DOWNLOAD PDF DEVELOPMENT OF CORRUGATED FIBER BOARD CARTONS FOR LONG DISTANCE TRANSPORT OF TOMATO IN INDIA

Chapter 1 : Corrugated box design - WikiVisually

Development of Corrugated Fiber Board Cartons for Long Distance Transport of Tomato in India January Tomato growers of Gujarat, north-west India, traditionally send produce to wholesale.

Various methods of packaging- packaging materials and transport Packaging fresh fruits and vegetables is one of the more important steps in the long and complicated journey from grower to consumer. Bags, crates, hampers, baskets, cartons, bulk bins, and palletized containers are convenient containers for handling, transporting, and marketing fresh produce. More than 1, different types of packages are used for produce in the U. Although the industry generally agrees that container standardization is one way to reduce cost, the trend in recent years has moved toward a wider range of package sizes to accommodate the diverse needs of wholesalers, consumers, food service buyers, and processing operations. Packing and packaging materials contribute a significant cost to the produce industry; therefore it is important that packers, shippers, buyers, and consumers have a clear understanding of the wide range of packaging options available. This fact sheet describes some of the many types of packaging, including their functions, uses, and limitations. Also included is a listing, by commodity, of the common produce containers standard to the industry. A significant percentage of produce buyer and consumer complaints may be traced to container failure because of poor design or inappropriate selection and use. A properly designed produce container should contain, protect, and identify the produce, satisfying everyone from grower to consumer. In the near future, almost all produce packaging will be recyclable or biodegradable, or both. Many of the largest buyers of fresh produce are also those most concerned about environmental issues. Variety The trend is toward greater use of bulk packages for processors and wholesale buyers and smaller packages for consumers. There are now more than 1, different sizes and styles of produce packages. Sales Appeal High quality graphics are increasingly being used to boost sales appeal. Multi-color printing, distinctive lettering, and logos are now common. Shelf Life Modern produce packaging can be custom engineered for each commodity to extend shelf life and reduce waste. Containment The container must enclose the produce in convenient units for handling and distribution. The produce should fit well inside the container, with little wasted space. Small produce items that are spherical or oblong such as potatoes, onions, and apples may be packaged efficiently utilizing a variety of different package shapes and sizes. However, many produce items such as asparagus, berries, or soft fruit may require containers specially designed for that item. Bulk packages moved by fork lifts may weigh as much as 1, pounds. Protection The package must protect the produce from mechanical damage and poor environmental conditions during handling and distribution. To produce buyers, torn, dented, or collapsed produce packages usually indicate lack of care in handling the contents. Produce containers must be sturdy enough to resist damage during packaging, storage, and transportation to market. Because almost all produce packages are palletized, produce containers should have sufficient stacking strength to resist crushing in a low temperature, high humidity environment. Although the cost of packaging materials has escalated sharply in recent years, poor quality, lightweight containers that are easily damaged by handling or moisture are no longer tolerated by packers or buyers. Produce destined for export markets requires that containers to be extra sturdy. Air-freighted produce may require special packing, package sizes, and insulation. Marketers who export fresh produce should consult with freight companies about any special packaging requirements. Additionally, the USDA and various state export agencies may be able to provide specific packaging information. Damage resulting from poor environmental control during handling and transit is one of the leading causes of rejected produce and low buyer and consumer satisfaction. Each fresh fruit and vegetable commodity has its own requirements for temperature, humidity, and environmental gas composition. Produce containers should be produce friendly - helping to maintain an optimum environment for the longest shelf life. This may include special materials to slow the loss of water from the produce, insulation materials to keep out the heat, or engineered plastic liners that maintain a favorable mix of oxygen and carbon dioxide. Identification The

package must identify and provide useful information about the produce. It is customary and may be required in some cases to provide information such as the produce name, brand, size, grade, variety, net weight, count, grower, shipper, and country of origin. It is also becoming more common to find included on the package, nutritional information, recipes, and other useful information directed specifically at the consumer. In consumer marketing, pack- age appearance has also become an important part of point of sale displays. The UPCs used in the food industry consist of a ten-digit machine readable code. The first five digits are a number assigned to the specific producer packer or shipper and the second five digits represent specific product information such as type of produce and size of package. Although no price information is included, UPCs are used more and more by packers, shippers, buyers, and Example of a UPC retailers as a fast and convenient method of inventory control and cost accounting. Efficient use of UPCs requires coordination with everyone who handles the package. Types of Packaging Materials Wood Pallets literally form the base on which most fresh produce is delivered to the consumer. Pallets were first used during World War II as an efficient way to move goods. The produce industry uses approximately of the million pallets produced per year in the U. About 40 percent of these are single-use pallets. Because many are of a non-standard size, the pallets are built as inexpensively as possible and discarded after a single use. Although standardization efforts have been slowly under way for many years, the efforts have been accelerated by pressure from environmental groups, in addition to the rising cost of pallets and landfill tipping fees. Over the years, the inch wide, by inch long pallet has evolved as the unofficial standard size. Standardization encourages re-use, which has many benefits. Besides reducing cost because they may be used many times, most pallet racks and automated pallet handling equipment are designed for standard-size pallets. Standard size pallets make efficient use of truck and van space and can accommodate heavier loads and more stress than lighter single-use pallets. Additionally, the use of a single pallet size could substantially reduce pallet inventory and warehousing costs along with pallet repair and disposal costs. The adoption of a pallet standard throughout the produce industry would also aid efforts toward standardization of produce containers. In the early s, an alternative to the pallet was introduced. It is a pallet-size sheet slipsheet of corrugated fiberboard or plastic or a combination of these materials with a narrow lip along one or more sides. Once the packages are in place, they are moved by a specially equipped fork lift equipped with a thin metal sheet instead of forks. Slipsheets are considerably less expensive than pallets to buy, store, and maintain; they may be re-used many times; and they reduce the tare weight of the load. However, they require the use of a special fork-lift attachment at each handling point from packer to retailer. Depending on the size of produce package, a single pallet may carry from 20 to over individual packages. Because these packages are often loosely stacked to allow for air circulation, or are bulging and difficult to stack evenly, they must be secured unitized to prevent shifting during handling and transit. Although widely used, plastic straps and tapes may not have completely satisfactory results. Plastic or paper corner tabs should always be used to prevent the straps from crushing the corners of packages. Plastic stretch film is also widely used to secure produce packages. A good film must stretch, retain its elasticity, and cling to the packages. Plastic film may conform easily to various size loads. It helps protect the packages from loss of moisture, makes the pallet more secure against pilferage, and can be applied using partial automation. However, plastic film severely restricts proper ventilation. A common alternative to stretch film is plastic netting, which is much better for stabilizing some pallet loads, such as those that require forced-air cooling. Used stretch film and plastic netting may be difficult to properly handle and recycle. A very low-cost and almost fully automated method of pallet stabilization is the application of a small amount of special glue to the top of each package. As the packages are stacked, the glue secures all cartons together. This glue has a low tensile strength so cartons may be easily separated or repositioned, but a high shear strength so they will not slide. The glue does not present disposal or recycling problems. Pallet Bins Substantial wooden pallet bins of milled lumber or. Depending on the application, capacities may range from 12 to more than 50 bushels. Although the height may vary, the length and width is generally the same as a standard pallet 48 inches by 40 inches. More efficient double-wide pallet bins 48 inches by 80 inches are becoming more common in some

