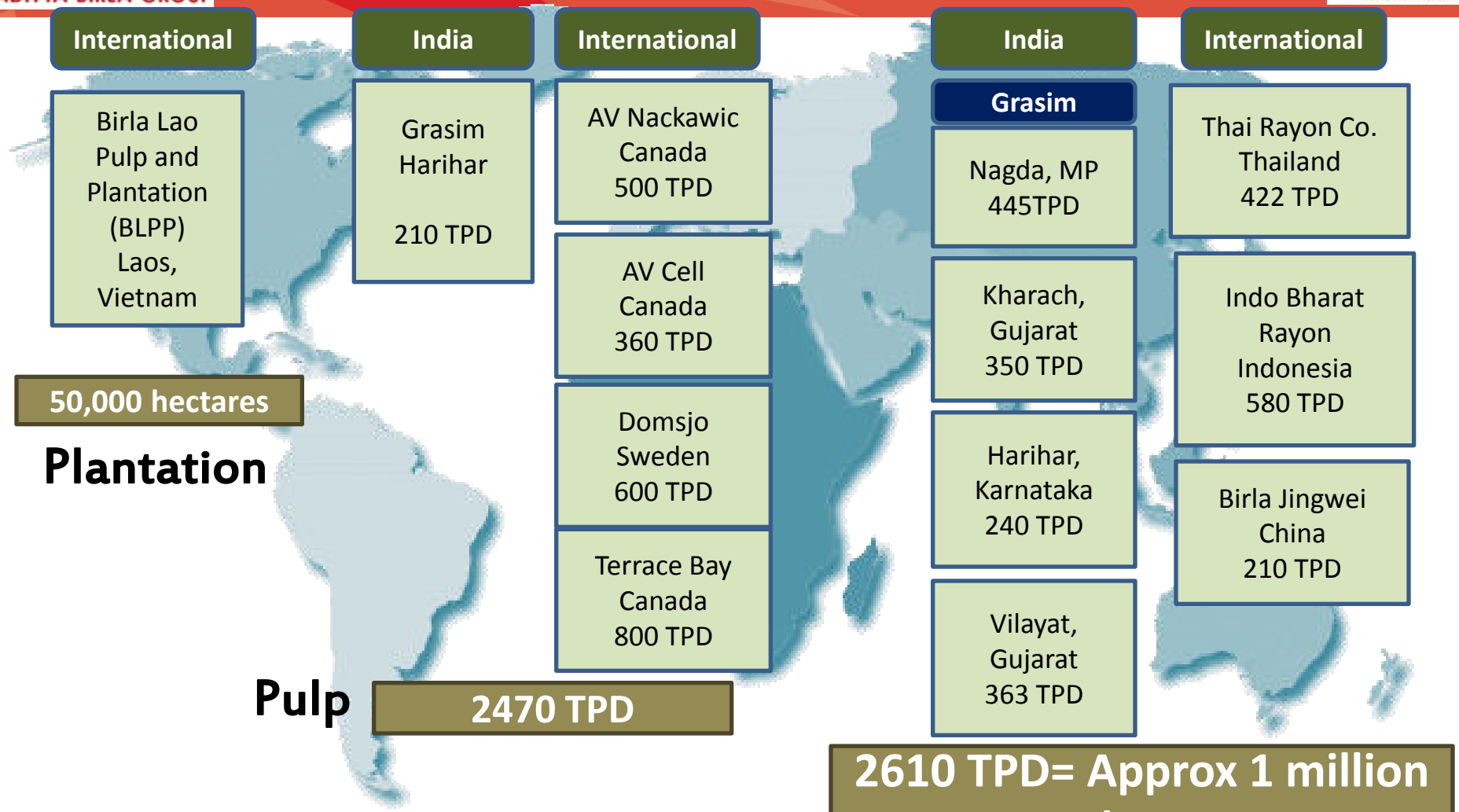
Cotton India - 2014
24th -26th November, Mumbai

Sanjay K Verma

Birla Cellulose,
Grasim Industries Ltd, Aditya Birla Group

Pulp & Fibre Business- Capacity Spread



Plantation		Pulp		Fibre	
International	India	International	India	International	
Birla Lao Pulp and Plantation (BLPP) Laos, Vietnam	Grasim Harihar 210 TPD	AV Nackawic Canada 500 TPD	Grasim Nagda, MP 445TPD	Thai Rayon Co. Thailand 422 TPD	
		AV Cell Canada 360 TPD	Kharach, Gujarat 350 TPD	Indo Bharat Rayon Indonesia 580 TPD	
		Domsjo Sweden 600 TPD	Harihar, Karnataka 240 TPD	Birla Jingwei China 210 TPD	
		Terrace Bay Canada 800 TPD	Vilayat, Gujarat 363 TPD		
50,000 hectares		2470 TPD		2610 TPD= Approx 1 million MT/Annum	

Expansions in fibre planned to almost double capacities.

