, Navi Mumbai - 400 710. India
Tel: + 91-22-27637900. | Fax: + 91-22-27622022 / 27622124 /27637921
E:mail : pci@vsnl.com, colorlab@premiercolorscan.com, premiercipl@mtnl.net.in


The 12th
Asian Textile Conference
Shanghai · China
2013.10.24—26
"New Prospects on Textiles"
Sponsor:
China Textile Engineering Society
visit us for Registration & Call for Papers
www.atc12.org

Good Better Premium

Experience the difference

Improve your performance with premium products.

That's not us talking - it's our customers.

We say:

Thank you!

Bräcker

Novibra

Suessen

Graf

www.premium-textile-components.com

an international textile expo 2013

Farm | Fiber | Yarn | Jari Lace & Thread | Ribbon & Elastics | Saree & Dress Material | Fabrics | Fashion Garment & Accessories | Home Textiles | Technical Textile & Non Woven | Textile Machinery & Parts | Textile Dyes & Chemical | Textile Technology |

5F Textile Expo

6-7-8 Sep 2013

Surat International Exhibition and Convention Centre,
Surat (Gujarat) India.

Fiber to Fashion

SGCCI

THE SOUTHERN GUJARAT CHAMBER OF COMMERCE & INDUSTRY
"Samruddhi", Makkai Bridge, Nanpura,
Surat, India - 395 001
Phone : +91-261-3090122
Cell : +91 97238 21937
Fax : +91-261-2472340
Web : www.sgcci.in
E-mail : marketing@sgcci.in,

kaviish

KATON EVENTS PVT.LTD.

602, A wing, Tirupati Plaza, Athwagate,
Surat - 395 001, (Gujarat) INDIA.
Phone : +91-261-6444030
Call : +91 98251 16812 | 98251 16813
Fax : +91-261-2280021
Web : www.katonevents.com
E-mail : info@katonevents.com

GLX®

ASPIRE
Speciality Chemicals for Textiles

We choose our car with the latest technology and best features.....

on a similar thought GLX presents Tyga process for cotton pretreatment

- Now you can choose to pretreat cotton the Tyga way
- A new revolutionary pretreatment process for cotton with Tyga HP
- Bleach cotton with minimal alkali safer subsequent dyeing
- Dye in subsequent bath
- No intermediate hot wash Save time water energy labour
- Reduced weight loss of fabric improved fabric feel
- Reduce load on ETP with minimum alkali in effluent

ASPIRE CHEMICALS PVT LTD.,

E-mail : glxindia@vsnl.com
www.glxindia.com
Phones : +91-22-26730272
Telefax : +91-22-26730940

Eco sustainable products conforming to OekoTEX , GOTS & REACH requirements

Supported by

सत्यमेव जयते

Office of the Textile Commissioner
Ministry of Textiles, Govt. of India

INDIATEX 2013

Textile Exhibition - Fibre to Fashion

State Partner

सत्यमेव जयते

Government of Gujarat

iNDEXTb
INDUSTRIAL EXTENSION BUREAU
GOVT. OF GUJARAT ORGANISATION
ISO 9001:2008 Certified

18, 19 & 20th October 2013

VIA Ground, Vapi Industries Association
Plot No. 135, GIDC, Vapi – 369 195 (Gujarat)

- Fibre
- Yarn / Texturising
- Weaving / Knitting
- Fabric
- Dyes / Chemicals
- Processing
- Printing
- Garment
- Fashion

Supporter

Mafatlal
MAFATLAL INDUSTRIES LIMITED
ASSOCIATED CHEMICALS

Supporting Bodies

CITI · VIA Vapi Industries Association · CMAI · UIA · TMA

Media Partners

Journal of the TEXTILE Association · FashionERA · Tecoya Trend · COLOURAGE · TIMES INTERNATIONAL · The Indian Textile Journal · TEXTILE VALUE CHAIN

Event Manager

green apple COMPLETE SOLUTIONS

Organised by

THE TEXTILE ASSOCIATION INDIA tai

MUMBAI UNIT

The Textile Association (India)
Mumbai Unit

Amar Villa, Behind Villa Diana, Flat No. 3, 3rd Floor, 86 College Lane, Off Gokhale Road, Near Portuguese Church / Maher Hall, Dadar (W), Mumbai – 400 028
Tel: 022- 2432 8044 / 2430 7702 Fax: 91-22-2430 7708 E-mail: taimumbaiunit@gmail.com / taimu@mtnl.net.in Website: www.textileassociationindia.com
Haresh B. Parekh, Exhibition Convenor, +91-9167 515 676 **Anil Mahajan**, Exhibition Co-ordinator, +91-9324 904 271

ALPENOL PRODUCTS

GET ZERO BREAKS IN LOOM WITH "ALPENOL" SINGLE SHOT SIZING MATERIALS.
APPROVED BY TEXTILES MILLS, INCREASING ORIGINAL EFFICIENCY BY 10 TO 20%.

'ALPENOL' SINGLE SHOT SIZING MATERIAL.

THE INTRODUCTION OF THE ABOVE MIRACULOUS MATERIAL HAS BROKEN THE UPPER BARRIER OF LOOM SHED EFFICIENCY WITH ZERO WARP BREAK, RESULTING IN BETTER SIZED YARN QUALITY WITH

- INCREASE IN TEXTILES STRENGTH
- INCREASE IN THE LIFE OF HEALDS & READS
- INCREASE IN BREAKING LOAD
- FULL PENTRATION OF THE YARN
- DECREASE IN DEAD LOSS AND DROPPINGS

MADE WITH LATEST TECHNOLOGY IN INDIA.
100% ECO-FRIENDLY AND ENVIROMENTALLY FRIENDLY.

M/S. ALPENOL
601, Satyanarayan Prasad Commercial Center,
Dayaldas Road, Vileparle (E), Mumbai – 400 057 INDIA
Tel. No.: +91-022-26122651, 26122809, 42336308, 42336309
Fax: +91-022-42336330
Email Id: alpenols@gmail.com , Website: www.alpenol.net

ALPENOL

PARTICIPATE IN

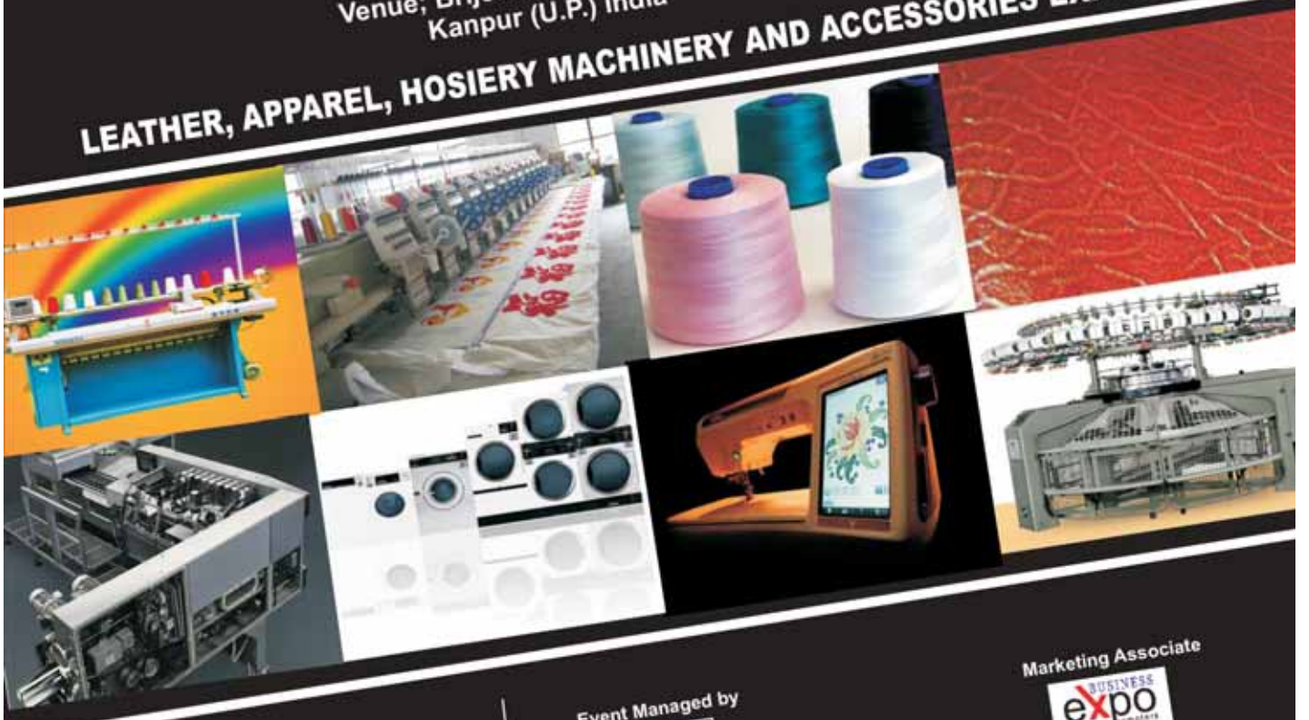
igmatex™ EXHIBITIONS

KANPUR

18th-20th OCT 2013

Venue; Brijendra Swaroop Park,
Kanpur (U.P.) India

LEATHER, APPAREL, HOSIERY MACHINERY AND ACCESSORIES EXHIBITION



Media Partner

Hosiery Times

Apparel Times

Journal of the Textile Association

Indian Leather

Event Managed by

ESSENTIAL

Online Media Partner

Bizz Duniya

Supported by

Marketing Associate

Business Expo

Knowledge Partner

Tech Talk

Organised by

IGMATEX FAIR
Sheltar Complex, Shop No. 11, Plot No 12B,
Sector-8, Kharghar, Navi Mumbai - 410210
Email:info@igmatexfair.com, URL:www.igmatexfair.com
Desk: 09594276081, 09324077881,

Regional Head

Vikash Srivastav
(M) 09212373277
09998649270
email; north@igmatexfair.com,
vikashu11@gmail.com

Marketing Associate

MS. Neha Aggarwal
Business Expo Promoter
(M) 09210586589, 09210586487
Email: info@bizexpro.com
neha@bizexpro.com

World Class Spinning Solutions
for unrivalled performance

A.T.E., a leader
in textile machinery,
is your single point contact
for all types of spinning solutions.

We provide the next generation
technology in blow room, cards,
draw frames, speed frames,
ring frames, twisting,
humidification and bobbin
transport systems.

TRÜTZSCHLER GERMANY | TRUETZSCHLER INDIA | ZINSER TEXTILE SYSTEMS | OERLIKON SCHLAFHORST | OERLIKON SAURER | LUWA | INNOSPIN

ate
An ISO 9001-2008 certified company

Marketed by:
A.T.E. ENTERPRISES PRIVATE LIMITED
T : +91-22-6676 6100 F : +91-22-2673 2463
E : spinning@ateindia.com
W : www.ateindia.com, www.ategroup.com

70 years
1939-2009

PRECITEX WORLD

PRECITEX is the undisputed leader in the domestic Indian market. That is not all. It is also the most preferred Indian brand of aprons and cots around the world, exported to more than 40 countries across the continents.

That is why we keep winning top export awards year after year. It is a testimony to the world class quality of PRECITEX products that go a long way in enhancing the productivity, profitability, and competitiveness of our highly demanding quality conscious customers.

PRECITEX WORLD CLASS APRONS & COTS

PRECISION RUBBER INDUSTRIES PVT. LTD.

(An ISO 9001:2000 Company)

201 A, Poonam Chambers, Worli, MUMBAI 400 018.
Tel: 91 22 40766444 / 40049750 Fax: 91 22 66605382 / 66605383
E-mail: precitex@vsnl.com Web Site: www.precitex.com

The Textile Association (India)
(Founded 1939)
ISO Certified Association

Printed at :
Sundaram Art Printing Press, Mumbai

Published by PAVITRA PUBLISHER
Mr. J. B. SOMA (Publisher)
7A/203, New Dindoshi Giridarshan CHS.,
Near N.N.P. No. 1 & 2, New Dindoshi,
Goregaon (E), Mumbai - 400 065.
M.: 9819801922
E-mail : pavitra1941@gmail.com / jb.soma@gmail.com

JTA is a Bimonthly Publication of
THE TEXTILE ASSOCIATION (INDIA)
Pathare House, 2nd Floor, Next to State Bank of India,
67, Ranade Road, Dadar (W), Mumbai - 400 028.
Phone : (91-22) 2446 1145 ● Fax (91-22) 2447 4971
E-mail : taicnt@gmail.com
www.textileassociationindia.org

JTA is Abstracted By :
Chemical Abstracts, USA | Indian Science Abstrats, India
World Textile Abstracts, UK | Texincon, India

Journal of the
JTA TEXTILE Association
TEXTILE SCIENCE ▮ TECHNOLOGY ▮ ENGINEERING ▮ MANAGEMENT

ISSN 0368-4636

May - June 2013
Volume 74 No. 1

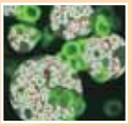
Contents

Editorial : Everyone wants Cleaner Technologies: But none knows who pays? 2
by Prof. (Dr.) Mangesh D. Teli,

Geotextiles and its Application in Coastal Protection and Off-shore Engineering 5
by Ashis Mitra

Dyeing of Milk Fibre with Marigold and Turmeric Dyes 12
by M. D. Teli, Javed Sheikh, Sanket P. Valia & Pushkar Yeola

Synthesis of Several Newly Disperse Dyes and their Application in Textile Printing 18
by M. M .El-Molla, Zeinab H. Ismaeil, Fekria M. A. Soliman & Shaimaa H. Abd-El Monem



Dendrimers - An Auxilliary in Dyeing 26
by Saptarshi Maiti & R. V. Adivarekar

Artificial Neural Network & its Applications in Textiles 31
by S. D. Bhambure, A. J. Dhavale, P. V. Kadole, & D. V. Kodavade

Texperience 38
Textile Industry - an ocean filled with opportunities
by Mr. V. R. Sai Ganesh

Texnotes 40
RSL in Textile Wet Processing
by Saptarshi Maiti & Shyam Phadke

OTHER FEATURES
News 42
Product Technology 57
Advertisement Index 37
Forthcoming Events 60

Editorial

Everyone wants Cleaner Technologies: But none knows who pays?

The Society of Dyers and Colourists organized the 10th International conference on Cleaner Technologies for Textile Processing for a Green Tomorrow. This conference held in Mumbai had in all 7 presentations sandwiched between panel discussions on brand expectations on the ZDHC (zero discharge of hazardous chemicals) roadmap and managing hazardous chemicals in the textile supply chain. Mr. Silvano Storti from Italy made a presentation on Zero liquid Discharge- a Reality. He sounded very confident of his experience with the technology application in various parts of the country.

Mr. Sunil Chaubal spoke on Membrane Technology for Cleaner production, where he discussed the advantages and disadvantages of micro, ultra and nano filtrations and explained their process of recovery of the Indigo dye from the textile waste effluents as well as poly vinyl alcohol from the waste discharge. Although, in the Indian industry they have not so far installed such systems, however they have developed the demonstration unit showing the concentration building exercise of Indigo from point 5gpl to around 40gpl using nano filters of various kinds. Similarly poly vinyl alcohol could be concentrated from 2% effluent into 12% concentration level.

Dr. Ton Kaarsgaren from Italy spoke on Clay Technology for a Cleaner production, in which he emphasised that clay being a mineral, it does not possess any COD and it is possible to reduce the COD levels of waste water as clay adsorbs the additionally soluble COD. Mr. Armin Traub from Germany spoke on Textile Printing solutions for Eco-Compliance, and he compared the textile printing based on plastisols, silicones and water based systems in terms of their merits and demerits and also the price comparisons.

Mr. D. Subaash Kumar from Tirupur presented a paper on Clean Production in a Dye-House- A Practical Study, wherein he described various measures taken in their unit in order to estimate the water first and subsequently reduce its use in the process. Use of solar energy for steam generation, application of natural evaporators as used in Germany, on-site water recovery by the use of eco-friendly anaerobic / ozone treatment, replacement of wood boiler by the fully automatic coal boiler, biogas for canteen cooking etc. were the various steps taken by them in order to conserve energy, water and chemicals and consequently bring down the costs of production. He in fact gave the example of the savings they generated during their efforts in cleaner production.

Dr. Mujeeb-ur-Rehman spoke on Cleaner Production: Initiative by the Chemical Industry, wherein he highlighted the significance of adopting the sustainability approach by design

rather than the end-of-the-pipe approach. He narrated various steps taken by their company towards ensuring ZDHC or the protection of the environment and the ecosystem at large. Finally, Ms. Aparna Khurana presented a paper on Enzymes for Cleaner Technology, wherein she described a multi-prong approach adopted by their company, DuPont, for sustainable solutions. Use of renewable energy to protect planet and the people is of primary importance and how Prima Green enzymes can create the possibility of shortening the textile wet processing sequence thus reducing the carbon footprint of the processed goods were the main aspects she emphasized in her presentation.

Then followed the Panel discussion which was ably chaired by Mr. Bart Van Kuijk and the panellists included Mr. Tirtha Ghosh (Huntsman), Mr. S. S. Aich (Alok Industries), Dr. Dirk von Czarnowski (Bureau Veritas), Mr. Rajesh Balakrishnan (DyStar) and Mr. Niraj Singh (Levi Strauss & Co). Most of the panellists agreed that it is high time the Indian textile and apparel manufacturing / processing industry concentrated on putting their house in order and see that the people and the planet are both well respected. The importance of following norms of REACH, eco labelling and maintaining the adherence to RSL (restricted substance list) etc. was once again stressed upon since it is in the interests of humanity as a whole and thus it becomes the responsibility of all the stakeholders in the value chain to maintain the prescribed standards. While it was agreed upon that the testing at various levels is not only becoming repetitive but also exorbitantly expensive, there is a need to create the trust among all the players so that their integrity in adhering to eco standards and social accountability becomes unquestionable. The presence of fashion brands such as H&M, Levis, C&A etc. further added flavour to this discussion while their readiness was understood to help the processors as much as possible, there was no commitment with respect to paying little more for such adherence to green technology.

However, no one was ready to blindly accept the cost of getting into greener technology, although it provides them a competitive edge; hence, while need for such cleaner technologies exists it was not clear that who should bear the costs entailed. Alas! One point on which all of them agreed was that it is the consumer who has to pay for it, as no one wanted to slash their slice of profit.

Prof. (Dr.) Mangesh D. Teli,
Chairman, Editorial Board, JTA

SUBSCRIPTION FORM

Journal of the TEXTILE Association

SUBCRIPTION FROM

I would like to subscribe / renew my subscription to Journal of the TEXTILES Association Bi-Monthly Magazine

Journal of the TEXTILES Association (Subscription Information)				
Frequency (Bi-monthly) Magazine		Cover Price	Your Discount	You Pay
❑	6 ISSUES (1 year)	₹ 500.00	---	₹ 500.00
❑	12 ISSUES (2 year)	₹1000.00	₹ 100.00	₹ 900.00
❑	18 ISSUES (3 year)	₹1500.00	₹ 200.00	₹ 1300.00

Personal Details

Name : _____

Designation : _____ **Company** _____

Address : _____

_____

City Pin : _____ **State :** _____

Country : _____

Phone : _____ **Fax :** _____ **Mobile :** _____

E-Mail : _____ **Website :** _____

Activity Desription : _____

Payment Details

Please find enclosed herewith Cheque / DD No. _____ **Dated :** _____

Form ₹ _____ **Rupees In words)** _____

Drawn on Bank _____ **Branch** _____

In favour of THE TEXTILE ASSOCIATION (INDIA) Payable at par in India

(Incase cheque is drawn outside Maharashtra, Add ₹ 50/-)

Date : _____ **Subscriber's Signature** _____

(Please attach Business Card)

Complete the details & Mail subscription from to :

THE TEXTILE ASSOCIATION (INDIA)
Pathare House, 2nd Floor, Next to State Bank of India, 67, Ranade Road, Dadar (W), Mumbai - 400 028.
Phone : (91-22) 2446 1145 • Fax (91-22) 2447 4971
E-mail : taicnt@gmail.com • www.textileassociationindia.org

Geotextiles and its Application in Coastal Protection and Off-shore Engineering

Ashis Mitra
Visva-Bharati University

Abstract
Geotextiles form part of a group of materials known as geosynthetics. Geotextiles are permeable textile materials designed rather engineered specifically for use in civil engineering and geotechnical applications like erosion control, soil stabilization, reinforcement, separation and drainage. The application is large and has expanded very rapidly worldwide especially during the last decade. Supported by the technological boom, geotextiles has invaded a large variety of domains and won trust and esteem around the world because of their inherent advantages like easiness and flexibility of use, softness (as compared to monolithic and rock constructions), rapidity of installation and long term efficacy. The use of geotextiles can save money by considerably reducing construction times, material costs and the costs of maintaining structures. This review paper highlights the constructional and functional aspects of this emerging branch of technical textiles, and emphasizes the potential role of various geotextile products in erosion control, soil stabilization, coastal protection and offshore engineering.

Keywords
Geosynthetics, Geotextiles, Erosion control, Soil stabilization, Off-shore engineering.

1. Introduction

A bridge between civil engineering and textile technology has been created by the invention of geotextiles. There are numerous geopolymeric materials which are used in civil engineering and other geotechnical applications, but probably the most important are geotextiles, which are permeable textile materials or fabrics used for soil stabilization, filtration, protection, and separation. Geotextiles were one of the first textile products in human history. Excavations of ancient Egyptian sites show the use of mats made of grass and linen. Geotextiles have been used for thousands of years. Geotextiles were used in roadway construction in the days of the Pharaohs to stabilize roadways and their edges. These early geotextiles were made of natural fibres, fabrics or vegetation mixed with soil to improve road quality, particularly when roads were made on unstable soil [1, 2]. In the early 1960s, woven monofilament fabric was used to eliminate an erosion problem along waterfront property in Florida. The success of this project resulted in the US Army Corps of Engineers using the monofilament fabric for erosion control and subsurface drainage. The US department of Agriculture Forest Service also began to experiment with woven geotextiles to stabilize logging roads in the mid-1960s. Around this same time in Europe, strong interest was growing in geotextiles, in part driven by higher prices and scarcity of gravel and sand [3]. Geotextiles are ideal materials for infrastructural works such as roads, harbours and many others. Geotextiles today are highly developed products that must comply with numerous standards.

All correspondence should be addressed to,
Ashis Mitra
Dept. of Silpa-Sadana, Textile Section,
Visva-Bharati University,
P.O. - Sriniketan, Dist - Birbhum, WB - 731236
E-mail : mitra.ashis1@gmail.com

2. Geotextiles Overview

2.1 Geotextiles Definition

Geotech segment comprises of technical textile products used in geotechnical applications pertaining to soil, rock, earth etc. This class of products is loosely called Geotextiles. However, geotextiles particularly refer to flat, permeable, polymer-synthetic or natural textile materials which can be non-woven, woven, knitted or knotted materials. They are used in contact with soil or rock and/or any other geotechnical materials in civil engineering earthworks and building constructions. In fact, geotextiles is one of the members of the geosynthetic family which comprises of geogrids, geonets, geotextiles, geomembranes, geosynthetic clay linters, geopipe, and geocomposites [1-4].

2.2 Construction and raw materials of geotextiles

Geotextiles are made from polypropylene (PP), polyester (PET), polyethylene (PE), polyamide (nylon), polyvinylidene chloride (PVC), and fiberglass, and their GSM varies from under 40 to over 3000 which are mainly used as landfills. PP and PET are the most widely used. Sewing thread for geotextiles is made from Kevlar or any of the above polymers. Different fabric composition and construction are suitable for different applications.

To survive aggressive underground environments, geotextiles must be resistant to various forms of attack, such as mechanical, chemical and biological. Chemical attack may be initiated directly by acidic and alkaline soils or indirectly by the active wastes present in the landfills. Depending on the type of chemical compound, changes in the polymer structure can be brought about by oxidation, chain scission, cross linking, swelling or dissolution of the polymers, volatilization or extraction of ingredients of the polymeric compound, or an increase in the crystallinity of the polymer. In addition the service temperature may accelerate the effects of chemical degradation.

2.3 Types of geotextiles

In general, the vast majority of geotextiles is made from polypropylene or polyester and can be formed into the following fabric categories [2, 4]

- Woven monofilament
- Woven multifilament
- Woven slit-film monofilament
- Woven slit-film multifilament
- Nonwoven continuous filament heat bonded
- Nonwoven continuous filament needle-punched
- Nonwoven staple needle-punched
- Nonwoven resin bonded
- Other woven and nonwoven combinations
- Knitted.

The non-woven geotextiles provide planar water flow in addition to stabilization of soil. Typical applications include, i) access road and rail building, ii) dam, canal and pond lining, iii) hydraulic works, sewer lines, iv) asphalt pavement overlays, v) soil stabilization and reinforcement, vi) soil separation, vii) drainage, viii) landfill, ix) filtration, x) weed control, xi) sport surfaces, xii) drainage channel liners, xiii) sedimentation and erosion control, etc. Woven geotextile looks like burlap. It is a fabric made of two sets of parallel strands systematically interlaced to form a thin, flat fabric. The strands are of two kinds - slit film which are flat, or monofilaments which are round. The way these two sets of yarns are interlaced determines the weave pattern that in turn determines the best application for that woven fabric. Weave patterns come in a virtually unlimited variety that do affect some properties of the fabric. Woven geotextiles are generally preferred for applications where high strength properties are needed, but where filtration requirements are less critical and planar flow is not a consideration [3]. Woven geotextiles are mainly used in coastal works, embankment and in or near dams, waterways, and woven geogrids for reinforcement. Both woven and knitted geotextiles are beneficially used for a wide range of both cohesive and non-cohesive soils and they support quick formation of a natural soil filter. They facilitate dissipation of pore pressures and, thanks to their strength characteristics and low elongation; they improve mechanical properties of soil and enable the construction of reinforcing ground structures in this way [5].

2.4 Desired Characteristics of Geotextiles

The desired characteristics of woven geotextiles are [1]:

- Ability to resist clogging,
- Excellent elongation at break,
- Excellent water permittivity,
- Good grab tensile strength,
- Good puncture resistance,
- Trapezoidal tear strength,
- UV resistance,
- Very good Mullen burst.

2.5 Segments of Geotech

There are mainly four segments of Geotech family namely [1],

- Geogrid,
- Geonet,
- Geomembrane, and
- Geocomposites.

2.6 Functions and Applications of Geotextiles

Geotextiles perform one or more basic functions in a

structure like filtration, drainage, separation, erosion control, sediment control, reinforcement, and (when impregnated with asphalt) moisture barrier. In any one application, a geotextiles may be performing several of these functions [2, 4]. The main functions are explained below.

2.6.1 Separation

In this case, a strong and flexible Geotextile is placed between different layers in the construction preventing migration and mingling of materials, yet allowing free movement of water. This increases bearing capacity and provides long-term stability to the foundation layers **(Figure 2.1)**.

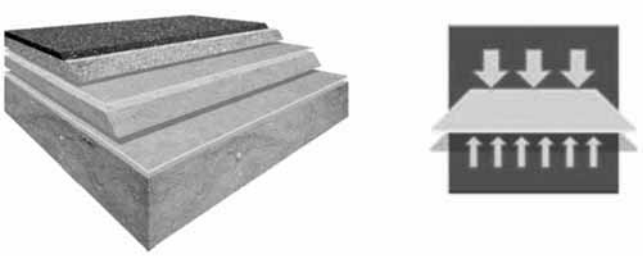


Figure 2.1: Separation function of geotextiles.