produce operations. Most pallet bins are locally made; therefore it is very important that they be consistent from lot to lot in materials, construction, and especially size. For example, small differences in overall dimensions Pallet bin can add up to big problems when several hundred are stacked together for cooling, ventilation, or storage. It is also important that stress points be adequately reinforced. The average life of a hardwood pallet bin that is stored outside is approximately five years. When properly protected from the weather, pallets bins may have a useful life of 10 years or more. Uniform voluntary standards for wood pallets and other wood containers are administered by the National Wooden Pallet and Container Association, Washington, DC. Wire-Bound Crates Although alternatives are available, wooden wire-bound crates are used extensively for snap beans, sweet corn and several other commodities that require hydrocooling. Wire-bound crates are sturdy, rigid and have very high stacking strength that is essentially unaffected by water. Wire-bound crates come in many different sizes from half- bushel to pallet-bin size and have a great deal of open space to facilitate cooling and ventilation. Although few are re-used, wire-bound crates may be dissembled after use and shipped back to the packer flat. In some areas, used containers may pose a significant disposal problem. Wirebound crates are not generally acceptable for consumer packaging because of the difficulty in affixing suitable labels. Wooden Crates and Lugs Wooden crates, once extensively used for apples, stone fruit, and potatoes have been almost totally replaced by other types of containers. The relative expense of the container, a greater concern for tare weight, and advances in material handling have reduced their use to a few specialty items, such as expensive tropical fruit. The , , and pound wooden lugs still used for bunch grapes and some specialty crops are being gradually replaced with less costly alternatives. Wooden Baskets and Hampers Wire-reinforced wood veneer baskets and hampers of different sizes were once used for a wide variety of crops from strawberries to sweet potatoes. They are durable and may be nested for efficient transport when empty. However, cost, disposal problems, and difficulty in efficient palletization have severely limited their use to mostly local grower markets where they may be re-used many times. Corrugated Fiberboard Corrugated fiberboard often mistakenly called cardboard or pasteboard is manufactured in many different styles and weights. Because of its relativity low cost and versatility, it is the dominant produce container material and will probably remain so in the near future. The strength and serviceability of corrugated fiberboard have been improving in recent years.

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Chapter 2 : Box - WikiVisually

Abstract - This paper contains an account of the development of corrugated fiber board (CFB) cartons for the transport of tomatoes for the growers of Gujarat, India and Himachal, India.

Brecht, and William Pelletier 2 Introduction Over 47, farms in the state of Florida produce nearly different commodities, most of which are considered specialty crops, defined as fruits and vegetables, tree nuts, dried fruits, horticultural, and nursery crops. The most recent United States Census of Agriculture revealed that For small farmers, delivering fresh, high-quality produce presents significant challenges in regards to handling, storage, and packaging. These challenges may be caused by a lack of access to financial capital, information and knowledge, and proper equipment. To ensure that product quality is maintained throughout the distribution environment, guidelines regarding short-term postharvest storage, packaging, and handling are necessary. For producers, the fruits of their labor culminate with a specific process each season depending on the crop, cultivar, and various environmental conditions. This process, known as the harvest, is the gathering of mature crops or yield from one growing season. The harvest marks the end of the growing season and represents significant social importance to communities as they celebrate its arrival each year. However, harvest time also creates challenges for producers trying to deliver fresh, high-quality produce to market. If not dealt with correctly, these challenges become barriers within the distribution chain, resulting in loss of revenue. Optimum postharvest practices for a given commodity serve to establish appropriate cold chains that maintain optimal temperatures, relative humidity, and slowing of respiration rates and ethylene production while utilizing appropriate packaging and following safety and sanitation protocols. Indeed, it is the postharvest handling activities that maintain fruit quality as fresh produce travels throughout the supply chain. However, depending on the size of the farming operation and its economic situation, different specific practices are most appropriate to achieve these ends. The objective of this publication is to provide postharvest storage, packaging, and handling recommendations for small farm specialty crop producers that sell directly to consumers and through institutional marketing channels such as schools that participate in Farm to School F2S programs. These programs benefit children by providing them with healthy, nutritious fresh fruits and vegetables while offering producers alternative marketing opportunities and reducing price uncertainty. Regardless of where a product is sold, proper handling and food safety practices must be observed. With these considerations, this publication serves as a general guideline for small farm specialty crop producers involved in the short-term storage, packaging, and handling of a variety of specialty crops commonly grown within the state of Florida. The recommendations in this publication are not intended to replace a comprehensive postharvest food safety plan. Postharvest and Storage Management Fruit and vegetable growers work diligently to ensure that they bring the best quality products to market. They possess the necessary skills to improve the value of their crops during the growing season. However, once the harvest begins, good postharvest handling practices must be used to safeguard the product throughout the distribution environment. According to Watkins and Nock , the primary objective of postharvest handling is to maintain quality by reducing metabolic rates that result in undesirable changes in color, composition, texture, flavor and nutritional status, and undesirable growth such as sprouting or rooting; reducing water loss that results in wilting, shriveling, softening, and loss of salable weight and crispness; minimizing bruising, friction damage, and other mechanical injuries; reducing spoilage caused by decay, especially of damaged or wounded tissues, and preventing contamination by human pathogens that can cause food poisoning; and preventing development of freezing injury or physiological disorders, such as chilling injury or senescent i. Products should always be harvested, if possible, when they are free of moisture, or they should be immediately dried off after harvest. Prolonged wetness almost always leads to a wide range of problems, such as excessive decay, mold, and cosmetic blemishes that render the product unsalable. Proper ventilation and maintaining proper relative humidity during storage are essential to maintaining the highest possible postharvest quality.