India: RW VSF, Non Wovens, Dyed VSF, Modal, Excel & other specialty fibres
Thailand: Raw White VSF,NW and Modal
China: Raw White VSF
Indonesia: Raw White VSF & VSF for Nonwoven Applications
Turkey – New Capacity planned for RW & NW

Global Fibre Output- All Fibers : 2007 - 2013

Figures are in Kilo Ton Per Annum

KTPA	2007	2008	2009	2010	2011	2012	2013	CAGR 2007-13
Cotton	26,073	25,448	24,441	25,002	23,921	23,462	23,766	-1.50%
VSF	2,779	2,497	2,732	2,994	3,347	3,982	4,521	8.40%
PSF	12,449	11,917	12,641	13,473	14,221	14,607	15,059	3.20%
PFY	18,957	18,658	20,259	23,724	26,376	29,126	31,313	8.70%
ASF	2,407	1,872	1,960	1,958	1,990	1,948	1,956	-3.40%
Nylon	3,970	3,677	3,587	3,826	3,874	4,074	4,341	1.50%
Others	9,293	7,453	6,919	7,204	7,370	8,062	8,070	-2.30%
Total	**75,928**	**71,522**	**72,539**	**78,181**	**81,098**	**85,261**	**89,026**	**2.70%**

High Growth

Globally, Total fibre consumption grown at **a CAGR of 2.7%** during period 2007-13.

VSF is **growing** over **8.4% CAGR** in last 6 yrs.

Complementing Qualities of VSF to Cotton , advent of 2nd and 3rd generation of Cellulose and Technological advancement in forward value chain are major reason for preferential use of VSF.

Source: Fibre Organon

Estimated Global Fibre Demand Scenario till 2020

Figures are in Kilo Ton Per Annum

KTPA	2014 (E)	2015 (E)	2016 (E)	2017 (E)	2018 (E)	2019 (E)	2020 (E)	CAGR 2013-20
Cotton	24,372	25,316	26,252	27,068	27,499	27,677	27,879	2.30%*
VSF	**4,555**	**4,732**	**4,874**	**5,090**	**5,298**	**5,519**	**5,707**	**3.70%**
PSF	15,511	15,976	16,455	16,949	17,458	17,981	18,521	3.00%
PFY	32,565	33,868	35,223	36,632	38,097	39,621	41,206	4.00%
ASF	1,844	1,851	1,861	1,865	1,870	1,870	1,872	-0.60%
Nylon	4,451	4,562	4,663	4,741	4,805	4,852	4,896	1.70%
Others	8,301	8,455	8,684	8,741	8,787	8,893	9,041	1.40%
Total	**91,599**	**94,760**	**98,012**	**101,086**	**103,814**	**106,413**	**109,122**	3.00%

As per estimation **VSF** will grow **at CAGR 3.7%** for **next 5-7 years** period.

Considering the growth pattern of other fibre, **growth rate of VSF (3.7%)** will remain high - **surpassing overall growth rate of fibre (3.0%).**

Source: Internal estimates, PCI, USDA OECD

Estimated Market wise VSF consumption till 2020

Figures are in Kilo Ton Per Annum

KT	India	China	Indonesia	Turkey	ROW	Global
2013	264	2,803	349	245	752	4,413
2014	309	2,895	363	255	733	4,555
2015	343	2,934	377	265	773	4,692
2016	355	3,058	393	280	788	4,874
2017	369	3,206	408	287	820	5,090
2018	376	3,356	425	298	843	5,298
2019	393	3,510	441	308	867	5,519
2020	421	3,637	460	324	865	5,707
CAGR 13-20	***6.90%***	***3.80%***	***4.00%***	***4.10%***	***2.00%***	***3.70%***

China will remain dominant consumption hub with 64% of global consumption followed by Indonesia , Turkey and India between 6% - 8%.
VSF consumption in China is growing at a faster rate than the average VSF growth globally And will retain its dominant position.

Further Slides detail the Technological Innovations which will help VSF Industry to sustain this growth rate.