2.6.2 Filtration

In this case **(Figure 2.2)**, the pore structure of Geotextiles is designed to retain particles while allowing free movement of water, making it possible to separate two layers during intense hydraulic activity. Migration of layers, which would reduce the load-bearing capacity of the system is thereby avoided and at the same time water flow is maintained with minimum pressure loss.

Figure 2.2 Filtration function of geotextiles

2.6.3 Drainage

The hydraulic properties of Geotextiles are designed to drain excess water off the construction not by passing through the fabric but by flowing in the plane of the fabric away from the construction. Use of a drainage geotextile **(Figure 2.3)** ensures ongoing drainage of fluids with minimum pressure loss.

Figure 2.3 Drainage function of geotextiles

2.6.4 Reinforcement

The mechanical properties of Geotextiles and Geogrid (100 % polyester grid), make them ideal for reinforcing slopes and other soil structures. Reinforcing with appropriate product prevents vertical soil walls and steep slopes from collapsing **(Figure 2.4)**.

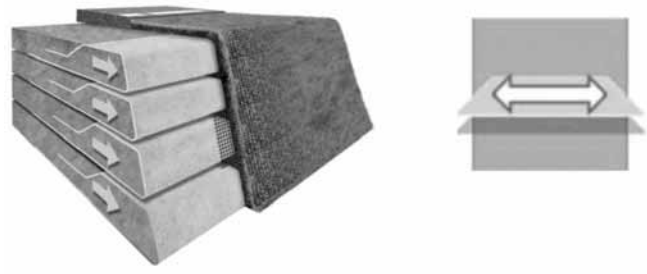


Figure 2.4 Reinforcement function of geotextiles

2.6.5 Stress relieving

The ?exible pre-compressed nonwoven Geotextile fabric designed especially for stress relieving **(Figure 2.5)** is ideal in both new road constructions and in road maintenance, as it absorbs differential movements in the road layers, preventing re?ective cracking. The bitumen-saturated paving fabric also forms a waterproof interlayer, protecting the subsoil from water intrusion and thereby loss of bearing capacity.

Figure 2.5 Stress relieving function of geotextiles

Geotextiles with their built-in functions are virtually tailor-made or designed based on end-use or application. Major requirements include: tensile strength; permeability to air, fluids and/or light; mesh size suited to

end-use, such as filtration, sieve or separation; chemical, mechanical or thermal resistance; and durability. Coating materials play a very important role in enhancing geotextile properties and functions. Primary coating materials used include polyvinyl chloride, bitumen, latex, plastisol, silicone and other similar materials [6,7].

Typical filtration applications might include the use of a geotextiles in land drainage, river and coastal defense works, or as an anti-pumping filter below railway ballast [2, 4]. When functioning as a drain, geotextile acts as a conduit for the movement of the liquids or gases in the plane of the geotextiles. Examples are geotextiles used as wick drains and blanket drains. In the most common reinforcement application, the geotextile interacts with soil through frictional or adhesion forces to resist tensile or shear forces. To provide reinforcement, a geotextile must have sufficient strength and embedment length to resist the tensile forces generated, and the strength must be developed at sufficiently small strains (i.e. high modulus) to prevent excessive movement of the reinforced structure. To reinforce embankments and retaining structures, a woven geotextile is recommended because it can provide high strength at small strains. When used as a separation layer, the geotextile prevents intermixing of particles from two soil layers with different properties. Typical separation applications might include geotextiles used in the construction of unpaved access roads, paved roads, railway tracks, domestic drives, paths and patios [2, 4].

Some typical applications of geotextiles are depicted in **Figures 2.6 - 2.11**.

Figure 2.6: Highways and roads construction

Figure 2.7: Golf course and sports field solutions

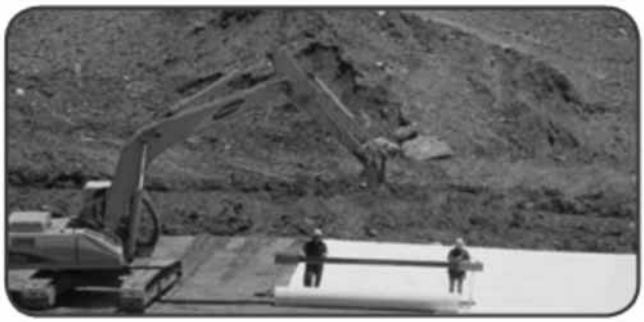


Figure 2.8: Mining solutions

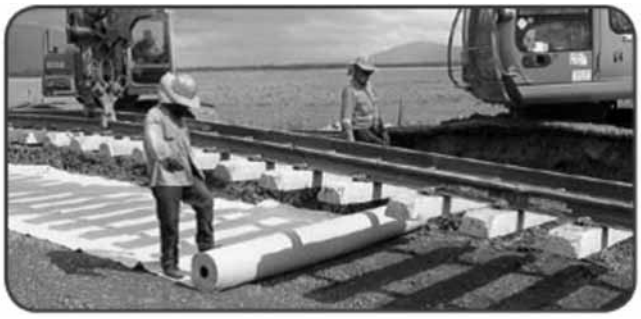


Figure 2.9: Application in railways

Figure 2.10: Solution for pavement cracking and water ingress in the sub-base

Figure 2.11: Non-woven geotextiles is being used in a drainage application during roadway construction

3. Erosion Control Mechanism and Role of Geotextiles

Erosion is caused by a group of physical and chemical processes by which the soil or rock material is loosened, detached, and transported from one place to another by running water, waves, wind, moving ice, or other geological sheet and bank erosion agents. Clay soils are less erodible than fine sands and silts.

In erosion control, the geo-textile protects soil surfaces from the tractive forces of moving water or wind and rainfall erosion. Geotextiles can be used in ditch linings to protect erodible fine sands or cohesionless silts. The geotextile is placed in the ditch and is secured in place by stakes or is covered with rock or gravel to secure the geotextile, shield it from ultraviolet light, and dissipate the energy of the flowing water. Geotextiles are also used for temporary protection against erosion on newly seeded slopes. After the slope has been seeded, the geotextile is anchored to the slope holding the soil and seed in-place until the seeds germinate and vegetative cover is established. The erosion control function can be thought of as a special case of the combination of the filtration and separation functions [3]. Ideally, vegetation can form the best erosion control, but this is often difficult to establish. The use of hydroseeding or seed impregnated fabric can be an effective method to establish vegetation. Hydroseeding, sometimes referred to as hydromulching is a process of planting grass that is fast, efficient and economical. A mix is made of mulch, seed, fertilizer, and water. This mix is then pumped and sprayed onto the ground where the slurry with a consistency of papier-mache provides an ideal germination medium. Geotextiles are only superior to hydroseeding, 1) when the growing season is short and plants cannot stabilize the slope quickly, 2) at high altitudes, or 3) where major storms are a frequent occurrence. Too often, synthetic geotextiles are used in situations where hydroseeding would be a far more appropriate choice. This overuse of geotextiles is because of the ease of use and low maintenance required. Geotextiles use, of course, will sometimes mask the slope failures until erosion is too far advanced to effectively and cheaply remediate the slope. When advanced erosion is detected, it means costly restoration. In contrast when a hydroseeded area has crust failure, whether from weather, human or animal activity, the damage is visible early and can be cheaply repaired.

Erosion control covers a variety of conditions from high velocity stream flow to heavy wave action, to less severe conditions. All conditions should be considered before selecting a method of control. In many arid and semi-arid areas the action of the wind causes considerable erosion. Geotextiles made from natural fibre such as coir, or jute can be used for wind erosion control, dust control, sand dune formation and stabilization. Jute is particularly useful for dust control because of the hairiness of the fibres. Plant fibre-based erosion control geotextiles are subject to decomposition and have a limited shelflife before their inherent durability suffers. The synthetic polymers have the advantage of not decaying under biological and chemical processes, but cause environmental pollution in their manufacture and use, and have associated health risks [3].

Some real-life projects on the application of natural fibre-based geotextiles for erosion control and riverbank protection are mentioned below,

- A live project carried out by the National Institute of Research on Jute and Allied Fibre Technology (NIRJAFT), Kolkata for protection of a part of the bank of Mayurakshi river at Mayureswar and of Brahmani river at Rampurhat, Birbhum, West Bengal (Figures 3.1a and 3.1b).
- Application of GarmatTM Erosion Control Mat at the coastal area of Vishakapatnam, Andhra Pradesh (Figure 3.2).
- Application of GarmatTM Erosion Control Mat at the Mahanadi Coal Fields, Talcher, Orissa (Figure 3.3).

Figure 3.1a: Natural fibre-based geotextiles is being installed on the river bank

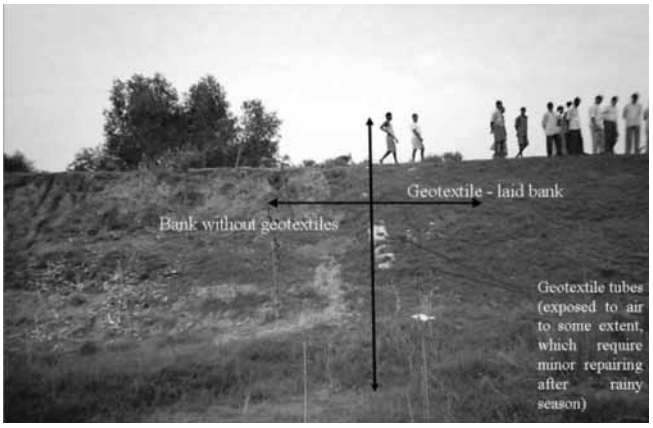


Figure 3.1b: Condition of river bank with and without geotextiles

Figure 3.2: Application of erosion control mat (Vishakhapatnam, A.P.)

Before application **After application**

Figure 3.3: Erosion control mat application at Mahanadi Coal Fields, Talcher, Orissa

4. Protection and Off-shore Engineering

Due to sea or river current, fine soils of the bank start migrating causing erosion. Conventional design of cementing the banks is not a solution due to hydraulic pressure of the soil. Only feasible solution is the application of geotextiles or geosynthetics. Geotextiles allow water to pass through but resist the fine soil migration.

Geotextiles protect the coast line as their flexibility and permeability ensure withstanding of the impact of waves and currents, preventing erosion and washing out of lines **(Figure 4.1)**.

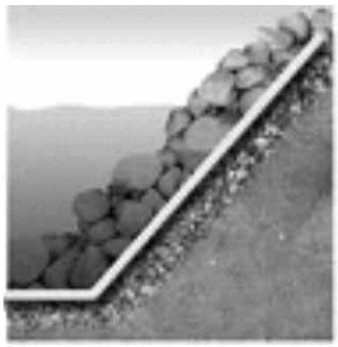


Figure 4.1

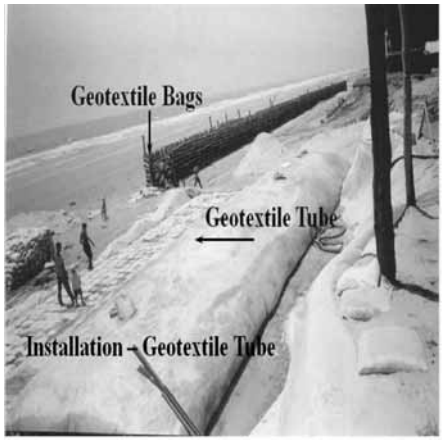


Figure 4.2

Figure 4.3

Woven geotextile containment systems in tubular forms filled with locally available sand/slurry are formed in-situ on land or in water to protect shore and marine environments. Geotextile Tubes are used as a cost-effective alternative to mitigate erosion on coastal shorelines, riverbanks, and lakes using readily available materials for infill. Geotextile Tubes filled with dredged materials or sand and strategically placed will dissipate the wave energy, as well as provide structural support against other erosive forces. Geotextile Tubes can be set in place along shorelines and river fronts either to be left exposed to battle the elements, or incorporated into the environment as part of a manmade dune or riverbank. They can also be placed in the water to serve as jetties and groins.

Few real-life projects on application of geotextile products for coastal protection and off-shore engineering works are mentioned below,

- Installation of geotextile bags and geotextile tubes along the coast line of the Bay of Bengal from Shankarpur to Haldia, West Bengal **(Figures 4.2 and 4.3)**.
- Application of Geotextile tubes at the coastal area of INS Hamla, Malad (W), Mumbai.
- Application of geotextile tubes to protect sea wall of Uppada, A.P.
- Reclamation bundh using imported geotextile containers at Adani Port, Gujarat **(Figure 4.4)**.

Figure 4.4 : Reclamation bundh at Adani Port

5. Geotextile Market

According to information provided by Dornier, the global geotextiles market is estimated to have been worth $3 billion in 2009. The nonwovens sector accounts for 74.5 % of the growth; wovens, 25 %; and other systems, 0.5 %. According to GMA, the U.S. and Canadian geosynthetics market has a current estimated value of $2.1 billion, with the U.S. share of that market put at 90 % and the Canadian share at 10 %. Within that market, geotextiles has a 32-percent share. Dornier reports that the growing Indian geotextiles market has a value of some $49.6 million, but it is expected to grow to nearly $66 million by 2012. Projected annual growth is 12 %, and long-term, it will increase to 20 %. The future for nonwoven and woven geotextiles is bright. Infrastructural programs are being undertaken mainly in emerging markets, but Europe and the United States are seeing increased demand. Especially in emerging countries such as Brazil, India, China and Russia, demand goes along with the rising mobilization and improved public transport facilities - including new airports. The use of geotextiles significantly reduces civil engineering construction costs and drastically extends the life of any construction associated with geotechnical applications [7].

6. Conclusion

Geotextiles offer a safe and economical solution to everyday engineering challenges and construction requirements. Used as replacement of natural materials, geotextile products perform a wide range of functions such as erosion control, soil stabilization, filtration, drainage, separation and reinforcement requirements. Geotextile bags, tubes and containers made with geotextiles are playing a major role in hydraulic, coastal, offshore engineering and river protection works. The use of geotextiles can save money by considerably reducing construction times, material costs and the costs of maintaining structures. The global geotextile market is enjoying strong growth but it is also highly competitive. In order to succeed, geotextile manufacturers have to develop cost effective, innovative products and processes. Furthermore, to increase their competitiveness in the global geotextile market, they must identify market requirements and introduce advanced products which are specific to end-use requirements.

References

1. Basant T. and Jahan S., Engineering use of textiles in geotextile, http://www.technicaltextile.net/articles/geotextiles.
2. Mandal D. N., *Man-Made Textiles in India*, **XXXV** (3), 88, (1990).
3. Geotextiles: The Fabric of Erosion Control; http://www.multigeo.com sited on August 11, 2013.
4. Mandal D. N., *Man-Made Textiles in India*, **XXXV** (7), 241, (1992).
5. Departments of the Army & the Air Force, Engineering use of Geotextiles; *Army TM 5-818-8/AFJMAN 32-1030*; **July** (1995).
6. Koffler A., Choura M., Bendriss A., and Zengerink E., *Journal of Coastal Conservation*, **12** (1), 11 (2008).
7. Rupp J., *Textile World*, **Jan/Feb** (2011), Published on http://www.textileworld.com

❐ ❐ ❐

Dyeing of Milk Fibre with Marigold and Turmeric Dyes

M. D. Teli*, Javed Sheikh, Sanket P. Valia & Pushkar Yeola
Institute of Chemical Technology

Abstract
Fabric made from Casein, the protein present in milk, has already acquired an important position in textile industry and its properties are hailed to be suitable for apparel as well as medical textiles. Also from the environmental perspective, it is considered to be sustainable fibre. The inherent bacteriostatic property of Casein fibres has played an incremental role in increasing its popularity as a fibre. A lot of marigold (which is antibacterial), used in idol worshipping, forms a temple waste and there is tremendous potential to use this waste as a good source of natural dye. Turmeric, a natural dye known for producing bright yellow shades was also used. In the current study, alum, copper sulphate and the tannin mordant extracted from tamarind (*Tamarindus indica L.*) seed coats were used as mordant in natural dyeing of Casein fabric using turmeric and marigold. The Casein fabrics were then evaluated for colour values, fastness properties, and anti-bacterial activities. The results clearly indicated the advantages of using such mordants both in case of obtaining antibacterial functionality as well as eco-friendliness.

Keywords
Casein, Natural dyeing, Bacteriostatic, Antibacterial properties.

1. Introduction

Textile materials (natural and synthetic) were coloured for value addition, look and desire of the customers. Anciently, this purpose of colouring the textile material was initiated using natural source of dye. After the synthesis of Mauveine by William Henry Perkin and its subsequent commercialization, the use of natural dyes receded and the position continued to be much the same until in the recent past when growing environmental protection regulations came into existence. For ready availability of pure synthetic dyes of different types/classes and its cost advantages, most of textile dyers/manufacturers shifted towards the use of synthetic colourants. However almost all the synthetic colourants are synthesized from petrochemical sources through hazardous chemical processes which poses a threat towards its eco-friendliness [1].

Increasing environment awareness has made people realize the importance of living with a clean atmosphere. Government of Germany was the first to take initiative to put up a ban on azo-dyes manufacturing, dyeing, and importing textile and other consumer goods dyed with these dyes [2]. There is considerable rise in the popularity of natural lifestyle based on naturally sustainable goods. The natural dyes for textile colouration has re-flourished due to their recently discovered de-odorizing, anti-microbial, UV protective properties in addition to the elegant shades on different types of fabrics [3 - 5].

Applications of waste materials as sources of natural dyes can also assist in the preservation of the environment and also decrease the cost of natural dyeing. There is common practice in India of throwing the temple flowers once used in Idol worship into river water which contributes to the water pollution. The waste disposal of such flowers is itself an issue and hence exploring the potential of using this marigold flower waste from temples for dyeing of textile is important. Dyeing of textiles with marigold flower as a dye as such has been reported earlier [6-13]. Turmeric has been quite popular for producing bright yellow shades and inherent anti-microbial characteristics.

Many of the natural conventional fibres are subjected to dyeing with natural colours. However, relatively very little work has been reported on dyeing of Milk fibres with natural colours in general and marigold and turmeric in particular.

**** All correspondence should be addressed to,***
Prof. (Dr.) M. D. Teli
Department of Fibres and Textile Processing Technology,
Institute of Chemical Technology, Mumbai.
Tel. +91-22-3361 2811
Fax : +91-(22)-3361 1020
E-mail : mdt9pub@gmail.com

2. Materials and Methods

2.1 Materials

Casein yarn was supplied by RSWM mills limited. The yarn was knitted to make fabric (single jersey) which was scoured and used for dyeing. All chemicals used were of laboratory grade. Marigold flowers and Turmeric powder was obtained from ISCON temple, Mumbai and Ayurvedic Chemist Stores respectively. The tamarind seeds were procured from local market.

2.2 Methods

2.2.1 Extraction of mordant

1% stock solution of alum was made by dissolving 10 gm of mordant powder in 1000 ml water. In case of natural mordants, 1% stock solution was made by boiling 10 gm of mordant powder in 1000 ml water for 1h. The extract was filtered, made to original volume and used for mordanting.

2.2.2 Extraction of dye

1% stock solution of the marigold dye was prepared by boiling 10 gm of dry marigold flowers in 1000 ml water for 1 h. The extract was filtered, made to original volume and used for dyeing.

2.2.3. Mordanting and dyeing of milk fibres

The mordanting of knitted Casein fabric was carried out in Rota dyer (Rota Dyer machine, Rossari® Labtech, Mumbai) keeping the liquor to material ratio of 30:1.The fabrics were introduced into the mordant solution at room temperature and slowly the temperature was raised to 60^0C. The mordanting was continued at this temperature for 30 min. After mordanting, the fabric was squeezed and dyed using marigold flowers extract as a dye. The mordanted fabrics were introduced in dyebath and dyeing was continued at 60^0C for 1h. After dyeing, the fabrics were squeezed and washed with cold water. The mordanting and dyeing using turmeric extract was carried out using the same procedure.

3. Testing and Analysis

3.1 Colour value by reflectance method

The dyed samples were evaluated for the depth of colour by reflectance method using 10 degree observer. The absorbance of the dyed samples was measured on Rayscan Spectrascan 5100+ equipped with reflectance accessories. The K/S values were determined using expression;

$$\frac{K}{S} = \frac{(1-R)^2}{2R}$$

Where, R is the reflectance at complete opacity; K is the Absorption coefficient & S is the Scattering coefficient Dyed fabrics were simultaneously evaluated in terms of CIELAB colour space (L*, a* and b*) values using the Rayscan Spectrascan 5100+. In general, the higher the K/S value, the higher the depth of the colour on the fabric. L* corresponding to the brightness (100- white, 0- black), a* to the red-green coordinate (positive- red, negative -green) and b* to the yellow-blue coordinate (positive -yellow, negative -blue). As a whole, a combination of these entire co-ordinates enables one to understand the tonal variations.

3.2 Washing fastness

Evaluation of colour fastness to washing was carried out using ISO II method [14]. A solution containing 5 g/L soap solution was used as the washing liquor. The samples were treated for 45 min at 50^0C using liquor to material ratio of 50:1 in rota machine. After rinsing and drying, the change in colour of the sample and staining on the undyed samples were evaluated on the respective standard scales (rating 1-5, where 1 - poor, 2 - fair, 3 - good, 4 - very good and 5 - excellent).

3.3 Light fastness

Dyed fabric was tested for colour fastness to light according to ISO 105/B02 [16]. The light fastness was determined using artificial illumination with Xenon arc light source, Q-Sun Xenon Testing Chamber with black standard temperature 65^0C with relative humidity of the air in the testing chamber as 40% and daylight filter, wavelength, 420 nm. The samples were compared with the standard scale of blue wool (ratings, 1-8, where 1 - poor, 2 - fair, 3 -moderate, 4 - good, 5 - better, 6 - very good, 7 - best and 8 -excellent).

3.4 Determination of antimicrobial activities of dyed fabrics

The antibacterial activity of the treated fabrics was estimated by AATCC Test Method 100-2004 [15]. The reduction in number of bacterial colonies formed with respect to the untreated control sample was estimated by using following equation,

$$R = \frac{100\ (B - A)}{B}$$

Where R = % reduction in bacterial count,

A = the number of bacterial colonies recovered from the inoculated treated test specimen swatches in the jar incubated for 24 h contact period,

B = the number of bacterial colonies recovered from the inoculated untreated control test specimen swatches in the jar immediately after inoculation (at "0" contact time).

3.5 Durability of antimicrobial activity

The durability to laundering was measured using washing conditions as per ISO 105-CO6-1M [16].

4. Results and Discussion

4.1 Colour values of marigold and turmeric dyed Casein fabric

The dyeing of Casein fabric using most commonly used metal mordants like alum and copper sulphate and natural mordant tamarind (tamarindus indica L.) seed coat was attempted and results are summarized in **Tables 4.1 - 4.8.**

Initial attempt of the study involved estimation of the contribution of mordant and dye towards colour values of the dyed fabrics. Hence Casein fabrics were initially in one case, just mordanted but not dyed and in second case just dyed without pre-mordanting. The results in **Table 4.1** show the increase in K/S values with increasing concentration of mordants. Copper sulphate showed least effect on colour values among the three mordants studied with increasing concentration from 5% to 20%. While the tannin mordants, tamarind seed coat showed highest K/S followed by metal mordant alum. The K/S values increases with increasing dye concentration from 5% to 20%. Casein fibres showed limited dyeability towards turmeric dye and marigold dye in absence of mordants, which might be due to lack of bonding of dye with the fibre in absence of mordants resulting in removal of superficially held dye, during washing. The results of dyeing of marigold and turmeric using different mordants are summarized in **Tables 4.2-4.7.**

The K/S values were found to be improving with increasing mordant concentration till 20%. For a constant alum concentration, K/S values were found to be increasing for both marigold dye and turmeric dye as their concentration was increased from 5% to 20%. Similarly for constant dye concentration, colour values increased with increase in mordant concentration. The colour values thus obtained, in the case of natural dyes is a combined contribution of the effect of mordant and the dye. Hence the K/S was improved with mordant and dye concentration initially till the near equilibrium values in some cases were reached. The increase in concentrations of either mordant or dye beyond optimum concentrations did not significantly contribute in the improvement of the depth of dyeing which is reflected in K/S values.

The results in **Table 4.8** clearly indicate the fastness properties of the dyed Casein fabrics obtained using various mordants. The only dyed samples showed much inferior fastness properties as compared to those which were pre-mordanted and dyed. In other words it indicates that the mordants play an important role in holding the natural dye to the fabric. The washing fastness obtained varied in the range of "very good" to "excellent" grade.

Table 4.1: Effect on colour values of only Mordanted and only Dyed Samples

	Conc. (%)	K/S	L*	a*	b*
Alum	5	0.9327	74.794	-3.794	14.438
	10	0.9582	77.323	-5.174	21.585
	15	1.0956	76.888	-5.426	21.263
	20	**1.9022**	**75.345**	**-2.486**	**16.568**
Copper sulphate	5	0.9446	73.711	1.305	17.268
	10	1.3995	73.222	2.264	17.49
	15	1.5764	71.838	4.622	15.791
	20	**1.7852**	**73.273**	**3.779**	**18.765**
Tamarind seed coat	5	1.2431	73.318	-8.556	12.941
	10	1.4218	72.947	-9.001	11.993
	15	1.5567	69.033	-10.008	20.391
	20	**1.911**	**67.82**	**-5.949**	**16.7**
Turmeric	5	0.9914	68.171	-1.683	15.364
	10	1.4347	72.178	-0.818	19.45
	15	1.9987	73.848	-0.735	20.765
	20	**2.4652**	**73.512**	**-0.306**	**20.72**
Marigold	5	1.3646	89.166	-7.334	56.821
	10	2.9508	89.276	-5.176	56.991
	15	2.4064	89.333	-3.699	57.572
	20	**2.5179**	**89.514**	**-5.148**	**57.008**

Textsmile

All my life I thought air was free, until I bought a bag of chips.

Table 4.2: Effect of different concentrations of alum mordant and turmeric dye solution on colour values.

Alum (%)	Turmeric (%)	K/S	L*	a*	b*
5	5	22.1589	79.026	-2.955	93.043
5	10	27.0809	78.475	1.778	94.759
5	15	28.7777	79.283	2.522	96.636
5	20	37.8263	78.672	4.004	96.225
10	5	26.0098	78.579	4.187	96.752
10	10	29.2929	79.496	-3.551	93.523
10	15	30.6079	78.907	3.652	97.165
10	20	33.137	78.714	1.729	95.445
15	5	30.0502	76.412	7.281	94.905
15	10	32.4005	79.855	-3.21	94.616
15	15	33.1288	79.705	1.991	97.268
15	20	34.7535	74.122	8.606	97.453
20	5	33.5436	72.249	11.348	95.58
20	10	34.0205	77.146	-1.342	97.891
20	15	36.434	77.468	1.246	99.103
20	**20**	**37.1631**	**76.121**	**3.864**	**98.41**

Table 4.3: Effect of different concentrations of copper sulphate mordant and turmeric dye solution on colour values.

