

Present Status & Future Trends of Jute Composites

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Major natural fibres of vegetative origin used as reinforcement

Fibre	Type
Bagasse	Cane
Bamboo	Grass
Banana	Stem
Coconut husk	Fruit
Flax	Bast
Hemp	Bast
Jute	Bast
Kenaf	Bast
Sisal	Leaf
Wood	Stem

Major Potential World Fibre Sources

Items	Produced per annum million Ton
Wood	1750
Bamboo	30
Jute	2.9
Sugar cane bagasse	7.5

Advantages of natural fibre reinforced composites

- **Reduction in density of products.**
- **Acceptable specific strength, toughness and stiffness in comparison with glass fibre reinforced composites.**
- **Lower energy consumption from fibre growing to finished composites**
- **Bast fibres exhibit good thermal and acoustic insulation properties.**
- **The manufacturing processes are relatively safe when compared with glass based reinforced composites.**
- **Ease of shaping into complex shapes in a single manufacturing process.**

Disadvantages of natural fibre reinforced composites

- **Lack of consistency of fibre quality.**
- **Poor compatibility between fibres and matrix, which requires surface treatment of fibres.**
- **High moisture absorption, which brings about dimensional changes in composite materials.**
- **Fluctuation in price depending upon the global demand and production.**
- **Problem of storing raw material due to possibility of degradation.**

Application areas of jute reinforced polymer composites with technical advantages

Application areas	Advantages
<p>Automobile industries</p> <ul style="list-style-type: none"> *door panels *headliners *trunk liners *seat backs *dash boards 	<ul style="list-style-type: none"> *Lighter in weight *Cost economic *Serviceable mechanical properties *Lesser raw material * Use of renewable resource
<p>Building Component</p> <ul style="list-style-type: none"> *Door *Wall partition *Floor *Window *Ceiling 	<ul style="list-style-type: none"> *Better physical properties *Fire, termite & better moisture resistance properties
<p>Transport Sector (railway coach & vehicle)</p> <ul style="list-style-type: none"> *Flooring *Ceiling *Seat & Backrest 	<ul style="list-style-type: none"> *Available at semi finished / finished state i.e. reduced labour & finishing cost
<p>Furniture</p> <ul style="list-style-type: none"> *Table *Chair *Kitchen cabinet etc. 	

Major Areas of R & D Activity of Composite Group at IJIRA

- **Flexible Composite**
- **Rigid Composite**
 - **Composite from normal jute**
 - **Pre treatment of jute**
 - **Physical method**
 - **Pre coating of jute**
 - **Steam stabilisation of jute**
 - **Chemical method**
 - **Cyanoethylation of jute**
- **Jute Polypropylene Mouldable Granules using compatibiliser**
- **Resin Transfer Moulding**
- **Composite from total jute plant**

Properties of jute composite from jute non -woven and low density polyethylene as matrix for packaging end- uses. (IIP- Kolkata)

Material	Average test value					
	gm/m ²	Puncture resistance oz-inch tear inch	Water absorption (surface) 24 hrs at 30 °C, gm/m ²	Bursting str. Kg/cm ²	Tensile str. (MPa)	Mod. of elasticity (MPa)
Jute non-woven + LDPE film	1470	577.1	20.7	45.3	31.36	1756

Ref: “Studies on jute composite from jute nonwoven”, 16th Technological conference, IJIRA, 11th – 12th Feb, 1993

