

India's wood imports – Opportunities & challenges for plastics industry

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Background

INDIA has been losing about 50,000 hectares of forest cover per year and hence wood imports have become more important. India's wood imports combined hardwood and softwood logs and hardwood and softwood lumber is around 7.5 million cubic meters. Wood is sourced from countries such as Malaysia (33%), New Zealand (23%), Myanmar (23%), Costa Rica, the Ivory Coast, Ecuador, Ghana, US, Europe, Canada. In 2013-14 Myanmar alone shipped 1.6 million tons of high quality teak to plywood peelers in India. Now Myanmar has banned log exports. Malaysia has 0.5% of total hardwood inventory in the world and yet contributes 25% of all log exports.

These imports feed 26,000 saw mills and 2500 plywood and veneer factories in India. 92% of all imports of wood have been round logs. With Myanmar and Malaysia banning export of wooden logs there may not be enough wood available to these operators. A log ban in Malaysia would have devastating consequences in India.

New Zealand is third major supplier of softwood logs to India. However New Zealand is more focused on China which imports 40 million tons as against 6.5 million tons imported by India.

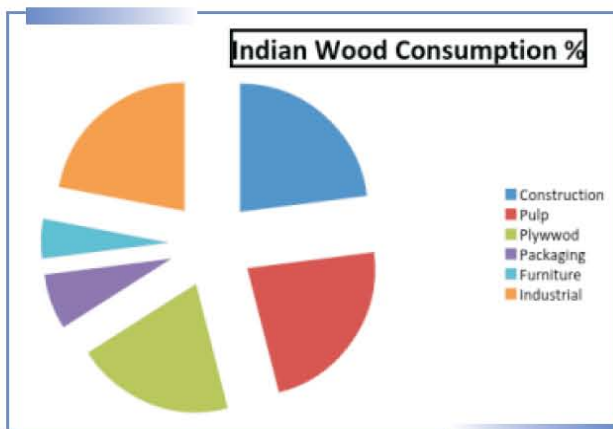
Indian wood requirement

Following are the major sectors of wood consumption in India

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Sector	Percentage
Construction	23
Pulp	23
Plywood	20
Packaging	7
Furniture	5
Industrial	22



Indian wood trade

During 2013-14, Indian hardwood and softwood imports were valued at \$2.1 billion (around 12,500 crore). This figure is likely to grow from 10% to 15% each year due to GOI commitment to projects such as ports, (\$30 billion or about Rs. 1,80,000

crore), railways (\$ 12 billion or about Rs. 72,000), highways related corridors (\$90 billion or about Rs. 5,40,000) over next five years apart from private consumption.

Out of six major sectors as mentioned above plastics play a vital role in offering substitute five sectors barring the pulp sector. However plastics can offer substitute for currency notes. RBI is already

working on the same and trials are on in select cities. Indian Defence forces are also a major consumer which gets covered under construction and packaging sector.

Every sector needs unique approach where material, plastic processing machines as well as plastic product

Projected demand for wood in India in 2020 (units in million cu.m.)

Industry Category	1999	2000	2005	2010	2015	2020
Pulpwood-Based	8.41	8.76	14.32	21.92	34.67	45.86
Panel Wood-Based	11.03	11.55	14.69	18.82	23.96	30.53
Durable wood – Based	35.56	37.69	44.99	54.26	64.37	76.61
Total	55.00	58.00	74.00	95.00	123.00	153.00

Projected supply of wood in India in 2020 (units in million cu.m.)

Source	Year 2000		Year 2010		Year 2020	
	Wood	Fuel wood	Wood	Fuel wood	Wood	Fuel wood
Natural Forest	14	37	14	37	14	37
Government Plantations	9.24	3.96	22.16	9.50	32.16	13.95
Social Forestry	5.80	3.10	13.80	8.44	13.80	8.44
Total (Rounded off)	29	44	50	54	60	

Source: Khanduri and Mandal, 2005; MOEF, 2006

design plays a vital role. All players need to work cohesively for success. The real life scenario in the plastic industry is however different for example lot of machines have got added for making plastic lumbers because machines are available cheap but products are not seen at the market end.

Product Innovation will come through fresh thinking. Plastic processing technologies such as rotomolding, foamed PVC in rod, slats, sheet form for making furniture in place of wood for carpenters, Polypropylene with multilayer honeycomb sheets to replace plywood in construction for partitioning and shuttering applications. This is only a partial list to address the shortage of wood that India will face.