Copper sulphate (%)	Turmeric (%)	K/S	L*	a*	b*
5	5	19.1493	60.785	0.558	64.658
5	10	22.8882	59.471	2.837	63.291
5	15	26.6792	60.499	5.435	65.349
5	20	29.5519	59.977	9.014	65.853
10	5	18.4003	59.977	-0.686	63.049
10	10	24.1356	60.672	2.923	65.085
10	15	27.3696	61.632	5.013	67.201
10	20	29.5705	59.877	7.729	65.307
15	5	18.1995	59.198	0.411	62.302
15	10	26.1536	61.087	3.847	65.867
15	15	28.4376	56.334	6.811	65.214
15	20	29.6454	54.779	9.743	63.531
20	5	17.532	53.75	0.657	60.556
20	10	23.9975	55.407	2.992	63.44
20	15	27.5476	55.895	6.979	64.612
20	**20**	**31.4385**	**55.795**	**9.129**	**65.132**

Table 4.4: Effect of different concentration of tamarind seed coat (TSC) mordant and turmeric dye solution on colour values.

TSC (%)	Turmeric (%)	K/S	L*	a*	b*
5	5	14.4435	70.887	-2.452	73.218
5	10	25.676	70.261	5.523	74.555
5	15	26.9971	73.293	1.372	78.519
5	20	28.4722	73.292	5.281	80.65
10	5	15.7206	65.131	3.749	65.248
10	10	25.7616	71.094	3.359	75.714
10	15	27.5722	71.297	4.294	76.523
10	20	29.1288	71.729	6.516	78.65
15	5	15.9238	64.352	3.498	64.739
15	10	27.0515	67.94	6.508	71.841
15	15	28.6639	62.83	8.539	74.51
15	20	30.1722	64.003	12.976	78.366
20	5	18.2661	59.05	5.502	67.201
20	10	26.8952	60.952	7.33	70.991
20	15	29.9193	60.927	8.86	71.488
20	**20**	**30.9436**	**60.185**	**14.185**	**72.787**

Table 4.5: Effect of different concentration of alum mordant and marigold dye solution on colour values

Alum (%)	Marigold (%)	K/S	L*	a*	b*
5	5	4.3008	63.285	3.399	34.299
5	10	6.699	67.647	3.119	38.539
5	15	8.3482	67.798	2.52	38.1
5	20	10.8415	69.509	2.245	39.718
10	5	4.8921	63.877	2.297	33.543
10	10	6.8251	65.573	2.68	35.466
10	15	10.3651	68.279	2.449	38.713
10	20	11.7715	69.495	2.613	40.081
15	5	4.9895	64.379	2.4	34.318
15	10	7.4599	66.005	2.482	36.116
15	15	10.5685	56.599	5.38	39.709
15	20	12.6795	58.357	5.657	41.893
20	5	5.212	50.231	3.581	31.652
20	10	7.7505	54.731	5.449	37.483
20	15	10.8714	56.617	5.62	39.516
20	**20**	**14.0678**	**57.958**	**5.42**	**41.188**

Table 4.6: Effect of different concentration of copper sulphate mordant and marigold dye solution on colour values

Copper Sulphate (%)	Marigold (%)	K/S	L*	a*	b*
5	5	3.2563	58.732	-1.156	21.202
5	10	4.0107	60.223	0.03	23.465
5	15	5.5203	62.779	1.327	27.14
5	20	6.6815	64.176	2.045	29.198
10	5	3.434	58.414	-1.898	20.518
10	10	4.239	59.945	0.112	23.188
10	15	5.5761	61.611	1.002	25.401
10	20	6.7413	63.258	1.844	27.778
15	5	3.8376	57.947	-2.448	19.638
15	10	4.5915	59.147	-0.686	21.797
15	15	5.8989	55.593	1.318	25.386
15	20	6.7894	57.494	2.495	28.306
20	5	4.102	51.925	-2.245	19.66
20	10	4.8049	53.093	-0.295	21.833
20	15	5.9798	54.583	0.722	23.987
20	**20**	**6.8065**	**56.78**	**1.934**	**27.07**

Table 4.7: Effect of different concentration of tamarind seed coat (TSC) mordant and marigold dye solution on colour values

TSC (%)	Marigold (%)	K/S	L*	a*	b*
5	5	1.5462	70.207	1.704	21.118
5	10	2.1284	73.573	1.192	24.582
5	15	2.884	74.302	1.084	25.63
5	20	3.5838	75.863	0.938	26.597
10	5	1.6281	69.356	3.177	20.8
10	10	2.2581	71.271	2.22	22.332
10	15	2.9508	73.46	1.614	24.42
10	20	3.6367	74.294	1.848	25.476
15	5	1.8772	70.235	2.706	22.773
15	10	2.4728	72.471	2.68	24.634
15	15	2.9632	65.32	4.468	26.875
15	20	3.8386	66.283	3.996	27.147
20	5	2.0361	61.959	5.85	25.184
20	10	2.5527	64.199	5.298	27.08
20	15	2.9957	63.904	6.182	25.462
20	**20**	**3.9897**	**64.63**	**5.56**	**25.396**

Table 4.8: Fastness Properties of dyed samples

Dye	Mordant (20%)	Wash Fastness		Light Fastness
		Change in colour	Staining on cotton	
Marigold (20%)	-	3	3	4
	Tamarind Seed Coat	4-5	4-5	6
	Alum	4-5	4-5	6
	Copper sulphate	4-5	4-5	7
Turmeric (20%)	-	2-3	3	2
	Tamarind Seed Coat	4	3-4	4
	Alum	4	3-4	4
	Copper sulphate	4	3-4	5
Only mordanted (0 % dye)	Tamarind	3-4	3-4	3
	Seed Coat Copper sulphate	3	3-4	3

4.2 Antibacterial activity of Casein fabric

The results of antibacterial activity of only mordanted samples and only dyed samples as well as that of mordanted and dyed samples are given in **Tables 4.9 and 4.10**. Only mordanted samples showed higher antibacterial property than that of the only dyed sample in case of copper sulphate as mordant whereas the trend was vice versa incase of alum and tamarind seed coat. The mordanted and dyed samples showed highest antibacterial property. All the three mordants gave more or less similar extent of overall antibacterial activity to casein on dyeing with marigold. Hence the natural dyeing of casein with marigold using different mordants, including ecofriendly natural mordants, can be claimed as simultaneous dyeing cum antibacterial finishing process. There is relative increase in the antibacterial nature with casein mordanted with copper sulphate and tamarind seed coat. In both the cases, copper sulphate mordanted casein followed by dyeing with turmeric first and in next case with marigold, showed the best anti-bacterial results in presence of bacteria like *Staphylococcus aureus* and *Escherichia coli*.

Table 4.9: Effect of mordant type (20%) and marigold (20%) on antibacterial properties

Mordant	Mordant conc.	Marigold conc.	Bacterial Reduction (%)	
			S.aureus	E. coli
Alum	20	-	61.00	76.25
	-	20	75.90	80.75
	20	20	98.50	98.75
CuSO4	20	-	82.50	86.75
	20	20	99.75	100
TSC	20	-	75.50	82.75
	20	20	99.50	100

Table 4.10: Effect of mordant type (20%) and turmeric (20%) on antibacterial properties

Mordant	Mordant conc.	Turmeric conc.	Bacterial Reduction (%)	
			S.aureus	E. coli
Alum	20	-	61.00	76.25
	-	20	70.85	72.75
	20	20	96.5	95.95
CuSO4	20	-	82.50	86.75
	20	20	98.75	99.25
TSC	20	-	75.50	82.75
	20	20	98.50	99.00

5. Conclusion

Ecofriendly dyeing and antibacterial finishing of Casein (Milk fibre) was successfully carried out using natural and metal mordants and marigold and turmeric dyes. The dyed products displayed good colour strength which was comparable with those obtained using alum as a mordant. The fastness properties were also comparable for selected mordants. The natural mordanted-dyed samples displayed broad spectrum and very high antibacterial activity. The concept of natural dyeing using natural mordant is thus found to be quite promising, as it has potential for replacement of non-ecofriendly mordants. The ecofriendly hygienic Casein (Milk) fabrics thus can be obtained using such a concept.

References

1. Samanta A.K. and Konar A, Dyeing of Textiles with Natural Dyes, Department of Jute and Fibre Technology, Institute of Jute Technology, University of Calcutta, India. www.intechopen.com
2. Vankar P.S., Shanker R., Srivastava J., *Dyes and Pigments*, 33-37, (2007).
3. Shahid M., Ahmad A., Yusuf M., Khan M.I., Khan S., Manzoor N., Mohammad F., *Dyes and Pigments*, **95**(1), 53-61, (2012)
4. Cardamone J.M., Proteolytic activity of Aspergillus flavus on wool., *AATCC Rev*; 2002:30-5.
5. Singh R, Jain A, Panwar S, Gupta D, Khare SK., *Dyes and Pigment*, 102, (2005).
6. Teli M. D., Sheikh J., Trivedi R. and Katkar F., *Asian Dyer*, **9** (3), 37-41, (2012).
7. Vankar P.S., Shanker R., Wijayapala S., *Journal of Textile and Apparel, Technology and Management*, **6** (1), 1-15(2009).
8. Jothi D., *Autex Res J*, **8** (2), 49-53 (2008).
9. Ujjin S.and Suesat J., *Advanced Material Research*, **486**, 384-387, (2012).
10. Saha P. and Datta S., *Colourage*, **55** (5), 52-54+56, (2008).
11. Sarkar D., Mazumdar K. and Datta S., *Man-Made Textiles in India*, **49** (11), 409-419 (2006).
12. Sarkar D., Mazumdar K., Datta S. and Sinha D.K, *Journal of Textile Association*, **66** (2), 67-72, (2005).
13. Samanta A.K., Agarwal P., Konar A. and Datta S., *International Dyer*, **193** (3), 25-33 (2008).
14. Trotmann E.R. Dyeing and Chemical Technology of Textile Fibres, England: Charles Griffin and Company ltd, 1984.
15. American Association of Textile Chemists and Colourists. *AATCC Technical Manual* 2007, 76, Research Triangle Park, NC: AATCC.
16. ISO Technical manual, Geneva, Switzerland, 2006.

❐ ❐ ❐

Synthesis of Several Newly Disperse Dyes and their Application in Textile Printing

M. M .El-Molla*
Textile Research Division, National Research Centre
&
Zeinab H. Ismaeil, Fekria M. A. Soliman
Chemistry Department, Faculty of Science (Girls'), Al-Azhar University
&
Shaimaa H. Abd-El Monem
Questioned Document Examiner, Department of Forgery and Counterfeiting Research, Forensic Medicine, Ministry of Justice, Lazoughly sq.

Abstract
Synthesis of new heterocyclic disperse azo dyes and their utilization in textile printing is attempted in this article. New selected disperse azo dyes were prepared by the reaction of 2-thiazinyl diazonium chloride (II) with either aromatic phenol or active methylene compounds. The prepared dyestuffs were established using element analysis, IR measurements, H-NMR and Mass spectra. The suitability of the prepared dyestuffs for traditional printing on polyester and nylon 6 fabrics has been investigated. The prints obtained from dyes containing non polar groups possess high color strength as well as good overall fastness properties when compared to those obtained using dyes containing polar groups.

Key words
Newly Disperse Dyes, Synthesis, Textile Printing, Polar groups.

1. Introduction

A long-term aim of researchers working on dyes has been to combine the brightness and fastness properties of anthraquinone dyes with strength and economy of azo dyes. This aim is now being realized with heterocyclic azo dyes which fall into two main groups, those derived from heterocyclic coupling components and those derived from heterocyclic diazo components. All the heterocyclic coupling components which provide commercially important azo dyes contain only nitrogen as the hetero atom.

They are indoles, pyrazolones, and especially pyridones, they provide yellow to orange dyes for various substrates. In contrast to the heterocyclic coupling component, all the heterocyclic diazo components that provide commercially important azo dyes contain sulphur, either alone or in combination with nitrogen. These dyes offer bright, strong shades that range from red through blue to green and therefore complement the yellow/orange colour of the nitrogen heterocyclic coupling components [1]. A lot of research work has been done which is of the interest, in synthesis of condensed arylazopyarzoles as new dyestuff [2-9]. The present work was carried out with the following objectives, synthesis and identification of some newly disperse azo dyes and the possibility of its use in traditional printing techniques on polyester and nylon 6 fabrics.

All the Correspondence should be addressed to,
Prof. Dr. M. M. El-Molla
National Research Centre, Textile Research Division, Dokki, Cairo, Egypt
Email : melmolla@yahoo.com

2. Experimental Methods

2.1. Materials

The following materials were employed in the study reported here,

2.1.1. Fabric

Polyester (Polyethylene terephethalate) knitted fabric of 150 gsm, supplied by a private sector company, was treated with a solution containing 1 g/l non-ionic detergent at 70^0C for 1/2 h., thoroughly washed, and air dried at room temperature.

Polyamide 6 (PA) of 212 gsm, supplied by El-Nasr Company for Spinning, Weaving and Knitting, was

treated with a solution containing 5 g/l soap at 50^{0}C for 15 min, then thoroughly washed and dried at room temperature.

2.1.2. Thickeners

Commercial sodium alginate thickener of high viscosity (alginate THV 30000), supplied by Françoise de Colloids Company.

2.1.3. Chemicals

6-(4-bromophenyl)-4-phenyl-4H-1,3-thiazin-2-amine,4-(2-methoxyphenyl)-6-(pyridine-4-yl)-4H-1,3-thiazin-2-amine, 6-(4-chlorophenyl)-4-(thiophen-2-yl)-4H-1,3-thiazin-2-amine, β-naphthol, α-naphthol, 0-nitrophenol, ρ-nitro phenol, acetyl acetone, ethyl acetoacetate, benzoyl acetone, sodium nitrite, sodium acetate, ethanol, sodium hydroxide (10%), hydrochloric acid, all of laboratory grade were used.

2.2. Dyestuff synthesis

Synthesis of azo dyes (III a-d) involved two steps:

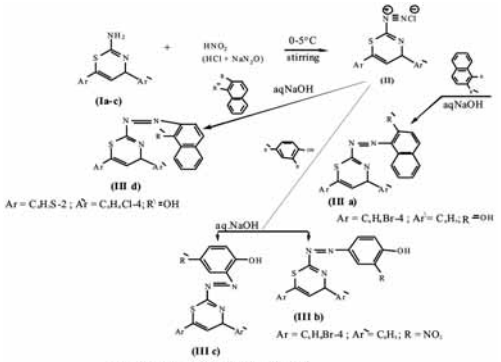
2.2.1. Diazotization of compounds (I a-c)

General procedure: A cooled, well stirred suspension of 0.01 mol of 2-thiazinyl diazonium chloride (II) was prepared in 30ml of absolute ethanol containing 0.02mol of anhydrous sodium acetate (1.6g). To this, a cooled solution of sodium nitrite (0.01mol, 0.69g) prepared in concentrated HCl (0.01mol, 0.36g) was added-in parts over a period of 30 min with continuous stirring and cooling below 5^{0}C. After this, stirring was continued for 2hr and the clear diazonium salt solution thus obtained was used for the subsequent coupling reaction.

2.2.2. Coupling reaction

2.2.2.1 Coupling with aromatic phenols

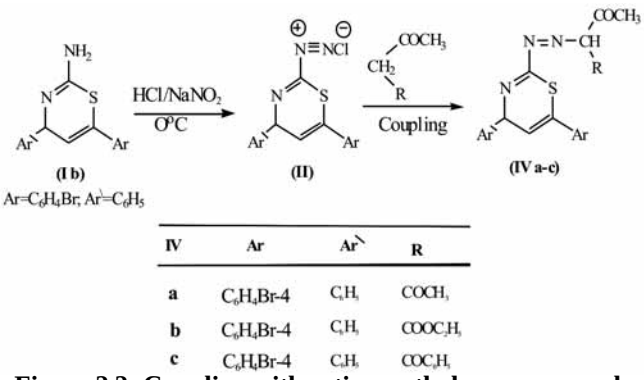
To a well stirred cooled solution of 2-thiazinyl diazonium chloride (II), a cold solution of aromatic phenol namely, β-naphthol, α-naphthol, 0-nitrophenol and ρ-nitro phenol (10%) was added drop wise while still stirring. The mixture was stirred for further 1hr at 0-5^{0}C and the product was left in the refrigerator overnight. The product was then collected, washed well with dilute alcohol and recrystallised from proper solvent to give III a-d (Figure 2.1).



Figu upling with aromatic phenols

2.2.2.2 Coupling with active methylene compounds

To a well stirred cooled solution of 2-thiazinyl diazonium chloride II, a cold solution of active methylene compounds namely, acetyl acetone, ethyl acetoacetate and/or benzoyl acetone (0.01mol) dissolved in 10ml cold aqueous sodium hydroxide (10%) was added drop wise while stirring. The reaction mixture was further stirred for extra 2 hr and was left overnight in the refrigerator. The product was collected, washed well with dilute ethanol then recrystallised form the proper solvent as IVa-c (Figure 2.2).



IV	Ar	Ar`	R
a	C_6H_4Br-4	C_6H_5	$COCH_3$
b	C_6H_4Br-4	C_6H_5	$COOC_2H_5$
c	C_6H_4Br-4	C_6H_5	COC_6H_5

Figure 2.2: Coupling with active methylene compounds

2.3. Printing method

The print paste recipe was composed of synthesized dye (3 g), sodium alginate (3 g) and water (94 g). Sodium alginate is added to cold water and kept overnight, after that the dyestuff was added and stirring was carried out for few minutes. Samples of polyester and nylon fabrics were silk screen printed using the above printing paste; the printed fabrics were dried and fixed at 17^0 C for different time of fixation i.e. 1, 3 and 5 min. Then it was washed twice with cold water, twice with hot water and finally rinsed with cold water and then air dried.

2.4. Testing and Analysis

Texttreasure

In the hopes of reaching the moon men fail to see the flowers that blossom at their feet.

-Albert Schweitzer

2.4.1. Melting point
Melting points of synthesized dyes were determined in open glass capillaries on Gallenkamp melting point apparatus.

2.4.2. IR spectra
The infra red spectrum of synthesized dyes was measured using Infra red spectrometer, Perkin Elmer/1650 FT-IR.

2.4.3. 1H-NMR spectra
The 1H-NMR spectra for the synthesized dyes was measured in a Varian 400 or Wilmad 270MHZ spectrometer for (CD3)SO solutions using SiMe4 as internal standard.

2.4.4. Mass spectra
Mass spectra for the synthesized dyes were recorded in a Varian MAT112 spectrometer. Analytical data were obtained from the micro analytical data centre at Cairo University.

2.4.5. Spectrophotometer measurements
The absorbance of the dyes was measured in the ultraviolet visible region between 300 and 700 nm by a UNICAM UV spectrophotometer using 1 cm quartz cell. The dyes were dissolved in absolute ethanol in concentration of 1024 mole/l.

2.4.6. Color measurements
The color strength (K/S) of the printed samples was determined by reflection measurements using an automatic filter spectrophotometer [10].

2.4.7. Fastness properties
Fastness to washing, rubbing, and perspiration were assessed according to standard methods [11-13].

2.4.8. Color fastness to light
Color fastness to light was determined according to ISO test method 105-B01. The evaluation was carried out using the gray scale reference for color change.

3. Results and discussion

3.1. Synthesis of various disperses dyes.

Diazo compounds are well known versatile intermediates in the synthesis of various disperse dyes. The principle advantages of the key compounds (I) used here are that, the yield is high, the reaction time is shorter, the procedure involves only one facile step, the work-up is convenient and thus the starting material can be easily prepared. The presence of an electron - withdrawing group such as 4-bromophenyl and/or 4-chlorophenyl in the positions 4, 6 at the heterocyclic diazotized amino group appears to increase its tendency to undergo diazotization (high yields 70-85%). The presence of the primary aromatic amino group at position 2 of the hetero aromatic ring was tested by diazotization and coupling with phenols [14] and/or active methylene compounds [15].

Thus, treatment of (I a-c) with nitrous acid at 0^0C in the presence of concentrated hydrochloric acid followed by coupling with phenols namely, β-naphthol, ρ-nitrophenol, 0-nitrophenol and/or α-naphthol afforded the corresponding azodyes (IIIa-d) respectively. Similarly, the 2-amino-1,3,thiazine derivative (Ib) intermediate was diazotized satisfactorily at 0-5^0C by nitrous acid in hydrochloric acid, and the diazonium salt solution was used immediately (since it gets decomposed on standing). Subsequent coupling reaction took place readily on adding the diazonium salt continuously to the solution of active methylene compounds in aqueous cold NaOH (10%) by careful addition, while stirring at 0-5^0C.

Thus, coupling of 4,6-diaryl-1,3-thiazin-2-yl-2-diazonium chloride (IIa) with active methylene compounds namely, acetyl acetone, ethyl acetoacetate and/or benzoyl acetone afforded the corresponding 3-[(6-(4-bromophenyl)-4-phenyl-4H-1,3-thiazin-2-yl)diazenyl]pentane-2,4-dione(IVa),ethyl-2-[(6-(4-bromophenyl)]-4-phenyl-4H-1,3-thiazin-2-yl)diazenyl]-3-oxobut-anoate(IVb)and/or2-[(6-(4-bromphenyl)-4-phenyl-4H-1,3-thiazin-2-yl)diazenyl]-1-phenylbutane-1,3-dione(IVc) respectively.

The structures of compounds (III a-d, IVa-c) were assigned from the following:
i) Correct analytical data (Table 3.1).

Texttreasure

Wise kings generally have wise counsellors; and he must be a wise man himself who is capable of distinguishing one.

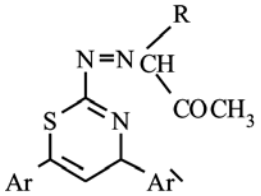
-Diogenes

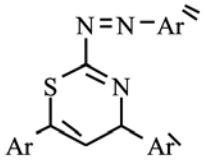
Table 3.1: Physical data of azo dyes (III a-d) and (IVa-c).

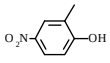
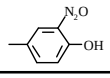
Comp. No.	M.P(^{0}C)/ Solvent of cryst.	Colour of crystals/ yield (%)	Molecular formula/ (Mol. wt)	Analysis calcd./found%				X	
				C	H	N	S	Cl	Br
III a	80-82/ EtOH	violet 85%	$C_{26}H_{18}SN_3OBr$ (500)	62.4 62.5	3.50 3.7	8.40 8.5	6.40 6.5	-- --	16.00 16.1
III b	98-100/ EtOH	Yellow 75%	$C_{22}H_{15}SN_4O_3Br$ (495)	53.33 53.4	3.03 3.1	11.31 11.3	6.46 6.5	-- --	16.16 16.2
III c	158-160/ EtOH	deep blue 80%	$C_{22}H_{17}SN_5O$ (447)	59.06 59.1	3.80 3.8	15.65 16.7	7.15 7.2	-- --	-- --
III d	104-106/ EtOH	Brown 80%	$C_{24}H_{16}S_2N_3OCl$ (461.5)	62.40 62.4	3.46 3.5	9.10 9.1	13.86 13.9	7.69 7.7	-- --
IV a	108-110/ EtOH	yellow 70%	$C_{21}H_{18}SN_3O_2Br$ (456)	55.26 55.3	3.94 4.0	9.21 9.2	7.01 7.1	-- --	17.54 17.6
IV b	98-100/ EtOH	pale yellow 70%	$C_{22}H_{20}SN_3O_3Br$ (486)	54.32 54.3	4.11 4.2	8.64 8.7	6.58 6.6	-- --	16.46 16.5
IV c	84-86/ EtOH	pale yellow 70%	$C_{20}H_{20}SN_3O_2Br$ (518)	60.23 60.2	3.86 3.9	8.108 8.1	6.17 6.2	-- --	15.44 15.5

ii) Visible absorption spectroscopy measurements of the dyes (IIIa-d) and (IVa-c) as they have shown absorption maxima (λmax) values directly proportional to the electronic power of the substituents in the aryl rings. (Table 3.2).

Table 3.2: Absorption maxima of Dyes (III a-d) and (IV a-c)





Dye	λ_{max} nm	Colour of the dye	Ar	Ar'	Ar''	R
XIII a	395	violet	C_6H_4Br-4	C_6H_5		--
XIII b	390	yellow	C6H4Br-4	C_6H_5		--
XIII c	585	deep blue		C_6H_4OCH3-2		--
XIII d	395	brown		C6H4Cl-4		--
XIV a	390	yellow	C_6H_4Br-4	C_6H_5	--	$COCH_3$
XIV b	390	pale yellow	C_6H_4Br-4	C_6H_5	--	COOEt
XIV c	390	pale yellow	C_6H_4Br-4	C_6H_5	--	COPh

It is clear from the above data that the introduction of an electron-releasing group (OCH_3-Ph) and an electron withdrawing group (NO_2 at position-2 of the aryl group) in the coupler ring (phenol), the absorption characteristics of the dye increased (λ_{max} 585nm). One cause of the increased intensity might be attributed to the greater polarity of the thiazine dyes. The bathochromic effect noted on replacement of an aryl ring (4-Br C_6H_4) with a pyridine unit for this class of dyes is well documented [16].On the other hand, the introduction of a strong electron withdrawing function such as -$COCH_3$, -COOEt and -COC_6H_5 adjacent to the diazotized thiazine system has a disadvantage that these groups reduce the basicity of the nitrogen atoms as they are highly polarized.

iii) The infrared spectral measurements of the dyes (III a-d) and (IVa-c) shown in **Tables 3.3 & 3.4**

* Where is in Cm^{-1}. 714.4 (for C-Cl).

The infrared spectral data of the dyes (III a-d) revealed the stretching vibration of CH (aliphatic and aromatic) in the region 3080, 2919-2856cm^{-1}. The absorption bands in the region 1643-1654.2cm^{-1} for stretching vibrations of cyclic C=N. The stretching vibrations in the region 1603.5^{-1}588cm^{-1} due to C=C and the bands around 1480.1-1487.8cm^{-1} are due to the -N=N- stretching vibration.

* Where is in Cm^{-1}.

The infrared spectral data of the dyes (IVa-c) revealed the stretching vibrations of cyclic C=N the region 1603.5-1596.7cm^{-1} and the stretching band in the region 1655-1654cm^{-1} for CO group as well as the other expected groups.

iv) The ^{1}H-NMR spectra of the dyes (III a-d) has shown the following signals in Table 3.5.

* Where δ is in Cm^{-1}.

The ^{1}H-NMR spectrum of (IVb) revealed the presence of signals at: δ 2.49, 2.50 ppm (2x5, 2x3H, 2xCH3), at δ 3.30 ppm (d, 1H, CH b), at 4.45 ppm (d,H,CHa), at δ 6.25 (s, 1H, CH) and at δ 7.46-8.11 ppm (m, 9H, Ar-H).

Table 3.3: IR spectral* data of the azodyes (III a-d).

Comp.No.	OH (br)	C-H	C=C	-N=N-	N-C-N	C-Br
III a	3420.1	3052.7, 2919.7	1596.7	1482	1329.6	534.1
III b	3431.7	3055.6, 2920.6	1603.5	1485.8	1329.6	531.2
III c	3422	3080, 2934.1	1597.7	1480.1	1392.6	-
III d	3223.4	3080.7, 2965, 2856	1588	1487.8	1322.9	-

Table 3.4: IR spectral* data of the Dyes (IVa-c).