Postharvest Ripening and Maturation A fruit is the mature ovary of a plant, whereas a vegetable is considered the edible portion of an herbaceous plant, such as the leaf, stem, root, tuber, bulb, immature fruit, or flower. Some fruits are commonly referred to and marketed as vegetables. Examples of ripe fruits typically categorized as vegetables are tomato, pepper, and acorn squash, and examples of immature fruits categorized as vegetables are okra, summer squash, and snap bean. Normally, fruit are regarded as fleshy, sweet structures with seeds, whereas vegetables are other edible parts of the plant. Many times plants may be categorized as a fruit or a vegetable such as with tomato. It often depends on whether a plant is described in biological terms or is being used for culinary purposes. Producers are often concerned with the quality of their crops and the development of horticulturally mature fruits and vegetables. As a result, this guide will refer to fruits and vegetables in regards to the biological processes that affect their quality and not in reference to their culinary meaning. For the purpose of this guide, fruits and vegetables are considered to be the horticulturally mature, edible portions of a plant intended for distribution. Fruits are classified in terms of two categories, 1 climacteric and 2 nonclimacteric fruits and vegetables, based on differences in their patterns of respiration and ethylene production that impact their optimum postharvest handling practices Rees et. Climacteric fruits are those whose ripening is accompanied by a distinguishable increase in the respiration rate and is generally associated with elevated ethylene production, ethylene being the natural ripening hormone in plants. After the respiration and ethylene production rates peak the climacteric peaks , both decrease significantly. Examples of climacteric fruits commonly grown in Florida are tomatoes, avocados, peaches, and muskmelons. Nonclimacteric fruits do not exhibit this behavior; but rather, the respiration rate undergoes a gradual decline during ripening and aging, and there is no increase in ethylene. Examples of nonclimacteric fruits commonly grown in Florida are citrus, grapes, strawberries, peppers, and watermelons. The respiration rate differs markedly among different fruits and vegetables, reflecting the intensity of the metabolic processes that they are undergoing Saltveit Thus, the respiration rate is strongly related to the relative perishability of different crops, with those harvested when fully mature tending to be less perishable than those harvested when immature and undergoing rapid developmental changes. Temperature, in addition to stage of development, strongly influences plant metabolism, and thus respiration rate. Respiration rates are also strikingly elevated when stress or physical injury is inflicted on the product. As seen in Figure 1, the respiration rate, as measured by carbon dioxide production, increases during ripening in climacteric fruits before reaching a peak and ultimately entering a post-climacteric decline. Nonclimacteric fruits and vegetables do not undergo this process. Climacteric and nonclimacteric patterns of respiration in ripening fruit. Adapted from Salveit Although climacteric fruits can be left to ripen on the plant, they often are not because the ripe fruit is more difficult to handle successfully. On the other hand, nonclimacteric fruits will not ripen once picked and therefore must be allowed to ripen on the plant before harvest. Because of their ripening behavior, when climacteric fruits can be harvested mature but unripe, the onset of ethylene production and ripening rate is delayed, and the fruit can be stored for extended periods of time or transported over relatively long distances. Some fruits are exposed to ethylene gas to initiate more uniform ripening e. Not all climacteric fruits benefit from being harvested mature but unripe. Blueberriesâ€”although climacteric, must ripen fully on the plant to attain acceptable flavor. Employing these strategies with climacteric fruits can prove to be advantageous when products require longer storage durations, transportation over great distances, or when growers want to take advantage of favorable market conditions. The storage life of commodities varies inversely with the respiration rate, which itself increases with an increase in temperature. In other words, the higher the temperature, the greater the respiration rate, and the more rapidly the commodity deteriorates, which reduces shelf life. The respiration rates for a given temperature and the ethylene production for selected Florida-grown commodities are listed in Table 2. Higher-ethylene-producing commodities such as avocadoes should not be stored near ethylene-sensitive crops, such as broccoli, celery, or watermelons, or any unripe climacteric fruits that one wishes to keep from ripening. Similarly, commodities that produce medium or moderate amounts of ethylene, such as tomatoes or cantaloupes, should be kept away from ethylene-sensitive commodities. In