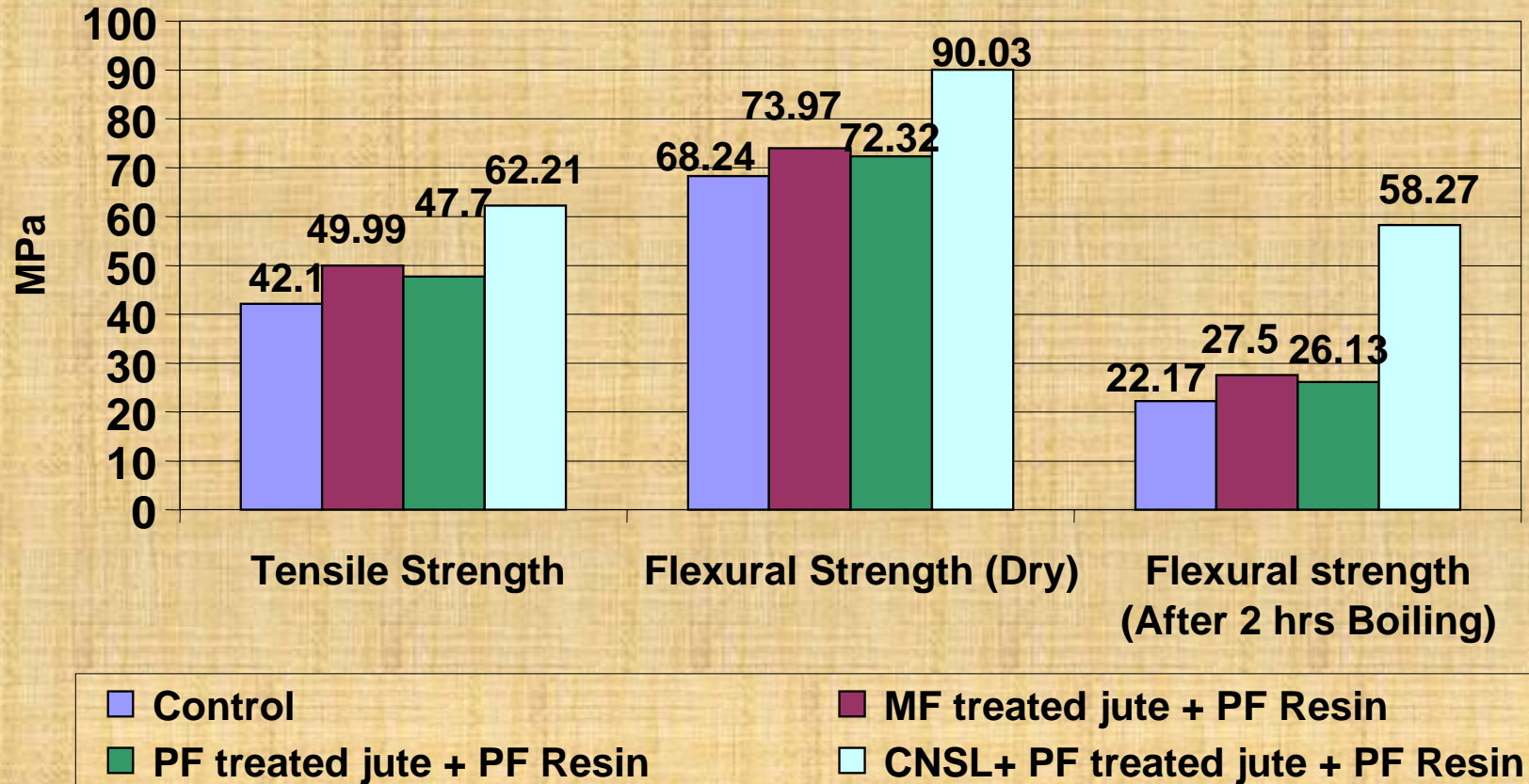
➤ Flexible Jute Composite

Matrix- Low Density Polyethylene (LDPE)

Reinforcement- Jute nonwoven/
woven fabric

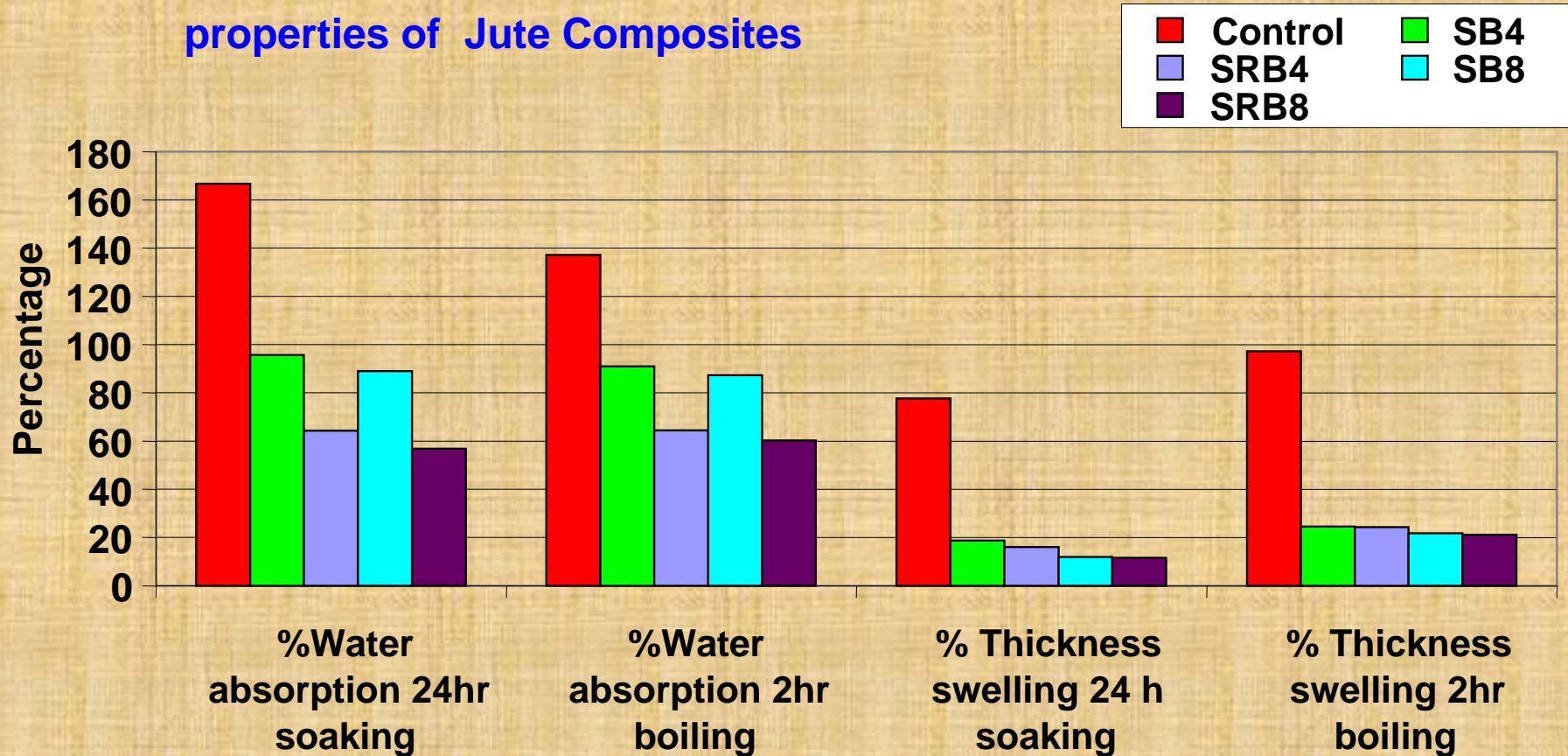


Effect of Pre treatment on Physical Properties of different Jute Composite samples