Dye	NH	CH aromatic	C-H aliphatic	C=O	C=N	N=N	C-Br
IV a	3432.6	3055.6	2918.7	1654.6	1599.6	1212.0	533.2
IV b	3438.4	3055.6	2920	1655.5	1603.5	1212.0	530.3
IV c	3426.8	3053.7	2919.7	1655.5	1596.7	1213.0	533.2

Table 3.5: ^{1}H-NMR spectra* (DMSO-d_6) of the dyes (III a-d).

Comp. No.	Ar-H	CH a	CH b	CH3	OH
III a	7.45-8.11(m,15H)	6.6 (d, 1H)	3.30 (d, 1H)	--	10.65 (s, 1H)
III b	7.43-8.08(m,12H)	6.6 (d, 1H)	3.36 (d, 1H)	--	9.65 (s, 1H)
III c	65-8.92(m, 11H)	6.8 (d, 1H)	3.29 (d, 1H)	3.8 (s, 3H)	11.1 (s, 1H)
III d	7.01-8.33(m,13H)	6.62 (d, 1H)	3.28 (d, 1H)	--	13.25 (s, 1H)

v) The ^{13}C-NMR spectrum of the dye (IIIb) has shown the following signals at: δ 188.2 (C1), 182 (C2), 144.4 (C3), 136.4 (C4), 134.5 (C5), 131.7 (C_6H, C_8H), 130.6(C_7H0, 130.4 (C_9), 128.8 ($C_{10}H$, $C_{11}H$), 127.2 ($C_{12}H$).

vi) The Mass spectrum of the dye (IIIc) has shown the molecular ion peak 449 M+2 for $C_2H_{17}O_4SN_5$ and the base peak at 64 (100%) for C_5H_4. The mass spectrum of (IVb) has shown the molecular ion peak M+1 at m/e 343 (20.9%), M at 342 (21.17%) for $C_{16}H_{10}N_2SBr$ due to (the elimination of an acyl ($COCH_3$) of m/e 43, a carbonyl ethoxy group at m/e 57 and HCN of m/e 27 respectively). It showed the base peak at m/e (100%) of $C_{13}H_4NSBr$.

3.2. Utilization of the prepared dyestuff in textile printing

3.2.1. Printing of polyester fabric

The effect of dyes (IIIa-d) and (IVa-c) using concentrations 1, 3, 5% on the colour strength (K/S) of printed polyester fabric with fixation temperature 17^0 C and time of fixation 3 min is shown in **Figure 3.1.**

It is clear from the Figure 3.1 that, increasing the dye concentration from 1 to 5% has a marked effect on the color strength of the prints of all the dyes used. It is also noticed that, the dye (IIId) possesses higher color strength and dye (IIIc) possesses the lowest color strength. This may be attributed due to the difference in the nature of subsistent present on the dye molecules, where dye (IIIc) contains non ionic/polar groups in its molecular structure, i.e., the presence of nitro group with in its molecular structure [17].

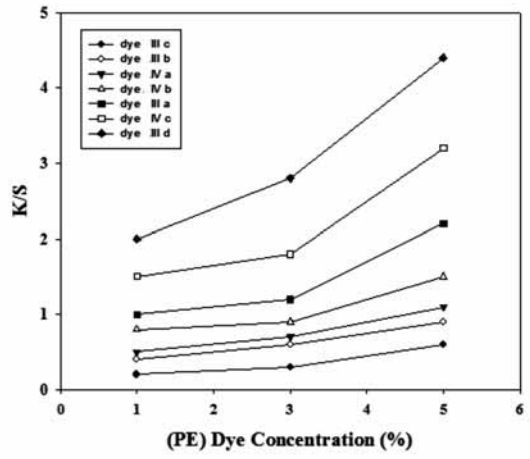


Figure 3.1: Effect of dye concentration (III a-d, IV a-c) on the color strength of printed polyester fabric.

The effect of fixation time on the color strength (K/S) of printed polyester fabric with fixation temperature 17^0 C is shown in **Figure 3.2.** The results show that the color strength of the prints of all the dyes increases as the fixation time increases from 1 to 5 min. The variations obtained in the color strength of the printed polyester fabrics with differently prepared heterocyclic disperse azo dyes could be attributed to the difference in molecular size, configuration and the presence of polar and non-polar groups in the dye molecule.

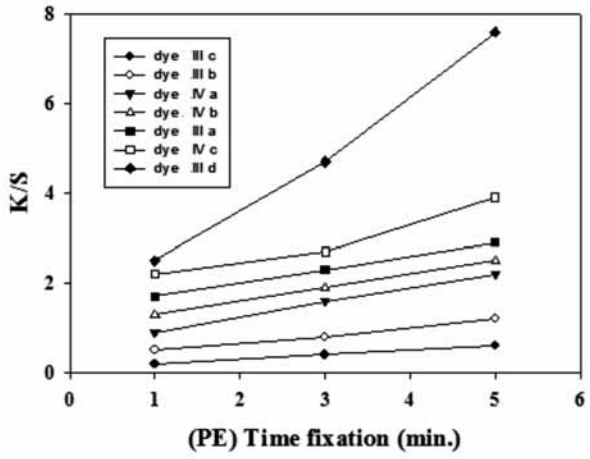


Figure 3.2: Effect of fixation time on the color strength of printed polyester fabric using dyes (III a-d, IV a-c)

The effect of storing time for 7 days on the color strength of printed polyester fabric with a fixation temperature 17^0 C for 3 min is shown in **Figure 3.3.** It is also noticed that, the dye (IIIa) possesses higher color strength and dye (IIIc) possesses the lowest color strength.

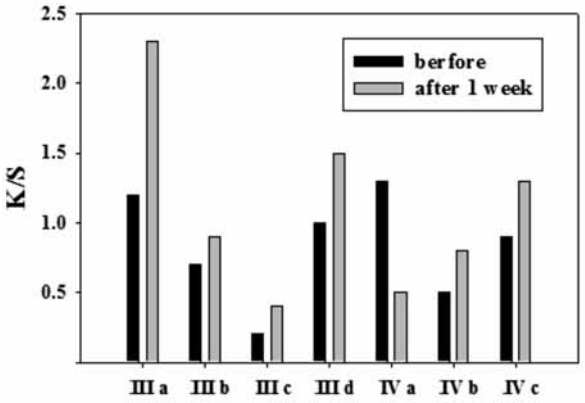


Figure 3.3: Effect of storing time on the color strength of printed polyester fabric using dyes (III a-d, IV a-c)

3.2.2. Printing of nylon6 fabric

Similar sets of experiments were carried out as above using nylon 6 instead of polyester. The results are

represented in Figures 3.4, 3.5 and 3.6 and were similar to the above sets of experiments with just a marginal difference due to change of fabric.

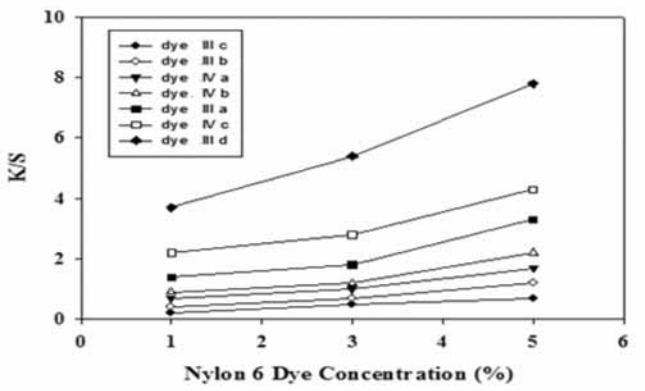


Figure 3.4: Effect of dye concentration (III a-d, IV a-c) on the color strength the Of printed nylon 6 fabric (fixation temp-170^{0}C, time- 3 min)

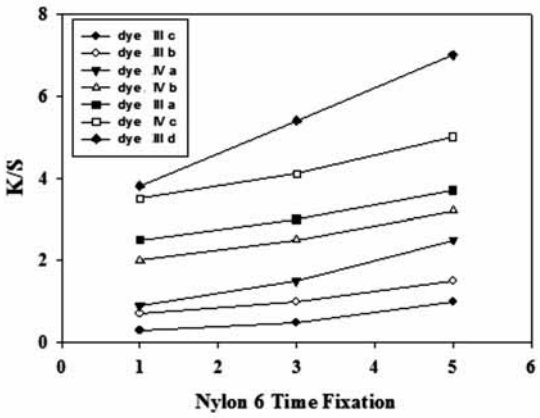


Figure 3.5: Effect of time of fixation on the color strength of printed nylon6 fabric using dyes (III a-d, IVa-c), fixation temperature at 170^{0}C

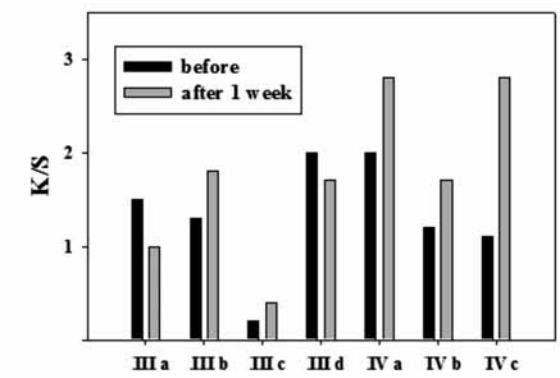


Figure 3.6: Effect of storing time for 7 days on the color strength of printed Nylon 6 fabric using dyes (1-5a-c), fixation temperature at 170^{0}C, fixation time 3min.

3.3. Fastness properties

Fastness properties of screen printed PE and nylon 6 are shown in Table 3.6

3.3.1. Wash fastness

It can be seen from Table 3.6 that the rating is between 3-4 for nylon and 4-5 for polyester. The nature and/or the number of substituents on the aromatic moieties of the dye molecules determined the wash-fastness for printed fabrics.

3.3.2. Perspiration fastness

The magnitude of the dye removal from Polyester and nylon fibers under influence of perspiration solutions (alkali and acidic) are shown in Table 3.6. The result indicates that the dye removal could be dependent on the molecular weight of the dye and the binding forces between the dye and the fiber, the dyes (IIIa), (IVb) and (IVc) had perspiration values 4-5 for nylon and 5 for Polyester.

Table 3.6: Color strength and fastness properties of printed polyester and nylon 6 fabrics, using synthesized dyes (III a, d and IV b, c).

Dye no.	K/S		Washing				Rubbing								Perspiration				Light fastness	
			Nylon		Polyester		Nylon		Polyester		Nylon				Polyester					
											Acidic		Alkaline		Acidic		Alkaline			
	Nylon	Polyester	Alt	St	Alt	St	Dry	Wet	Dry	Wet	Alt	St	Alt	St	Alt	St	Alt	St	Nylon	Polyester
IIIa	2.6	1.9	3	4	5	5	4	4	5	5	4	4	4	4	5	4	5	5	4-5	4-5
IIId	8.2	4.6	3	4	5	5	4	4	5	5	4	4	4-5	4	5	5	5	5	5-6	5-6
IVb	1.7	1.3	4	4	5	5	4	3	4	4	4	4	4	4	5	5	5	5	5	5
IVc	3.7	3.2	4	3-4	5	5	4	3	5	5	4	4	4-5	4-5	5	5	5	5	5	5

Fixation temp.-170^{0}C; Fixation time-5 min. St. = Staining; Alt. = Alteration.

3.3.3. Rub-fastness

Rub-fastness is an indication of the quantity of loosely adhered dye molecules on fiber. It can be seen from Table 3.6 that, the value of rubbing fastness for dyes (IIIa), (IVb) and (IVc) is 3-4 (both dry and wet) for nylon and 4-5 (both dry and wet) for polyester. High rubbing fastness values are associated with high molecular weight of the dye.

3.3.4. Light fastness

Light fastness is largely affected by the dye aggregation with in the fiber. Generally, light fastness increases with the increase of the color strength. It was found that the light fastness of most dyes range between 4 and 5.

4. Conclusions

New selected disperse azo dyes were successfully prepared by the reaction of 2-thiazinyl diazonium chloride (II) with either aromatic phenol or active methylene compounds. These disperse azo dyestuffs proved to be suitable for use in printing of polyester and nylon 6 fabrics. All the above dyes produced bright colours and possess very good over all fastness properties on both fabrics. The prints obtained from dyes containing non polar groups possess higher colour strength.

References

1. Hunger K., Industrial Dyes, Chemistry, Properties, Applications, Wiley-Veh Verlag GmbH & Co. KGaA, Weinheim (2003).
2. Elgemeie G.H., Riad B.Y., Nawwar G.A. and Elgamal S., *Arch. Pharm. (Weinheim)*, **320**, 223-8, (1987).
3. Elgemeie G.H., Elghandour H.A. and Elshimy H., *J. Prakt. Chem.*, **331** (3), 466-74, (1989).
4. Elgemeie G.H., Fathy N.M., Faddah L.M. and Ebeid M.Y., *Arch. Pharm. (Weinheim)*, **324**, 149-52, (1991).
5. Elgemeie G.H., El-Ezbawy, S.E., Ali, H.A. and Mansour, A.K., Bull. *Chem. Soc. Japan*, **67**, 738-42, (1994).
6. Elgemeie G.H., Helal, M.H. and El-Sayed, H.M., *Pigment & Resin Technology*, **32**(2), 100-6, (2003a).
7. Elgemeie G.H., Helal, M.H. and Ahmed, K.A., *Pigment & Resin Technology*, **32**(1), 10-22, (2003b).
8. Elgemeie G.H., Helal, M.H. and El-Sayed, H.M., *Pigment & Resin Technology*, **33**(2), 91-8, (2004).
9. El-Kashouti M.A., Elgemeie G.H., El-Molla M.M., El-Sayed H.S and Ahmed K.A.E., *Pigment & Resin Technology* **36**, 382, (2007).
10. Jdd D.B. and Wysezecki, G., Color *in Business Science and Industry, 3rd ed.*, Wiley, New York, NY. (1975),
11. DINEN ISO 150 105E04, 6. (1997),
12. AATCC Standard Instrument, AATCC, Research Triangle Park, NC. (2002),
13. DINEN ISO 150 105E04, 6. (1996),
14. Maradiya H.R. and Patel V.S., *Chem. Heterocyclic. Comp.*, **38**, 1324, (2002).
15. Zohair M.Y., Soliman F.M.A and Ahmed F.E., *Polish J. Chem.*, **55**, 1007, (1981).
16. Gordon P.E. and Gregory P., "Organic Chemistry in Color", *Springer-Verlag, Heidelberg*, **134,** (1983).
17. Griffiths J. and Jones F., *JSDC*, **93**, 178, (1977).

❐ ❐ ❐

Dendrimers - An Auxilliary in Dyeing

Saptarshi Maiti & R. V. Adivarekar*
Institute of Chemical Technology

Abstract
Dendrimers are a new class of polymeric materials. They are highly branched monodisperse macromolecules coming under the fourth class of polymeric architecture and are termed as 'generations'. The other three classes are linear, branched and cross-linked polymers. Dendrimers are well-defined 3-D class structures with three different functionalities called core, branches and terminal groups. Apart from the bio-medical applications, utilization of dendrimers has been tried on cellulosic fibres like cotton. Dyeing of cotton requires high usage of electrolyte especially in case of reactive dyes. Also cotton textiles provide suitable environment for the growth of micro-organisms causing their degradation. Dendrimers can be used to reduce the application of salt in dyeing and inhibit the growth of micro-organisms on cellulosic substrate acting as an anti-microbial agent.

Keywords
Dendrimer, Monodisperse macromolecules, Electrolyte, Dyeing, Anti-microbial.

1. Introduction

Dendrimers are large and complex molecules with very well-defined chemical structures. From a polymer chemistry point of view, dendrimers are nearly perfect monodisperse macromolecules with a regular and highly branched three dimensional architecture [1]. They consist of three major architectural components: core, branches, and end groups [2, 3].

Dendrimers are produced in an iterative sequence of reaction steps, in which each additional iteration leads to a higher generation dendrimer i.e., the reaction process is repeated [4]. The creation of dendrimers using specifically-designed chemical reactions is one of the best examples of controlled hierarchical synthesis, an approach that allows the 'bottom-up' creation of complex systems. Each new layer creates a new 'generation', with double the number of active sites (called end groups) and approximately double the molecular weight of the previous generation. One of the most appealing aspects of technologies based on dendrimers is that it is relatively easy to alter and regulate the size, composition and chemical reactivity very precisely.

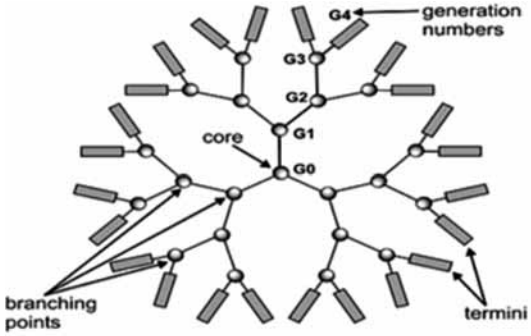


Figure 1.1: Structure of a Dendrimer

2. Types of Dendrimers

The first dendritic structures that were exhaustively investigated and received widespread attention were Tomalia's PAMAM [poly (amidoamine)] [1].

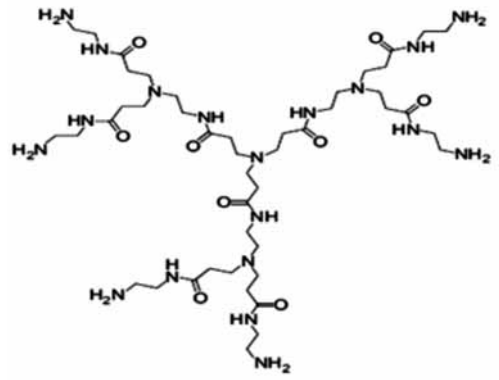


Figure 2.1: Polyamidoamine (PAMAM) dendrimer (Trade name: StarbustTM)

All the correspondence should be addressed to,
Prof. R. V. Adivarekar
Central Institute for Research on Cotton Technology,
Matunga, Mumbai - 400019,
E-mail : rv.adivarekar@ictmumbai.edu.in

PAMAM dendrimers are synthesised by the divergent method starting from ammonia or ethylenediamine as an initiator core reagent [5]. They are constructed using a reiterative sequence consisting of (a) a double Michael addition of Methyl acrylate to a primary amino group followed by (b) amidation of the resulting carbomethoxy intermediate with a large excess of ethylenediamine [6, 7]. Products upto generation 10 (a molecular weight of over 9,30,000 g/mol) have been obtained [1].

Based on the original work of Vogtle (in 1993), divergently produced (from the core to the periphery) poly(propylene imine) dendrimers were created by Meijer at DSM of the Netherlands. Today, these PPI i.e., poly(propylene imine) dendrimers are synthesised in large quantities by DSM and are commercially available (as seen in Figure 2.2).

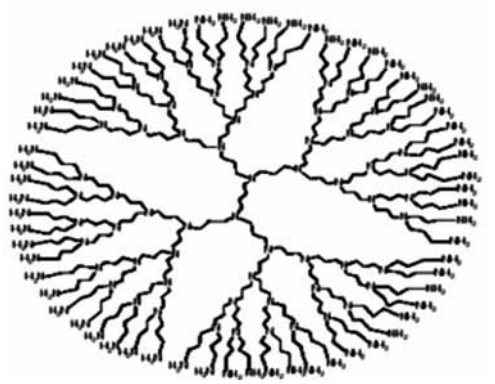


Figure 2.2: Polypropylenimine (PPI) dendrimer (Trade name: AstramolTM)

PPI dendrimers are synthesised by the divergent method starting from 1, 4-Diaminobutane. They are grown by a reiterative sequence consisting of (a) a double Michael addition of acrylonitrile to the primary amino groups followed by (b) hydrogenation under pressure in the presence of Raney cobalt. Products are made upto generation 5 [1, 8, 9].

In 1990, Fretchet introduced the convergent approach to create dendrimers. In convergent synthesis, the procedure is started at the periphery and elaborated to the core. Fretchet's aromatic polyether dendrimer (Figure 2.3) are easily accessible and have been frequently studied [10].

In the last few years many other types of interesting dendritic systems have appeared, although they have been less widely investigated and many have not left the lab.

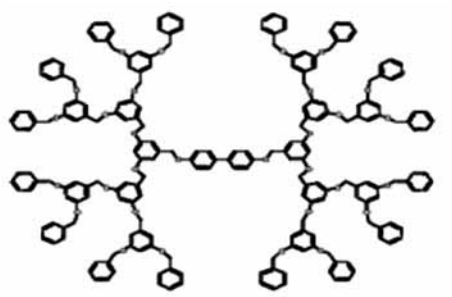


Figure 2.3: Fretchet's aromatic polyether dendrimer

3. Synthesis of Dendrimers

3.1. Divergent Method

The dendrimer is assembled from a multifunctional core, which is extended outward by a series of reactions, commonly a Michael reaction. The schematic representation of divergent method is as shown in Figure 3.1. Each step of the reaction must be driven to full completion to prevent mistakes in the dendrimer, which can cause trailing generations (some branches are shorter than the others). Such impurities can impact the functionality and symmetry of the dendrimer, but are extremely difficult to purify out because the relative size difference between perfect and imperfect dendrimers is very small [11-13].

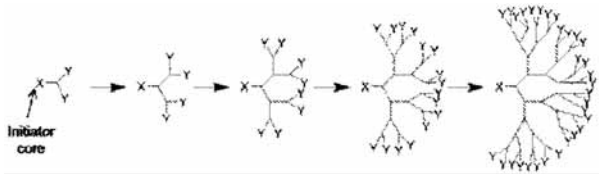


Figure 3.1: Schematic of divergent synthesis of dendrimers

3.2. Convergent Methods

Dendrimers are built from small molecules that end up at the surface of the sphere, and reactions proceed inward (reaction starts from terminal groups progressing towards initiator core) and are eventually attached to a core. This method makes it much easier to remove impurities and shorter branches along the way, so that the final dendrimer is more monodisperse. However dendrimers made this way are not as large as those made by divergent methods because crowding due to steric effects along the core [11, 12, 14].

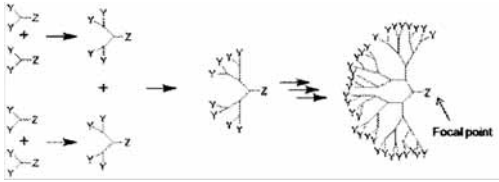


Figure 3.2: Schematic of convergent synthesis of dendrimers

4. Application of Dendrimers in Textile

The most available technique followed for application of dendrimer on textile is pad-dry-cure. Samples of cellulosic fabrics can be padded with the aqueous solution of the dendrimer in the presence of bi/ polycarboxylic acids like glutaric/citric acid and sodium hypophosphite (SHP) as a catalyst. The padded samples need to be dried at 80 °C for 5 min and then cured in a laboratory oven at 150 - 160 °C for 3 min. The treated cellulosic fabrics are rinsed thoroughly in hot water for 5 min to remove unfixed materials and air-dried at room temperature. Glutaric/citric acid helps in grafting. The grafting mechanism is as given in Figure 4.1 [15].

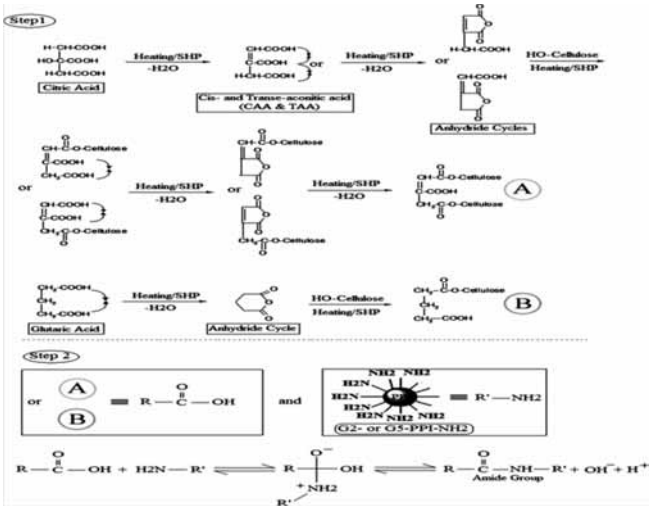


Figure 4.1: Grafting mechanism on the cotton fabric with the PPI dendrimer using bi/polycarboxylic acids

Exhaust technique can also be used for dendrimer application. Zolriasatein et. al have used jute yarns and immersed them in poly (amidoamine) dendrimer-ethanol solution at concentration 2.5% owf for 3 h at room temperature, using a 15: 1 liquor ratio. Then, the resulting material was air-dried for 24 h. The samples were then cured at 100 °C for 50 min. This grafting is carried in an alcoholic media when the generation of poly (amidoamine) dendrimer used is lighter than water, the reaction is shown in Figure 4.2 [16].

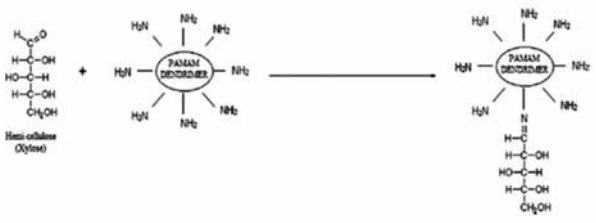


Figure 4.2: Modification of Jute fibre with dendrimer

4.1. Dyeing

Cellulosic fibres like cotton is hydrophilic in nature and therefore, it can absorb sweat from the human body and can release onto the surface that makes it comfortable. But it has some inherent limitations such as it is prone to wrinkles, shrinkage, low dye uptake in absence of salt/electrolyte and microbial degradation. Dendrimers serve the purpose of reducing some of those problems when applied on natural cellulosic fibres like cotton, jute, etc [17].

Natural cellulosic fibres are negatively charged due to the presence of carboxylic acid groups from oxidation at the primary hydroxylic sites [18]. Some of the hydroxyl groups on the hydroxymethyl side chains may be ionized at pH 7-8 increasing the negative charge significantly [19]. The negative charges on the surface of cellulose repel anionic dyes and hence lead to inefficient exhaustion which is the ultimate cause of low fixation in cellulose. To avoid this phenomenon, a number of studies mainly on cotton dyeing have been carried out to improve the dye uptake and fastness properties. Exhaust dyeing of cotton with anionic dyes, specially direct and reactive, requires the presence of electrolytes (NaCl or Na_2SO_4) to suppress negative charge at the fibre surface and promotes dye exhaustion [20, 21]. Modification of cotton fibre to increase the dye-fibre interactions is one of the best means to avoid the less affinity of cotton for commercial dyes of different classes. There are numerous chemicals that can be used to impart cationic charge to cotton fibre. Since reactive and direct dyes are anionic, cationic cotton would be expected to have higher affinity for these dyes. A number of researchers have confirmed the possibility of pre-treating cotton with cationic materials prior to dyeing. Dendrimer is considered one among those chemicals.