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USDA Handbook 66, Salveit provides a summary of respiration rates for nearly all fruits and vegetables over a range of temperatures and indicates their relative ethylene production rates. Warm temperatures are required for production, but they can be detrimental to commodities during postharvest handling, promoting spoilage, waste, and ultimately a loss of revenue. Among the various factors that affect the quality of fresh produce, temperature is without a doubt the most important. Failing to cool products will increase the rate of respiration and thus the rate of senescence, or aging, and related deterioration. Methods for rapidly cooling fresh fruits and vegetables to remove field heat and the appropriateness of the different methods for various commodities are described later in this guide. Mathematically, the Q10 value is defined as the following: In most postharvest applications, the Q10 value is often used as an evaluation method for predicting the effect of a temperature increase on respiration rates and, inversely, on shelf life. Therefore, if the Q10 is 2. If the producer wishes to promote or facilitate fruit ripening, it may be desirable to maintain produce at warmer temperatures, but unless the goal is to speed ripening, warm temperatures should be avoided at all costs. For small-scale producers, appropriate practices for managing postharvest temperatures can include harvesting crops during cooler times of the day, such as early morning even before dawn , immediately moving the harvested product out of direct sunlight and, in the absence of refrigeration, quickly transporting the produce to a cool storage area such as an insulated structure. The higher the harvest temperature, and the higher the respiration rate and Q10 of the product, the more critical postharvest temperature management becomesâ€”and the more of a priority it should be for a small farmer to invest in refrigerated storage. With regard to refrigerated storage, small window air conditioning units are relatively inexpensive; therefore, small-scale producers may find it advantageous to purchase a window unit and retrofit one into their storage facilities. These can be used in a variety of buildings such as insulated storage sheds or garages, marine cargo containers, or other similar facilities. Additionally, moisture loss can be mitigated by placing plastic liners over stacked boxes of product. While changes in temperature will affect the respiration rates of fruits and vegetables, extreme temperatures can also cause physiological damage to fresh horticultural products, depending on the commodity. Commodities vary considerably in their temperature tolerance Food and Agriculture Organization of the United Nations Symptoms of extreme heat injury in produce include bleaching, surface burning or scalding, uneven ripening, excessive softening, and desiccation water loss. Higher-than-recommended temperatures may be satisfactory for certain commodities in short-term storage conditions, but over longer terms will almost certainly damage produce. For example, warmer temperatures with high humidity may promote healing, such as with storage potatoes, but potato tubers intended for fresh market become extremely susceptible to bacterial soft rot if held at normal late spring or summer-time temperatures. Similarly, for some tropical and subtropical crops, extreme cold temperatures can result in chilling injury. The optimum postharvest temperature for most fruits and vegetables is the lowest temperature that does not freeze the commodity. But some commodities are susceptible to chilling injury, which occurs at temperatures above freezing, but below a characteristic threshold temperature. It is important to know that this injury is cumulative, with multiple low temperature exposures, even before harvest, contributing to development of chilling injury symptoms. Chilling injury symptoms may include pitting, surface decay, internal browning, surface scald, as well as poor flavor, aroma, and color Wilson, Boyette, and Estes These symptoms may take some time to develop. For chilling-sensitive crops, such as tomatoes, peppers, squash, eggplants, and citrus fruits, the optimum postharvest temperature shown in Table 1 is the chilling threshold temperature. Recommendations for optimum postharvest temperatures for additional fresh fruits and vegetables can be found in USDA Handbook 66 United States Department of Agriculture Fruit and Vegetable Packaging There are as many types of packages available as there are products to put in them. Packaging systems are available in a variety of materials such as plastic, corrugated fiberboard, wood, and even sustainable materials such as bioplastics and fibers that decompose. One of the most common plastic packaging containers is the clear clamshell, manufactured from polyethylene terephthalate PET and other plastics using mechanical or vacuum thermoforming. Although plastic containers are necessary for certain

commodities, corrugated and non-corrugated fiberboard is the dominant material used in fresh produce packaging. Wooden containers, usually wirebound, are a traditional form of produce packaging. They are an option for growers, although their use has gradually diminished over time because they are relatively heavy, expensive, and abrasive to the fruits and vegetables, and because they can present disposal issues. Sustainable packaging options are becoming increasingly more common and offer many advantages over traditional packaging containers. While beneficial to some, they are not appropriate for every operation. While there are a variety of functional packaging options available to growers of fresh fruits and vegetables, it is important to select the appropriate format for each specific commodity. Regardless of the material used, for a given commodity, it is important to use standard packaging sizes during the postharvest process so that growers can readily calculate total harvest by weight, count, and volume and thus more easily communicate production volumes to their buyers Daniels and Slama Also, some buyers require that packaging footprints conform to the dimensions of the standard grocery pallet, which measures 40 x 48 inches Packaging plays an important role in the fruit and vegetable distribution chain.

Chapter 3 : HORT :: Lecture 09

Girja Sharan & S Srivastav & Kishor P Rawale & Umang Dave, "Development of Corrugated Fiber Board Cartons for Long Distance Transport of Tomato in India," IIMA Working Papers WP, Indian Institute of Management Ahmedabad, Research and Publication Department.