Indian paper industry

The Indian paper industry is estimated between Rs 30,000 to Rs 35,000 crore and accounts for over 2.5% of the world's paper. The paper industry in India, comprises of more than 800 mills and provides direct and indirect employment to 1.3 million people. For past ten years from 2000-2010 paper consumption in India has grown at a CARG of 9.93%.

The industry is expected to cross 20 million tons by 2020 and 40 million by 2030 with an annual growth rate of 7- 8 per cent. Per capita consumption of paper has increased from 5 kg per annum in 2003 to 12 kg per annum current compared to the world average of around 50 kg and 40 kg for the Asia Pacific region. India shares 2% of global paper production and it is one of the high priority industry of Government of India.

National Forest Policy 1988 triggered a major transition in raw material sourcing for Indian Pulp & Paper Industry. The traditional dependency on state forests has been progressively replaced by dependence on farm forestry. On average the industry in India uses only 3.5% of the total wood from forests. However, the potential for significant increase in per capita paper consumption in India positions the industry for major expansion in ensuing years.

The major sources of domestic production are

- government owned forest and plantations
- farm/agro forestry
- private plantation.

The total industrial demand for wood, in terms of round wood equivalent (RWE) is expected to rise from 58 million cubic

meters in 2000 to 153 million cubic meters in 2020.

The productivity of timber in India is only 0.7 m³/ha/year whereas the world average is 2.1 m³/ha/year. The rising demand for RWE would trigger loss of dense forests and valuable biodiversity.

In the absence of suitable environmental safeguards, these operations can result in several social and environmental problems including destruction of tropical forests, illegal logging, permanent loss of natural habitats, and loss of biodiversity. This is particularly relevant in the case of Southeast Asia where plantations for the pulp and paper sector are resulting in destruction of tropical rainforests, illegal felling and forest destruction.

In Northern Europe, forests are managed so that there are more trees growing than being harvested. In fact the annual surplus of growth over harvest is a staggering 252 million cubic metres – roughly 30 times the UK's total annual consumption of wood.

Furniture market

This is a fancy sector which demands product innovations to attract consumer attention. Overall, furniture, décor and home finishing market in India is around Rs. 1.2 lakh crore. Furniture market is around Rs. 60,000 crore and 91 % of this market is in unorganized sector. The organized market which is 9% includes brands such as Godrej Interio, Home Center, Home Town, Home Stop, Durian, @Home etc. However with on line retailers this will change over a period of time.

Online retailers enjoy hefty margins of 50 to 75% in furniture, home décor and furnishing category. 4% of this margin goes into four layer packaging and 6% in shipping. Furniture manufacturers who are in unorganised sector make less margin of maximum 15%. Most online retailers sell unbranded furniture which is made by craftsmen spread all over the country.

Online retailers experience 65% of sale happening after 7 pm. 48% of sale is in South India mostly Bangalore followed by Delhi and Mumbai around 20%. This is new demand coming in via online retailers who products of unorganized sector at hefty margins.

There must be some attention given to the fact that this Rs. 60,000 crore per year industry must be employing lakhs of people who work every day with hardwood and softwood, plywood and particle boards which is their primary form.

It is necessary to make primary form in plastics. Wood is a gift of nature which needs to be preserved in the forest areas.

In past plastics industry has worked on such projects such as Plastic Ivory for reducing killing of elephants (unfortunately it still continues but much reduced). This project was called "Beauty without Cruelty" in past. There are plastic materials which look like Ivory and are sold at the market place. These products also have limitations due to the localized exotherm while making and the differential shrinkage in spite of using many novel low profile additives etc. Natural Ivory does not chip off while carving miniatures while synthetic Ivory does show its limitation. This clearly shows that nature is superior to all the intelligence human being has.

Similarly, to save wood, plastic industry should create plastic wood and give the same to craftsmen to work and create new products. Synthetic Wood will have its limitations but Plastic industry can bring in the best of products using injection molding, blow molding, rotomolding and extrusion processes. This paper also discusses various products made using different processing technologies.

Wood replacement by plastics

Plastic industry has been promoting alternate product in this sector such as plastic chair, tables etc. which are predominantly made out of Polypropylene. These products are made by Injection Molding process. PVC profiles are used for windows, doors and as partitioning material. PVC profiles are made by extrusion process. These are factory made products where traditional craftsmen have nothing to contribute. The objective of this paper is to elaborate on wood look alike plastic material which can be handled by designers and craftsmen who can create various fabricated products. Plastic Wood can be created by process of extrusion.

