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Bio based wood plastic composites : Marketing technology trends and challenges in India

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Abstract

Wood Plastic Composites (WPCs) appear today as one of the most dynamic sectors in the plastic industry. This study was aimed at identifying the technology and market trends of the WPCs industry in India.More research about the manufacturing process is needed in order to take full advantage of the natural attributes of fibers. In terms of processes, extrusion is currently the primary technology for the manufacturing of WPCs. Emerging products include fencing and siding, among several others. The incorporation of cellulosic fillers for WPCs from non-wood natural fibers such as agricultural fibers presents one of several new technological opportunities, especially in developing countries. The most commonly used thermoplastic polymers in the plastic industry are polyethylene (PE), polyvinyl chloride (PVC), and polypropylene (PP). PE is the dominant polymer in the manufacturing of WPCs world-wide. Thermoplastic polymers combined with natural fibers and new added compounds could significantly improve the mechanical properties of the new generation of WPCs.

Keywords

Wood Plastic Composites (WPCs), Market trends in India, Technology, Fibers, Decking, Attributes and Prospects.

INTRODUCTION

This growth has been driven by several market and societal factors, such as demand for environmentally friendly products, stricter regulations on the use of chemicals, changes in lifestyles, a growing builder acceptance, increased consumer awareness, and ultimately the intrinsic value proposition that WPCs bring about. WPCs have been largely manufactured from polyethylene (PE), polypropylene (PP) or polyvinyl chloride (PVC) polymers combined with wood under pellet or flour form. Non-wood natural fibers such as flax and hemp have also been used, acting as a cheap, largely inert filler. Availability, physical properties and closeness to market allow forecasting an increased participation of crop fibers, and a decrease of wood-based fiber.

Rice hull has been and will continue to be used, given its good properties (low water intake, lack of digestible nutrients that support the growth of mold and mildew), availability, and distribution channels. The latter points will likely limit the use of crop fiber only to species already readily available (e.g. wheat straw). Chemical additives seem practically ***"invisible"*** (except mineral fillers and pigments, if added) in the composite structure. They provide for integration of polymer and wood flour (powder) while facilitating optimal processing conditions.

Since independence, plastic industry in India have been playing a predominant role in shaping our lives. As it an indispensable item in our day to day activity, so its importance cannot be undermined. From last decade with the advent of new and improved technologies, the industry has gained greater importance with the production of better and improved quality of polymers (plastics) which has supported the radical change in human life and its day to day activities.

The name "plastic" has been coined from ***"Plastikos"***- a Greek word meaning capable of being shaped or molded. The material is formed by repeating units of monomers forming long chains consisting of large molecules and characterized by light weight, high corrosion resistance and low melting points. Presently, there exist about 50 different types of plastics. Broadly plastics can be classified into two types namely,

- **Thermosetting** (can be softened or molded into a shape by applying heat and pressure only once) and
- **Thermoplastic.** (can be softened repeatedly by application of heat and pressure).

India's economy is the eleventh largest economy in the world by nominal GDP and the fourth largest by *Purchasing Power Parity (PPP)*. With a large pool of human and natural resources, and a growing large pool of skilled professionals, India is likely to be among the leading economies of the world by 2020 as per economists' predictions.

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This gives the motive to analyse this plastic industry in India as it has huge impact on every sector of the economy as seen from the background study. India is the world's second largest populated (1,186,920,000) country after China followed by USA accounting for about 17.3 percent of total world's population.

Definition

Wood plastics material can be defined as ***'a composite consists of two or more dissimilar materials which when combined are stronger than the individual".***

ATTRIBUTES OF WPC

Lower Life Cycle cost, the use of recycled stock, low & easy maintenance, safe & non-toxic, improved thermal/dimensional stability over plastics, no or reduced twisting/warping/splitting/splintering, low moisture absorption, resistance to rot, ability to be engineered, and lower variability than wood.