Source: Internal estimates, PCI, USDA OECD

Technological Advancement in Viscose

Improvement in Fibre Quality Attributes of VSF

Fiber Properties	Last Decade	Existing	Future Developments	Advantage
Tenacity	2.7 gpd (24.9 gpt)	2.9 gpd (26.1 gpt)	> 3.3 gpd (>29.7 gpt)	Sustainable at High-speed Spinning Process.
Fineness	1.2 denier (3.4 µ)	0.9 denier (2.5 µ)	< 0.7 denier (2.0 µ)	Enable to produce finer counts & fabrics. Improved Tenacity.
Splinters Index	100	25	10	Conducive to high Speed Spinning & Knitting Applications.
Spin finish	High Dynamic friction	Low Dyn. & F to F friction	Heat Stable – Low ER finish.	Sustainable at High speed Spinning Process.

Advancement in Viscose Spinning - Technologies

Spinning Technology	Year 2000-2010		Year 2010-2015		Developments under way	
	Max. Avg Machine Speed	Avg Prodn./pos./day	Max. Avg Machine Speed	Avg Prodn.(Kg)/pos./day	Max. Avg Machine Speed	Avg Prodn.(Kg)/pos./day
Ring	16,000 rpm	0.58	17,500	0.66	20,000 rpm	0.75
OE	105,000 RPM	3.6	125,000	4.50	140,000 rpm	5.10
MVS	380 MPM	10.0	450 MPM	12.1	550 MPM	14.8

Over the Years Machine Productivity has been constantly improved by robust designing, Improved MOC & Use of Robotics.

Improvements in inherent VSF quality has ensured its sustenance to technological advancement in Yarn Spinning which has seen quantum jump from Ring Spinning 0.58 Kg /day /position to high speed MVS of 12 Kg /day /position production.

Technological Advancement in Viscose

Yarn Quality Statistics : '07 – '13

30's Ne – 100% Viscose

Quality Parameters	Statistics @ 50%	Statistics 2007	Statistics 2013
CVm (%) Mass Variation		12.7	12.2
Hairiness (H)		4.3	4.3
IPI/Km (IPI-Imperfections)		65	55
Yarn Tenacity (CN/Tex)		15.0	15.8

1) Internationally accepted Yarn Quality Study and related Statistics shows Yarn Quality In terms of Mass Variation – Imperfection - Hairiness – Tenacity have become more stringent over the years.
2) This has ensured usage of VSF in knit applications particularly finer counts. This segment has been among the fastest growing applications.

Technological Advancement in Viscose

Advancement in Generics of Manmade Cellulose Fibre

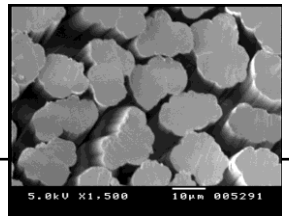
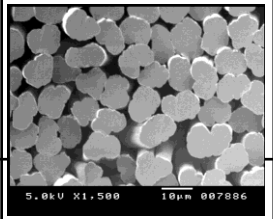
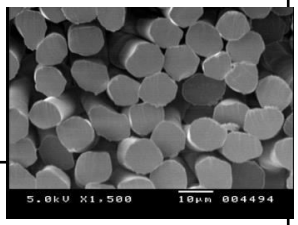
SpunShades™
Colours Inspired by Nature

Birla Modal

Birla Cellulose
excel
TIMELESS FASHION.

Technological Advancement in Viscose

Comparative Properties of Cellulose Fibres

	Cotton	Viscose	Modal	Excel
Electron Microscope Photographs				
• **Tenacity**				
Dry (gpd)	2.80	2.90	3.80	4.20
Wet (gpd)	3.20	1.70	2.40	3.50
Ratio wet/dry	1.14	0.58	0.63	0.84
• **Elongation %**	8	19	15	13
Moisture Regain	7.5	13	13	13
• **Initial wet modulus gpd**	1.10	0.40	0.70	1.42

Viscose is among most preferred fibers for complimenting and supplementing Cotton.
Modal VSF offers excellent Fabric Feel while Excel is the Green Fibre with Highest Tenacity among all.

Technological Advancement in Viscose

Birla Spun Dyed Viscose Fibres

Birla Cellulose are Pioneers in Spun Dyed Viscose Fibers having a range of more than 3000 shades and producing more than 100 KTPA. On a regular basis more than 100 shades are being produced. These offer vibrant and **delightful color palette with unmatched fastness** property to World Textile Industry (both Textiles and Non Woven).

Available in **1.30 – 12 Denier** fineness & **32mm to 120mm** Cut length.

Spun Shade are Green Fibers - **Eco friendly** – **Cost competitive** – **Minimum Effluent discharges at Value Chain end**. Provide Solution to customers with **Excellent Fastness** property.