4.2. Colour Strength

It has been observed that colour strength in terms of K/S is highest for the dendrimer treated materials than the untreated one. As mentioned, for the reaction of reactive dyes with cellulosic fibres, they rely on an elevated pH (commonly over 10.5) and large amount of electrolyte (NaCl or Na2SO4) to achieve satisfactory results [22]. Figure 4.3 reveals that for untreated cellulosic substrates like cotton, a reduction in colour strength occurs when alkali like Na2CO3 is not used and also when electrolyte as NaCl is not used; lowest colour strength is achieved when both electrolyte and alkali are absent which clearly demonstrate the impor-

tance of using a high pH and electrolyte in the dyeing of cotton with the reactive dye used. It also shows that identical behaviour is obtained for the dyeing of pre-treated cotton so far as a reduction in colour strength occurs when both alkali and electrolyte are not used; lowest colour strength is achieved when both electrolyte and alkali are absent. However, it clearly shows that the colour strength achieved for the dendrimer pretreated cotton is much larger than that obtained for the corresponding dyeing of untreated material. The K/S values displayed in the Figure 4.3 shows that the colour strength of both electrolyte-free and alkali-free dyeings of pretreated cotton are higher than those of the conventional dyeing (i.e. with alkali and electrolyte present) [16, 23].

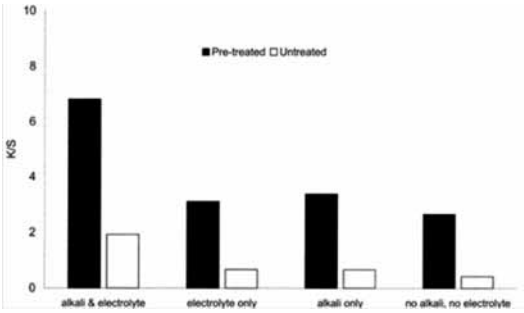


Figure 4.3: Effect on colour strength of Reactive dyeing in the absence and presence of electrolyte and alkali on dendrimer pre-treated and untreated fabric

4.3. pH

The dendrimer application can be carried out at three different pH levels i.e. acidic, neutral and alkaline and it is observed that acidic pH gives better result in terms of dye uptake. Figure 4.4 reveals that the application of dendrimer at pH 4 produces dyeing of highest colour strength than that at other pH [23].

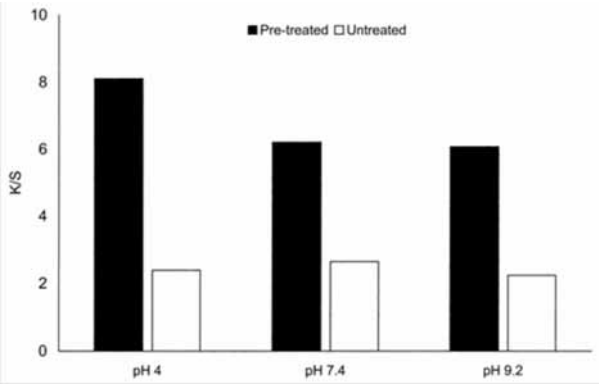


Figure 4.4: Effect of pH of dendrimer application on colour strength achieved by Reactive dyeing

4.4. Light Fastness

Compared to the untreated material in salt-free dyeing, the dendrimer treated cellulosic substrates display a good light-fastness. This is attributed due to increased uptake of the photostable dye on the fibres as shown in Figure 4.5 [16].

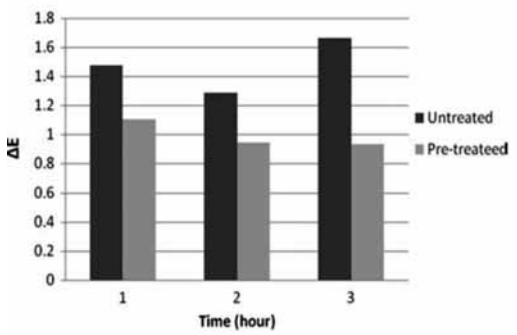


Figure 4.5: Effect of dendrimer treatment on light fastness

4.5. Anti-microbial Finishing

As cotton is a natural fibre, it exhibits an excellent environment for the growth of micro-organisms, this is because of their large surface area and ability to retain moisture [24- 26]. Various chemicals have been engaged to impart protection against microbial degradation of cotton. Those chemicals include inorganic salts, organo-metallics, iodophors (substances that slowly release iodine), phenols and thiophenols, antibiotics, heterocyclics with anionic groups, nitro compounds, urea, formaldehyde derivatives, and amines. But many of the aforementioned chemicals are toxic to humans and are not biodegradable. The demand for eco-friendly process in textile industries substitutes the toxic and hazardous chemicals. Use of dendrimer can be considered in this aspect [27, 28].

In order to evaluate the anti-microbial activity of the polypropylenimine (PPI) dendrimer, aqueous solutions were tested against Staphylococcus aureus (Gram-positive bacterium), Escherichia coli (Gram-negative bacterium), Pseudomonas aeruginosa (Gram-negative bacterium) and Candida albicans (fungus), by broth dilution test methods. In broth dilution test, serial dilutions of the PPI dendrimers are prepared in Brain heart infusion (BHI) nutrient medium and are then inoculated with a standardized concentration of the test bacterium. After 24 h incubation, the lowest concentration of PPI dendrimers that is able to inhibit the growth of the bacteria is referred to as minimum inhibitory concentration (MIC) [27, 29].

Moreover, anti-microbial activity of the PPI dendrimer grafted fabrics has been evaluated using a qualitative

and quantitative anti-microbial test against the mentioned micro-organisms according to ISO and AATCC standard methods respectively [29].

The anti-microbial activity shown by the PPI dendrimer grafted cotton fabrics is directly related to the number of free amino groups in the samples. The anti-microbial activity is attributed to the interaction between polycationic structures of PPI dendrimer and anionic cell membranes of bacteria. This interaction induces intracellular component leakage of bacterial cells which inhibits the growth of bacteria or prevents nutrient entry into the bacterial cells by formation of polymeric membrane on the surface of bacterial cells. Hence, it seems that the PPI dendrimer's abundant amino end groups and inherent polycationic nature can provide strong anti-microbial activity [27].

Although there is a slight decrease in the anti-microbial activities of the PPI dendrimer grafted fabrics after washing cycles, the anti-microbial activity is maintained over 92 % after 5 washing cycles. This durable anti-microbial activity of the grafted cotton fabric is probably due to the covalent bonds formed between the PPI dendrimer and the fabric during the grafting process [29].

5. Conclusion

Dendrimer pre-treated cellulosic textiles display markedly enhanced colour strength even in the absence of both electrolyte and alkali. Their use in the pre-treatment of cellulosic fibres may thus offer considerable savings of electrolyte and alkali and may allow good fixation of reactive dyes. Apart from that, dendrimers prove to be an effective anti-microbial agent for the cellulosic textiles. Dendrimers play the role of quaternary ammonium compounds and is successful in showing inhibition (approximately 92%) of micro-organisms. Thus the dendrimers can endow a range of applications to textile materials by their unique structure.

References

1) Holister P., Vas C. R. and Harper T., *Cientifica Ltd*., **6**, Oct., 6-13, (2003).
2) Tomalia D. A., *Materials Today*, **8**, Mar., 34-46, (2005).
3) Jain K., Kesharwani P., Gupta U. and Jain N. K., *International Journal of Pharmaceutics*, **394**, July, 122-142, (2010).
4) Taton D., Feng X. and Gnanou Y., *New Journal of Chemistry*, **31**(7), 1097-1110, (2007).
5) Peterson J., Ebber A., Allikmaa V. and Lopp M., *Proceedings of the Estonian Academy of Sciences Chemistry*, **50**(3), 156-166, (2001).
6) Tomalia D. A., Naylor A. M. and Goddard W. A., *Angewandte Chemie International Edition (English)*, **29**(2), 138-175, (1990).
7) Tomalia D. A., Baker H., Dewald J. R., Hall M., Kallos G., Martin S., Roeck J., Ryder J. and Smith, P., *Polymer Journal*, **17**(1), 117-132, (1985).
8) de Brabander-van den Berg, E. M. M. and Meijer E. W., *Angewandte Chemie International Edition (English)*, **32**(9), 1308-1311, (1993).
9) Tang M. X., Redemann C. T. and Szoka F. C., *Bioconjugate Chemistry*, 7(6), 703-714, (1996).
10) Grayson S. M. and Fretchet J. M. J., *Chemical Reviews*, **101**, 3819, (2001).
11) Tomalia D. A. and Fretchet J. M. J., *Journal of Polymer Science*, **40**, 2719-2728, (2002).
12) Walter M. V. and Malkoch M., *Chemical Society Reviews*, **41**(13), 4593-4609, (2012).
13) Klajnert B. and Bryszewska M., *Acta Biochimica Polonica*, **48**(1), 199-208, (2001).
14) Pittelkow M. and Christensen J. B., *Organic Letters*, **7**(7), 1295-1298, (2005).
15) Abkenar S. S. and Malek R. M. A., *Cellulose*, **19**(5), 1701-1714, (2012).
16) Zolriasatein A. A., Yazdanshenas M. E., Khajavi R., Rashidi A. and Najafi F., *Journal of Applied Polymer Science*,**127**, Mar., 4203-4210, (2013).
17) Wei M. A., Shu-fen Z. and Jin-zong Y., *The Proceedings of the 3rd International Conference on Functional Molecules*, 69-75, (2005).
18) Stan-Kleinschek K and Ribitsch V., *Colloids and Surfaces*, **140**, Sept., 127-138, (1998).
19) Bashar M. M. and Khan A. M., *Journal of Polymer and the Environment*, **21**(1), 181-190, (2012).
20) Ahmed N. S. E., *Dyes and Pigments*, **65**(3), 221-225, (2005).
21) Trotman E.R., Dyeing and chemical technology of textile fibres, 6th edn. Charles Griffin & Company Limited, Nottingham, 405-429, (1984).
22) Zhang F., Chen Y., Lina H. and Lua Y., *Coloration Technology*, **123**, 351-357, (2007).
23) Burkinshaw S. M., Mignanelli M., Froehling P.E. and Bide M. J., *Dyes and Pigments*, **47**, 259-267, (2000).
24) Zhang F., Zhang D., Chen Y. and Lin H., *Cellulose*, **16**(2), 281-288, (2009).
25) Yuan G. and Robin C., *Textile Research Journal*, **78**(1), 60-72, (2008).
26) Lim S. H. and Hudson S. M., *Carbohydrate Polymers*, **56**, 227-234, (2004).
27) Abkenar S. S. and Malek R. M. A., *Cellulose*, **19**(5), 1701-1714, (2012).
28) Ghosh S.,Yadav S., Vasanthan N. and Sekosan G., *Journal of Applied Polymer Science*, **115**(2), 716-722, (2010).
29) Lopez A. I., Reins R. Y., McDermott A. M., Trautner B. W. and Cai C., *Molecular BioSystems*, **5**, 1148-1156, (2009).

❐ ❐ ❐

Artificial Neural Network & its Applications in Textiles

S. D. Bhambure*, A. J. Dhavale, P. V. Kadole, & D. V. Kodavade
D. K. T. E. Society's Textile & Engineering Institute

Abstract
The artificial neural network (ANN) is increasingly used as a powerful tool for many real world problems. ANN has proved its usefulness for many problems in textiles such as prediction of yarn properties, analysis of fabric defects, process optimization, etc. The power of neural networks lies in their ability to represent complex relationships and learn them directly from the data being modeled. The prediction of properties or performance of a process in advance is required to minimize the setup cost and time involved. The ability to predict these properties accurately has become a challenge due to highly non-linear and interactive behavior of textile materials. This paper presents basics of ANN and its applications in different textile domains.

Keywords
Back propagation, Cotton grading, Fabric engineering, Image processing, Multilayer feed forward network.

1. Introduction

The artificial neural network (ANN) is an information processing paradigm that is inspired by the way biological nervous system works, such as brain processes an information. ANN uses numeric and associative processing to mimic models of biological system. It resembles the human brain in two respects: i.e. knowledge is acquired by the network from its environment through a learning process and interneuron connection strengths, known as synaptic weights are used to store the acquired knowledge [1].

Today, ANN is being applied to increasing number of real world problems of considerable complexity. The advantage of ANN lies in their resilience against distortion in the input data and their capability of learning. They are often good at solving problems which are too complex for conventional technologies e.g. problems that do not have a conventional algorithmic solution [2].

1.1. Definition

A set of processing units when assembled in a closely interconnected network, offers a rich structures exhibiting some features of the biological neural network. Such a structure is called as Artificial Neural Network (ANN). The ANN is a massively parallel distributed processor made of single processing units, which has a natural propensity for storing experiential knowledge and making it available for use [1].

The procedure used to perform the learning process is called as learning algorithm, the function of which is to modify the synaptic weights of the network in an orderly fashion to attain a desired design objective. In practice, the ANN cannot provide the solution by working individually; rather it needs to be integrated into a consistent system engineering approach [3].

1.2. History

In 1943, Warren McCulloch and Walter Pits proposed a model of computing element, called as McCulloch Pits neuron. In 1949, Donald Hebb proposed a learning scheme for pre-synaptic and post-synaptic values of variables. In 1958, Rosenblatt proposed the Perceptron model, which can adjust weights by perceptron learning law. In 1960, Widraw proposed Adaline model for computing element. In 1985, Akley, Hinton and Sejnowski proposed feedback neural network with hidden units. For many years, Neural Networks have been used in various areas of engineering and economics in order to describe the relationship between the parameters that cannot be determined analytically. They were used to simulate learning from examples, detecting patterns, associative memorizing and recalling information [2].

All correspondence should be addressed to,
S. D. Bhambure,
Department of Textiles,
D. K. T. E. Society's Textile & Engineering Institute,
Ichalkaranji, 416115.
Email : sachindb.dkte@gmail.com

1.3. Classes of Neural Network

There are three classes of neural networks: viz. Single layer feed forward networks, Multilayer feed forward networks and Recurrent networks as shown in **Figures 1.2** and **1.3** respectively.

1.3.1. Single layer feed forward network

The neurons are organized in the form of layers. In a simplest form of a layered network, an input layer of source nodes projects onto an outer layer of neurons. The network is strictly feed forward and hence called as single layer feed forward network [1].

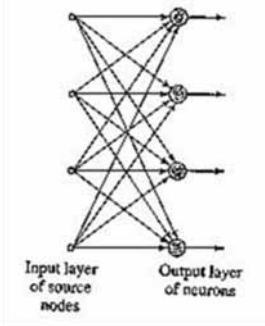


Figure 1.1: Single layer NN

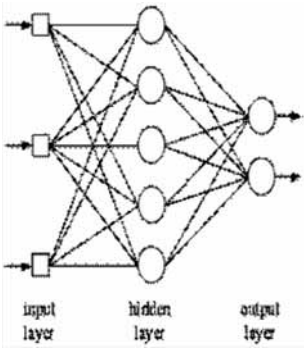


Figure 1.2: Multilayer NN

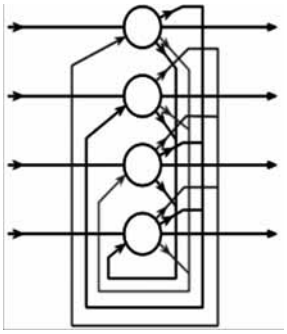


Figure1.3: Recurrent NN

1.3.2. Multilayer feed forward network

In multilayer network, there is presence of one or more hidden layers whose nodes are called as hidden neurons. Their function is to intervene between external input and network output in some useful manner. By adding more hidden layers, the network is enabled to extract higher order statistics. The source nodes in input layer supplies respective element of activation pattern, which constitutes input signals applied to neurons in first hidden layer. The output signals of the first hidden layer are used as input to the second hidden layer and so on. The set of output signals of the neurons in the final output layer of network constitutes the overall response of the network to the activation pattern supplied by the source nodes in the first input layer.

1.3.3. Recurrent network

The recurrent neural network is distinct in the sense that, it has at least one feedback loop. A recurrent network may consist of a single layer of neurons, with each neuron feeding its output signals back to inputs of all other neurons. The recurrent network may or may not have hidden neurons. The presence of feedback loops has a profound impact on learning capability of the network and its performance [1].

1.4 Learning of a network

A network can be learnt with or without training. The objective of learning is to mold the mapping surface according to desired response. Once the network is structured for a particular application, that network is ready to be trained. To start with, the initial weights are chosen randomly. There are two approaches to learning; supervised and unsupervised.

1.4.1. Supervised learning

In this system, both input and output data are provided to network. Then it processes the inputs and compares the resulting outputs against the desired outputs. Errors are propagated backwards through the system, causing system to adjust the weights. The same set of data is processed many times, as the weights are refined. When the system has been fully trained, no further learning is required and the weights can be frozen. A vast bulk of networks utilizes supervised learning.

1.4.2. Unsupervised learning

This type of network is provided only with inputs. The system itself decides which features to be used to group the input data. It is also called as Adaptive learning. This learning technique is not commercially practiced [4].

1.5 Training of multilayer feed forward network by using back propagation algorithm

In multilayer feed forward networks, the processing elements are arranged in minimum of three layers i.e. input layer, hidden layer and output layer. The information propagation is only in the forward direction and there are no feedback loops. Even it does not have back connections; the errors are back propagated during training. The multilayer feed forward network involves the minimization of an error function in the least mean square sense, it is also trained by applying this gradient descent method. The back propagation algorithm is also called generalized delta rule, it provides the way to calculate the gradient of error function efficiently using the chain rule of differentiation. The error after initial computation in the forward pass is propagated backward from the output units, layer by layer justifying the name back propagation. For training of neural networks any number of samples can be used, but the accuracy increases with increase in number of samples [3].

There are mainly two types of algorithms; genetic algorithm and back propagation algorithm. The genetic algorithms are algorithms for optimization and learning, based loosely on several features of biological evolution. The field of genetic algorithms was created by John Holland. The back propagation algorithm is often used in actual applications because it has higher learning accuracy, faster recall and simple theory. Its goal is adapting the weights so as to minimize the square error.

2. Applications of ANN in Textiles

2.1 Fibres

An Artificial neural network in its simplest form i.e. a single layer neural network is used by Mukhopadhay and Siddiquee for the prediction of copolymer components [4]. The free radical copolymerization of acrylamide with quaternary ammonium cationic comonomer diethylaminoethyl acrylate (DMAEA) has been investigated in inverse emulsion. The copolymer composition is determined from residual monomer concentrations and different temperature levels. The results shown that, ANN can predict copolymer composition with moderate accuracy of 68-70 %, as a function of reaction conditions and conversions.

Figures 2.1 shows the intelligent fibre classification system. Here, ANN in its recurrent form is used to classify two kinds of animal fibres; Merino and Mohair. The model extracting six scale parameters with image processing and other using an unsupervised neural network to extract features automatically, which are determined in accordance with the complexity of scale structure and the accuracy of the model. It can achieve higher accuracy by increasing number of samples for learning, since accuracy of ANN largely depends on the parameters selected i.e. fineness, staple length and cross section of fibres [5].

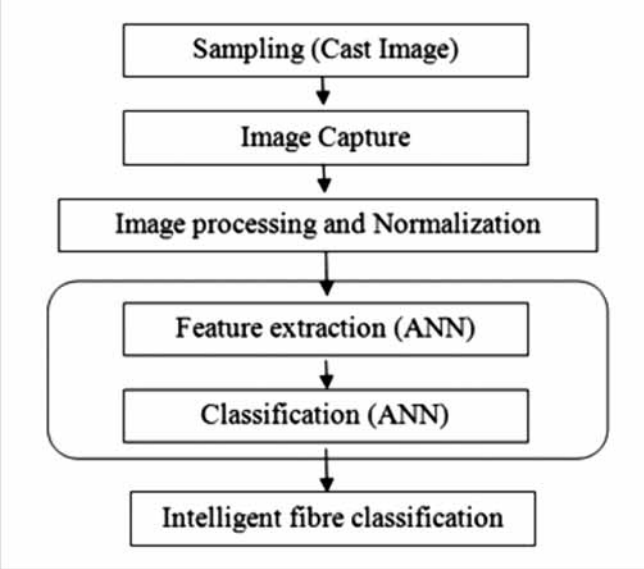


Figure 2.1: Intelligent fibre classification system

Cotton trades in India assess the commercial value of cotton on the basis of "grades" assigned by hand and eye methods by professional cotton classers. Now, a neural network of single layer type can be used to develop models to predict the cotton grading. By this way, cotton grading can be made more reliable and user friendly. Research is going on in this direction to replace the existing subjective grading with the objective one. To be precise, the properties of cotton that are measured by using ANN are colour of cotton, trash present and ginning preparation and the parameters selected were staple length, Micronaire value, moisture and short fibre contents. The blend out of two different kinds of fibres, the exact proportion in which the mixing has to be done (to obtain the required properties of the yarn) can be predicted using ANN [6].

2.2 Spinning

Zeng et al. have analyzed modeling methods for predicting the tensile properties of air jet spun yarns [7]. Numerical simulation provides a useful insight into a relationship between yarn tenacity and the fibre parameters, which are selected as inputs to neural net-

work. The neural network model of multilayer feed forward type predicts yarn tenacity using input parameters. The predicted and experimental values showed an excellent agreement upto 90%, indicating that the neural network is the successful method for predictors. They also analyzed the effect of input parameters on yarn tenacity with neural network model and found to be significant.

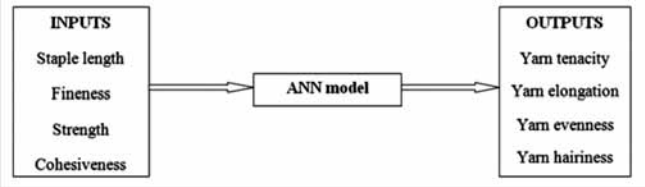


Figure 2.2: ANN model for yarn engineering

Ramesh et al. predicted the tensile properties of yarn from fibre properties [8]. The feasibility of yarn engineering is demonstrated in **Figure 2.2**, by developing a yarn to fibre "reverse" model using ANN. This approach is entirely different from the prevailing forward models, which predict the properties of final yarns by using the fibre properties as inputs. The cost minimization of cotton fibre was ensured by using classical linear programming approach in combination with ANN. The engineered yarns demonstrated good agreement with the targeted yarn properties. Spinning consistency index (SCI) was chosen as input for this purpose, as the regression equation of this index comprises most of cotton properties. The results of experiment had shown a moderate accuracy of prediction, as the single layer feed forward neural network with supervised learning method was employed.

Luo. Cheng and David Adams used an ANN for prediction of relationship between fibre properties and yarn strength [9]. A three layer feed forward network along with a correlation regression is used. They used USDA cotton fibre and processing test results for this investigation. The fibre properties like upper half mean length, length uniformity, short fibre content, strength, fineness and maturity ratio were measured using HVI. All cotton samples were spun into 22s ring spun yarn. Yarns were tested for skein test, elongation, appearance and imperfection. The CSP was used as a prediction target. When the neural networks were trained by a training set CSP values could be predicted from the neural networks in the prediction mode. Then the predicted CSP were correlated with the actual CSP and a good agreement upto 80% is found to be exist between fibre properties and yarn strength.

Chung Feng Jeffrey et al. studied the relationship between process variables and molecular structure of polyester (PET) yarns [10]. The thermo-mechanical properties of PET yarns were determined from melt spinning process parameters by using ANN. Although the internal structure of ANN is incomprehensive with respect to mechanisms of modeled relations, it was accurate way to make data and relations between data sets easily accessible. The accuracy of prediction between actual and predicted values was judged by using regression analysis method.

2.3 Texturing

Das used a multilayer feed forward network with back propagation algorithm to determine the optimized machine settings of a draw texturing machine, with regard to desired yarn properties [11]. The properties of yarn like tenacity and elongation are predicted by using regression analysis and the process parameters used are draw ratio, D/Y ratio (the ratio of surface speed of friction discs to the yarn linear speed), yarn delivery speed and primary heater temperature. The values predicted by ANN and regression analysis are compared by using correlation analysis and found that, the ANN values are showing correlation coefficient of higher degree (R=0.9023). The supervised learning method was used, in which both input and output are fed to the network.

Traditionally, the quality grades of false twist yarn packages are classified by human inspection, but the result may be affected by personal and subjective factors. Shih-Hsuan Chu et al. used the image processing technology to extract the defects in yarn packages [12]. They used recurrent neural networks with an unsupervised learning algorithm, to classify the quality grades of the yarn packages. The parameters assessed for classification were weight, diameter and length of yarn wound on packages. From the experimental results, they obtained the classifying rate higher than 90%.

2.4 Knitting

Ertugrul and Ucar studied the prediction of bursting strength of knitted fabrics [13]. Bursting strength of cotton plain knitted fabrics is predicted before manufacturing by an intelligent technique of neural network and neuro fuzzy network, by achieving a significant savings in cost and time required for trial and error. Among many parameters that affect fabric bursting strength; the fabric weight, yarn breaking strength,

elongation and loop length are the input elements for this prediction. The bursting strength had shown higher degree of correlation coefficient (R=0.9442) with respect to the selected parameters.

Prediction of total hand value of knits is reported to be successful by Park [14]. A fuzzy neural network provides an effective tool for prediction of total hand value of outerwear knit fabrics. The principal mechanical properties like stretchiness, bulkiness, flexibility, distortion, weight and surface roughness of the knitted fabrics are correlated with experimentally determined Kawabata total hand values and fuzzy transformed overall hand values. A fuzzy neural network is developed to predict and display the drope images of garments made of different fabrics and styles. The new approach is used to develop a prototype drope prediction system, to predict drope of women's dress styles made from different fabrics.

2.5 Weaving

Rocco Furferi et al. provided a predictive model of a coating process for forecasting the final characteristics of a coated fabric, based on the process parameters [15]. The process parameters selected were coating blade angle, temperatures of coating and curing, thickness of coating film and speed of coating; for prediction of air permeability, tearing strength and thermal conductivity of the coated fabrics. The multilayer feed forward ANN is trained and validated using a wide experimental database. The work is proved to be useful for technicians in selecting the optimal processing parameters for obtaining the desired coated fabric properties. The developed system requires technicians to set the values of process parameters and to stimulate the ANN based model to forecast the quality of coated fabric. The research work reported highest prediction performance of about 97% between actual and predicted values.

An image processing system is used by Atiqul Islam et al. as a tool for dynamic inspection of fabrics; the inspection sample is a piece of plain white fabric. The four defects are holes, oil stains, warp lacking and weft lacking. The image treatment employs a high resolution linear scan digital camera. Fabric images are acquired first, and then the images are transferred to a computer for analysis. Finally, the data is adopted as input for neural network which is obtained from readings after treating the images. In this system, there are three feed forward networks with supervised learning are used; consisting of an input layer, one hidden layer and an outer layer. As it has the ability to cope with the non-linear regression property, this method can reinforce the effects of image identification [16].

Automatic recognition of woven fabric patterns are presented by Boong et al [17]. The neural network and image processing technology are introduced for classifying woven fabric patterns. An auto correlation function is used to determine one weave repeat of the fabric. The reflected fabric image is captured by CCD (charged coupled device) camera and digitized by computer system. The learning vector quantization's algorithm as a learning rule of the artificial neural network enables recognition of woven fabric types more effectively. The results demonstrated that, the three fundamental weaves can be classified accurately and structural parameters such as yarn spacing, its variance and the ratio of warp to weft spacing can also be obtained. The system consists of a PC and CCD camera equipped with an attachable zoom lens. The fabric image is captured by a lightening device which is mounted at the end of the camera and it is zoomed on the image, which is also displayed on the coloured monitor. The image is then digitised by the AC to DC convertor and processed using techniques such as thresh-holding and auto-correlation to analyse the fabric pattern. The original image is converted into a grey level image to improve computer processing time and speed and the histograms are obtained.