Their main disadvantages are: higher upfront costs, lower stiffness than wood, creep problems, lower fire resistance, thermal/discoloration, and some surface finishing issues. Other challenges are the development of design specifications (codes & standards) and intellectual property (IP) issues.

Current WPCs applications: Decking, Railing, Windows and Doors Lineals, Roofing, Picnic Tables and Benches, Fencing, Landscape Timber, Patios, Gazebos, Pergolas, Auto Parts, Playground Equipment, Etc. (Smith P.M. & Wolcott M.P 2006).

METHODOLOGY

The study relied basically on literature review and commercial reports.

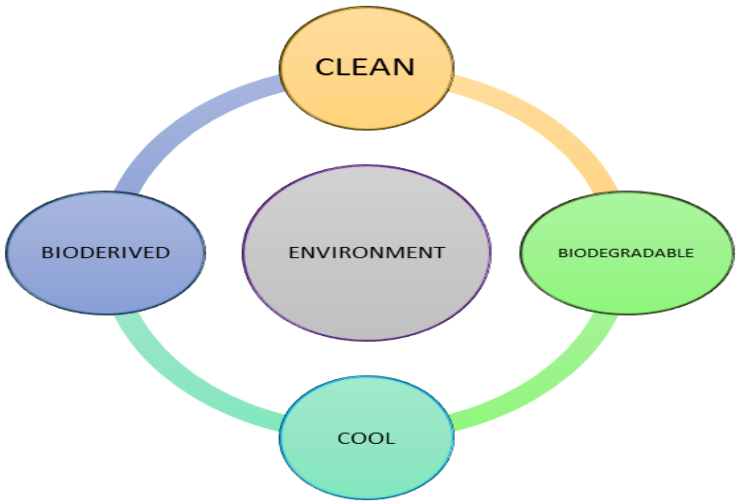
***Data Sources*:**

All relevant data used in this paper have been collected from published and online secondary sources. The main sources for this study were scientific literature from the forest products industry, chemistry, composites, civil engineering, conference proceedings, commercial reports, the web and personal communications and interviews.

BIODEGRADABILITY AND RECYCLE

While many polymers are marketed as being biodegradable, a better term would be "environmentally degradable".

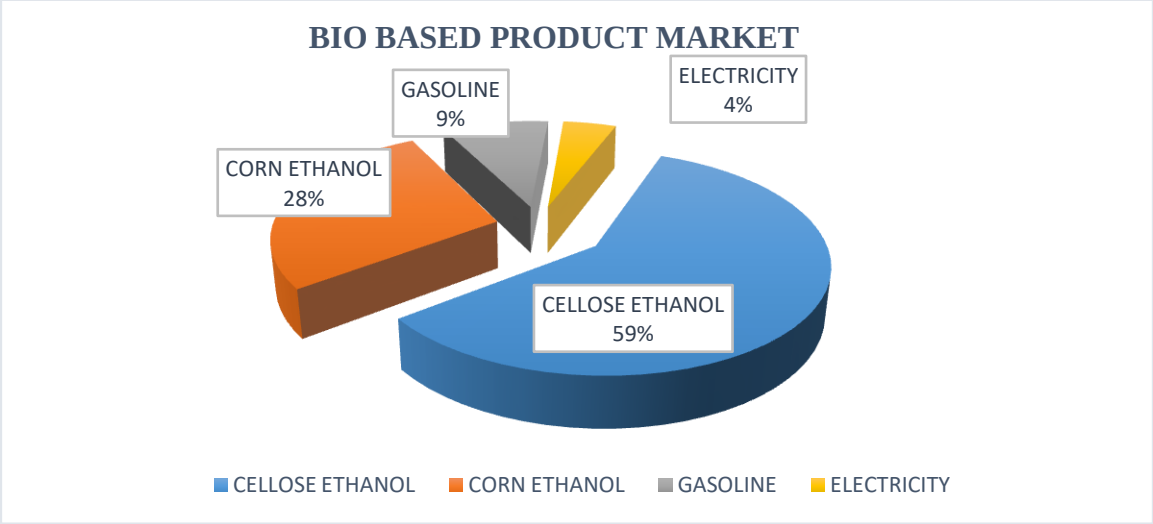
FIG: 1 BIO BASED PRODUCT LIFE CYCLE CURVE