Ref: "Studies on jute composite from jute non woven", 16th Technological conference, IJIRA, 11th – 12th Feb, 1993

Effect of Steam Stabilisation on Dimensional properties of Jute Composites



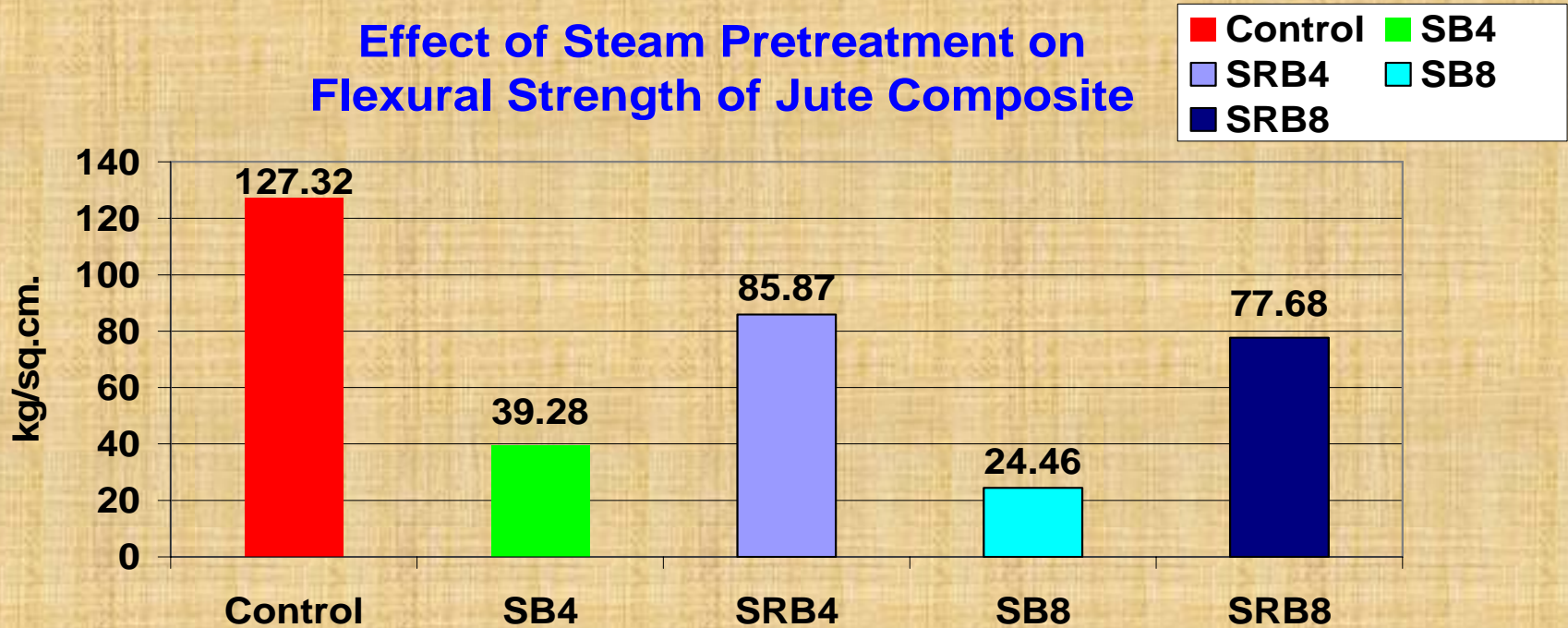
Control- board from jute fibre + 7% PF

SB4- board from 4 min. steam stabilized fibre; SB8- board from 8 min. steam stabilized fibre.