Plastic lumber industry

The plastic lumber industry, as well as



composite decking, has experienced substantial growth over the last ten years in developed world, largely due to its increasing popularity as a low-maintenance, long lasting alternative to wood. There are many varieties of lumber which are made from recycled and virgin plastics with or without fillers but made in nice colors.

Recycled plastic lumber is perfect for most outdoor applications and utilized by industry, and manufacturing for OEM projects, park and recreation, government and agriculture.

Plastic lumber's combination of longevity and consumer friendliness makes it the leading alternative to wood, concrete and metal building materials.

Its resistance to decay and ability to withstand severe weather ensures a lifetime of use, without sacrificing the look of the product. In half a century, recycled plastic lumber will look as good as new. Plus, no maintenance or replacement is needed which relieves the consumer of both a financial and physical burden. Plastic lumber remains impervious to rot, mold, mildew, insects, water and other decay. While the initial cost of recycled plastic lumber is higher, the product is a better value over time.



The uses for Recycled plastic lumber is only limited by imagination. It can be used for decks, docks, landscaping, outdoor furniture and much more.

Plastic industry has created plastic lumber which is used outdoor however it is also necessary to create products which are more elegant for indoor use and therefore it is necessary to understand wood properties.

Structure and properties of timber

Timber is a natural organic cellular material. It can be harvested, sawn, dried and finished to meet the requirements of the construction, furniture industry. Timber can be described as either softwood or hardwood. Softwood comes from

coniferous trees which are evergreen, such as pine and spruce. Hardwood comes from broad-leaved trees such as oak and poplar. These trees shed their leaves once in year.

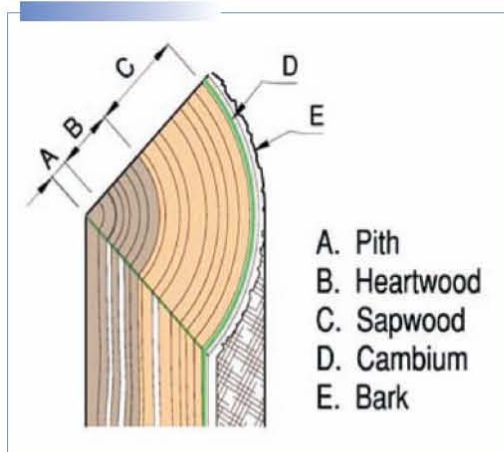
Botanically, hardwoods are angiosperms; their seeds are enclosed in the ovary of the flower. Anatomically, hardwoods are porous as they contain vessels. Most tropical woods are hardwoods.

Botanically, softwoods are gymnosperms or conifers; their seeds are not enclosed in the ovary of the flower. Anatomically, softwoods are nonporous as they do not contain vessels.

Factors that determine the strength classification of timber include species, density, slope of grain, knots, ring width and defects such as checks, splits and rot. Other important factors for strength include timber moisture content, temperature and load duration.

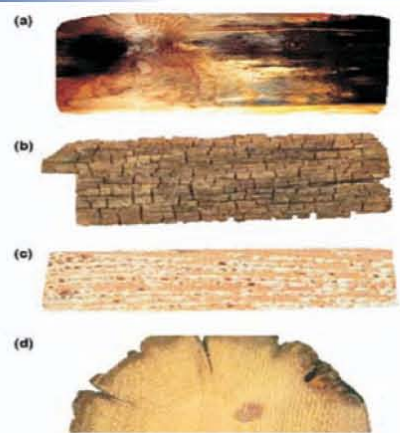
Cross sectional diagram of Timber

Young tree primarily contains sapwood which functions as sap conduction and food storage. The inner zone which is darker in color is called heartwood. The function of the heartwood is to provide mechanical support for the tree. Sapwood should be regarded as having low resistance to fungal decay or insect attack regardless of species.



Decay of wood

Following figure gives four types of decays in wood caused by fungi



(a) mold discoloration; (b) brown rotted pine (note the dark color and cubical checking in the wood); (c) white rot in maple (note the bleached appearance); (d) soft rotted preservative-treated pine utility pole. (note the shallow depth of decay).



Mold and fungi attack on wood.

The more common types of damage caused by wood attacking insects are shown in following pictures



Termite attack; feeding galleries (often parallel to the grain) contain excrement and soil.