Jasper W. J. used the back propagation algorithm along with the recurrent neural network to study the missing ends and picks, oily fabrics and broken fabric, all often found as a defect in fabric [18]. The correct selection of parameters for input layer plays a great role in recognition rate. Once a defect occurs in a fabric, its periodicity is changed so that corresponding intensities at specific position of spectrum obviously changed. These intensions can act as characteristics parameters and can be substituted in ANN for learning.

In a study by Tsai and Hu, the efficiency and accuracy of a method of detecting fabric defects that have been classified into different categories by a recurrent neural network [19]. Four fabric defects (missing ends and picks, oily fabrics and broken fabric) most likely found during weaving were learned by network. The method used for processing image is co-occurrence based method, by which six parameters are obtained. The results shows that, the fabric defects inspected by

means of image reorganization in accordance with ANN agrees with initial expectations. For each fabric, the results show that the total classification rates are above 96%. The total classification rate is 88% with the statistical method, while that with the ordinary method is 24%.

The Uster fabric scan system uses ANN in evaluating wrinkled fabrics with image analysis. Wrinkles in cloth usually develop with deformation during storage [20]. It is not easy even for trained observers judge the wrinkles. The visual information stimulates their senses and make them to judge the grade of wrinkle. Since visual evaluation is complex and bias, we cannot use linear evaluation system for auto inspection of wrinkles in fabric. For this purpose neural networks are widely used. Since networks are non-linear, the training rule is regularized as non-linear optimization problem.

Input parameters such as angular second moment (to measure the smoothness of digital images), contrast, correlation, entropy and fractal dimension are obtained using image analysis and are fed to the neural network algorithm. The mean sensory value presenting the grade of wrinkled fabric as output is obtained with desired parameters. The parameters to be perceived such as density, size, form and contrast can be inspected using multi-input and multi-output concept of neural network. A specific algorithm named "Kalman's Filter Algorithm" is used for this purpose and results are referred to be very much feasible for evaluating wrinkled fabrics.
The relationship between structure and properties of the fabric is complex and inherently non-linear, to create a predictive model one must resolve these complexities. The optimization of input parameters required to produce a fabric as per end use is called as fabric engineering [21]. Fabrics can be engineered either by weaving, knitting or bonding. Neural networks in feed forward mode are successfully implemented in all three to optimize the input parameters. The yarn properties and machine settings are used as inputs to predict the fabric properties as outputs. The construction of neural network for fabric engineering is shown in **Figure 2.3**

Textsmile

During a test, people look up for inspiration, down in desperation, and left and right for information.

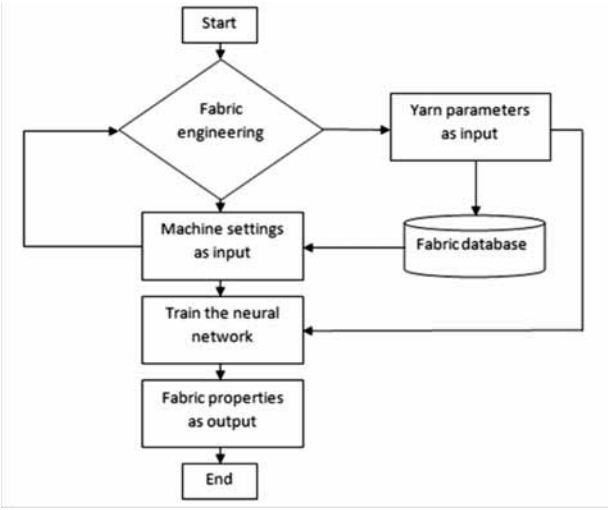


Figure 2.3: Neural network for fabric engineering

In prediction of human psychological perceptions of clothing sensory comfort, ANN is widely used. The objective is to know the predictability of the clothing sensory comfort from psychological perceptions by using feed forward back propagation network in ANN system. In order to achieve the objective, a series of wear trials are conducted in which 10 sensory perceptions (clammy, clingy, damp, sticky, heavy, prickly, scratchy, fit, breathable and thermal) and overall clothing comfort is rated. Good agreement between predicted and actual clothing comfort perceptions proved that, the neural network is effective technique for modeling the psychological perceptions of clothing sensory comfort. It is also found that, the predicted comfort score from the model with hidden neurons and the linear output neuron has a better fit with the actual comfort score than other models with different combinations of hidden and output neurons. Compared with statistical modeling techniques, the neural network is a fast and flexible predictive tool with a self learning ability for clothing comfort perceptions [22].

3. Conclusion

Ultimately, an ANN is one of the hopes available to textile industry to integrate elements such as production, properties, quality, cost, statistical process control and process optimization. ANN is computer based technology that can simulate characteristics of human interference for industrial benefits. ANN aims at the requirements of the industry like least downtime (the time for which machine remains idle or unproductive), highly competitiveness and reliable estimates of properties and process parameters. The function of ANN is not constant but can be changed dynamically.

References

1) Simon H., Neural Networks - A comprehensive Foundation, 2nd edition, Prentice Hall of India Pvt. Ltd., 2,21, (2006).
2) Yegnanarayana B., Artificial neural networks, 5th edition, Prentice Hall of India Pvt. Ltd., Sep., 24,118, (2007).
3) Rao M. A. and Srinivas J., Neural networks - algorithms and applications, 2nd edition, Narosa Publishing House,17-31, (2005).
4) Mukhopadhay S. and Siddiquae Q., *Asian Textile Journal*, **56**, Mar., 72-77, (2003).
5) She F. H., Kong L. X., Nahavandi S. and Kouzani A. Z., *Textile Research Journal*, **72**(7), 594-600, (2002).
6) Xu B., Su J., Dale D. S. and Watson M. D., *Textile Research Journal*, **70**, 430-436, (2000).
7) Zeng Y. C., Wang K. T. and Yu C. W., Textile Research Journal, **74**, (6), 689-694, (2004).
8) Ramesh M. C., Rajamanickam R. and Jayaraman S., *Journal of Textile Institute*, **86**(3), 459-469, (1995).
9) Cheng L. and Adams D. L., *Textile Research Journal*, **65**(9), 495-500, (1995).
10) Chung Feng Jeffrey Kuo, Kun Iuan Hsiao and Yi Shiuan Wu, *Textile Research Journal*, **74** (9), 840-843, (2004).
11) Das A., Network application in texturing process and parameters, Texturing viabilities- Proceedings, The Textile Association India- Mumbai unit, 95-116, (2005).
12) Shih-Hsun Chu, Hung Ming Chen and Jyh Yeow Chen, *Textile Research Journal*, **71**(4), 313-317, (2001).
13) Ertugrul S. And Ucar N., *Textile Research Journal*, **70**(10), 845-851, (2000).
14) Park S. W., Hwang Y. G. and Kang B. C., *Textile Research Journal*, **70**(8), 675-681, (2000).
15) Rocco Furferi, Lapo Governi and Yary Volpe, *Textile Research Journal*, **82**(12), 1282-1294, (2012).
16) Atiqul Islam, Shamim Akhter and Tumnun E Mursalin, Automated textile defect recognition system using computer vision and artificial neural network, Proceedings of world academy of Science, Engineering and Technology,**13**, May, 1-6, (2006).
17) Boong Soo Jeon and Ji Hyun Bae, *Textile Research Journal*, **73**(7), 645-650, (2003).
18) Jasper W. J. and Potlapalli H., *Textile Research Journal*, **65**(11), 683-692, (1995).
19) Tsai L. S. and Hu M. C., *Textile Research Journal*, **66** (7), 474-482, (1996).
20) Meier V., Uster fabriscan: The intelligent fabric inspection, http://www.kotonline.com/english_pages/ana_basliklar/uster.asp
21) Fan K., Wang T., Cheng T., Jou C. and Kou T., *Textile Research Journal*, **68**(3), 179-185, (1998).
22) Wong A. S., Li Y. and Yeung P. K. W., *Textile Research Journal*, **73**(1), 31-37, (2003).

❐ ❐ ❐

ADVERTISEMENT INDEX

A.T.E. Enterprises Pvt. Ltd.	A-9	Precision Rubber Ind. Pvt. Ltd.	A-16
All India Textile Conference	A-6	Premier Colorscan Instruments Pvt. Ltd.	A-7
Alpenol	A-13	Reliance Industries Ltd.	Cover 1
Asian Textile Conference	A-8	Rieter Components India Ltd.	A-9
Aspire Chemicals Pvt. Ltd.	A-11	Rieter India Ltd.	A-3
Igmatex	A-14	SGCCI International Textile Expo	A-10
India Tex 2013	A-12	SSP Pvt. Ltd.	Cover 2
Journal of the Textile Association	A-4	Super Tex Industries	A-5
Lakshmi Machine Works	Cover 3	Unitech Techmech	Cover 4
Lenzing AG	A-1	World Traders Mfg. Pvt. Ltd.	A-2
NITRA	A-4		

Textile Industry - an ocean filled with opportunities

Mr. V. R. Sai Ganesh

Mr. Sai Ganesh is currently General Manager (Business Development) in Atul Limited (A Joint Venture Company of M Dohmen & Atul) Thane.

He has completed B.Sc from Osmania University, Hyderabad, B.Sc (Tech) and M.Sc (Tech) in Textile Chemistry from University of Mumbai, ICT (formerly UDCT), a Post Graduate Diploma in Management from Essae TAPMI, Manipal in Marketing Management and Post Graduate Diploma in Computer Applications for Andhra Pradesh productivity Council.

He has worked for various European MNC's like BASF (I) Limited, Ciba Specialty Chemicals (I) Limited and DyStar India (P) Limited, for over 18 years. He is recipient of the best Key Account Manager award in 2001 and 2003 in Ciba Specialty Chemicals (I) Limited. He also has under his belt a Bronze Medal from SDC, UK, for promotion of trainings in India. He is member of various associations like, the Textile Association (India) TAI, AATCC, ASTM, and SDC. He is Hon. Trustee of SDC, EC, India. He is very Energetic and motivating leader with proven ability to effectively manage both personnel and projects. He is also a member of BJP and involved in various social work activities in his personal life.

Being a part of the Indian Textile Industry for nearly 19 years, my thoughts take me down the memory lane to the early 90's, as a student exposed to the best of technologists and of course the concern was the future job opportunities. In those days, the textile industry was on the verge of revival from infamous strikes of the 80's, which took the Industry a few decades back in terms of technology upgradation. The 90's saw the beginning of technological advances and the mill sectors moved from composite units under one roof to fragmented core of expertise development; this lead to many units focussing on spinning, weaving, processing and garmenting expertise, thus a vacuum for the need of technologists to run the show was created. This brought about a change in the mindset of management of these units to develop and harness new skills; there is an ever increasing need of the young technicians who can be the future of this Industry. The textile industry in India is highly fragmented. It is vertically integrated across the whole value chain and interconnected with various operations. The organised sector consists of spinning mills and composite mills. The unorganised sector consists of handlooms, power looms and handicrafts. The major sub-segments of the textile industry are cotton, blended, silk, wool and manmade. The major products in which Indian textile industry deals is readymade garments, suiting and shirting, shirts and trousers, fabrics, bed linen and embroidery work.

One should take immense pride for being part of the Indian Textile Industry, which is one of the most important industries of the Indian economy and is the second largest provider of employment after agriculture sector. India's textiles and clothing industry is one of the mainstays of the national economy. It is also one of the largest contributing sectors of India's exports worldwide. The report of the Working Group constituted by the Planning Commission on boosting India's manufacturing exports during 12th Five Year Plan (2012-17), envisages India's exports of Textiles and Clothing at US$ 32.35 billion by the end of XIth Five Year plan, as against of US$ 55 billion envisaged in the Report of Working Group on Textiles for the XIth Five Year Plan and based on historic growth rate of 10% (CAGR), a business as usual approach, will result in exports of US$ 52 billion by the end of XI Plan. An export target of US$ 65 billion and creation of 25 million additional jobs has been proposed with a CAGR of 15% during the XII Plan. At current prices the Indian textiles industry is pegged at US$ 55 billion, 64% of which services domestic demand. The textiles industry accounts for 14% of industrial production, which is 4% of GDP; employs 35 million people and accounts for nearly 12% share of the country's total exports basket. Above all these figures, most importantly provides direct employment to over 35 million people, the second largest provider of employment after agriculture.

The Textile Industry has witnessed phenomenal growth in recent years and attracted fair amount of foreign direct investment (FDI). The

textile and apparel industry in India is estimated to be about US$ 36 billion. It is the largest foreign exchange earner, contributing to approximately 15% of India's exports and 14% of industrial output. India's solid performance and growth in textile sector is fuelled by several key advantages that the country enjoys in terms of abundant availability of raw material and cheap labour, large domestic market, presence of supportive industries and supportive policy initiatives by the government.

Government of India has a vision to increase India's share in the global textile trade to 10% by year 2015 from current 3%. To realize its vision, the Government has taken various steps to strengthen the textile sector that include-

- Technology Mission on Cotton (TMC)
- Setting up of Apparel Training and Design Centres (ATDCs)
- 100% Foreign Direct Investment (FDI) in the textile sector under automatic route
- Revival plans of the mills run by National Textiles Corporation (NTC). Already, for the revival of 18 textile mills, US$ 2.21 million worth of machineries has been ordered for the upgradation and modernisation of these mills.

The fundamental strength of this industry flows from its strong production base of wide range of fibres / yarns from natural fibres like cotton, jute, silk and wool to synthetic /man-made fibres like polyester, viscose, nylon and acrylic. We can just track the strong multi-fibre strong base by highlighting the following important positions reckon by this industry across globe are,

- Cotton - Second largest cotton and cellulosic fibres producing country in the world.
- Silk - India is the second largest producer of silk and contributes about 18% to the total world raw silk production.
- Wool -India has 3rd largest sheep population in the world, having 6.15 crores sheep, producing 45 million kg of raw wool, and accounting for 3.1% of total world wool production. India ranks 6th amongst clean wool producer countries and 9th amongst greasy wool producers.
- Man-Made Fibres - the fourth largest in synthetic fibres/ yarns globally.
- Jute - India is the largest producer and second largest exporter of the jute goods.

The cotton based products, especially in the readymade garments and home furnishings segment will be the key drivers of growth for the industry.

An important sector is Technical Textile, which has also tremendous additional potential to the textile market. Currently the consumption of technical textile is 3% which is expected to be 11% this will lead to several benefits, viz,

1. Manufacturers will become educated and they will invest in building their brands
2. Entry of large manufacturers will result in price decrease, and in providing consumers same products at cheaper rates same as mobile phone industry
3. Job opportunities will develop indirectly
4. Increase in export will lead to increase in market value of India

In the liberalized post-quota period, India has emerged as a major sourcing destination for buyers from all over the globe. As a measure of growing interest in the Indian textiles and clothing sector, a number of reputed houses opened their sourcing / liaison office in India. These include Marks and Spencer, Haggar Clothing, Kellwood, Little Label, Boules Trading Company, Castle, Alster International, Quest Apparel Inc., etc. Commercially the buoyant retailers across the world are looking for options of increasing their sourcing from the Indian markets. Indian manufacturers are also pro-actively working towards enhancing their capacities to fulfil this increased demand.

The job opportunities for Textile Technologists is not only in the traditional Mill sector, but the Dyes and Chemical Manufacturers, Garment sector, Brand houses as colourists and merchandisers, Service providers like textile testing laboratories, Certification agencies, Audit companies, Fashion houses etc., The future of students in Textiles is bright and remember our Industry still caters to the basic essentials of Clothing of Mankind.

Textsmile

Q. Bay of Bengal is in which state
A: liquid

RSL in Textile Wet Processing

Eco friendly wet processing of textiles is the buzz word of the day. The textile industry is very much criticized for the pollution and environmental hazards that we have today. In the face of this predicament, the concept of restricted substance list (RSL) started gaining significance. Many RSLs were launched by statutory and other bodies. This gave rise to a complicated process for the textile chemists. There were very few RSLs which were followed universally. Therefore there was need for a widely accepted RSL. One such RSL is proposed by REACH. REACH (Registration, Evaluation and Authorization of Chemicals), is designed by European Commission and got into effect since June 2007. REACH encompasses the entire sub disciplines of chemical technology, since we are more concerned with textiles, following is an account of such chemicals which find their application in textiles but are proven to be hazardous.

◆ **Heavy metals**

In recent years, the US consumer products safety commission has witnessed numerous cases of non-compliance recalling due to the excess of heavy metals (especially lead content) in various products. Lead and other heavy metals such as cadmium and chromium, are closely linked to our day to day life and are widely used in consumer products such as electronics, toys, packaging materials, food containers, ceramics, furniture, stationery, and metal attachments, etc. Excessive content of heavy metals in consumer products has an adverse impact on human health and environment. For example, lead can cause trouble to children's intellectual development if accumulated in their blood.

In order to protect human health and reduce pollution of heavy metals to the environment, the international community has issued a series of safety standards to restrict and control the use of heavy metals in consumer products.

◆ **Azo Dyes**

The textile wet processing includes the use of dyes for colouration. Also there are many auxiliaries to be used in order to achieve desired effects. But, unfortunately many of these dyes and chemicals are found to cause hazardous effect to the human health. Therefore, textile industry is one amongst other industries which causes pollution and environmental hazards. So, those dyes and chemicals which are found to be hazardous (many are carcinogenic and mutagenic) are included in RSL.

Azo dyes are widely used because they cover entire shade gamut and have very high tinctorial value. Azo dyes are manufactured by using diazotization and coupling reactions. Therefore, various amines are used in the synthesis of these dyes. The table below depicts the restricted amines.

◆ **Phthalates**

Pthalates are a group of plasticizers with softening and elastic effects. They are widely used in hundreds of types of products such as toys, food packaging materials, medical appliances, shoes, and apparels, etc.

Studies have shown that men's sperm reduction over the past few decades may be related to the use of phthalates as softeners. Experts also found phthalates contained in soft plastic toys and children's products may be placed in the mouth of a child. However, placing long enough in the mouth will result in phthalates dissolution whose amount may exceed the safety standards, which endangers liver and kidneys.

◆ **PFOS**

PFOS is a fully fluorinated anion, widely used in the surface treatment of textiles, leather products, paper, furniture and carpets for its waterproofing and oil-resistance. It is also used as intermediates for the production of paints, foam extinguishing agents, floor polish, pes-

4-Aminobiphenyl	3,3'- Dimethylbenzidine
Benzidine	4'-Methylenedi-o-toluidine
4-Chloro-o-toluidine	p-Cresidine
2-Naphthylamine	4,4'-Methylene-bis-(2-chloro-aniline)
o-Amino-azotoluene	4,4'-Oxydianiline
5-Nitro-o-toluidine	4,4'-Thiodianiline
4-Chloroaniline	o-Toluidine
4-Methoxy-m-phenylenediamine	4-Methyl-m-phenylenediamine
4,4'-Methylenedianiline	2,4,5-Trimethylaniline
3,3'-Dichlorobenzidine	2-Methoxyaniline
3,3'-Dimethoxybenzidine	4-Amino-azobenzene

ticides and termite control agents for its chemical stability.

In December 2002, PFOS was classified as persistent, bio-accumulative and toxic (PBT) in the 34th OECD Chemical Committee meeting. Consequently the European Parliament has placed a restriction on marketing and use of PFOS and its salts (now included in EU REACH Annex XVII - Restriction List in 2009).

◆ **Bisphenol A**

Bisphenol A is 2,2-bis-(4-hydroxyphenyl) propane, or BPA in short. The substance is mainly used as an important raw material for the synthesis of epoxy resin, polycarbonate, polysulfone, aromatic polyester, phenolic resin, unsaturated polyester resin and flame retardant chemicals, etc. In addition, it is occasionally used as rubber aging inhibitor. It is reported that Bisphenol A is an endocrine disrupter, which can mimic the body's own hormones and may lead to negative health effect.

It is quite clear that textile wet processing includes certain chemicals and auxiliaries which have the potential to cause environmental hazards and adverse effects to human health. The RSL helps in creating awareness amongst the processors for identification of such chemicals. Also, it is a user friendly tool since all the banned substances can be reviewed in one single list along with their hazardous effects. This can further encourage the industries and researchers in finding the alternate and safe chemicals. Such an approach would guide the industry to make the available technologies cleaner and more sustainable.

- Saptarshi Maiti & Shyam Phadke

International Conference: Advances in Functional Textiles

An International Conference is organized by Manchester & Cheshire Section jointly with Technical Textiles Special Interest Group (SIG) The Textile Institute, Manchester (UK) and the Technical Textile Sector of the Materials KTN (UK) on 25-26 July 2013 at The Chancellors Hotel and Conference Centre, Chancellor Way Mosley Road, Fallowfield, Manchester, M14 6 NN, UK.

The Textile Association (India) has donned the remarkable role for the development of sector since more than 7 decades. The phenomenal steady growth achieved by TAI through the true democratic spirit of a vast number of dedicated professionals who have worked tirelessly for the cause of TAI.

Now it is proud to mention that another feather in the glory has added to The Textile Association (India). TAI member Mr. Arvind Sinha (Chief Advisor and CEO of Business Advisors Group) is presenting "Defence Textile & Camouflage Fabrics" on 25th July 2013 and Prof. (Dr.) M.D. Teli (Department of Fibres and Textile Processing Technology, Institute of Chemical Technology & Chairman - Editorial Board - JTA) is presenting "Cellulose-Metal Nanoparticles Composite Multifunctional Textile Materials" on 26th July 2013 during this conference.

Detail programme is attached.

Kirloskar Toyota Textile Machinery Pvt. Ltd.

(KTTM) a joint venture between the Kirloskar Group of India and M/s Toyota Industrial Corporation, Japan is equipped with all latest manufacturing facilities and being patronized by many renowned Textile groups in India. KTTM started its operation in 1997 at Jigani near Bangalore by manufacturing High speed Ring Frames with world class technology and till now supplied around 3 Million spindles to spinning industries in India and Abroad.

Looking to the growing demand for Super Long Frames, KTTM had been the front runner to continuously work with latest developments & introduced 1440 Spindles Frame in India & showed this during ITME 2008 at Bangalore. This development of KTTM received overwhelming response from market. Since then, Ring frames with spindles up to 1440 or 1632 per machine were popular in the market.

Mr. M. Kunito switching on the first machine. Mr. K. Nagireddy, Mr. S.V. Govindraj and Mr. Ashok Juneja is also seen in picture.

By maintaining continuous technological developments, KTTM introduced & showcased Design of "Super Long Ring Frame" with 1824 Spindles per frame during India ITME 2012 held at Mumbai and subsequently announced the first order from M/s Kallam group during the event. The first machine of RXI240e with 1824 Spindles was switched on at M/s Kallam Brothers cottons Pvt. Ltd. Sattenapalle by Managing Director of KTTM-Mr. Masafumi Kunito on 30-05-13.

Mr. M. Kunito, while inaugurating the first machine expressed that launching of longest machine is a mile stone in KTTM's history and wished the various spinners of India and abroad would be beneficiaries out of this new development.

Mr. K. Nagireddy, Managing Director of M/s Kallam Brothers opined that with Toyota's strength in automation and present availability of maximum spindles per machine, RXI 240e with 1824 spindles will become the obvious choice for any new spinner.

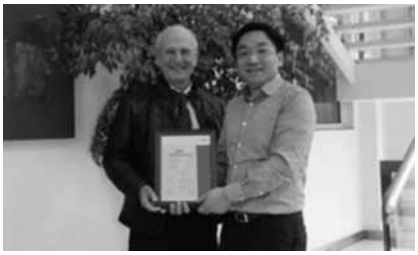
Mr. S.V. Govindraj, Vice President of M/s Kallam group pitched confident that this longest machine will add considerably to the profitability of new spinning mills.

Mr. Ashok Juneja Vice president of M/s KTTM, while cherishing association with Kallam group for more than 4 years, appreciated the initiatives always taken by Kallam Group for having latest technology machines at various concerns in their group.

For more details contact:
Mr. Ashok Juneja
Vice President (Textile)
Kirloskar Toyota Textile Machinery Pvt. Ltd.
Plot No.10-13, Phase II, Jigani Industrial Area, Bangalore - 560 105
Tel.: 080-27826201/205,
Fax: 080-27826207
E-mail:juneja@kttml.com; mktg@kttml.com

Rieter handed over the first Com4®jet license in China

Rieter handed over the first Com4®jet license in China 05/13/ 2013 - Rieter handed over the first Com4®jet license in China: Yangtse Spinning has recently been made a licensee of Rieter Com4®jet yarns. During the official ceremony Mr. Heiner Eberli, Head of Sales Rieter China, officially handed over the certificate to Mr. Xia Risheng, Head of Sales and Deputy General Manager of Yangtse.



From left: Mr. Heiner Eberli, Head of Sales Rieter China, Mr. Xia Risheng, Deputy General Manger Yangtse Spinning during the handover of the Rieter Com4®jet license.

The spinning company, Zhangjiagang Yangtse Spinning Co.,Ltd, located about 100 km west of Shanghai, a Sino-German joint venture invested in by Südwolle GmbH & Co.KG, is highly regarded as a premium quality yarn supplier in China. Yangtse Spinning, as all other mills in the Südwolle Group, is operating at the same high standard which assures constant quality and high efficiency in production. With its brand new and complete Rieter air-jet spinning machine line consisting of 14 J 20 air-jet spinning machines, Yangtse Spinning produces Com4®jet yarns of high quality and perfect piecing. Applications such as in 100 % viscose and yarn count Ne 30 - 40 for knitting yarn with high quality requirements are very attractive for premium quality customers. Yangtse Spinning, as the first Rieter Com4®jet licensee, has therefore set a new quality benchmark for air-jet yarn in the Chinese market.

New yarn with new properties. The form of the yarn construction on the air-jet spinning machine by means of an air stream in a spinning nozzle results in a new type of yarn structure. Typical features are the unique low hairiness, high volume, low tendency for staff and high abrasion resistance. This yarn from the Rieter air-jet spinning machine is marketed under the brand name Com4®jet. It creates many benefits, not only in downstream processing but also in the end product and opens up new areas of application.

License package from Rieter

Rieter actively promotes the supply sources for licensed yarns and also provides a direct link to the licensee via the Rieter website. Licensed customers have the option of profiting from the know-how of the Rieter specialists and attending the Rieter Com4® yarn trading seminar. Also with their own marketing activities, licensed customers receive support from Rieter.

TEXGIULIA Becomes COM4®ROTOR Yarn Licensee

The Italian company, Texgiulia, is committed to yarn quality spun on Rieter rotor machines type R 60. In order to optimally promote the yarns, the company decided to become a Rieter yarn licensee for rotor yarns. The ceremonial presentation of the Com4®rotor certificate took place mid-March 2013 at the company's headquarters in north Italian Rovellasca-Como.

L to R: Ezio Tollardo, Dr. Emilio Moltrasio, Matthias Stuessi and Sergio Zonca while ceremonial presentation of the Rieter Com4®rotor, certificate to the Management of the Gabel Group.