SRB4- board from 4 min. steam stabilized fibre + 7% PF

SRB8- board from 8 min. steam stabilized fibre + 7% PF

Effect of Steam Pretreatment on Flexural Strength of Jute Composite



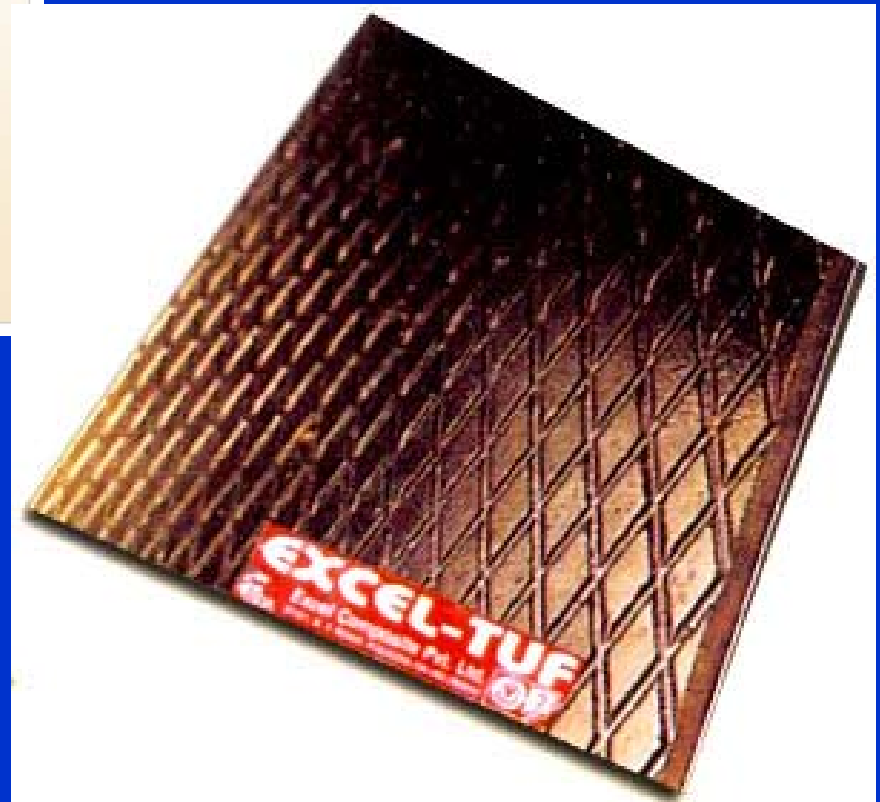
Ref: "Effect of steam pretreatment of jute fibre on dimensional stability of jute composite", J. of Applied Polymer Science, vol.76, 1652-1661 (2000)

Effect of Cyanoethylation on Mechanical Properties of jute composites

Sample	Tensile Strength (MPa)	Flexural Strength (MPa)	Flexural Mod (GPa)	Water absorption %		Thickness swelling %	
				2hr in boiling water	24hr in cold water	2hr in boiling water	24hr in cold water
Control	74.24	84.81	12.97	48.09	49.76	62.31	31.94
MJC-4	108.60	136.90	18.05	12.46	5.45	12.97	10.36

Ref: "Improvement of functional properties of jute based composite by acrylonitrile pretreatment", J. of Applied Polymer Science, vol. 78, 495-506 (2000)