Dry wood Termite attack

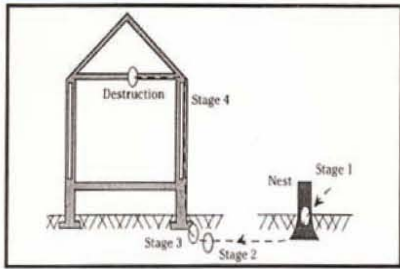


Illustration of the four time events of termite attack.

in size, general appearance, and habit of living in colonies. From the standpoint of their methods of attack on wood, termites can be grouped into two main classes: (a) ground-inhabiting or subterranean termites and (b) wood-inhabiting or non-subterranean termites. Ground-inhabiting termite attack is normally faster.

Marine Borer Damage

Damage by marine-boring organisms to wood structures in salt or brackish waters is practically a worldwide problem. The rapidity of attack depends upon local conditions and the kinds of borers present.

Plastic industry should develop products to address this situation and hence the concept of Plastic Wood.

Plastic wood

Zero maintenance Superior Aesthetics, Termite proof, no attack by soil bacteria, Water resistant, Not inflammable, Light weight, High Strength are some of the advantages plastic wood can offer over conventional wood. Following are some of the examples

Plastic cane

Plastic cane can be made with foamed PVC and wood flour to match the cane density. PVC has an advantage that it can be

varnished easily with varnishes that are normally applied to cane furniture. WPVC thus produced can be bent easily using kerosene lamp. Craftsmen who normally use cane for making cane have used such product to make cane furniture as seen in the photographs below. Since it is foamed the chairs made are as light as made of cane. In India cane is not available easily due to depleting forest cover. This would be alternate material for thousands of craftsmen and artisans whose livelihood depends on availability of natural product.

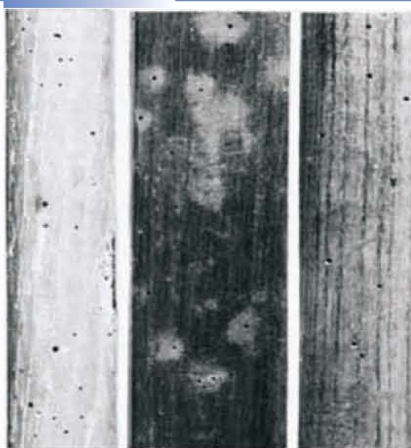
Plastic slats & plywood

Hard wood as well as softwood is used in making these slats. These are normally small pieces coming from saw mill. This is a profile extrusion and foaming is done while extruding these profiles so that the density is similar to wood.

Process of making plywood is known however plastic plywood has been made by making a foam board with density matching the wood density.

Most properties of wood such as cutting sawing, planing as well as screwing and nailing and nail holding capacity comes in these synthetic plastic material.

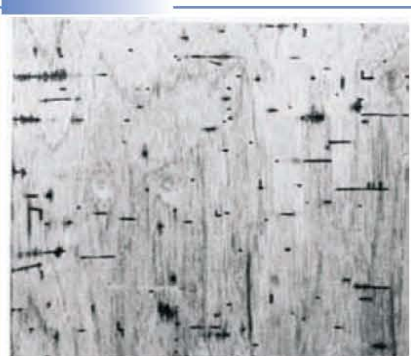
Following pictures show plywood and the slats and the furniture made from basic plastic wood.



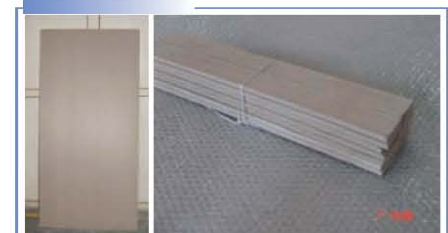
Powder-post beetle attack; exit holes usually filled with wood flour.



Carpenter ant attack; nesting galleries usually cut across grain and are free of residue.



Beetle attack; feeding galleries (made in the wood while green) free of residue and surrounding wood darkly stained.



Plastic Plywood

Plastic Slats

Size:- 6' X 4' WPC Sheet
Thickness:- 6,12 &18mm

Furniture from plastic plywood



Advantages

- Termite proof
- Water resistant
- Not inflammable

Termites

Termites superficially resemble ants

Wood Replacement

- Recyclable
- Less wastage
- Less machining required
- Energy saving.

Plastic wood and natural wood

Wood plastic composites as shown above are based on commodity plastics and this fact should not be forgotten while making use of Plastic Wood. Wood is a commonly used construction material in many parts of the world because of its reasonable cost, ease of working, attractive appearance and adequate life if protected from moisture and insects. However, forests are a valuable natural resource that must be conserved. As good a material as wood may be other materials should be considered first, simply on a conservation basis. Plastic wood would play important role in conservation of our forests. Following are the major characteristics of wood.