The fully-integrated open-end spinning plant Texgiulia is part of the Italian Gabel Group and is one of the leading manufacturers of bedding and home textiles in Italy. The company generates its complete added value domestically - starting from yarn production up to the product sales through its own distribution network.

First and foremost, Texgiulia produces for its own requirements. By the acquisition of further Rieter R 60 rotor spinning machines, the

plant now has a sufficiently large capacity to also produce yarns for third parties. The Rieter yarn license for high-quality Com4®rotor yarns thus offers Texgiulia the optimal promotion platform to win new customers for rotor yarn in future and to develop customer relationships.

The ceremonial presentation of the Com4®rotor certificate was held mid-March at the headquarters of the Gabel Group in Rovellasca-Como (north Italy). In the presence of Dr. Emilio Moltrasio (Delegate of the Board of Directors and Partner in the Gabel Group) and Sergio Zonca (Technical Director General of the Gabel Group), Rieter sales engineer Matthias Stuessi (Rieter sales engineer) handed over the certificate to the Management.

Yarn quality further improved
With the yarns, spun on the new R 60 rotor spinning machines, Texgiulia was able to further increase the already very high quality standard of the yarns and substantially improve the running properties in its own weaving unit. Yarn purchasers will also profit from this quality in future.

License package from Rieter
Rieter actively supports and promotes the supply sources of licensed yarns, one of the measures being a direct link on the Rieter website to the licensee. Licensed customers have the opportunity to profit from the expertise of Rieter specialists and to participate in Rieter Com4® yarn further training courses. Over and above these activities, Rieter supports licensed customers with the implementation of their own marketing actions.

Suvin and Wadia TESL : a perfect collaboration…

Suvin Advisors

Wadia Techno-Engineering Services Ltd., which is a part of the reputed Wadia Group of companies, and Suvin Advisors to collaborate for providing value added services to industrial clients in India & around the world.

In 2012, pursuant to mutual agreement Wadia group raised its stake in the erstwhile Gherzi Eastern Limited (GEL) to 100%, as a result of which Gherzi A.G. has ceased to be a promoter of GEL and the name of 'Gherzi Eastern Limited' has been changed to "Wadia Techno-Engineering Services Limited (WTESL)" with effect from November 8th, 2012. WTESL has more than 53 years of experience andover 2500 real estate, industrial and infrastructure projects of various natures across the globe. Wadia TESL has wide network with branches in major cities like New Delhi, Chennai, Kolkata, Pune, Gandhinagar, Bangalore, Hyderabad etc. and more than 380 employees on their roll. Wadia TESL is also registered with renowned banks and financial institutions like World Bank, ADB etc.

Suvin is one of the reputed consulting firms for "textile and food industries" in India, offering the entire gamut of Management & Engineering consultancy services from business strategies to overall project management to process management. Suvin, in the past few years, is known to have a good reputation as a qualified consultant in the textile industry providing satisfactory services for more than 125 projects in India & globally.
The Wadia TESL - Suvin collaboration shall enhance the capabilities of both the organization as Wadia TESL has enriched experience in implementation for varied sectors like residential & commercial projects, hotels & hospitals, educational institutions, urban planning, industrial, roads & highways while Suvin has a well-experienced team for management consulting and implementation of textile and food projects. Hence the services of both organizations are complementing each other to provide customers with one-stop solutions for specialized textiles and other industries.

Wadia Techno-Engineering Services Ltd. & Suvin have come together to meet the dynamic demands of the rapidly expanding global and domestic industry. This association will enrich the industry with effective solutions for future growth which is particularly essential in today's highly competitive market.

Tool for export competitiveness

Information technology or IT has been embedded in all spheres of business be it auto, metal finishing, electronics, jewellery, pharma or any other sector. IT has emerged a prime tool for creating competitive advantage for enterprises of all types and all sizes. However misappropriated IT can distort markets and weaken legitimate competition and give birth to unfair competition. The governments worldwide are working to ensure fair competition among trading partner and level playing field.

A new law known as the "Unfair Competition Act" (UCA) (www.lexology.com , June 2012) has been enacted in US. UCA intends to ensure fair competition among the trading partners and also promote legitimate trade practices including restricting the undue advantage created by using illegal software. The law actually mandates that companies using IT in their business must legalise their IT usage to sustain and make their business grow. Compliance with the UCA has become a mandatory obligation for export to USA. Recently a case came into limelight (www.indianexpress.com , 25 Jan 2013) when lawsuits were filed against, an Indian company and a Chinese company in California, USA. It was alleged by the state Attorney General, Ms. Kamala Harris that these companies have used pirated/unlicensed software in the production of clothing that they exported and sold in California. She further suggested that such practices were anti-competitive and companies over the globe indulging in such practices should be warned. The law actually mandates that companies using IT in their business must legalise their IT usage to sustain and make their business grow in US market.

The USA is one of the most important export markets for Indian products, so undoubtedly the law poses particularly serious implications for Indian companies selling their products in US market. India faces stiff competition in international trade from countries like China, Vietnam, Japan, Pakistan etc. These countries have a higher usage of unlicensed or illegal software which gives them unfair cost advantages as compared to those who use genuine or licensed software. But due to requirement of IT compliance under UCA, these countries will looser their competitiveness to those countries where piracy is low like India. Thus UCA has actually provided an opportunity to grow in the export market. Furthermore UCA is not applicable to only those firms who are direct supplier of goods to the US market but extends to all the firms involved in the entire value chain (The national law Journal ; 6 May). So it is required on the part of the Indian manufacturers and exporters to be cautious even when purchasing raw material from a supplier in India or abroad. They should make sure the supplier is using only the genuine IT. In light of this law the companies in USA will prefer to engage only with those suppliers who used genuine IT.

Ms. Tamanna Chaturvedi, consultant Indian Institute of Foreign Trade cautions Indian manufacturers and exporters thus (The daily , Feb 22-25 ,2013) "China is our tough competitor and adherence to legal IT will provide us an upper edge over China, but we have to avail this opportunity as quickly as possible even before our competitors starts thinking about it"

One way out for companies to manage their software better and connect with those customers who want to do business with ethical and legally compliant entities is registration on verafirm.org (earlier known as LMR360) Verafirm is a unique platform which provides a brand identity by self-declaration of your software assets. Once companies register on verafirm.org they get digital certificates stating that they are "verafirm verified" or "verafirm certified company". There is no charge taken from the firms for registration on verafirm.org. To get digital certificate and more information please visit www.verafirm.org.

References

www.indianexpress.com,
www.lexology.com,
globalstudy.bsa.org/2011

UCMTF President Interview 2013

French Textile Machinery Hi Tech machinery for Hi Tech textiles

UCMTF groups 30 specialty textile machinery manufacturers which are world leaders on their specific markets. Their total annual consolidated turnover of 1 billion Euros (1.3 billion US dollars) makes France the sixth textile machinery exporter. They are particularly strong in long fibre spinning, yarn twisting and texturing, heat setting, Jacquard and dobbies, dyeing, non-woven and recycling processes.

Interview of Bruno AMELINE, the President and Evelyne CHOLET, the Secretary General, to know more about French Textile Machinery manufacturers;

Bruno AMELINE, the President

The global economy is growing but it is not the case in Europe and particularly in France. How are the French textile machinery manufacturers doing?

We are back to the best levels that we reached before the crisis which hit the global economy in 2008-2010. In 2012, many of our companies have achieved record sales and order intakes.
The only drawback of this positive situation is that the delivery lead times may be close to one year and sometimes even more. This means that we have a very good visibility for the whole 2013 and into 2014. Geographically speaking, the differences are huge compared with what prevailed before the crisis. For quite a while our national market for apparel and home textiles has collapsed. More recently, it has been the case also for many of our historical European markets. These markets have shifted to such countries as China and India and to specific places like Turkey but each market can be quite volatile. China has been less buoyant recently but seems to come back; India is very active with the governmental and local investments incentives. For the technical textiles which represent close to 40% of the fiber consumption, the situation is more balanced as the production of these fast growing products is approximately one third in each continent: Europe, the Americas and Asia.

Do you think it is dangerous to rely on such remote markets?

No. We are not competing on the mass markets like cotton spinning. Our companies are SME's, designing, producing and servicing specialized machines offering the latest innovations. This is in our DNA, remember Jacquard, the most well known textile machinery inventor, he was French! Today, with our skills, expertise and experience, we develop creative and innovative solutions for our customers.

Even if mostly SME's, the French machinery manufacturers have set up a very effective network to offer the best service to most remote customers' locations. We support our clients wherever they operate at least as well as a local supplier could do. We do it through offices, warehouses, agents or distributors.

For the spare parts, our members are more and more pro-active, some have recently opened warehouses in important markets to deliver the much awaited parts without transportation lead time and with the right level of service. We work with our clients to help them to introduce new products on their markets, to have reliable and cost efficient production processes. It gives us a real competitive advantage. As we strongly believe that our strategy is right, we are optimistic for our future.

Another danger could be the copies, how do you deal with this issue?

So far, each company had its own policy but, recently, within our association, we have established an active working group on this strategic topic. We absolutely need to protect our intellectual property, it may be our most important asset. We have collectively concluded that the counterfeited machines or parts come from a small number of countries. We will sue the counterfeiters very aggressively. We have strong arguments: our patents, our brands. Most of our customers who, as I said are our long term partners, understand that this strategy is in their long term best interest. We will become more and more pro-active concerning the use of counterfeited parts as we cannot guarantee a machine which uses counterfeited parts.

Each company, national associations and Cematex and the machinery

shows have to work together on this strategic sensitive feature of our business. In this war against copycats we receive more and more support from the governments, the international bodies and the judiciary systems.

Is UCMTF active to promote sustainable development?

On Wikipedia, I found an interesting definition of sustainable development: a mode of human development in which resource use aims to meet human needs while ensuring the sustainability of natural systems and the environment, so that these needs can be met not only in the present, but also for generations to come.

I have been thinking for many years on our responsibilities as industrialists and good citizens.

At first, sustainable development and our corporate goals may have looked, at least

partly, contradictory. It is actually not.
First of all, end users are more and more demanding on sustainability. This is true for all textile products. For apparel or home textiles, the consumers' demands go up to the textile pipeline from the very powerful international brands and distributors up to us, the machinery manufacturers. For technical textiles, the public and private procurement policies follow the same trends. For example, in France, public procurement criteria include sustainability.

Another reason is that we design machines and production processes which save energy, water, and raw materials. Our national manufacturers have found many ways: fine tuning the machines, finding new processes for individual machines, optimizing a whole production line. The textile producers of apparel, home textiles and technical textiles are extremely sensitive to energy, water and raw material savings and compare precisely the investment costs and the savings. Often their own desire to promote sustainable development is supported by profitable returns on their investments. I can conclude in a very positive way, which is now embedded in our corporate strategies and for which we invest heavily in technical expertise: to deliver sustainable profits for our companies we have to act in the context of a sustainable development framework for all our stakeholders and for our global community.

Our machines, themselves, have to be manufactured to leave the least possible footprint on the environment. We have to put more emphasis on their eco-design, propose upgrading schemes and plan how the materials used will be recycled at the end of their life. UCMTF can promote such policy.

Do you check that the machines you sell are used in safe conditions for the labor force?

You are probably thinking of the collapse of a garment factory in Bangladesh which killed more than 1 000 workers and other such horrible drama. Our machines are not used in the garment industry but in the textile industry. The two are fundamentally different. For example, a T-shirt manufacturer's process is mainly labor intensive. On the contrary very high capital investments are necessary in the textile production. The labor force in the textile industry includes a great number of engineers and highly skilled workers. In order to be efficient in spinning, yarn processing, knitting or weaving the plant itself has to be modern with such equipments as air-conditioning. Then, even if our customers do not face the same risks as some garments makers, more and more the products of our customers have to be both eco-friendly and people-friendly. Even though the supply chain in apparel is so complex that it becomes quite abstract to the consumers, the recent events may change that attitude and make it compulsory to be much more vigilant on safety. I just read in the news that Bureau Veritas, the global inspection and certification body, had been awarded big contracts to check on the safety issues in Bangladesh.

How your association helps the individual companies?

First of all, after all the reorganization of our industry, we do not compete against each other.

On the contrary, we offer complementary machines, sometimes full lines which are very much appreciated by our customers as they can get a single technology point of entry, it is real competitive advantage.

UCMTF is very active to promote our offer worldwide. At major textile shows, UCMTF helps the smaller companies organize a national booth and promote collectively our exhibitors, particularly thanks to its very good relationships with you, the textile media.

UCMTF organizes seminars and with the help of Ubifrance and the

French local representations, invites the local textile companies to attend. In the last 12 months, UCMTF has focused its efforts on the Indonesian and the Indian markets. I am glad to report that the seminars which took place in Bandung attracted more than 150 Indonesian companies from Jogjakarta, Samarang, Solo and Surabaya and that this March in Delhi and Surat (State of Gujarat) we attracted more than 300 Indian companies. Very interesting contacts have been initiated and it is now up to our companies to follow up on these. The next seminar will be held, in the second semester, in Algeria.

Last but not least, UCMTF organizes press conferences and meetings with you, the textile press. We trust you are an efficient and neutral link between the different textile stakeholders. Our website www.ucmtf.com is also a very easy portal to use both for the press and our customers.

PHD CHAMBER

National Seminar on "Innovations & Technological Advancement: Growth Mantra for Textile Industry"

In an era when the Textile industry is passing through a critical phase, with stiff competition both in the domestic as well as international markets, product diversification, innovation, technology advancement and value addition are the thrust areas for the textile industry to remain competitive in the years to come. Even India's global textile share is 5%, which is far less than that of China, which is 34%. Technology advancement & innovation offers new ways, means and opportunity to the Indian textile industry to sustain the present growth and thrive in near future. The emerging opportunities for the Indian textile industry due to recent unstable situations in Bangladesh and growing demand for cotton yarn and fabrics in China have brought to the forefront the need and the opportune time for the modernization of processing, spinning, weaving, garmenting and technical textiles segments. This could catapult a fresh growth with generating employment and value-addition.

Keeping this backdrop in mind PHD Chamber is keen to organize a National Seminar on "Innovations & Technological Advancement: Growth Mantra for Textile Industry" at PHD Chamber, New Delhi on 29th July to 3rdAugust, 2013.

The main theme of the conference will focus on the emerging and cutting-edge advancements in the frontier areas of Textiles, Machinery, Nonwoven and Technical Textiles which will emphasis on the entire value-chain of textiles, from fibre to fashion fabric, and apparel fabric to technical textiles.

The Seminar will have 8 distinct sessions:

- Technology Upgradation Fund: opportunities and current challenges
- Advances in Modern Woven Fabrics Technology, Spinning, Knitting & Non woven
- Advances in the dyeing and finishing of technical textiles
- Advances in Textile Testing and Quality Control
- Computer technology for te.xtiles and apparel & soft computing in textile engineering
- 3-D fibrous assemblies: Properties, applications and modelling of three-dimensional textile structure
- Nanofibres & Nanotechnology in Textiles
- Innovation in Textiles

Society of Dyers and Colourist Silver Medallist Dr. K. S. Murthy

SDC is the world's leading independent, educational charity declared to advancing the science and technology of colour in a changing world. SDC awards medals in recognition of exceptional service to the Society, outstanding knowledge of colouration technology or in the interest of the tinctorial and allied industries or both and achievement in the knowledge and practice of colour science and technology. Medals conferred are Gold, Bar to Silver, Silver, Bronze, Centenary Levels. Service to the Society may include an outstanding single contribution to the work related to a particular project or devoted service over many years to the headquarters-based and /or regional committees. Service to the industry (which includes academia) recognises an outstanding single contribution to the tinctorial or allied industries or prolonged valuable contribution (technological or educational nature).

Dr. K. S. Murthy received the Award and Certificate in person from President Richard Straughan for, "Sustained support for the Indian Textile Industry" at the award ceremony on 26th April 2013 in Bradford, UK. The occasion was graced by his research supervisor Prof. Ian Ratee (formerly of University of Leeds), student successor Dr. David Lewis (his batch mate), immediate past President Dr. S. Y. Kamat and his close relatives.

Dr. Murthy was immensely pleased that his work years of committed efforts have been recognised and acknowledged by SDC internationally, rewarding him with this prestigious honour. He attributed this honour to support from Pidilite Industries Ltd, alma mater, classmates and print media. He believes that pursuit of knowledge is a lifelong process and knowledge learnt should be passed to the others and he will continue to support the textile industry by the way of writing.

The Enkaptivate Leaders Café meet with TAI

The Textile Association (India) - Central Office organized a meet with The Enkaptivate, a customer Engagement Company on the topic "Current Financial Market in Textiles Industry" on 15th June 2013 at Ramee Guestline Hotel, Dadar, Mumbai.

The Enkaptivate is specializing in conceptualizing and executing catchments centric and product specific engagement programs for customer augmentation and acquisition. Majority clients are from the Financial & Banking Sectors. The Enkaptivate Leaders Cafe is a small step in that direction of facilitating a platform for intellectual discussion and interaction.

Mr. Avinash Mayekar delivering the presentation

On behalf organizer Mr. Madhu Nair & Ms Ranjana Thakur gave the introduction and the brief of activities of the Enkative. Mr. Madhu Nair replied to various questions asked by the attended audience.

Mr. Arvind Sinha delivering the presentation

Mr. Arvind Sinha, Business Advisors Group, Mumbai presented "Scenario in BRICS Region and Textile Potential" which was very informative paper. Mr. Avinash Mayekar, MD & CEO, Suvin Advisors Pvt. Ltd. presented very interesting on the topic "New Business development and Financial Planning". Mr. Suresh Kotak, Mr. Mr. V.Y. Tamhane, stated about the current scenario of textile industry.

Mr. D.R. Mehta, National President, TAI thanked the organizer for organizing the meet and he requested them to organize such short meets in future. About 30 Business Owners and Decision Makers in Textiles Industry were attended.

VDMA: Graduate engineers respond to current challenges

Techtextil in Frankfurt provided the framework for this year's award ceremony of the Walter Reiners-Stiftung (Foundation) of the German Textile Machinery Industry, honouring three successful junior engineers. Energy efficiency and lightweight construction are actually at premium for the junior engineers - the emphases of the promotion, diploma and project studies documents this.

Award-winners with Members of the Board of Foundation and Professors from left to right: Prof Cherif, Waldmann, Hampel, Dornier, Award-winners Appel, Schneider and Dr. Schenuit, Liebrandt, Prof. Gries

Sustainability -realistic and tangible

Peter D. Dornier, chairman of the Lindauer DORNIER GmbH Board of Management and chairman of Walter Reiners-Stifung paid homage to the awardees. In his celebratory speech he outlined the textile machinery industry as the starting point of intelligent applications - in the field of sport, automotive, aviation and space industry, construction and engineering. Fibre-reinforced materials, i.e. composites, exert a special fascination in these sectors. They prove particularly useful, where reduction of weight is required: For example in motor cars and aircrafts. Composites make a major contribution to reduction of petrol and kerosene consumption and are as such concrete examples for sustainability, said Dornier.

Increase energy efficiency - rationalise production processes

The promotion prize in the dissertation category endowed with 5,000 Euros has been awarded to Dr. Heiko Schenuit of RWTH Aachen. In his thesis he developed solutions which considerably increase the energy efficiency of weaving machines.

Furthermore, Lars Appel, also of RWTH Aachen, has been awarded with the promotion prize of 3,000 Euros in the diploma category. The procedure presented in his diploma thesis helps to further rationalise the production of composites. Sebastian Schneider of TU Dresden has been rewarded for the best student research with the creativity prize endowed with 2,000 Euros. His study explains creative concepts to optimise material flow during production of composite components. This is another step forward to a substantial automation of composite manufacturing.

Walter Reiners-Stiftung (Foundation) - Promoting Talents

With the Walter Reiners-Stiftung the VDMA Textile Machinery Association is actively engaged in promoting junior engineers. Each year, the foundation provides an incentive for top performers by granting two promotion prizes for dissertations and master/diploma thesis as well as one creativity prize for seminar papers. Students regularly gain an insight into practice with excursions to member companies and to the leading textile exhibition ITMA, which are financially supported by the foundation. Particularly high-performance students are supported by scholarships.

Niketan College of Home Science

Right First Time-Role of Sustainability

society of dyers and colourists

This seminar was conducted by Department of Fashion Technology of Nirmala Niketan College of Home Science in collaboration with SDC-India and UK on 13th June 2013 in the college hall. The speakers were Mr. Richard Straughan (President SDC UK) and Mrs. Elizabeth Straughan (Trustee SDC UK) both experts in dyeing. They shared their deep knowledge with staff and students of the department. Principal Dr. Machado welcomed the guest.

L to R: Dr. Ela Dedhia, Dr. Deepa Rathi, Mr. Richard Straughan, Mrs. Elizabeth Straughan

The seminar was inaugurated by Mr. Richard and Mrs. Elizabeth along with Dr. Ela Dedhia, the Head of Specialisation and Dr. Deepa Rathi, senior faculty. Dr. Dedhia introduced the guest and the theme of the topic. Mr. Richard explained how it is possible to dye with reactive dyes using less water and energy for better sustainability of resources that are very important for sustenance of the globe. He spoke on the concept of 'Right First Time' where, uniform and correct dyeing takes place at the very first time. Exhaust Dyeing process helps in reduction in the use of resources such as energy & water and thus promotes sustainability.

Mrs. Elizabeth spoke on microencapsulation for finishes such as fragrances that can be used for their Aromatherapeutic effects, so called Cosmetotextile finishes that donate a body benefit to the skin such as Super Moisturisers or vitamins such as vitamin E and capsules that can work as deterrents against mosquitoes or forest ticks. She also mentioned of thermochromic microcapsules that will change colour with heat, such as body heat on a garment for fashion novelty or at much higher temperatures. These higher temperature changes can be utilized to highlight a safety issue such as having a very high temperature change in a coating that could be put on a motor housing. This would enable the housing to start to change colour if the motor was to overheat which would allow it to be shutdown to prevent it from burning out.

She also highlighted on the richness of India. She said that she was very impressed with our beautiful country and many of the things that she had experienced during her short visit. She said that one of the things that had struck her the most was the wonderful family values that seemed to still exist in our country which she felt were being lost in parts of the UK. She told the students to continue to embrace this as well as embracing all of the opportunities that were available to them for their careers. In her opinion it was possible for these two things to co-exist as they were both very important.

It was followed by a very lively question answer session. The session was very well taken.

Group photo with Guest, faculty members and students attended the seminar

The vote of thanks was proposed by Mrs. Pratima Goyal

IMPORTANT

The Textile Association (India) Members of TAI

Kindly update your email ID & Mobile Nos. to ensure to receive regular updates from our end.

Name	
TAI Unit	
Membership Type	
Membership Number	
Mobile No.	
E-mail ID	

Please forward the same to Jb.soma@gmail.com

Okhla Garment & Textile Cluster

OKHLA GARMENT & TEXTILE CLUSTER (OGTC) is organizing 9TH International Conference on Apparel & Home Textiles ICAHT - 2013 on 20th & 21st September, 2013 at India Habitat Centre, New Delhi with the Theme "CREATIVE THINKING".

Department Institute MSME, Govt. of India and Office of the Textile Commissioner, Ministry of Textile, Govt. of India has consented for their support for this event. AEPC is a lead sponsor.

India apparel industry has a hope of coming into the picture of preferred sourcing destination due to the changing scenario in China, Europe, US and Bangladesh.

The global apparel manufacturing industry is expected to grow more than ever in times to come. The apparel manufacturers are now adopting new techniques to increase their trade. New business models and competitive strategies are used to enhance profits and growth. The conference is intended to cover all aspects of the apparel industry, including the problems of small-scale enterprises in the developing world, the barriers which are hindering the growth of this industry, the strength and weakness of the manufacturers in different region, globalization issues, resource and manpower scarcity, quality of the product, trade laws, adopting new techniques to improve productivity, managing global supply chain and finally changing apparel industry trends with ever-changing fashions.

A cross-disciplinary event, the idea is to explore creativity and the creative process through the lenses of imagination and innovation. The conference aims to provide an environment for academics, researchers and practitioners to exchange ideas and recent developments in the field of apparel manufacturing. The conference is also expected to foster networking, collaboration and joint effort among the conference participants to advance the theory and practice as well as to identify major trends in apparel manufacturing.

The Convention will be a great opportunity for international trade fraternity to know the dual strengths that India can offer, not only as a great supplier base, but also as a fashion destination for international brand.

Key Issues To Be Addressed In Icaht -2013

- Environment : Carbon Foot Print Measurement in Garment Industry
- Direction: A Clear sense of where the organization is heading and how it will get, there that is meaningful to all employees
- Leadership: The extent to which leaders inspire action
- Culture: Shared benefits and quality of interaction within and across unit
- Accountability: The extent to which individuals understand what is expected of them, have authority to carry it out and take responsibility for delivering results.
- Coordination: Ability to evaluate organizational performance and risk and to add opportunities when they arise.
- Capabilities: The presence of institutional skills and talent required to executive strategy and create competitive advantage.
- Motivation: Presence of enthusiasm that drives employees to put in extraordinary effort to deliver results.
- External: Quality of suppliers, partners and other external shareholders to drive value.
- Innovation : of new ideas and the ability of the organization to adopt and shape itself as needed
- Responsible Fashion: Leading to Responsible Competitiveness
- Technological Up gradation: Appropriate and Continuous up gradation and absorption

The garment industry owners, their CEO's, industry professionals, academicians, representatives from industry associations, researchers, consultants, service providers from India and other part of countries will be attending this conference also the final year and post graduate students etc. will get benefited.

Day One -20th September, 2013 - Presentations

1) Presentations from International and Indian invited speakers from varied fields of management, manufacturing, marketing, social responsibility etc. And

2) Design Creations in fashion Show format by Students of Lady Irwin College, Department of Fabric Science

3) On the sidelines of the conference there will be a Poster Presentation to encourage the research

& postgraduate students a poster competition on the conference theme will be held where 3 best poster presentations will get cash reward.

Day Two - 21st September, 2013 - Workshops

Specific workshops are arranged on selected areas from the above list by eminent experts from India and Abroad for specific skill professionals

It may not be out of place to mention that the concept of workshops and general interest presentations is a novel concept adopted by OGTC and has been found extremely beneficial to the industry in terms of specific skill up-gradation and creation of general awareness in the present times, which are really termed as knowledge economy.

