

# DEVELOPMENT OF THE DIFFERENT METHODS FOR BETTER UTILIZATION OF WASTE PLASTICS

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## ABSTRACT

*This paper describes in brief the utilization of plastics in value added product such as lumber for a variety of low technology application. This project deals with development of techniques to utilize plastic lumber through recycled. Also increased plastic waste consumes to maintain environmental balance on earth. Discuss different types of utilization of recycled plastic in home, office and industrial purpose.*

*Keywords:- Food, Pharmaceuticals, Rubber, Electronic, Building and Construction, Automotive.*

## INTRODUCTION

Wooden pallet was a traditional tool for product handling sales worldwide approximate \$20 billion a year. Currently wood pallets account for 90% of the market with plastic and other materials accounting for the other 10%. The pallet market is shifting from wood to plastic at the rate of 3% to 5% per year and accelerating. Within five to seven years, the market will be about 50/50 wood to plastic. Fueling this rapid transition to plastic was a March 2002 edict by 90 countries banning the use of soft wood packaging materials. Wood pallets shipped overseas must be fumigated or treated, which is costly and time-consuming. Exporters are clamoring for alternatives and plastic pallets sales are burgeoning.

Composites - hybrids between plastic and some other material, such as wood or natural fibers - may hold the most promise for pallet design and manufacturing in the future.

## Polymers used in Plastic Pallets

The predominant plastic used to make pallets is a thermoplastic resin, which softens when energy is added. Thermoplastic resins include polyethylene, polypropylenes, poly-vinyl, poly-nylon, polyesters, polycarbonate, and engineered thermoplastics. The thermoplastic group of resins is less expensive, easier to process and to recycle, and is more resistant to shock and impact than thermosetting resins. The principal thermoplastic raw material in plastic pallets is polyethylene. (The dominant type in Europe is polypropylene.) Of the various polyethylene, high density ones - whose properties may be changed dramatically by modifications - are most common in pallets.

## General considerations for making Plastic Pallets

Most plastics are extremely strong but are less stiff than wood. Low stiffness may limit the load-carrying capacity of plastic. For that reason, they were usually not used in free-span racking. However, recently many plastic pallet manufacturers are turning to reinforcements to meet stiffness requirements. A Cheap prototype, for example, has small I-beams imbedded in the polyethylene bottom deck; the I-beams are made of a different resin. In order for a plastic pallet, which costs more to purchase, to compete in the market place on a cost-per-use basis...it has to be more durable. To make something more durable, it has to resist shock and impact. But when you take a material and make it more impact resistant, you are going to sacrifice stiffness because those two properties are in opposition to one another. To make something more shock resistant, you make it less stiff. To make something stiffer, you're going to lose shock resistance. Plastic...is more shock resistant than wood, but it is less stiff. The solution for this particular problem...will be composites or reinforcing techniques. Experiments are underway on many composite materials. An ideal composite would contain material that is very resistant to impact and a second material for stiffness, the latter may be provided by glass, carbon or wood fibers.

## Types of Plastic Pallets

Various types of Plastic Pallets have been available at the market for about 20 years, but only recently have gained significant market presence and continue to grow at unprecedented rate. Metal pallets contribute to very small pan of the market especially in aviation for airdrops. Plastic pallets are sold in a variety of styles and dimensions. In general, the market includes low priced export (or one-trip) pallets, nestable pallets, double-deck pallets for the products that must be stacked on top of each other or placed in racks designed to provide the pallet with some degree of support, and rackable pallets used in sophisticated warehousing with minimum support available to hold the pallet.

## Various types of pallets available are

**Nestable Pallets:** Used primarily for the delivery of commingled products from distribution centers to retail stores. Offer up to a 4-to-1 nesting ratio, reducing costs by saving warehouse and shipping space.