Wood characteristics

Strength in wood is its ability to resist breaking when it is used in beams and columns. Not only is strength related to

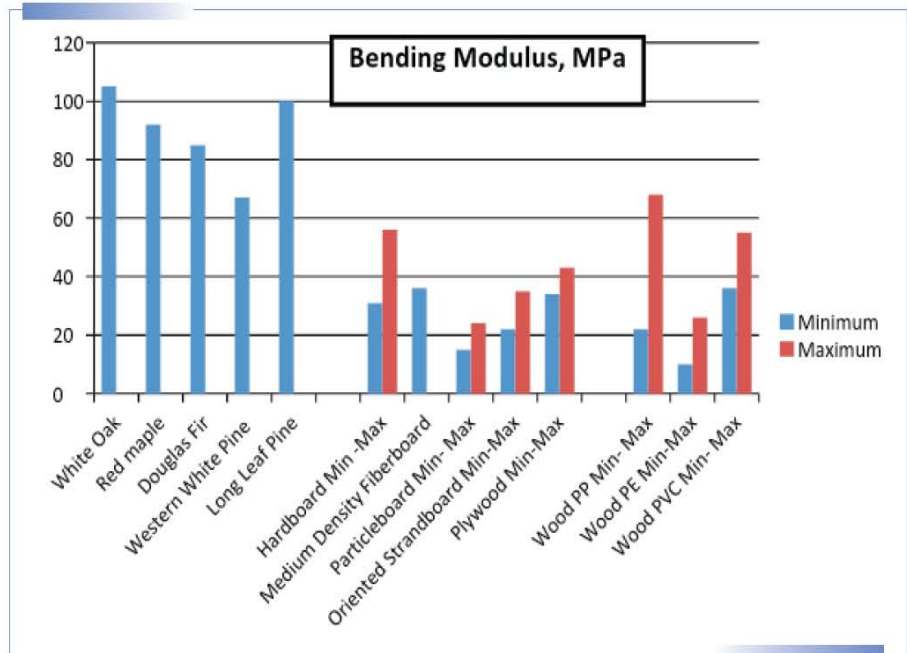


Table 2: Selected properties of extruded wood-plastic products

Composite	Tensile strength (MPa (lb in ⁻²))	Compression strength (MPa (lb in ⁻²))	Bending strength (GPa (×10 ⁶ lb in ⁻²))	Bending modulus (MPa (lb in ⁻²))	Shear strength (MPa (lb in ⁻²))	Dowel bearing strength (MPa (lb in ⁻²))
Polypropylene (PP) ^{a,b}	20.0 (2,900)	55.2 (8,000)	3.49–5.97 (0.506–0.866)	22.2–60.8 (3,220–8,820)	22.0 (3,190)	84.8 (12,300)
High-density polyethylene (HDPE) ^c	5.5–15.2 (800–2,200)	11.7–26.9 (1,700–3,900)	1.79–5.17 (0.260–0.750)	10.3–25.5 (1,500–3,700)	7.79–10.3 (1,130–1,500)	35.7 (5,180)
Polyvinylchloride (PVC) ^c	25.1 (3,640)	61.2 (8,880)	4.81–7.58 (0.697–1.100)	35.9–54.5 (5,200–7,900)	20.2 (2,930)	72.4–128.2 (10,500–18,600)

Table 1: Static bending properties of different wood and wood-based composites

Material	Specific gravity	Static bending properties			
		Modulus of elasticity		Modulus of rupture	
		GPa	(×10 ⁶ lb in ⁻²)	MPa	(lb in ⁻²)
Clear wood					
White oak	0.68	12.27	(1.78)	104.80	(15,200)
Red maple	0.54	11.31	(1.64)	92.39	(13,400)
Douglas-fir (Coastal)	0.48	13.44	(1.95)	85.49	(12,400)
Western white pine	0.38	10.07	(1.46)	66.88	(9,700)
Longleaf pine	0.59	13.65	(1.98)	99.97	(14,500)
Panel products					
Hardboard	0.9–1.0	3.10–5.52	(0.45–0.80)	31.02–56.54	(4,500–8,200)
Medium-density fiberboard	0.7–0.9	3.59	(0.52)	35.85	(5,200)
Particleboard	0.6–0.8	2.76–4.14	(0.40–0.60)	15.17–24.13	(2,200–3,500)
Oriented strandboard	0.5–0.8	4.41–6.28	(0.64–0.91)	21.80–34.70	(3,161–5,027)
Plywood	0.4–0.6	6.96–8.55	(1.01–1.24)	33.72–42.61	(4,890–6,180)
Structural timber products					
Glued-laminated timber	0.4–0.6	9.00–14.50	(1.30–2.10)	28.61–62.62	(4,150–9,080)
Laminated veneer lumber	0.4–0.7	8.96–19.24	(1.30–2.79)	33.78–86.18	(4,900–12,500)
Wood-nonwood composites					
Wood plastic		1.53–4.23	(0.22–0.61)	25.41–52.32	(3,684–7,585)

the species, but also to moisture content and defects. Strength is also quite closely related to density.