Often designs are made with Computer Aided Design programs connected to automated sample making tables. Several design and construction options might be considered. Structural design is matched with graphic design. For consumer based designs, marketing personnel sometimes use Focus groups or more quantitative means of assessing acceptance. Test markets are employed for major programs. The process starts by making corrugated board on a corrugating line, a long series of linked machines which may be in size of a football field. A finished piece of singlewall corrugated board is a single corrugated layer sandwiched between two liners. Printing dies and patterns are prepared on large, flexible, rubber or tin sheets. They are loaded onto rollers and the box blanks are fed through it, where each is trimmed, printed, cut, scored, folded, and glued to form a box. Finished boxes are then stacked and sent to a banding machine to be wrapped and shipped. All flaps are the same length from score to edge. Typically the major flaps meet in the middle and the minor flaps do not, unless the width is equal to the length. A regular slotted container is coded The box is shipped flat knocked down to the packager who sets up the box, fills it, and closes it for shipment. Box closure may be by tape, adhesive, staples, strapping , etc. Many other styles of corrugated boxes and structures are available: Full-overlap flaps provide extra stacking strength and edge protection. They are useful when an open-top container is desired. HSCs can be used to create a telescope box. A Full Telescope Box has two fully telescoping sections. The sections may be formed by staples, die-cut locks, adhesive, etc. A Partial Telescope Box has two sections. The top telescopes partially over the bottom. Commonly used for holding printing paper. A corrugated tray is often used for display purposes or used with a shrink wrap Corrugated corner pads can be used for product support and cushioning Special die-cut shapes have almost endless designs and uses. The size of a box can be measured for either internal for product fit or external for handling machinery or palletizing dimensions. Boxes are usually specified and ordered by the internal dimensions. Wholesale outlet using corrugated boxes to stock shelves. Bag-In-Box containing liquids to dispense Box lug used for fruit. Box needs to be open to allow respiration and access to cold chain. Tabs interlock when stacked on pallet. Note security tape used as closure Telescope box used for bananas. Note hand holes and ventilation holes Die-cut folder for a faucet Corner cut carton for beverage cans [7] Corrugated box, inner corrugated support, and cushioning for hard drive Take-out Pizza in a die-cut folder Display box for cans of cookies Display boxes for bottles of juice Main article: Shelf-ready packaging Retailers often ask for merchandise to be delivered to them in shipping containers which allow the easy stocking of full case loads. The goal is to put the case directly onto shelves and stocking locations without individually handling the unit packs or primary packages. Retailers often require products to come in shelf -ready packaging to reduce stocking costs and save labor expenses. Several specialized box designs are available. Packages designed for controlled shipments of uniform pallet loads may not be suited to mixed shipments with express carriers. Many items are shipped individually in part or entirely by express carrier, mail, or other mixed logistics systems. The demands of multiple manual handlings, automated sortation, and uncontrolled stacking in trucks or air containers put severe stress on boxes, box closures, and the contents. Boxes designed for unit load handling and storage may not be suited to mixed logistics systems. Less than truckload shipping puts more stress on corrugated shipping containers than shipment by uniform pallet loads in trucks or intermodal containers. Boxes sometimes need to be heavier construction to match the needs of the distribution system. Government, military, and export[edit] Many items being supplied to governments are handled very well: Special box specifications for government shipments are often applicable. Weather-resistant fiberboards, box construction, box closure, and unitizing are needed. Water-resistant boxes closed with strapping. Military mail and supplies being sorted on an aircraft

carrier Humanitarian aid bottled water being handled by military personnel: Half slotted containers with hand-holes Humanitarian aid in bulk boxes or bins Export[edit] Many international shipments are handled very well: Break bulk cargo needs to be water resistant and heavy duty. Even shipments initially sent via intermodal freight transport may have subsequent logistics operations that are extreme and uncontrolled. The specific conditions in the destination port and the country of use need to be considered for design of export boxes. Dangerous and hazardous goods[edit] Doublewall box with dividers for shipping four bottles of corrosive liquid Shipment of dangerous goods or hazardous materials are highly regulated. Based on the UN Recommendations on the Transport of Dangerous Goods model regulations, each country has coordinated design and performance requirements for shipment. Corrugated boxes are described in 4G requirements. Performance severe drop test, etc. Some carriers have additional requirements. Box closure[edit] The means of closing a box is an important aspect of design. It affects the types of equipment available to production lines, the measured laboratory performance, the field performance, and the ability of end-users to easily and safely open the box. Adhesive , water based or hot-melt adhesive -Adhesives are applied manually or by machine. Staples - staples are used to attach the box flaps. Taping is done either manually or by semi automatic machine. Water activated gummed paper - it consist of a heavy paper in which adhesive is applied and dried,when water is applied to it adhesive tackeness and binding ability is again generated. However, the packed box will be protected from environment as it will work as a barrier. Packaging Technology and Science.

Chapter 4 : Development of Corrugated Fiber Board Cartons for Long Distance Transport of Tomato in Ind

Girja Sharan & Srivastav S & Kishor P Rawale & Umang Dave, "Development of Corrugated Fiber Board Cartons for Long Distance Transport of Tomato in India," Working Papers id, eSocialSciences.

Typical blank for folding carton Folding carton with circular security tape seal Partially open carton showing tuck flap and locking tab tongue The folding carton created the packaging industry as it is known today, beginning in the late 19th century. The process involves folding carton made of paperboard that is printed, laminated , cut, then folded and glued before transport to packagers. The cartons are shipped flat to a packager, which has its own machinery to fold the carton into its final shape as a container for a product. The classic example of such a carton is a cereal box. Some styles of folding cartons can be made of E-flute or micro-flute corrugated fiberboard. Invention and development In the s, cartons were made by hand and held together with tacks and string , and used only for expensive items such as jewelry. Although Charles Henry Foyle is described by some as the "inventor" of the paper carton, mass production of the cartons was invented, partly by accident, at the Robert Gair Company in Brooklyn, New York. Machinery at the end of the press had been set up carelessly by a pressman, and machinery cut through the material. This ruined the press but gave them an idea: Previously, cutting of printed cardboard had been done manually. From the mistake in , Gair developed a process for mass production of boxes. In , the National Biscuit Company Nabisco became the first large company to adopt the new cartons, for Uneeda Biscuits. Other manufacturers soon followed. With inexpensive packaging now even common items could be placed in a showy carton and each carton became its own advertisement. The product was also protected, and the contents had a longer shelf life. This trend was to continue with force, through the 20th century. Typically, cylinder board made from pulp from reprocessed scrap paper is used for most packages. Cartons for food are made from a higher grade and lighter solid sulfate board with plastic coating. Because of the limitations of cutting machinery, the thickness of the board is limited to 0. Opening Opening a carton can be accomplished by opening an access flap, cutting, use of tear tapes or perforations.