These are being blended in 1% - 35% proportion in C/V Mélange, for Knit Segment. These fibers are also being used advantageously in 100% V in MVS Technology for both Woven/ Knits segment.

Technological Advancement in Viscose

Excellent Wash Fastness

Fastness to	Scale	Spun Shade Route	Other Dyeing Routes (Fiber /Yarn / Piece Dyed)
Wash	1 - 5	4-5	3-4
Rubbing	1 - 5	4-5	4
Light	1 - 8	6-8	5
Iron	1 - 5	4-5	4

Eco Friendly Green Fibre – Less Polution to Environment

Particulars	Piece Dyed viscose	Spun Dyed viscose	Benefit
Water Consumption in ltr/ kg of fabric	91	31	60 liter/kg of fabric
Power consumption in KW/ kg of fabric	16.43	6.87	9.56KW/kg of fabric
Total Process time in hrs	10.22	3.8	6.42 hrs/batch
Value loss	2%	0.5%	1.5% on material cost

Source: Internal R&D Trial

Technological Advancement in Viscose

Highly Cost Competitive

Dyeing & Processing Cost is 40% Less in case of **Spun Shade** Fibre as compared to other Dyeing Routes (Piece Dyed) .

Piece Dyed (Black shade) 180-220 GSM		Spun Dyed viscose (Black Shade) 180 – 220 GSM	
Process Sequence	**Cost Rs./kg**	**Process Sequence**	**Cost Rs./kg**
Pre washing	2.48	Pre washing	2.48
Scouring	2.89	Scouring	2.89
Dyeing & Washing	47.76	Dyeing & Washing	18.00
Chemical Finishing	5.81	Chemical Finishing	5.81
Compaction	2.63	Compaction	2.63
Total	**61.57**	**Total**	**31.81**
ETP cost	1.80	ETP cost	0.80
Other cost	4.50	Other cost	4.50
Rework & value loss (6%)	5.84	Rework & value loss (2.5%)	1.30
Grand Total	**73.71**	**Grand Total**	**38.41**

Source: Internal R&D Trial

Technological Advancement in Viscose

Application of Spun Shade Viscose Fibre

Popular products	Popular construction	Advantages
Formal Suitings Uniform	**-Spundyed Poly/Viscose** 1/15s, 1/20s, 1/30s, 2/18, 2/30, 2/40s Ne	- Durability of colors - Cost effective Production route
100% or Melange Knits	- **100% Spun Dyed Viscose** - **Cotton+Spun Dyed VSF Melange** 1/20s, 1/30s, 1/40s Ne	- Cost effective Production route -Durability of color (Improved Fastness) - New color development by blending of colors - Brighter appearance than cotton dyed Melange
Carpets (Piles & Motifs)	**100% Spun Dyed Viscose** 2/16s Ne, 4/16, 2/30s	- Comfort & Feel - New color development by blending of colors -
Stoles and Scarves	**100% Spun Dyed Viscose** 100% Spun dyed VSF Xsilk/Nylon/Poly.	- Softer Feel -Compatible to blend with specialty fibers
Cleaning Wipes	-Needle Punch Cleaning wipes (**GSM 110-250 for cleaning**) -Also entered in Spunlace	- Highly absorbant - Comfort of use due to Low static electricity
Non Woven for Automotives	Needle punch 6 den X 76 -120 mm Spun dyed VSF	- Best fit for insullation due to high Ash ratio compared to other synthetic option.
PVC Back Fabrics	Fabric Made of Spun lace for Backup in coating of PVC (1.5X38 MM)	

Technological Advancement in Viscose

2nd Generation VSF – Modal / Micro Modal Fibers

Modal as defined by BISFA is a distinct viscose fibre genre, with higher Wet Modulus (HWM) that satisfies a minimum value of tenacity in the wet stage at 5% elongation.

Looking to Immense Potential of this fibers both in Blend with Cotton (India being Dominant producer) & 100% Modal, **Birla Cellulose has invested more than 2300** crore in its Greenfield State of Art Production facility at Vilayat – Gujarat. This is in addition to its capacity in Thailand.
Put together Birla Modal / Micro Modal capacity will be 65,000 TPA.