Plastic Wood based on commodity plastics may not match the above

properties and it necessary to create composites or create different product designs. Most Plastic Wood products shown earlier are extruded products and following table summarizes the properties of extruded wood-commodity Plastics.

Comparison of Bending Properties- Following Chart shows that Wood has higher bending modulus and hence has been used as construction material. Therefore Plastic Wood is not a direct replacement of natural wood which gets its strength due to its inherent structure which is shown earlier. It is important to note that wood density is much lower and plastic products have to be foamed to achieve wood like characteristics in Plastics. This aspect is often forgotten while designing wood replacement.

Most players of wood filled plastics try to make composites by adding wood flour to plastics such as polypropylene as given in the table. The density of various products is not matching that of wood and hence these are targeted not as wood replacement products. In current scenario there is fashion of calling such products as eco-friendly, Green Plastics due its renewable content such as wood, jute, husk etc.

Wooden poles

In farm buildings and rural structures,

Table 3: Selected properties of wood-plastic products*

Composite	Specific gravity	Tensile properties				Flexural properties				Izod impact energy (J m ⁻¹)	
		Strength		Modulus		Strength		Modulus		Notched	Unnotched
		MPa	(lb in ⁻²)	GPa	($\times 10^6$ lb in ⁻²)	MPa	(lb in ⁻²)	GPa	($\times 10^6$ lb in ⁻²)		
Polypropylene (PP)	0.90	28.5	(4,134)	1.53	(0.22)	38.30	(5,555)	1.19	(0.17)	20.9	656
PP + 40% wood flour	1.05	25.4	(3,684)	3.87	(0.56)	44.20	(6,411)	3.03	(0.44)	22.2	73
PP + 40% wood flour + 3% coupling agent	1.05	32.3	(4,685)	4.10	(0.59)	53.10	(7,702)	3.08	(0.45)	21.2	78
PP + 40% wood fiber	1.03	28.2	(4,090)	4.20	(0.61)	47.90	(6,947)	3.25	(0.47)	23.2	91
PP + 40% wood fiber + 3% coupling agent	1.03	52.3	(7,585)	4.23	(0.61)	72.40	(10,501)	3.22	(0.47)	21.6	162

wood is often used in the form in which it has grown, i.e. round poles. These poles have many uses in small building construction, such as columns for the loadbearing structure, rafters, trusses and purlins. Sticks and thin poles are often used as wall material or as a framework in mud walls.

Where straight poles are selected for construction, it is as easy to work with round timber as with sawn timber. However, somewhat crooked poles can also be used if they are turned and twisted and put into positions in which the effects of the bends are unimportant.

Round timber can generally be considered stronger than sawn timber of the same section area because the fibres in round timber are intact. Many species of eucalyptus, from which poles are obtained, are very fast and straight-growing hardwoods. However, they warp and split easily. Dimensions suitable for building construction are obtained by harvesting the still immature trees. These poles provide a strong and durable material if chemically treated to prevent attack of bacteria, fungi and insects as mentioned earlier.

Plastic Wood does not have enough strength to replace round timber poles but as first step it can replace cane in the furniture as shown above.

Material scientists have understood this limitation and the new material on the horizon is Plastic Steel out of wood filled commodity materials.

New processing technologies: "Plastic steel from wood filled PP"

Synthetic Hardwood Technologies (SHW); USA has developed a new

technology of applying low temperature die drawing to take advantage of a new raw material; expanded, oriented, wood filled polypropylene (EOW PP). It looks and feels almost like natural wood, but is 150 % stronger. It is also 300 times stronger than PP & close enough to the strength of steel. Hence the term "Plastic Steel" is no exaggeration.

This unusual new material is made of a combination of two metalwork processes: solid -state extrusion & die drawing. SHW's new low density, wood filled PP composites profiles are targeted mainly for four application areas, indoor construction (flooring), automotive, outdoor construction & defence applications. Market opportunities are promising for outdoor construction.