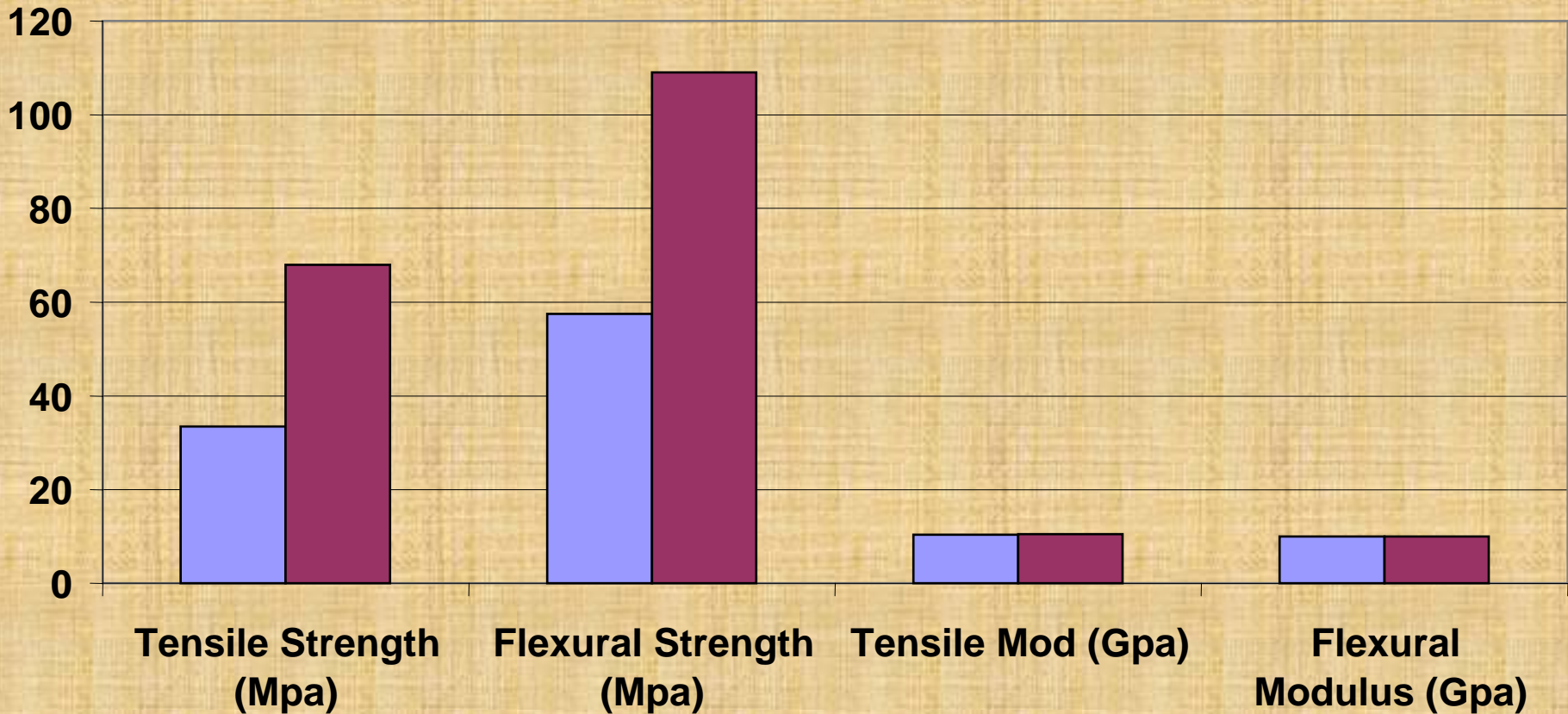
Rigid Jute Composite



Furniture from Rigid Jute Composite Board



Effect Of Compatibiliser On Jute - PP Composite

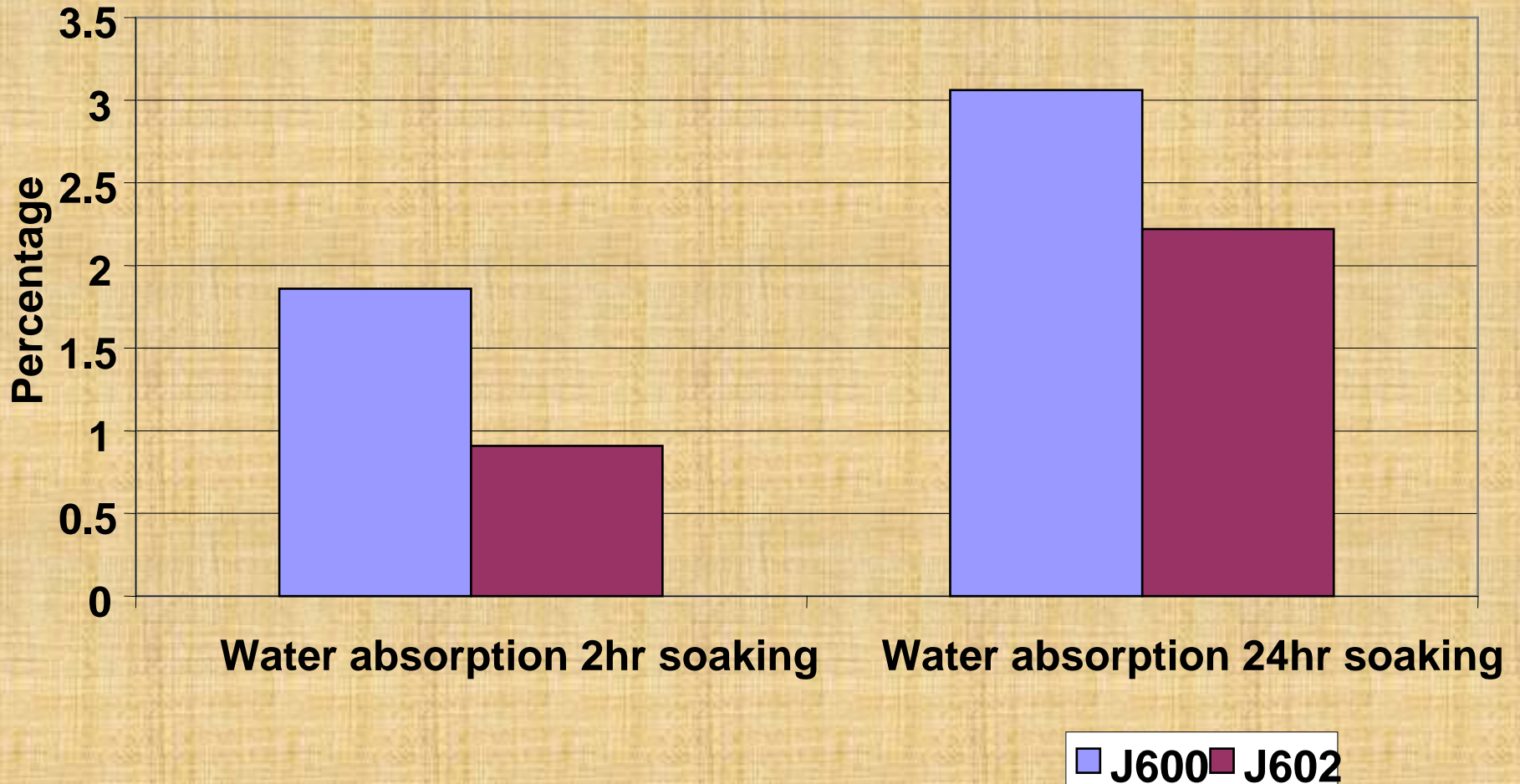


J600- Jute fibre 60% + Polypropylene 40%

**J602- Jute fibre 60% + Polypropylene 38% +
Maleated polypropylene 2%**

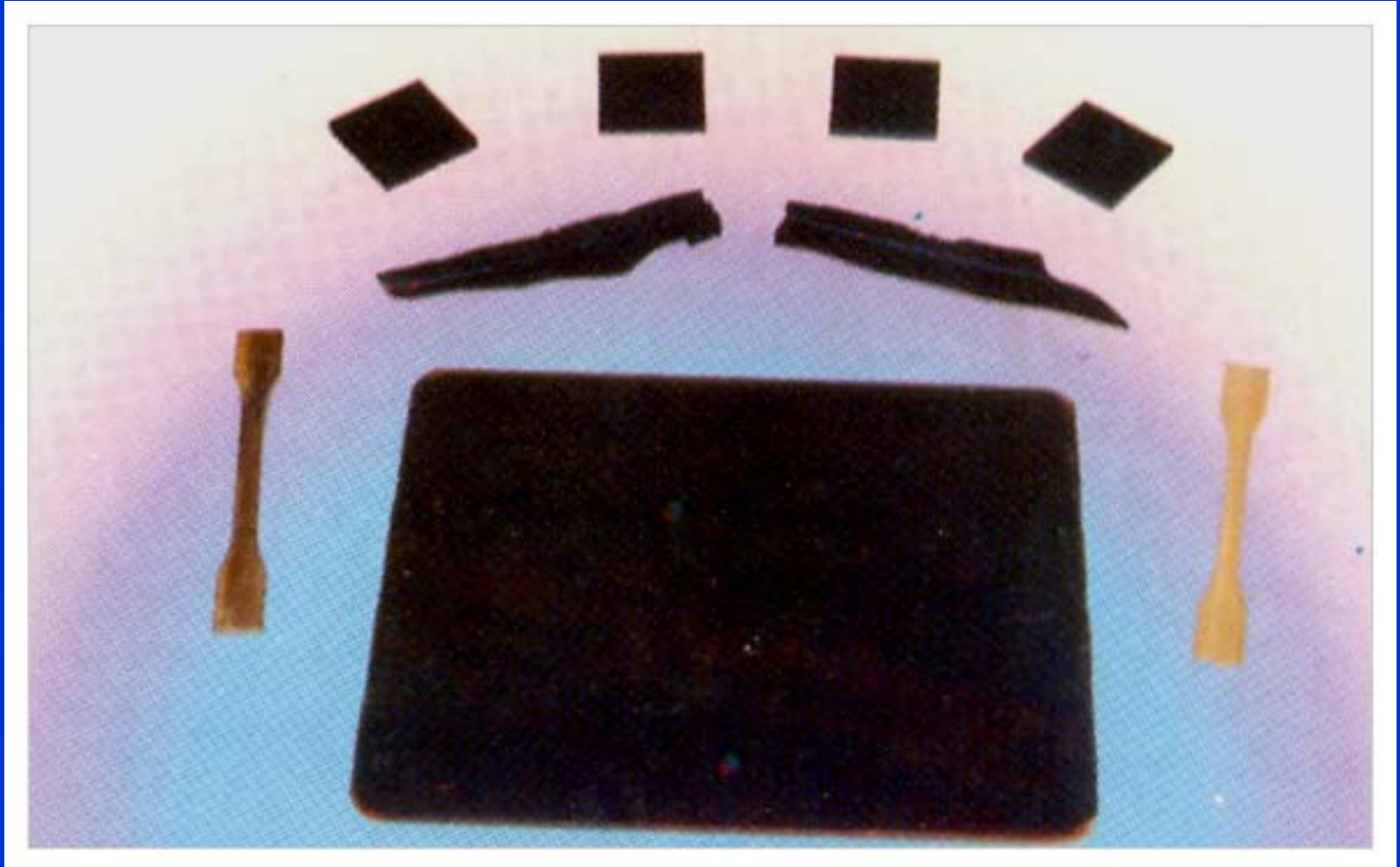


Water Absorption Properties Of Jute - PP Composite



Ref: "Short jute fibre reinforced polypropylene composites: Effect of compatibiliser", J. of Applied Polymer Science, vol.69, 329-338 (1998)

Jute PP Composite



Flexural Properties of jute and jute-glass fibre composites fabricated by resin transfer moulding

Sl. no	Weight of fibre %			Flex. Str. (MPa)	Flex. Mod. (GPa)
	Jute	Glass	Total		
1	33	--	33	95.65	6.65
2	28	--	28	82.55	5.85
3	18	15	33	121.51	6.88
4	--	33	--	153.77	7.12

Ref: "Jute composites by Resin Transfer Moulding- An improved alternatives for hand lay up technique", 20th Technological Conference, April 18, 1998

Moulded Chair by Resin Transfer Moulding



Flexural Properties of jute composites fabricated from total jute plant

Sample No	Binder Type & content	Flex. Strength, N/mm ²	Flex. Modulus, N/mm ²	Internal bond Strength, N/mm ²
1	UF & 21%	16.18	1840.12	2.99
2	PF & 8%	18.69	1406.78	2.87

Ref: Project work under UNDP Project- Jute Non-Textile Materials (IND/92/302)

Production, Trade and Consumption of all Timber by India (million m³)

Product	Production		Imports		Exports		Domestic Consumption	
	2007	2008	2007	2008	2007	2008	2007	2008
Logs	23.19	23.19	4.65	4.95	0.009	0.007	27.83	28.13
Sawn wood	14.79	14.79	0.368	0.337	0.021	0.032	15.13	15.09
Veneer	0.285	0.29	0.017	0.024	0.027	0.038	0.275	0.276
Plywood	2.15	2.15	0.054	0.065	0.118	0.071	2.089	2.148

Ref: Annual Review and Assessment of the World of Timber situation 2008,
International Tropical Timber Organisation, Yokohama, Japan.