The American Society of Testing and Materials (ASTM) defines,

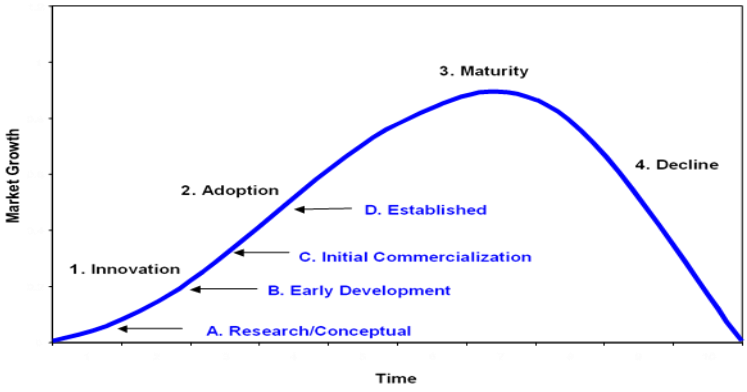
"Biodegradation as degradation demonstrated to be caused by biological activity, particularly enzyme activity, leading to significant changes in chemical structure. The resulting degradation products must be chemicals such as water, carbon dioxide, methane, inorganic compounds or biomass".

FIG.1ASSESSMENT OF BIO BASED PRODUCTS, INDIAN MARKETS



Bio Based Products in India

The *second largest producer of ethanol* in Asia, India also is one of the world's largest sugar producers. Installed ethanol production capacity amounts to approximately 700 million gallons but capacity utilization rates are low (total ethanol production in 2004 amounted to 450 million gallons).



Source: Informa

In 2004, only approximately 26 million gallons of ethanol were used for blending with gasoline. Assuming that the ethanol program will be implemented in those States and Union territories originally envisaged by the government, the projected demand for fuel ethanol will be 396 million gallons in 2010 if E-10 is sold, as is now planned.

A ***Fuel Ethanol Program***was introduced in India in 2003. Measures currently in place include an excise tax reduction for E-5, the obligation to blend all petrol with 5% ethanol in certain regions since January 2003 and government regulation of the ethanol selling price because of ethanol production costs. Currently, 5% ethanol blends are used in 10 sugar producing States and 3 contiguous Union Territories. In addition to the federal moves, several Indian States have also attempted to support local ethanol production using additional fiscal measures.

However, recently, the Indian fuel ethanol program suffered from a crisis. Following a drought, the 2003/04 and 2004/05 sugar crop and therefore also molasses output was unusually low, which resulted in sharply increased feedstock prices for ethanol production. Thus, local producers in India's Southern States concentrated on production of industrial and potable alcohol. The ethanol blending obligation was suspended in the autumn 2004. In the meantime, India has become increasingly dependent on molasses and ethanol imports to meet its ethanol requirements. However, it is likely that the molasses supply will increase substantially over the coming years with the recovery of cane production.

Bio based Motor Oils

The government is currently developing a new biodiesel support program for the country. According to Petroleum Ministry officials, biodiesel is likely to be fully exempt for excise duty in the 2006 budget year. Under the government's new biodiesel (vegetable oil) purchasing policy, public sector oil firms will purchase straight vegetable oil extracted from plants, such as ***Jatropha, Pongamia***etc. for mixing in diesel at INR25 (ca. US$0.55) a liter beginning January 2006. In a first step, 5% straight vegetable oil will be mixed with diesel during trial runs and will be increased to 20% in phases. In 2003, the country's Planning Commission had drafted plans to encourage the widespread planting of ***Jatropha curcas*** trees and use the oil produced for blending with conventional diesel. It set a target of a ***'vegetable oil for fuel use'*** output of 13 million tonnes/year. In Bangalore, there are plans to transform a plant producing straight vegetable oil from ***Karanjia***and ***Jatropha*** into a biodiesel production unit.