Properties of Modal / Micromodal

Properties	Range
Fineness (denier)	0.80 - 1.20
Tenacity (gpd)	> 3.90
Elongation (%)	14
Wet to Dry Ratio	64

Technological Advancement in Viscose

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Excellent Wear Comfort* in Cotton / Modal Blends : 100% Cotton Fabrics

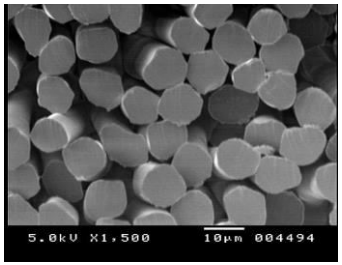
Properties	Value Offered by Modal	Test Reference
Softness - Elastic Properties	4.20% Softer	Bending Rigidity
Softness - Movement Freedom	5.10 % Softer	Bending Hysteris
Evenness	7% better	Mean Deviation of Coefficient of Friction
Surface Smoothness	17% smoother	Surface roughness
Durable Press Rating	1 Point Better	DP rating as AATCC

* Source: Internal R&D Trial

Technological Advancement in Viscose

3rd Generation VSF – Birla Excel Fibers (Solvent Spinning)

- **Excellent colour and high colour depth**
- **Fibrillation** and ability to create **suede effect**
- **Unique drape and fluidity**
- **Highest strength** cellulosic fibre with **lowest environmental impact**

Property	Value	Cross-section
Tenacity (GPD)	4.0 - 4.4	
Elongation %	12 - 14	
Wet-Dry tenacity ratio %	84	
Moisture Regain %	13	

Birla Excel is available **in 0.9 and 1.2 Denier Fineness** and **38 and 44 mm Cut length**.

Birla Excel is widely used in **Home Textile, Fashion Apparels** and **Denims**.
Birla Excel is also **Preferred fibre for Non Woven application.**

Technological Advancement in Viscose

Advancement in Viscose Fabric Processing

New dyeing technology support to reduced pilling formation

Air flow dyeing technique

Low ML ratio , reduced cost , less effluent, uniform dyeing specially for knit .

E –control dyeing technique

Very less water requirement, (10-15% of conventional) , less effluent, highly uniform dyeing technique for continuous dyeing.

Cold Pad Batch dyeing

Low cost & less water consumption dyeing technique for long batches. High yield

Process technique to improve shrinkage/stability

Continuous pre treatment range cum relax drier specially for woven/knit fabric- low cost , high production,

One step Pad –dry-cure technique for cross linking process.

Combi bleach process for processing of white shade, reduced cycle time and reduced cost.

One step process for Pre treatment cum chemical finish application : Reduced Cycle time & Low cost for spun dyed knit fabric.

Viscose in Non Woven

	2009	2010	2011	2012	2013	CAGR
All Fiber Consumption in NW	6618	7100	7727	8410	8998	7.98
VSF in NW	365	375	390	410	430	**4.18**

VSF is widely used in NW Technology. Use of VSF in Non Woven Technology is growing at **CAGR 4.18%.**

Due to its super absorbent characteristics majority of the fiber is used in Wet wipes with Spun lace Technique.

Spun Dyed fiber is also used in Needle Punch Technology for kitchen wipes – Automotive end uses.

Source: INDA & other industry reports

Application of VSF in NonWoven

Automotive

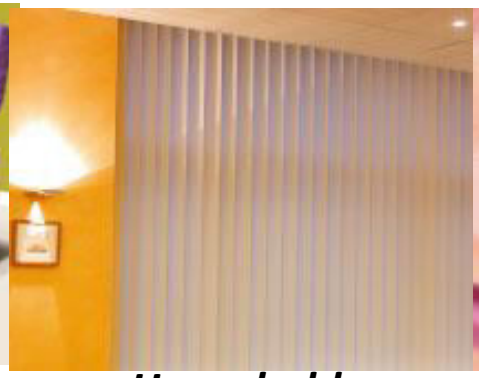
Buildings

Cleaning Cloths

Filtration

Geo Textile

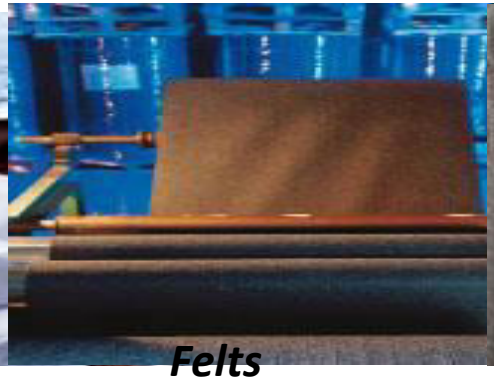
Home Furnishings



Household

Hygiene

Medical



Felts

Interlinings

Wipes

ADITYA BIRLA GROUP

Birla Cellulose
Fibres from nature

Thank You