

A New Horizon of Utilization of Bamboo for Production of food packaging Pulp, Paper and Board

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Author Introductory slides

- ▶ Dr.Priti S.Lal is Scientist E-II and Head of Pulping Bleaching Division, CPPRI also looking after Delhi Base Office CPPRI.
 - ▶ She is Doctorate in Environment Analytical Chemistry and awarded CSIR fellowships SRF and RA.
 - ▶ She has 34 yrs of research experience in area of environment, Raw material, Pulping and Bleaching.
 - ▶ She has published more than 60 research papers in different international and national journals and presented papers in various seminars.
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Indian Pulp and Paper Industry 2020-21

Total Number of Mills	900		
Total Installed Capacity, million tons	29.11		
Operating Installed Capacity, million tons	23.99		
Production of Paper, Paperboard, and Newsprint, million tons	21.36		
Capacity Utilization, %	~89		
No. of Running units	526		
No. of Mills Closed	374		
Idle installed capacity, million tons	5.12		
Import (in Million tons)	3.54		
Export (in million tons)	2.07		
Consumption (in million tons)	22.83		
Per capita Consumption (kgs)	~15.63		
Contribution from Different Segments (million tons)			
Segment wise Production	Wood-Based	Agro-Based	Recycled based
Production in Million tons	3.91	1.16	16.29

Various materials used for food packaging

Food processing industry selects the packaging material according to food product requirement considering factors

- like heat sealability,
- process ability,
- printability, strength,
- barrier properties (water, oil and gas barrier),
- cost-effectiveness,
- sustainability

materials like paper, plastic, glass, aluminium, wood or combination of any of these are used for food packaging

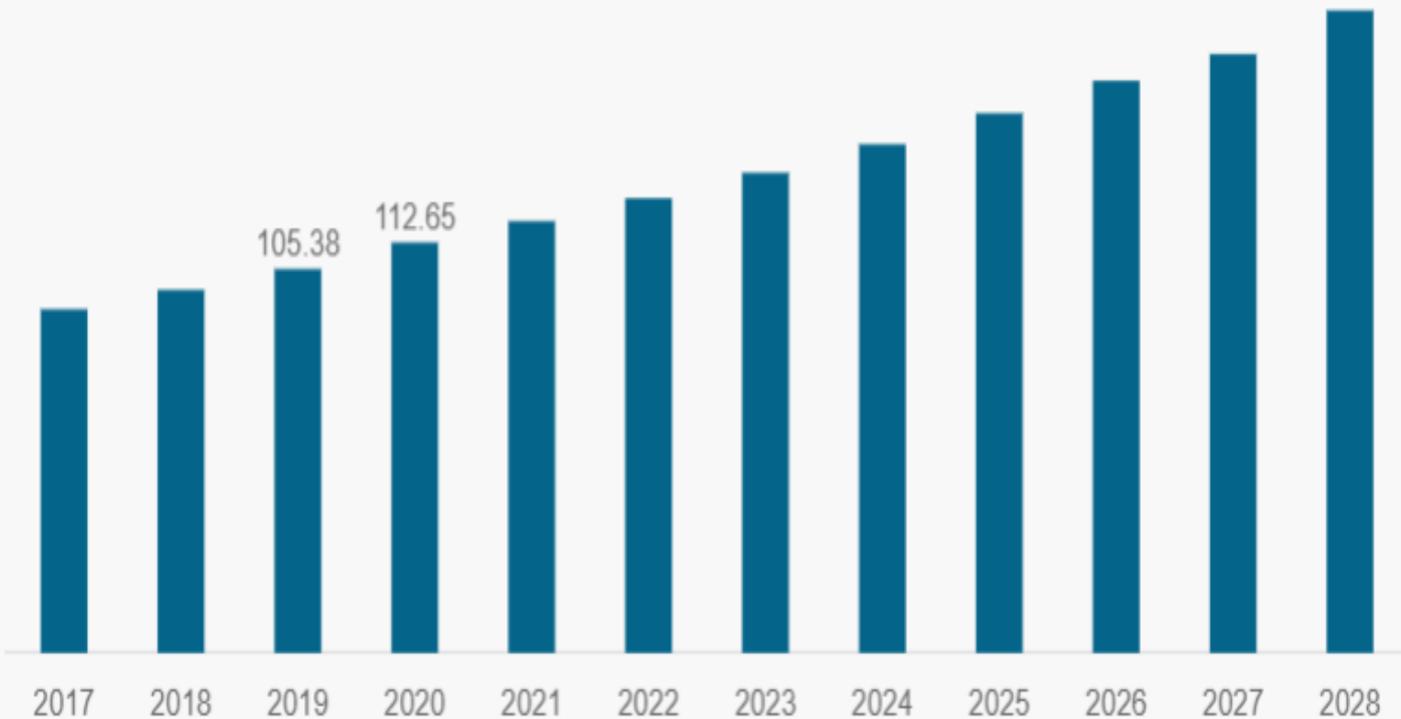
Paper and paperboards encompasses 31% of the global packaging market segment and are most widely used in food packaging for containment protection of the food products, convenience during storage or consumption and communication of the relevant information to consumers including its marketing aspects