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Chapter 5 : Fiberboard - WikiVividly

Tomato growers of Gujarat, north-west India, traditionally send produce to wholesale market in Ahmedabad city for auction. Growing areas lie about km from the city. Growers were constrained to sell there even if the prices were not attractive which the case usually as season advanced was.

Engineered wood â€" These products are engineered to precise design specifications which are tested to meet national or international standards. Engineered wood products are used in a variety of applications, from construction to commercial buildings to industrial products. The products can be used for joists and beams that replace steel in building projects. Typically, engineered products are made from the same hardwoods and softwoods used to manufacture lumber. Sawmill scraps and other wood waste can be used for engineered wood composed of particles or fibers. Some engineered wood products, like oriented strand board, can use trees from the poplar family, flat pack furniture is typically made out of man-made wood due to its low manufacturing costs and its low weight, making it easy to transport. Plywood, wood panel, is sometimes called the original engineered wood product. Other structural wood panels include oriented strand board and structural composite panels, particle board is manufactured from wood chips, sawmill shavings, or even sawdust, and a synthetic resin or other suitable binder, which is pressed and extruded. Oriented strand board, also known as flakeboard, waferboard, or chipboard, is similar, particle board is cheaper, denser and more uniform than conventional wood and plywood and is substituted for them when cost is more important than strength and appearance. A major disadvantage of particleboard is that it is prone to expansion and discoloration due to moisture. The individual layers are cross-oriented to provide strength and stiffness to the panel, produced in huge, continuous mats, OSB is a solid panel product of consistent quality with no laps, gaps or voids. Glulam can also be produced in curved shapes, offering extensive design flexibility, Laminated veneer lumber is produced by bonding thin wood veneers together in a large billet. The grain of all veneers in the LVL billet is parallel to the long direction, the resulting product features enhanced mechanical properties and dimensional stability that offer a broader range in product width, depth and length than conventional lumber. Cross-Laminated Timber is a versatile multi-layered panel made of lumber, each layer of boards is placed cross-wise to adjacent layers for increased rigidity and strength. CLT can be used for long spans and all assemblies, e. Parallel strand lumber consists of long veneer strands laid in parallel formation, PSL is a member of the structural composite lumber family of engineered wood products. Laminated strand lumber and oriented strand lumber are manufactured from flaked wood strands that have a high length-to-thickness ratio, combined with an adhesive, the strands are oriented and formed into a large mat or billet and pressed 2. Plywood â€" Plywood is a sheet material manufactured from thin layers or plies of wood veneer that are glued together with adjacent layers having their wood grain rotated up to 90 degrees to one another. It is a wood from the family of manufactured boards which includes medium-density fibreboard. All plywoods bind resin and wood fibre sheets to form a composite material, there is usually an odd number of plies, so that the sheet is balancedâ€"this reduces warping. In Samuel Bentham applied for patents covering several machines to produce veneers, in his patent applications, he described the concept of laminating several layers of veneer with glue to form a thicker piece â€" the first description of what we now call plywood. Samuel Bentham was a British naval engineer with many shipbuilding inventions to his credit. Veneers at the time of Bentham were flat sawn, rift sawn or quarter sawn, i. One can thus presume that rotary lathe plywood manufacture was a process in France in the s. Plywood was introduced into the United States in and industrial production started shortly after, in , the first standard-sized 4 ft by 8 ft plywood sheets were introduced in the United States for use as a general building material. Artists use plywood as a support for paintings to replace traditional canvas or cardboard. Ready-made artist boards for oil painting in three-layered plywood were produced, in India, plywood is more commonly called Kitply after a leading brand which pioneered the concept of waterproof plywood in the early s. A typical plywood panel has face veneers of a higher grade than the core veneers, the