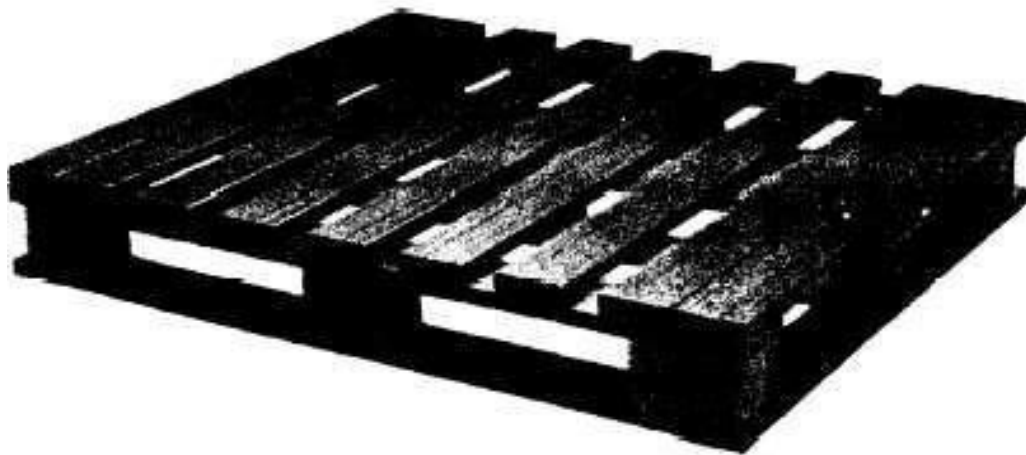
**Stackable Pallets:** For stack loading and for use in pallet racks. They are compatible with a broad range of conveyor systems and automated material handling equipment. Stackable pallets are offered in two versions: one-piece and two-piece assembled configurations.

**Rackable Pallets:** Rackable pallets are heavy-duty pallets with blocks or stringers between two pallet decks allowing the pallet to be supported by edge racking. These types of pallets are often

used to transport goods from manufacturers to distribution centers where they are racked (stacked). By comparison, nestable pallets are often used to transport goods between distribution centers and retail stores.

**Top Caps:** Available to protect and secure pallet loads. By utilizing top caps, multiple pallet/top cap systems can be securely stacked.

**Seat Belt Systems:** Attach to the pallet and top cap to secure the pallet load. The seat belt system eliminates the need for banding, stretch wrapping, and associated machinery, while reducing labor costs.



*One of many styles of plastic lumber pallets. Different fastening styles include nails and various kinds of bolts. Plastic lumber can be extruded and can use recycled plastics.*

#### **Various Pallet-Manufacturing Processes:-**

There are several plastic pallet-manufacturing processes: thermoforming, injection molding, structural foam molding, blow molding, compression molding, rotational molding and profile extrusion.

In thermoforming, one or two sheets of polyethylene are heated and put into a mold under a vacuum or pressure to finish the molding process. The resulting pallets are very durable but not as stiff as other types of molded pallets without reinforcement

Another drawback is that they are hollow: forklift tines may pierce the pallet, allowing water or other contaminants to accumulate and perhaps create unsanitary conditions. Thermoform plastic pallets are used by the U.S. Postal Service and are popular with grocery distributors for retail. A common thermoform plastic pallet is lightweight, neither rack-able nor stackable, has no bottom deck, can handle light to moderate loads, and is fully nestable - an attractive feature for retailers.

**Injection Molding:** Uses high pressure to produce a high quality pallet rapidly. However, there is a huge difference in the cost of tools. A machine used for thermoforming costs about \$60,000 to \$80,000; a high-pressure injection-molding tool costs about \$400,000 or more.

**Structural foam Molding:** One of the most common types of manufacturing plastic pallets, is similar to injection molding except that a gas is added to the resin during the process. The gas expands in the mold, forcing the resin against the surfaces. The process requires less pressure and the tools are not as costly as injection molding. Structural foam molding produces a pallet that is lower in density, lightweight, stronger and stiffer.

**Structural foam molding:** Plastic and nitrogen gas are injected into a closed cavity mold. The part is cooled to create the exact shape of the mold. The combined use of these materials creates a cellular core that forms a solid skin.

These pallets have high strength to weight ratio, reduced deflection, accurate tolerances, are cleanable, and have superior static load capacity for racking, distribution, stacking, and ASRS equipment.

### **SINGLE OR TWIN SHEET THERMOFORMING (HMWPE):-**

In single sheet thermoforming, a sheet of plastic is heated and then drawn by vacuum over a mold. In twin sheet thermoforming, two sheets of plastic are heated and drawn by vacuum over separate molds and then fused together through pressure to form a structural double walled part. Pallets made by thermoforming are lightweight, cleanable, have flex memory and are impact resistant. Applications include distribution, textile, food, auto assembly and work-in-process applications.

**Injection Molding:** Plastic is injected, under pressure, into a closed cavity mold then the material is cooled to ensure that it maintains the exact shape of the mold. This process produces a solid wall, solid core part.