The growing market of pulp and paper based food packaging:

- ▶ The food packaging market is rapidly increasing after ban on utilization of single used plastics for food packaging.
- ▶ The presence of traces of chemicals like ink, surfactants, bleaching chemicals etc in Recycled pulp, it is not considered safe as food packaging pulp
- ▶ According to FSSAI, only virgin grade packaging material should be used for direct food contact.
- ▶ Growing demand of virgin pulp is there to meet out food packaging of various items.
- ▶ The global biodegradable packaging market is expected to grow at CARG 20.8% during the period 2021 to 2027.

Food packaging Market

Asia Pacific Food Packaging Market Size, 2017-2028 (USD Billion)



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The Driving forces.....

- The food processing industry is growing at 6–7% and the retail sector is also expected to grow at 14– 15% per annum .
- The food packaging segment is expected to grow at 15–20% backed by surging demand from the nuclear family system, increasing young population and per capita income, a higher propensity to spend, health awareness and a higher acceptance of new products.
- Food packaging accounts for 48% of the total packaging industry, contributing the largest share in the industry. Moreover, the area is highly unexplored as the value addition to food in India is only 7% as compared to 23% in China, 45% in Philippines, and 188% in the UK.
- The food packaging segment in India faces competition from China and Thailand, where the taxes and import duties are comparatively lower.

- ▶ Paper and Board Packaging The use of paper and paperboards for food packaging dates back to the 17th century with accelerated usage in the later part of the 19th century
 - ▶ Paper and paperboards are commonly used in corrugated boxes, milk cartons, folding cartons, bags and sacks, and wrapping paper. Tissue paper, paper plates, and cups are other examples of paper and paperboard products
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Different types of food packaging paper/board

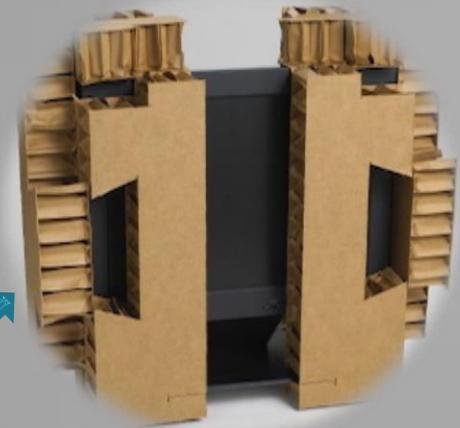
Paper /board	specifications	End uses
wrapping tissue	25 gsm	wrapping of bakery products liner,wrapping,tea and coffee bags
greaseproof paper	laminated with moisture proof coating of chitosan(5g/m ²), polybutane	wrapping of butter, biscuit
wax paper	wax coating for improved barrier properties	liquid packaging
paper board	>200gsm	single or multilayer board, fbb,solid board for liquid packaging
rigid box	400–1600gsm	chocolates confectionary,indian sweets
moulded pulp	200–300	moulded pulp crockery,egg trays etc.
folding cartons		secondary containers for bakery and confectionary

Why Bamboo..

Due to GOI initiative Bamboo is not considered as a forest based commodity now, through “Restructured National Bamboo Mission approved by the Cabinet Committee on Economic Affairs (CCEA) in 2018”.

GOI is also giving subsidy to bamboo growers under farm pharmacy programs, which will result into sustainable source of fibre in future.