principal function of the core layers is to increase the separation between the outer layers where the bending stresses are highest, thus increasing the panels resistance to bending. As a result, thicker panels can span greater distances under the same loads, in bending, the maximum stress occurs in the outermost layers, one in tension, the other in compression. Bending stress decreases from the maximum at the layers to nearly zero at the central layer. Shear stress, by contrast, is higher in the center of the panel, the most common dimension is 1. Plies vary in thickness from 1. Furniture â€" Furniture refers to movable objects intended to support various human activities such as seating, eating, and sleeping. Furniture is also used to hold objects at a convenient height for work, Furniture can be a product of design and is considered a form of decorative art. In addition to furnitures functional role, it can serve a symbolic or religious purpose and it can be made from many materials, including metal, plastic, and wood. Furniture can be using a variety of woodworking joints which often reflect the local culture. People have been using natural objects, such as stumps, rocks and moss. Archaeological research shows that from around 30, years ago, people began constructing and carving their own furniture, using wood, stone, early furniture from this period is known from artwork such as a Venus figurine found in Russia, depicting the goddess on a throne. The first surviving extant furniture is in the homes of Skara Brae in Scotland, complex construction techniques such as joinery began in the early dynastic period of ancient Egypt. This era saw constructed wooden pieces, including stools and tables, sometimes decorated with valuable metals or ivory. The evolution of furniture design continued in ancient Greece and ancient Rome, with thrones being commonplace as well as the klinai, multipurpose couches used for relaxing, eating, the furniture of the Middle Ages was usually heavy, oak, and ornamented. Furniture design expanded during the Italian Renaissance of the fourteenth and fifteenth century, the seventeenth century, in both Southern and Northern Europe, was characterized by opulent, often gilded Baroque designs. The nineteenth century is defined by revival styles. The first three-quarters of the century are often seen as the march towards Modernism. One unique outgrowth of post-modern furniture design is a return to natural shapes and textures, the English word furniture is derived from the French word fourniture, the noun form of fournir, which means to supply or provide. Thus fourniture in French means supplies or provisions, the practice of using natural objects as rudimentary pieces of furniture likely dates to the beginning of human civilisation. Early humans are likely to have used tree stumps as seats, rocks as rudimentary tables, during the late palaeolithic or early neolithic period, from around 30, years ago, people began constructing and carving their own furniture, using wood, stone, and animal bones. The earliest evidence for the existence of constructed furniture is a Venus figurine found at the Gagarino site in Russia, a similar statue of a Mother Goddess was found in Catal Huyuk in Turkey, dating to between and BC. The inclusion of such a seat in the figurines implies that these were already common artefacts of that age, a range of unique stone furniture has been excavated in Skara Brae, a Neolithic village in Orkney, Scotland. Each house shows a degree of sophistication and was equipped with an extensive assortment of stone furniture, ranging from cupboards, dressers and beds to shelves, stone seats 4. Wood â€" Wood is a porous and fibrous structural tissue found in the stems and roots of trees, and other woody plants. It is a material, a natural composite of cellulose fibers which are strong in tension embedded in a matrix of lignin which resists compression. Wood is sometimes defined as only the secondary xylem in the stems of trees, in a living tree it performs a support function, enabling woody plants to grow large or to stand up by themselves. It also conveys water and nutrients between the leaves, other growing tissues, and the roots, Wood may also refer to other plant materials with comparable properties, and to material engineered from wood, or wood chips or fiber. In , the stock of forests worldwide was about billion cubic meters. As an abundant, carbon-neutral renewable resource, woody materials have been of intense interest as a source of renewable energy, in approximately 3. Dominant uses were for furniture and building construction, a discovery in the Canadian province of New Brunswick discovered the earliest known plants to have grown wood, approximately to million years ago. Wood can be dated by carbon dating and in species by dendrochronology to make inferences about when a wooden object was created. People have used wood for millennia for many purposes, primarily as a fuel or as a material for making houses, tools, weapons, furniture,

packaging, artworks. Constructions using wood date back ten thousand years, buildings like the European Neolithic long house were made primarily of wood. Recent use of wood has changed by the addition of steel. The year-to-year variation in tree-ring widths and isotopic abundances gives clues to the climate at that time. This process is known as growth, it is the result of cell division in the vascular cambium, a lateral meristem. These cells then go on to form thickened secondary cell walls, composed mainly of cellulose, hemicellulose, if the distinctiveness between seasons is annual, these growth rings are referred to as annual rings. Where there is little seasonal difference growth rings are likely to be indistinct or absent, if the bark of the tree has been removed in a particular area, the rings will likely be deformed as the plant overgrows the scar. It is usually lighter in color than that near the portion of the ring. The outer portion formed later in the season is known as the latewood or summerwood. However, there are differences, depending on the kind of wood 5. Packaging and labeling â€" Packaging is the technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of designing, evaluating, Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, in many countries it is fully integrated into government, business, institutional, industrial, and personal use. Package labeling or labelling is any written, electronic, or graphic communication on the package or on a separate but associated label. The first packages used the materials available at the time, baskets of reeds, wineskins, wooden boxes, pottery vases, ceramic amphorae, wooden barrels, woven bags. Processed materials were used to form packages as they were developed, for example, early glass, the study of old packages is an important aspect of archaeology. The use of tinplate for packaging dates back to the 18th century, by , John Hanbury had a rolling mill at Pontypool for making Pontypoole Plates. The method pioneered there of rolling iron plates by means of cylinders enabled more uniform black plates to be produced than was possible with the practice of hammering. Tinplate boxes first began to be sold from ports in the Bristol Channel in , the tinplate was shipped from Newport, Monmouthshire. By ,80, boxes were made and 50, exported, tobacconists in London began packaging snuff in metal-plated canisters from the s onwards. With the discovery of the importance of airtight containers for food preservation by French inventor Nicholas Appert, after receiving the patent, Durand did not himself follow up with canning food. By , they were producing the first canned goods for the Royal Navy, the progressive improvement in canning stimulated the invention of the can opener. In , another lever-type opener of a complex shape was patented in the United States by Ezra Warner of Waterbury. Set-up boxes were first used in the 16th century and modern folding cartons date back to , the first corrugated box was produced commercially in in England. Corrugated paper received a British patent in and was used as a liner for tall hats, scottish-born Robert Gair invented the pre-cut paperboard box in â€"flat pieces manufactured in bulk that folded into boxes. Gair discovered that by cutting and creasing in one operation he could make prefabricated paperboard boxes, commercial paper bags were first manufactured in Bristol, England, in , and the American Francis Wolle patented a machine for automated bag-making in Packaging advancements in the early 20th century included Bakelite closures on bottles, transparent cellophane overwraps and these innovations increased processing efficiency and improved food safety. As additional materials such as aluminum and several types of plastic were developed, they were incorporated into packages to improve performance, in , Michigan State University became the first university in the world to offer a degree in Packaging Engineering 6. Paper mill â€" A paper mill is a factory devoted to making paper from vegetable fibres such as wood pulp, old rags and other ingredients. While the use of human and animal powered mills was known to Chinese and Muslim papermakers, the general absence of the use of water-power in Muslim papermaking is suggested by the habit of Muslim authors to call a production center not a mill, but a paper manufactory. Although scholars have identified paper mills in Abbasid-era Baghdad in â€", in the Moroccan city of Fez, Ibn Battuta speaks of mill stones for paper. Since Ibn Battuta does not mention the use of water-power and such a number of water-mills would be grotesquely high, the passage is generally taken to refer to human or animal force. An exhaustive survey of milling in Al-Andalus did not uncover a single water-powered paper mill, Burns remains