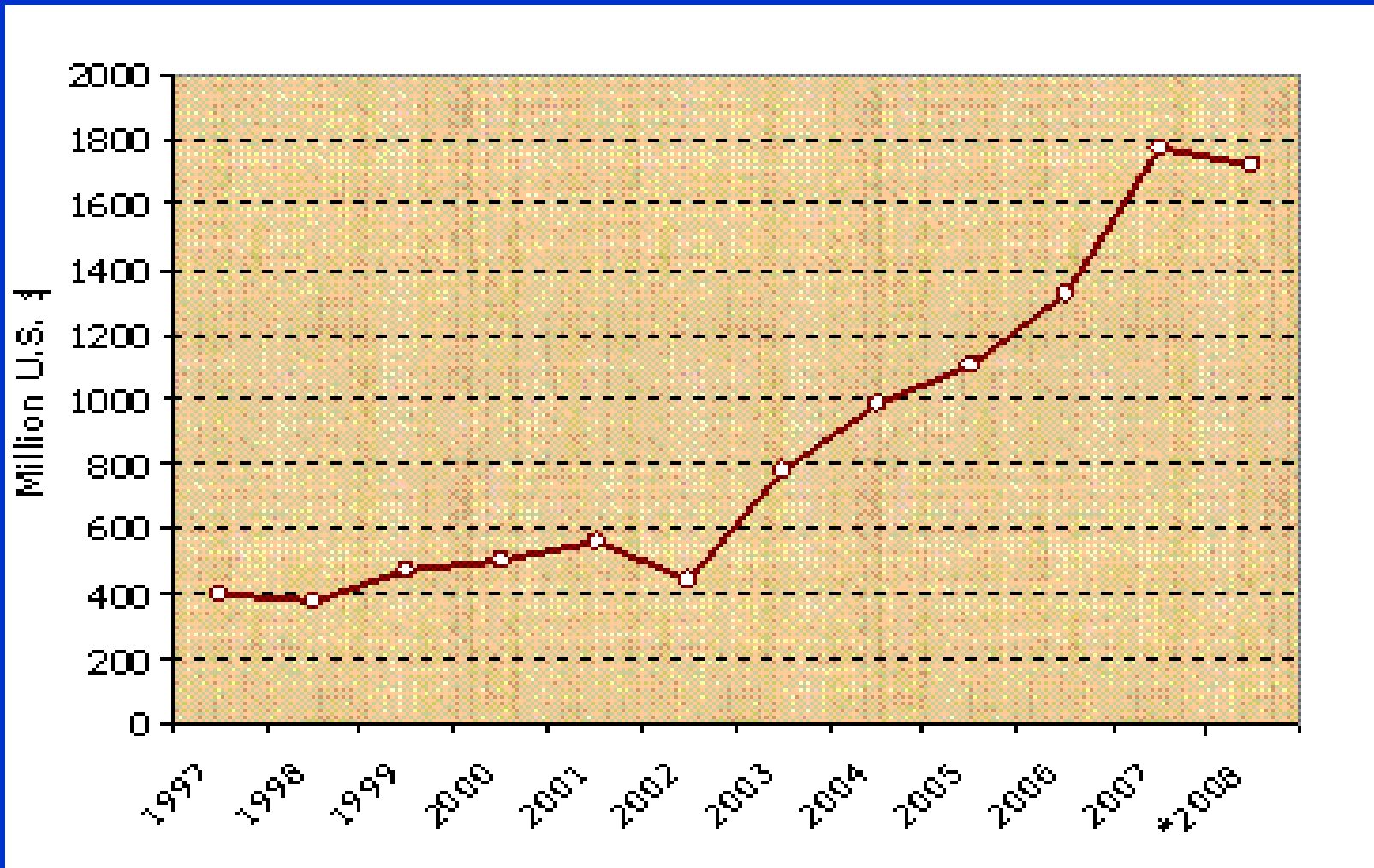
India's Imports of Wood Products by Category (Million US \$)

Item	2005/06	2006/07	2007/08	*2008/09
Wood Logs	831.6	908.5	1171	1147.34
Sawn Lumber	20.9	22.8	25.5	30.51
Veneer	11.2	14.2	18.5	21.22
Plywood	8.2	12.8	28.5	34.47
MDF/HDF	27.9	35.3	57	50.94
Particle Board	26.5	32.2	46.5	41.85
Wooden Furniture	150.3	250.5	358	324.29

Ref: Directorate General of Commercial Intelligence and Statistics, Kolkata, IFY- Indian Financial Year & GAIN Report No: IN9124, (Date: 9/16/2009), USDA Foreign Agricultural Service