With the innovation of pulping and papermaking technology, the use of bamboo for production of various grades of pulp is a viable potential alternate of quality raw material



Chemical Analysis of bamboo

Sr. No	Parameters	Unit	Results
1.	Ash Content	%	2.15
2.	Cold Water Solubility	%	5.14
3.	Hot Water Solubility	%	7.44
4.	1/10 N NaOH Solubility	%	21.2
5.	Alcohol Benzene Solubility	%	2.23
6.	Pentosan	%	16.24
7.	Holocellulose	%	75.67
8.	Acid insoluble Lignin	%	25.0
9.	Acid soluble Lignin	%	1.23
10	Fibre length	mm	1.8

Results of Chemical (kraft) Pulping of Bamboo

S.No	Parameter	Bamboo
1.	Cooking chemical applied, % as Na ₂ O	15
2.	Unscreened Pulp yield, %	46.4
3.	Kappa.no	17.5
4.	Reject, %	0.5
5.	Screened Pulp Yield, %	45.9
6.	Pulp viscosity cc/g	850
7.	Initial freeness, ml csf	690

Physical Strength Properties of bamboo pulp

Sl. No.	Properties	Bamboo (Jati) Pulp		
1.	PFI, (rev.)	0	3000	4000
2.	Freeness, CSF	690	330	240
3.	Apparent density, (g/cm ³)	0.51	0.69	0.72
4.	Burst Index, (kPa m ² /g)	1.00	4.60	5.00
5.	Tensile Index, (Nm/g)	12.0	68.0	72.0
6.	Tear Index, (mNm ² /g)	5.4	9.45	9.35
7.	Fold Kohler (log)	*	2.46	2.58
8.	Bendtsan porosity (ml/min)	>3000	298	127

Utilization for packaging of cereals, vegetables, whole grains and in multilayer board.

Semi chemical and CTMP Pulping of Bamboo

Parameters	CTMP	CTM P	Semi Chemical (soda)	Semi Chemical (soda)	Semi Chemical (NSSC)
Chemical applied	NaOH, low	NaOH high	NaOH low	NaOH high	NaOH+ Na ₂ SO ₃
Time required to raise temp. from Ambient to 135° C/150°C, min	60	60	60	60	60
Time at Top temperature,min	120	120	150	150	150
Bath ratio	1:4	1:4	1:4	1:4	1:4
Refining clearance thou	25,10,8	25,10, 8	25,10,8	25,10,8	25,10,8
Unscreened pulp yield, %	85.6	82.4	76.8	71.1	77
Rejects,%	7.8	6.4	3.8	2.7	2.1
Screened pulp yield, %	77.8	76	73	68.4	75.9
Unbleached pulp Brightness, %ISO	20.0	21.0	21.8	22.7	34

Physical strength properties of Semichemical and CTMP pulp of Bamboo

S.No	Particulars	CTMP	CTMP	Semi Chemical (soda)	Semi Chemical (soda)	Semi Chemical (NSSC)	Semi Chemical (soda)	Semi Chemical (NSSC)
1	CSF (ml)	350	380	390	370	368	370	368
2	Hand sheet GSM	200	200	120	120	120	40	40
3	Burst index (k.Pa.m ² /g)	1.4	2.0	2.3	2.86	3.25	2.16	2.9
4	Tensile index (Nm/g)	11.9	16.6	30.0	35.1	38.0	30.0	31.1
5	Tear strength (mN.m ² /g)	4.1	5.32	5.7	6.01	6.33	3.5	4.1

for production of food carry bags, moulded pulp crockery, liquid packajing solid board

Conclusions

- ▶ With the experiments and results obtained it is well proven that bamboo is a potentially viable raw material for production of virgin pulp of different grades and have application of food packaging of different varieties.
- ▶ the multilayered board linerboard, fbb required both chemical and mechanical pulp. The properties of bamboo may help in development of products with required specifications.
- ▶ The Government of India support in cultivation of bamboo, market growth (because of growing demand), demand due to e commerce activities related to different range of food packaging explore the future prospects of utilization of bamboo for production of food packaging grade pulp and paper which is an environment friendly and economical solution.

Food for thought

- ▶ to understand the core requirements of various end uses of food packaging paper and board.
 - ▶ to have a perspective to adoption of process which has better economic and environment viability.
 - ▶ a patriotic sentiments of **Atmnirbhar bharat and circular economy**
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Thankyou