Die Drawn OPP profiles with & without 30 % wood

Product	Flexural Strength MPa	Flexural (Bending) Modulus MPa
PP	48	1862
Wood	96	8694
Oriented PP	276	7585
Expanded Oriented PP	138	7585

Wood characteristics

Hardness is the resistance to denting and wear. While hardwoods are more difficult to work, they are required for tools, tool handles, flooring and other applications subject to wear, or where a high polish is desired. Stiff woods are not necessarily very strong. They may resist bending up to a point and then break suddenly. Tough woods will deflect considerably before breaking. Even after fracturing, the fibres tend to hang together and resist separation. Tough woods are resistant to shock loading.

Plastic Wood compares very well in hardness and the Shore D hardness is around 65 for Natuural as well as Plastic Wood.

Warping is the twisting, bending or bowing distortions shown by some woods. The method of sawing and curing affects the amount of warping, but some species are much more prone to warping than others.

Warping needs to be controlled while under production. Processing without any built in stresses would reduce the warpage in Plastic Wood.

Nail-holding resistance for hardwoods is greater than for softer woods. However, woods that are so hard that they tend to split when nailed, lose much of their holding ability. Preboring to 75 percent of the nail size avoids splitting. The workability, such as sawing, shaping and nailing, is better for soft, low-density woods than for hardwoods, but usually they cannot be given a high polish.

Plastic Wood with matching density will have similar properties that of natural wood.

Natural-decay resistance is particularly important in the warm, humid regions. A wide range of resistance is shown by different species. However, for all species, the heartwood (the darker center area of the tree) is more resistant than the sapwood (the lighter outer area of the tree). In addition to selection for natural-decay resistance, wood preservatives should be considered where contact with the ground is likely.

Plastic Wood performs better than the natural wood as it resists the attack of bacteria, fungi, termites and insects.

Paint-holding ability differs between woods. However, wood accepts paints and varnishes easily. Plastic Wood based on PVC outperforms polyolefins in paint holding and gluing ability.

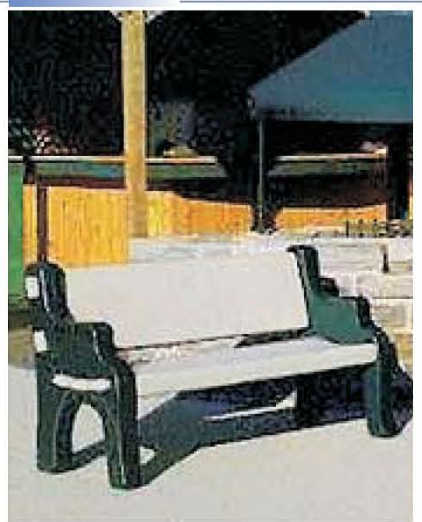
Plastic furniture

Injection molded Plastic Furniture is a mature segment now in India. It does help reducing wood consumption. There are further innovations needed considering Indian living habits especially for the rural markets. Injection molding as well as blow molding needs to be looked at while designing plastic products as wood replacement. Picture show some of the products offered by Indian Plastics Industry.

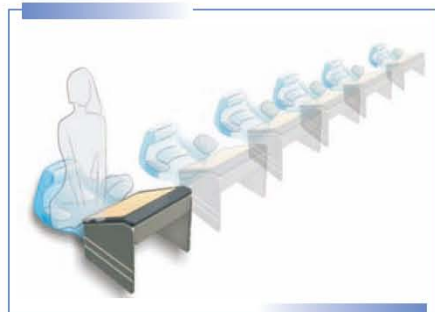


The most important property in creating new designs is the Creep Data of plastic materials that needs to be understood while designing.

Furniture made with Blow and Roto molding Processing technologies



Blow molded bench



Rotomolded Indian seating with desk made with PVC profiles and blow molded polyethylene.

Rotomolded products if designed

well can also help in wood replacement. Products from Aluminum molds give good finish to rotomolded products which would induce consumers to buy rotomolded products.



Wood replacement - A practical experience.

Multilayer roto-molded products with foamed layer sandwiched were created by perfecting the technology as below.



This modified process was used in making storage tanks of fishing boats/ trawlers.



The boat deck does not give an idea how big is this fish storage tank, which is seen in the picture below.



Foamed polyethylene rotomolded tank performed better than the wooden tank as it did not allow the ice /salt mixture to melt fast.

There are many thousands of such

fishing vessels which go to sea everyday along our vast coast line. Such fishing vessels are made in the country which can consume plastic products and plastic wood. The picture above shows that there is lot of wood that gets consumed and some of it can be replaced by plastic wood.