Invited Speakers

Speaker	Country	Subject
Dr. Mike Fralix	USA	Opportunities for business growth in manufacturing- How does India capture the transition
Mr. Virender Goyal	India	Competitive growth of manufac turing industry in Bangladesh- A Case Study
Mr. Devdas	India	3G Train the Trainer concept and System Implementation
Mr. Prashant Agarwal	India	The Road to 2025- Market, Trade and Investment Trends
Mr. Jean Michele	France	Using Fashion Trend to Glasman come out with winning model
Aquarell	India	Path of a Market focused company: A case Study
Mr. Harinder Lamba	Bahrain	Supply Chain management - Key to growth globally as well as locally
Wazir Advisors	India	ROI: Converting employees into productive assets- Case Studies
Mr. Aman Gulati	India	MSME Lean Experience as an auditor
Mr. David Birnbaum	Hong Kong	Competitiveness in Indian Apparel Industry
Dr. Rajesh Bheda	India	Results & Grand Benefits for Business & workers programme A case study

DELEGATES FEES:

1. (a) Members of OGTC (b) The Textile Association (India) (c) Noida /Gurgaon / Apparel Export Cluster (d) ATDC Faculty	Rs.3000/-
2. Others	Rs.5000/-
3. Indian Students through Institutes	Rs.2000/-
4. Foreign Delegates	US$.200/-

Organizing Committee:

Mr. PMS Uppal, Chairman
Mr. Vijay Mathur, Co-Chairman

For further details if any contact:

Mr. R.C. Kesar, Conference Chairman 09810091812
Mr. M.K. Mehra, Conference Advisor 09868200116

OKHLA GARMENT & TEXTILE CLUSTER

D-104, Okhla Industrial Area, Phase I,
New Delhi-110020 India
Ph. (91)11- 41609550, Fax (91)11- 26816520
Email. ogtc@airtelmail.in, ogtc@ogtc.in , ogtc@rediffmail.com Visit us at www.ogtc.in

oerlikon Textile - Background Information BCF Technology

99 % higher efficiency -things you need to know about carpet manufacturing

Carpet manufacturing is a handicraft with an ancient tradition. It is assumed that the Babylonians were already weaving fibers 3000 years before Christ. Today, new carpets are presented at the various international trade fairs and markets - each distinct in terms of their pattern, their color and the end-customer properties.

Over the past 50 years, the importance of various raw materials used in the carpet industry has changed dramatically. Up until the 20th Century, natural materials were predominantly used - such as plant fibers made from cotton or coconut or fibers of animal origin including wool and silk, for example. Currently, natural products only make up approximately 12 percent of all the raw materials deployed, while manmade raw products constitute 88 percent. Manufacturers of manmade yarns use polypropylene, polyamide and polyester in their products.

Either filament yarn or spun yarns can be used to manufacture carpet yarn. The latter are produced using manmade staple fibers and are usually combined with natural fibers. Spinning filament yarns has manifested itself as the prevalent method for producing carpet yarn: it is more cost-effective to manufacture and the finished carpet is lower-maintenance, more robust and more hypoallergenic.

Manufacturing filament yarn requires the polymer to be melted in an extruder and pressed through spinnerets. In the case of spun-dyed yarn, the dye is added prior to extrusion using a metering unit. Downstream to the spinning system - the filament bundle, which generally comprises 144 individual filaments and has an overall titer (unit of measure for determining the fineness of the manmade fibers and given in "tex" or, more commonly, in "dtex") of between 1000 and 3000 dtex - is drawn using godets (driven rolls that act as yarn guides or take-off devices); hence creating a strong and extremely thin filament material. In the subsequent process step, the yarn is textured (physical and/or chemical manipulation of the smooth filament yarn with the aim of giving the yarn textile properties) and cooled on a cooling drum. To this end, it acquires the properties essential for processing it into carpet (volume and bulk) and is transformed from smooth filament yarn into bulked continuous yarn (BCF= bulked continuous filament). Subsequently, the yarn is tangled using a tangling unit (for tangling the filament yarns) in order to keep the tangled multifilament together for further processing and finally the yarn is taken up. The take-up speed, which is dependent on the polymer and titer, is 3000m/min for standard polypropylene yarn.

The BCF carpet yarn systems in the Oerlikon Neumag product portfolio are called S5, S3, Sytec One and S+. Each of these is customized to the specific requirements of various client groups. The S5, S3 and S+ are three-end systems, whereby the S5 is Neumag's to date most-sold BCF system. The single-filament Sytec One is particularly flexible. The latest S+ standard machine is the successor to the S5 and S3 systems and unites their benefits in a fast and simple-to-operate machine with proven components. Thanks to a straight yarn path and increased spinning height, it reaches higher production speeds. Compared to the S5, these results in is an increase in productivity of 10 percent at dtex and an increase in productivity of up to 40 percent at 2100 dtex. Furthermore, a redesigned winder mechanism enables an efficiency increase of up to 99 percent.

Following the manufacture of the BCF yarn

Optionally, the BCF yarn can either be cabled or twisted. In this step, a yarn is twisted or several yarns, also of different thicknesses, are brought together and plied. In this way, the yarn receives greater bulk and the carpet acquires a denser appearance. To ensure that the cabling or twist effect is durable, the yarn is treated with heat and steam within the context of a thermosetting process.

To manufacture carpets, the yarns are either woven or tufted. Woven carpets require three yarns, so-called warps, in order to form the carpet including the product's upper surface and the backing material. If manufacturers wish to produce carpets with a fleecy surface - so-called velvet-pile carpets - the woven loops are cut open evenly sheared and fixed by applying a latex layer to the reverse of the carpet.

In the case of tufting, which was first invented in the USA, the yarns

are needled through a needle bar into a prefabricated backing material, for instance a fabric or a nonwoven, and form a series of loops. In the case of loop-pile carpet, these loops are left as they are. However, the loops are cut off using a blade in the case of a velvet-pile carpet. Tufted carpets must also always be stabilized with a binder coating made of latex and a secondary carpet backing.

To produce a colored carpet, makers can choose between various methods depending on the polymer and the manufacturing technique used: dyes can be added during the spinning process or the yarn or the entire carpet can be printed or dyed as a single piece. In the case of the piece dyeing process or printing the carpet, the yarn is manufactured from raw white polyester or polyamide and the carpet is predominantly produced using the tufting process. With this method, manufacturers can respond to short-term customer color requirements.

Applications

We distinguish between three different applications: the residential sector, the public sector and the automotive sector, whereby the residential sector makes up the largest share, for which carpets are supplied as wall-to-wall carpeting or rugs. In the public sector, carpets must above all be particularly friction and flame-resistant. However, the automotive applications are the most challenging, as the carpet manufactured from spun-dyed yarn has to be very closely shorn and hence irregularities become quickly apparent. With a three-quarters share of the market, demand is dominated by tufted carpets. Furthermore, artificial turf, bath mats or carpets made from needled felt are additional applications.

Orbitz
Business Tours

Canton Fair Autumn 2013 - A colossal event with awesome business potential.

中国进出口商品交易会
CHINA IMPORT AND EXPORT FAIR

The 114th session of China Import and Export Fair - or popularly known as the Canton Fair - is all set to storm the global stage this autumn. It will be held at the colossal Pazhou complex in Guangzhou, China in three phases of five days each namely:
Phase 1: Oct 15-19, 2013
Phase 2: Oct 23-27, 2013
Phase 3: Oct 31- Nov 4, 2013

This biannual event held in Guangzhou every spring and autumn is the largest trade fair in China. It is also a comprehensive one with the longest history, the highest level, the largest scale, having the most exhaustive exhibits with the broadest distribution of overseas buyers and the greatest business turnover in China. The Fair is co-hosted by the Ministry of Commerce of China and People's Government of Guangdong Province, and organized by China Foreign Trade Centre.

The previous hosting of Canton Fair in April 2013 attracted over 24,500 exhibitors and close to 2,02,766 visitors.

The 114th Canton Fair in October 2013 will focus on improving value-added products and competitiveness in international markets. About 48 trading delegations, comprising over 20,000 of China's best foreign trade corporations (enterprises) with good credibility and sound financials, take part in the Fair. These include foreign trade companies, factories, scientific research institutions, foreign invested enterprises, wholly foreign-owned enterprises, private enterprises, etc. Business people from all over the world gather in Guangzhou, exchange business information and develop trade relations. Canton Fair is divided into 3 phases: the first phase focusing on Machinery, Electrical and Electronic products, the second phase focusing on Home and Decoration, while the third phase focusing on textiles, garments and fashion accessories.

Orbitz Corporate & Leisure Travels (I) Pvt. Ltd is the Official Travel Company for Canton Fair for 2013 appointed by The China Foreign Trade Centre (CFTC). Hence Orbitz enjoys certain privileges, among others, like easy group registrations and relevant services for its delegates so that all formalities are simplified and expedited with special privileges to VIP delegates in terms of lounge services.

To promote this mega bilateral trade event at press conferences in Mumbai and Delhi, a team of 3 delegates from the China Foreign Trade Centre presented the scope and opportunities at the Canton Fair and how it is an indispensable event for business growth. The Orbitz team also gave a presentation on its travel packages to Canton Fair and its role as a facilitator to participating at Canton Fair. It has thus emerged as India's leading and most preferred travel company for business travel to the Canton Fair.

True to its reputation for having led the largest Indian delegations to Canton Fair, Orbitz Business Tours has a plethora of travel packages for the upcoming Canton Fair too. (These include world class airlines, conveniently located 5 & 4-star hotels for independent travellers and visitor groups, Indian dinners by Indian chef in the comfort of the hotel and all transfers. Depending on the choice of package, there will be a half day city tour of Guangzhou with an enchanting Pearl River Cruise).

It therefore makes sound business sense to travel to the Autumn session of Canton Fair - one of the world's biggest trade fairs - with Orbitz, officially the best in India.

For more information contact: Orbitz Corporate & Leisure Travels (I) Pvt. Ltd.
101, Navyug Industrial Estate,
T. J. Road, Sewri (W),
Mumbai - 400 015.
Tel.: 022-2410 2801-03, 6728 2400
Fax : 022-2410 2805
Contact person: Ms. Laju Jariwala
E-mail : btmktg@orbit-star.com
Website : www.orbit-star.com/go/canton2013

COLORANT®
An ISO 14001:2004 Company

Colorant Limited Receives Dmai Award

Colorant Limited, a leading Reactive Dyes Manufacturer and exporter based in Ahmedabad received the Award for the outstanding performance in Domestic Market by a SME for the year 2012-13 organised by Dyestuff Manufacturer Association of India held on 22nd June, 2013 at Hotel Sea Princess, Mumbai. Colorant is an ISO 9001:2008 & ISO 14001:2004 certified Company and one of the leading Manufacturers and Exporters of Dyes in India. Most of the products are "GOTS" Certified and Preregistered with "REACH". The Company also enjoys status of Government recognised "Export House".

Mr. Sanjay Chavda, Sales Manager receiving the award from Chief Guest Dr. Anil Kakodkar, Nuclear Scientist and Ex-Chairman Atomic Energy Commission.

Colorant has become the first Indian Company to offer it's clients in India and overseas a range of Fluorine based Reactive dyes in the name of COLRON "CN" series. Colorant recently concluded a MoU with the Color Root of China - the biggest manufacturer of Fluorine based Reactive dyes in the world. Under the agreement, Colorant is having an exclusive marketing rights for these dyes in India enabling the company to offer most modern and environmentally green chemistry to it's customers for the first time in India thereby revolutionizing the dyeing industry due to the energy saving and emission reduction. Colron High Performance Reactive dyes like SD series, GLX series, CN series and SF series are already being used by 650 customers (including Corporate Houses) in India and well accepted in Export market for its quality, cost-effectiveness and timely supply.

A.T.E. now offers complete range of printing solutions from Zimmer

A little over a year after Zimmer tied-up with A.T.E. for the marketing and sale of Zimmerdigital printing machines in India, Zimmer Austria has also entrusted A.T.E. with the marketing, sales and after sales service of its entire range of printing machinery including rotary screen printing and flat-bedscreen printing machines.

Zimmer, the world leader in printing technology, manufacturers a complete range of machinery for textile and carpet finishing covering digital printing systems, flat screen and rotary screen printing, coating, steaming, washing, and drying in its plants situated at Klagenfurt and Kufstein.

Zimmer rotary screen printing, Rotascreen, is equipped with a magnetic squeegee system and is modularly constructed, thus allowing for a wide spectrum of applications. Rotascreen enables top quality results with single or multi-colour printing on different substrates such as home textiles, fashion fabrics, automotive, and other materials.

(Rotascreen)

Zimmer flat bed machine, Magnoprint, is a well proven flat bed screen printing machine successful world wide. Its magnetic system and roll rod technology in the longitudinal direction enables single or multi-clour printing on different substrates such as flags, home textiles, banners, towels, blankets, and automotive technical textiles.

(Magnoprint)

Zimmer triple coat is a compact coating machine with precision back roll and is equipped with knife, screen, and slot coating unit for different substrates such as textiles, paper foil, nonwoven, fibre, glass, tissues and other innovative materials.

(triple coat)

With an expanded portfolio in printing solutions, A.T.E. now provides the full range of the latest technologies in processing and caters to the end-to-end needs of all processing customers.

Rieter Com4® Yarns - Yarns of Choice

Com4® - the yarn brand from Rieter - has been an established name in the textile industry for more than a decade. To date Com4® stood for high-quality compact yarns spun on Rieter compact spinning machines. Most recently, the brand has been extended to all 4 spinning systems that Rieter offers on the market.

Belonging to the family of Com4® yarns (Fig. 1) are Com4®ring, Com4®compact, Com4®rotor and Com4®jet which stand for high-quality yarns spun on all 4 Rieter end spinning systems.

Com4® is a worldwide registered Rieter trademark. As well as Rieter customers who wish to have their yarns licensed, downstream processors can also have their textile fabrics which are verifiably manufactured from Com4® yarn licensed.

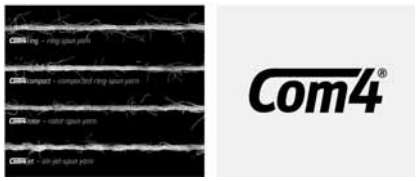


Fig. 1: The 4 Com4® yarn brands

Every spinning technology creates a typical yarn structure. It determines the individual yarn characteristics and therefore the character of the brand. Both the characteristics of the yarn itself and the characteristics in downstream processing or of the subsequent textile product, are determined by the yarn structure. As the structure forms the basis of all characteristics, the yarn structure images have also been selected as the central illustration for the yarn brand Com4®.

Your advantage in using the Com4® trademark

Your advantage in using the Com4® trademark is, briefly stated, the securing of your sustainable success (Fig. 2). To distance yourself from competitors means being different or better, being able to offer your customers more than the others can. By selling and trading Com4® yarns, you are showing that you offer high-quality yarns. You profit directly from the Com4® campaign launched by Rieter. Knitters and weavers know the benefits of Com4® yarn and trust in the quality of the delivered yarn.

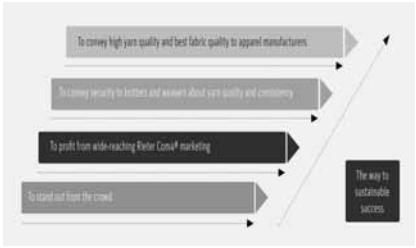


Fig. 2: Your path to success with Com4®

Diversity results in flexibility and creativity

Creativity has no limits in the textile industry. In order to produce innovative textile surfaces, varied yarns are needed. To bring special designs or functions into the fabric, textile designers require a vast selection of yarn types. In addition to the yarn structure variants such as the yarn fineness, volume and the fiber material in use, options are necessary to provide designers with a large yarn variety (Fig. 3).

Fig. 3: Extended Com4® yarn range to make creativity possible for designers

The 4 end spinning systems can produce additional yarn variants by adaptation of special facilities. For instance, core yarns can be produced in Com4®ring-core and Com4®compact-core versions. Fancy yarns are possible in the Com4®ring-vario, Com4®compact-vario and Com4®rotor-vario versions. Twin facilities - for manufacture of spin plied yarns - are made possible by Com4®ring-twin und Com4®compact-twin. A special yarn is Com4®compact-light with reduced compacting of the yarn. As you can see, variety and creativity are practically unlimited.

The path to your licensing

You, as spinning unit or fabric manufacturer, can contact Rieter any time and apply for the Com4® license (Fig. 4).

Fig. 4: The path to Com4® licensing

Rieter experts from the sectors sales, product management, service and textile technology validate the applications. Spinning companies, who have their spinning process completely under control, maintain their machine park well and have high quality expectations that they also implement, have the best chance to obtain a license.

Examined is whether the applicant manufactures yarns on the specified machine generations. Com4®ring must be produced on the ring spinning generations G 32, G 33 and G 35. Com4®compact on the compact spinning genera-

tions K 44 and K 45. Com4®rotor yarn on the rotor spinning machines R 40 and R 60. Com4®jet yarn is produced on the air-jet spinning machines J 10 and J 20.

Following a positive decision, a license contract is concluded. The new licensee can directly profit from the yarn marketing.

The Com4® family is steadily growing (Fig.5). Almost 100 spinning companies have applied for the new branding. Over 3 000 yarn qualities have already been traded as Com4® yarns.

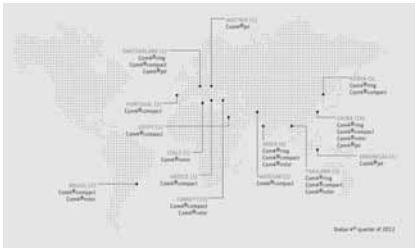


Fig. 5: The Com4® world

United to success

How will you now profit from the Com4® campaign? The marketing concept is based on the classical pull-and-push effect (Fig. 6). This means, a licensee offers (push) the market Com4® yarns through their sales promotions. Simultaneously, the downstream processors - the knitter and the weaver - ask for Com4® yarns (pull). This effect only happens when all those involved know and value the benefits of Com4® yarns. Here the Rieter marketing concept becomes effective.

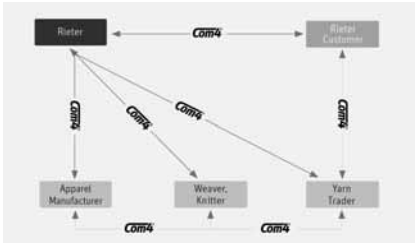


Fig. 6: Com4® pull-and-push effect in the yarn market

The Com4® yarn concept for your success

Which marketing activities support the marketing concept? Through good structuring and clear target group segmentation, efficient publication is rapidly and securely achieved.

Fig. 7: Com4® marketing vehicles and actions

As is shown in Fig. 7, Rieter has actively implemented a variety of actions since 2012. A strong and informative Com4® Internet presence not only helps the already licensed customers to introduce themselves but also provides interested companies with information on Com4®. A Com4® brochure and presentation supports communication. We wish to give prominence to the license and reference brochures. In the practical book, all licensed customers with their products are listed. The book is regularly updated, can be downloaded from the Com4® website and is actively distributed at trade fairs, symposia or other events. Downstream yarn processors and yarn trader repeatedly confirm to us that the book forms part of their everyday range of tools.

Furthermore, Rieter is permanently active in preparing the latest technological findings for Com4® yarns and publishing them. In the trade press, an advertising concept supports promotion of the yarn brand. The consistent use of the key visuals - the yarn structures - is a further important component of publication and ensures a recognition effect. Seminars with yarn traders, yarn sellers and downstream processors such as knitters and weavers are a must for the campaign. Rieter also actively participates at trade fairs at which licensees have the opportunity to present their own products.

Licensed Com4® spinning plants and downstream processors are supplied with a starter kit with sales-supporting resources. Their success is also our success.

Iris Biermann

INDIA

The Southern Gujarat Chamber of Commerce & Industry (SGCCI) presents
International Textile Expo 2013 - 5F Textile Expo
Date : 06th-08th September, 2013
Venue : Surat International Exhibition and Convention Center (SIECC), Surat, Gujarat India
Contact : Mr. Paresh Patel, The Southern Gujarat Chamber of Commerce & Industry Sumruddhi, Makkai Bridge, Nanpura, Surat - 395 001, Gujarat, India
Tel. : +91 261-3090122, Fax: +91 261-2472340
M. : +91-97123821937
E-mail : marketing@sgcci.in,
Website : http://www.sgcci.in

Okhla Garment & Textile Cluster (OGTC)
9TH International Conference on Apparel & Home Textiles - ICAHT - 2013
Theme - "CREATIVE THINKING"
Date : 20th & 21st September, 2013
Venue : India Habitat Centre, New Delhi
Contact : Mr. R.C. Kesar, Conference Chairman
Mr. M.K. Mehra, Conference Advisor
Okhla Garment & Textile Cluster, D-104, Okhla Industrial Area, Phase I, New Delhi - 110 020 India
Tel. : (91)11- 41609550, Fax (91)11- 26816520
E-mail : ogtc@airtelmail.in,
ogtc@ogtc.in, ogtc@rediffmail.com
Website : www.ogtc.in

International Conference on Advances in Fibers Finishes, Technical Textiles and Nonwovens (AFFTTN)
Date : 1st & 2nd October, 2013
Venue : Mumbai For more information, please contact: AATCC - India Conference, 1069, 3rd Main, 4th Cross, AECS Layout, D-Block, Kundalahalli, Bangalore - 560 037 KA, India
Tel. : +91-9742578711, 9449835605
E-mail : aatcc.india@gmail.com, info@tecnitex.in
Website : www.aatcc.org, www.tecnitex.in

Igmatex Exhibition
Leather, Apparel, Hosiery Machinery and Accessories Exhibition
Date : 18th - 20th October, 2013
Venue : Brijendra Swaroop Park, Kanpur (UP), India
Contact : Ms Neha Aggarwal, Business Expo Promotor Shelter Complex, Shop No. 11, Plot No. 12-B, -504, Goodwill Gardens, Sector-8, Kharghar, Navi Mumbai - 410 210
M. : 9594276081, 9324077881
E-mail : info@igmatexfair.com,
Website : www.igmatexfair.com

The Textile Association (India) - M.P. Unit organizing National Textile Summit 2013 - "Intro-inspection on TextileBusiness [Fiber To Garment]"
Date : 30th & 31st, August 2013
Venue : S.V.I.T.S., Indore, M.P.
Contact : Mr. N.S.Nirban (Mob. 9826151119)
Prof. Ajay Joshi(Mob. 9826078355)
Mr. Ashok Veda (Mob. 9826047355)
Prof. Hiren Jaiswal (Mob. 8827304778)
E-mail : taimpunit@gmail.com

THE TEXTILE ASSOCIATION (INDIA) - Mumbai Unit organises
India Tex 2013 - Textile Exhibition - Fibre to Fashion
Date : 18, 19, & 20th October, 2013
Venue : VIA Ground, Vapi Industries Association, Plot No. 135, GIDC, Vapi - 369 195 (Gujarat).
Contact : Mr. Haresh B. Parekh, Exhibition Convener - +91-9167515676
Mr. Anil G. Mahajan, Exhibition Coordinator - +91-9324904271
The Textile Association (India), Mumbai Unit
Amar Villa, Behind Villa Diana, Flat No. 3, 3rd Floor, 86 College Lane, Off Gokhale Road, Near Portuguese Church / Maher Hall, Dadar (W), Mumbai - 400 028
Tel. : +91-22-24328044, 24307702,
Fax : +91-22-24307708
E-mail : taimumbaiunit@gmail.com, taimu@mtnl.net.in,
Website : www.textileassociationindia.com

3rd National Symposium on Functional Applications (NSFAC 2013)
Date : 24th & 25th October, 2013
Venue : Institute of Chemical Technology (ICT), Mumbai
Contact : Prof. Dr. N. Sekar
Convener (NSFAC 2013) Head, Department of Dyestuff Technology Institute of Chemical Technology (ICT), N.P. Marg, Matunga, Mumbai - 400 019 MS
Tel. : +91-22-33612707, Mob.: +91-9867958452
E-mail : nsfac2013@gmail.com
Website : www.nsfac.com

Texfair 2013 - Largest Expo of Textile Machinery, Accessories & Spares
Date : 13th to 16th December, 2013
Venue : CODISSIA Trade Fair Complex, Coimbatore
Contact : The Southern India Mills' Association 41, Race Course, Coimabtore - 641 018
Tel. : +91-0422 4225333, Fax: +91-422 422536
E-mail : texfair@simamills.org

The Textile Association (India) - South Gujarat Chapter hosting 11th International & 69th All India Textile Conference
Theme : "Indian Textiles: Global prospects and Perceptions"
Date : 20th & 21st December, 2013
Venue : The Gateway (TAJ) Hotel, Surat, Gujarat, India
Contact : Mr. Viren Jariwala, Hon. Secretary The Textile Association (India) - South Gujarat Chapter Kanjibhai Desai Hall, Samaj Shikshan Bhavan, Opp. Museum Chowk, Surat - 395 003, Gujarat, India
M. : 09099025253
E-mail : viren1001@yahoo.com;

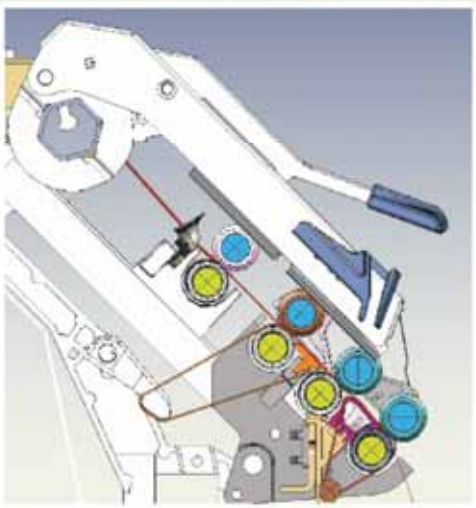
ABROAD

12th Asia Textile Conference - ATC 12
Theme : "New Prospects on Textiles"
Date : 24th to 26th October, 2013
Sponsor : China Textile Engineering Society
Venue: The Gateway (TAJ) Hotel, Surat, Gujarat, India
Contact : China Textile Engineering Society 6F., Main Building, No.3, Yanjingli Middle Street, Chaoyang District, Beijing 100025, China
Tel : +86-010-65917740
E-mail : atc12china@vip.126.com
Website : www.atc12.org

Every effort is made to ensure that the information given is correct. You are however, advised to re-check the dates with the organizers, for any change in schedule, venue etc., before finalizing your travel plans.

RING FRAME LRJ 9 SERIES

Hi-Tech, Unique Suction Compact Spinning System



Ring frame LRJ 9 Series with upto 1824 spindles are designed with a blend of cutting edge technologies and proven LR9 series features to cater to the needs of compact yarn spinners. The superlative features of these machines are configured in every facet to deliver high quality yarn.

Salient Features

- Hi-tech, Unique Suction Compact System with Ease of Handling
- Maximum number of spindles up to 1,824
- AC Servo Drive for compact drive rollers - Flexibility in fine tuning the tension draft through display
- Duo Compact Nozzle
- Unique Suction Arrangement
- Synthetic apron with perforations - Less Maintenance and Longer life
- 4 QM drive for drafting with T-Flex drive
- AC Servo drive for ring rail movement
- TPI change from display
- Maximum spindle speed up to 25,000 rpm (mechanical)
- Auto doffer and provision to link with winder

adsync

LAKSHMI MACHINE WORKS LIMITED

Perianaickenpalayam, Coimbatore - 641 020, India.
Phone : +91 422 3022255 Fax : +91 422 2692541
Email : sales@lmw.co.in / exports@lmw.co.in www.lakshmimach.com

Leadership through Excellence

Scan QR code for more details

Redg. No. R. N. 11386/57 (Formally Textile Digest)

Introducing New Range of Rings & Travellers

- UNI QC Hi-Pe
- UNI SX +
- UNI ULTIMA NG

UNITECH

Since1976

W-28, M.I.D.C. Bhosari Industrial Area, Pune - 411 026, INDIA. Tel. : +91 20 27120379, 27127674 Fax : +91 20 27126272, 27656315
Email : admin@unitechtexmech.com, sales@unitechtexmech.com URL: www.unitechtexmech.com