In November 2005, Petroleum Ministry officials were quoted saying that under the next State budget, the excise duty on both biodiesel and ethanol would be likely go to zero and states would be asked to have a favourable sales tax regime. The government plans to achieve a countrywide ethanol-petrol blending rate of 5% in the near future, which would require 132 million gallons of ethanol. Later on, it plans to increase the ethanol content in petrol to 10% and to blend conventional diesel with 5% ethanol. The country's Planning Commission proposes increasing the proportion of biofuels used in India from 5% to 20% by 2012.

Motor oils have been utilized since the development of steam engines as buffer between moving and static engine components. The basic jobs of motor oils are to prevent metal-to-metal contact and to transfer heat from friction away from the contact point. Automotive engine oil presents a huge market opportunity, but tough performance requirements and the low price of petroleum alternatives make this a difficult market for bio based to enter.

Bio lubricants

The development of bio based lubricants is a natural part of the greening and sustainability process in the motor oil industry.

The Asia-Pacific Partnership on Clean Development and Climate

The six members of the Asia Pacific Partnership Clean Development and Climate – Australia, China, India, Japan, South Korea, and the United States – collectively account for 54% of global economic output, 45% of global population, 48% of global.energy use and 50% of global greenhouse gas emissions. The main purpose of the partnership is to facilitate the development, deployment, and transfer of more energy efficient and cleaner technologies to allow emissions to be reduced without undue cost to the member countries' economic growth. The partnership has not yet agreed to any binding greenhouse gas reduction commitments, nor is it likely to do so.

A study commissioned by APPCDC from Australia's Bureau of Agricultural and Resource Economics estimated that technology transfer could result in a 23 – 24% reduction from the baseline in oil production in the partnership countries by 2050, while global greenhouse gas emissions could be lowered by 23% by 2050 from the baseline scenario.

Table 1: World Carbon Dioxide Emissions by India (in million metric tons of Carbon dioxide)

MATURE MARKET ECONOMIES	HISTORY				PROJECTIONS		
	1990	**2001**	**2002**	**2010**	**2015**	**2020**	**2025**
INDIA	**583**	**1,009**	**1,025**	**1,369**	**1,581**	**1,786**	**1,994**

The report concludes that both technology ***'PUSH'*** and emissions trading '***PULL'*** will be required to bring about significant greenhouse gas reductions. However, the emissions trading would have to wait until technology for significantly reducing emissions exists.

PROSPECTS OF COMPOSITES IN DEVELOPING COUNTRIES

Composites present immense opportunities to play increasing role as an alternate material to replace timber, steel, aluminium and concrete in buildings. Their benefits of corrosion resistance and low weight have proven attractive in many low stress applications. The use of high performance FRP in primary structural applications, however, has been slower to gain acceptance although there is much development activity. They are being used for the manufacture of prefabricated, portable and modular buildings as well as for exterior cladding panels, which can simulate masonry or stone. In interior applications, composites are used in the manufacture of shower enclosures and trays, baths, sinks, troughs and spas. Cast composite products are widely used for the production of vanity units, bench tops and basins. Composite material properties can be converted into important financial and performance benefits during offshore operations. Studies have shown that the use of composite products can reduce offshore capital requirements, decrease maintenance costs, and enable operations that otherwise are not feasible both technically and financially. Drilling operations constitute approximately 25-40% of the total project cost; so, extended reach drilling capability is very important in offshore operations. Offshore oil and gas reservoirs are often accessed through horizontal drilling. There are other advanced composites that are currently being used in oil field production applications (Fowler et al., 1998).

CONCLUSIONS

Most developing countries desire rapid industrialization, export enhancement, self-reliance and minimizing the import in order to strengthen the economy. Hence, there is the need to look more inwards to exploit the available resources to enhance the desired technological advancement. This can only be achieved by giving more attention to Research and Development.

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