Injection molded pallets are lightweight and cleanable, have accurate tolerances, superior static load capacity, and superior impact resistance with reduced deflection. Applications include racking, distribution, ASRS equipment, work-in-process and cold storage.

### **Applications of Plastic Pallets:-**

The international trend has switched towards the use of polymer pallets and they are already in use in a wide range of industries including: Pallets are used in virtually all industries in which products are broadly distributed, including, but not limited to, the automotive, chemical, consumer products, grocery, produce and food production, paper and forest products, retail

and steel and metals industries. Forklifts pallet trucks and pallet jacks are used to move loaded pallets, reducing the need for costly hand loading and unloading at distribution centers and warehouses. Pallets come in a wide range of shapes and sizes, depending on the purpose and use. Plastic pallets find

#### **Applications in following major industries:-**

Food  
Pharmaceuticals  
Rubber  
Electronics  
Building and Construction  
Automotive  
Freight Forwarding  
Agriculture  
Nurseries

#### **Major applications:**

##### **Grocery Distribution:**

Pallets are used to move goods through all links of distribution chain. Pallets typically travel through three segments of the grocery industry: the manufacturing plant, the distribution center, and the retail store. The grocery industry traditionally uses a 48 x 40 inch stringer, nonreversible pallet. 90% of all dry groceries are moved on this type of pallet. This standard pallet is used for all grocery products except dairy, health and beauty aids, slow-selling items, and automated meat and frozen food storage systems.

Plastic Pallets used in the distribution industry replicate the form and dimensions of this traditional pallet. Plastic Pallets used in Europe are designed to substitute standard 9 blocks 1200 x 800 mm Euro-pallet.

Grocery distribution is the largest potential market for Plastic Pallets both in the U.S.A. and in the emerging markets of Asia, Africa and Latin America.

##### **Automotive:**

Customs made testable are used to ship parts from manufacturing plants and outside vendors to assembly factories and to move pans on the assembly floor.

##### **Postal Services:**

Plastic Pallets are used in transportation of mail and telephone books within mail shipping system.

**Warehousing:**

Plastic Pallets find increasing acceptance in warehousing operations. Plastic Pallets design allows using legs for load support instead of long bars used in standard stringer-type wooden products. Plastic Pallets provide better compatibility with automated material handling systems than wooden products. Plastic Pallets also can be easily stacked to achieve significant savings of valuable warehouse space. Plastic Pallets can also be stored in open areas; sun and rain do not damage it

**Food processing:**

Food processing industry is increasingly using Plastic Pallets because of their superior sanitary properties. Plastic Pallets are resistant to bacteria and fungus that can use wooden products as a substrate for growth. Plastic Pallets can easily be cleaned and returned to the distribution network while wooden products contaminated with bacteria and fungus should be disposed. Increasing safety and sanitary requirements for food processing further encourage use of Plastic Pallets. Recyclable Plastic Pallets can eliminate disposal costs that are constantly growing, especially in countries with scarce laid resources. It increases wooden resources in any country for other more effective usage for wood.

**Agriculture:**

Plastic pallets increases hygienic and bacterial spread in general .Rubber, electronics, building, construction, automotive and freight forwarding industries. These industries changed to a large extent to Plastic Pallets. They found that the saving in transport cost, durability, ease of handling, storage space savings and recycle options of Plastic Pallets save a lot of money and time.

**CONCLUSION****Commingled Plastic Lumber:**

The growth of plastic pallets industry has been phenomenal in the last decade. Plastic pallets are made mainly from recycled thermoplastics. Multi-layer packaging materials are at present non recyclable. Converting such waste materials into plastic pallets not only reduces the burden on landfills but also results in value addition. The addition of various additives to multi-layer waste in different compositions has a remarkable effect on the mechanical and thermal properties of the composition. One major drawback in the methodology followed was that the waste material used was not analyzed for the presence of various polymers and their concentrations that is primarily responsible for variation in physical properties. As the type and concentration of various polymers will differ from source to source (from where the waste is collected), the values for mechanical and



properties so obtained will not hold true if this experiment is repeated again i.e. these values are not generalized. However, the methodology and experimental conditions can be followed with any composition. The methodology followed in this project resulted can be improvised to result in compositions that exhibit better mechanical and thermal properties. For example we can use some compatibilizer to increase the adhesion amongst various polymers present in multi-layered waste plastic materials. Better and more efficient mixers can be used to increase the homogeneity and hence the strength. There are endless options and methods available that are being exploited by industries world over. This may result in a slight increase in cost but the end product is stronger and long lasting.

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