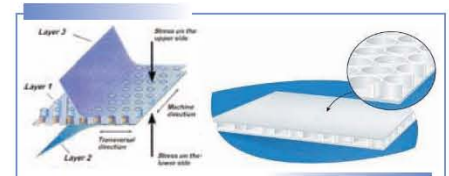
However there was negative publicity as the contractors saw that they will have to compromise on their margins as plastic products would be obtained from the organized trade and would not be obtained from the unorganized trade. Craftsmen found the plastic products and plastic wood is as good as wood in fabrication but they were misled and the plastic products got rejected.

We have seen above that the country would be short of wood in time to come and it is upto the plastics industry to create momentum in terms of efforts to penetrate with correct product, impressive designs which would attract the end user as well as all those who are part of the trade.

Following is one such example where the engineering excellence along with, advance olefinic materials with various decorative techniques are employed to create novel products.

Engineered products based on commodity plastics such as polypropylene

There have been engineered solutions and most promising is the honeycomb board made continuous extrusion process. The patented product is called Bubble Guard Board and available as RMD Board. It is a complex board of three layers and the middle layer is lightweight and contains bubbles arranged neatly due to the process design.



The three layers consist of proprietary combinations of types of PP and property modifying additives.

On the top and bottom surface of the boards in-process lamination of laminates / planer engineered structures possible for value addition. Lamination is done with Decorative foils of special structures (Aesthetics) and Self Reinforced Polypropylene Sheets (Strength). Wide

variety of products have been created and can be further created and the process is endless. Following are some of the examples.

Decoration on wall – wall panels

RMD wall panel is the latest innovations in both concept and design for Building and Construction industry and Interior decoration applications.



Decoration of Ceilings – Ceiling Tiles and Walls



RMD wall panel – Innovative product features:

- All plastic composite structure with dimensional integrity.
- Meets highest expectations of connoisseurs & experts with unique decorative values
- Light weight – nearly ¼ of the weight of conventional MDF / Gypsum board
- Easy & fast installation with solvent free adhesives – nearly 10 minutes* for installation of one wall panel of 8'X4' size
- Excellent Aesthetics
- Lighter in weight
- Easy to install - no mudding, sanding or painting required

- Can be applied directly over existing wall
- Easy to clean, Hygienic
- Significant time saving, reduced labour cost
- Higher Sound and Thermal insulation due to bubble structure
- Resistant to mild Acids and Alkalies.
- Adequate abrasion resistance for cleaning
- Numerous surface finishes
- Can be made available with suitable class of Fire rating
- Recyclable & Reusable
- Higher salvage value at the end of functional life
- Stain & Fade resistant.
- Temperature resistant.
- Washable & Waterproof.
- Termite proof.
- No shrinkage or swelling.
- Odourless and safe.
- Available in brilliant explosion of colors to subtle tones of nature.
- Elegant, Beautiful with superior Aesthetics
- Requires no framework and can be directly pasted on walls.
- Requires minimum maintenance

Being recyclable and reusable, RMD wall panel board can be plus point for obtaining Green Building, LEED certification and help us to reduce the carbon foot print and support sustainable development. It will help us to reduce the wood consumption and arrest deforestation.

Shuttering application

RMD Shuttering Boards is the latest innovations in both concept and design for Building and Construction industry and replaces plywood.

RMD Shuttering Boards – Innovative product features:

- All plastic composite structure with dimensional integrity.
- 60% Lighter in weight than plywood
- Easy to move and fix at construction site
- No need of molding oil - RMD board comes easily from dry concrete

- Excellent slab finish : No requirement of plastering , direct painting can be done
- More turnarounds, less cost of board per usage
- Adequate for repeatable load bearing capability
- Significant time saving, reduced labour cost
- Excellent Slab surface finish
- Water resistant
- Higher salvage value
- Resistant to mild alkalies
- Can be made available with suitable class of Fire rating
- Recyclable & Reusable
- Higher salvage value at the end of functional life
- Washable & Waterproof
- Corrosion Proof
- Termite proof
- No shrinkage or swelling
- Odourless and safe
- Easy & fast installation with standard supporting structure for installation.

Overall, Plastics industry has been very innovative in creating various products which would replace wood and reduce import of wood.



Conclusion

There are very strong possibilities of addressing wood shortage of India with wide varieties of plastic products made by using different processing technologies. Plastic industry and wood trade have to work and promote together the concept of Plastic Wood and other novel products created by Indian Plastics Industry to address the wood shortage of the country. ■