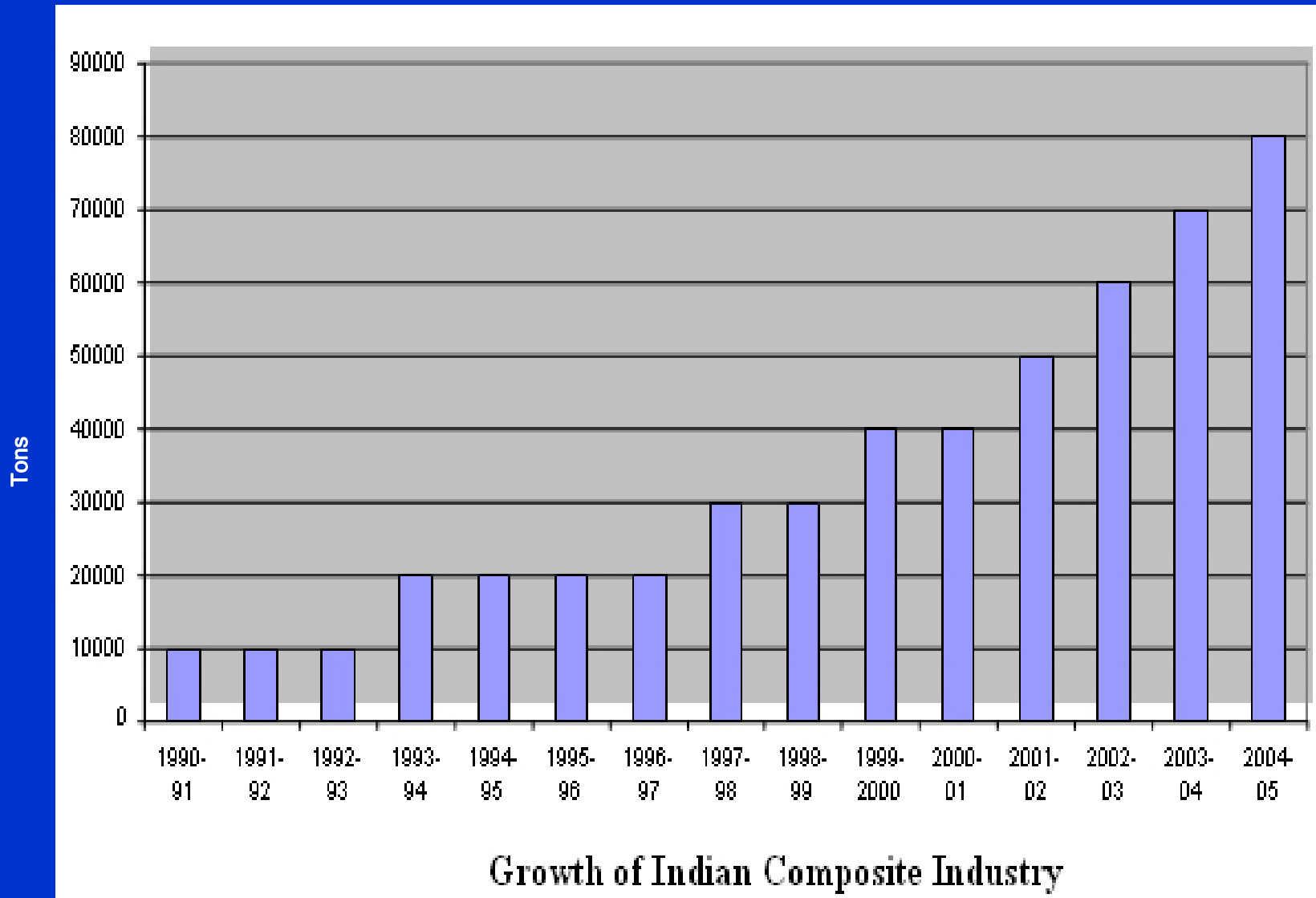
Note: 2008/09 estimated import

Import of Wood and Wood Products in India, 1997/98 through 2008/09



Ref: Directorate General of Commercial Intelligence and Statistics, Kolkata, & GAIN Report No: IN9124, (Date: 9/16/2009), USDA Foreign Agricultural Service
Note: 2008/09 estimated import

Growth of Indian composite Industry



Growth of Indian Composite Industry

Ref: "Indian composite Industry makes progress" by S. Baksi and S. Biswas, TIFAC, DST, Govt. of India, www.tifac.org.in

Mechanical Properties of Plywood, MDF & Jute Composites

Types of board Properties	Plywood (veneer)	Fibre Board		Particle Board	Jute Composite
		HDF	MDF		
Density, gm/cc	0.55 – 0.70	0.9	0.68 – 0.75	0.70	0.9 – 1.30
Flex. Str. N/mm ²	60 - 100	40 - 60	20 - 40	22	65 - 110
Modulus of Elasticity, N/mm ² x 10 ³	7 - 12	--	2 - 2.2	4.5	3 - 10
% Thickness swelling, 24h	--	18	6 - 17	14	7 - 15
% Water absorption, 24h	--	45	15 - 35	--	7 - 18

Ref: Chapter XI- composite wood materials, Phenolic Resins edited by A. Knop & L. A. Pilato, 1985

Problems in Commercialisation

- Density of Jute Composite
- Dimensional Stability
- Non-availability of Indigenous machines

Market shares of Plywood, Particle Board and MDF

Item	India	China	World average
Plywood	90%	10%	20%
Particle board	6%	30%	55%
MDF	4%	60%	25%
Total	100	100	100

Ref: Plyworld June-July 2007

Thank you