altogether sceptical given the isolated occurrence of the reference and the prevalence of manual labour in Islamic papermaking elsewhere. Likewise, the identification of early hydraulic stamping mills in medieval documents from Fabriano, the earliest certain evidence to a water-powered paper mill dates to in the Spanish Kingdom of Aragon. A decree by the Christian king Peter III addresses the establishment of a royal molendinum, the first permanent paper mill north of the Alps was established in Nuremberg by Ulman Stromer in , it is later depicted in the lavishly illustrated Nuremberg Chronicle. From the midth century onwards, European paper milling underwent an improvement of many work processes. The size of a paper mill prior to the use of machines was described by counting the number of vats it had. Thus, a one vat paper mill had only one vatman, one coucher, by the early 20th century, paper mills sprang up around New England and the rest of the world, due to the high demand for paper. At this time, there were many leaders of the production of paper, one of such was the Brown Company in Berlin. By the late 20th and early 21st-century, paper began to close. Due to the addition of new machinery, many millworkers were laid off, Paper mills can be fully integrated mills or nonintegrated mills.

Chapter 6 : Development of Corrugated Fiber Board Cartons for Long Distance Transport of Tomato in Ind

Development of Corrugated Fiber Board Cartons for Long Distance Transport of Tomato in India Girja Sharan S. Srivastav Kishor P. Rawale Umang Dave W.P. No November

Increasing relative humidity Throughout the period between harvest and consumption, temperature control has been found to be the most important factor in maintaining product quality. Fruits, vegetables and cut flowers are living, respiring tissues separated from the parent plant. Keeping products at their lowest safe temperature 0 C or 32 F for temperate crops or C or F for chilling sensitive crops will increase storage life by lowering respiration rate, decreasing sensitivity to ethylene and reducing water loss. Reducing the rate of water loss slows the rate of shriveling and wilting, causes of serious postharvest losses. It is important to avoid chilling injury, since symptoms include failure to ripen bananas and tomatoes , development of pits or sunken areas oranges, melons and cucumbers , brown discoloration avocados, cherimoyas, eggplant , increased susceptibility to decay cucumbers and beans , and development of off-flavors tomatoes Shewfelt, If a ready supply of electricity is available, mechanical refrigeration systems provide the most reliable source of cold. Methods include room cooling, forced-air cooling and evaporative cooling. A variety of portable forced-air coolers have been designed for use by small-scale growers and handlers Talbot and Fletcher, ; Rij et al, ; Parsons-and Kasmire, However, a variety of simple methods exist for cooling produce where electricity is unavailable or too expensive. Some examples of alternative systems from Thompson in Kader, include night air ventilation, radiant cooling, evaporative cooling, the use of ice and underground root cellars, field clamps, caves or high altitude storage. Cooling involves heat transfer from produce to a cooling medium such as a source of refrigeration. Heat transfer processes include conduction, convection, radiation and evaporation. Several simple practices are useful for cooling and enhancing storage system efficiency wherever they are used, and especially in developing countries, where energy savings may be critical. Shade should be provided over harvested produce, packing areas, for buildings used for cooling and storage and for transport vehicles. Using shade wherever possible will help to reduce the temperatures of incoming produce. Trees are a fine source of shade and can reduce ambient temperatures around packinghouses and storage areas. Light colors on buildings will reflect light and heat and reduce heat load. Sometimes spending money will save money, as when purchasing lighting equipment. High pressure sodium lights produce less heat and use less energy than incandescent bulbs. Another aspect to consider when handling fruits and vegetables is the relative humidity of the storage environment. Loss of water from produce is often associated with a loss of quality, as visual changes such as wilting or shrivelling and textural changes can take place. If using mechanical refrigeration for cooling, the larger the area of the refrigerator coils, the higher the relative humidity in the cold room will remain. It pays however, to remember that water loss may not always be undesirable, for example if produce is destined for dehydration or canning. For fresh market produce, any method of increasing the relative humidity of the storage environment or decreasing the vapor pressure deficit VPD between the commodity and its environment will slow the rate of water loss. The best method of increasing relative humidity is to reduce temperature. Another method is to add moisture to the air around the commodity as mists, sprays, or, at last resort, by wetting the store room floor. Another way is to use vapor barriers such as waxes, polyethylene liners in boxes, coated boxes or a variety of inexpensive and recyclable packaging materials. The liner vents must line up with the package vents to facilitate cooling of the produce inside. Vented liners will decrease VPD without seriously interfering with oxygen, carbon dioxide and ethylene movement. Room cooling Room cooling is a relatively low cost but slow method of cooling when electricity for mechanical refrigeration is available. It is important to leave adequate space between the stacks of boxes inside the refrigerated room in order for produce to cool more quickly. Stacks should be narrow, about one pallet width in depth. Air circulating through the room passes over surfaces and through any open space, so cooling from the outside to the center of the stacks is mostly by conduction. See Mitchell in Kader, for more information. Low cost cold

rooms can be constructed using concrete for floors and polyurethane foam as an insulator. Building the storeroom in the shape of a cube will reduce the surface area per unit volume of storage space, thereby reducing construction and refrigeration costs. All joints should be calked and the door should have a rubber seal. Coolroom construction for the fruit and vegetable grower. Department of Agriculture and Fisheries, South Australia. Forced-air cooling Forced-air cooling pulls or pushes air through the storage containers themselves, greatly speeding the cooling rate of any type of produce. Many types of forced-air coolers can be designed to move cold moist air over the commodities. The example provided below is a fixed unit, where a fan is housed inside the wall of a cold room Cold wall forced-air cooler: A portable forced-air cooler can be constructed using a canvas or polyethylene sheet. This unit is designed to be used inside a refrigerated storage room. A portable forced-air cooler: Forced-air unit to rapidly cool small lots of packaged produce. The illustrations below show two types of forced-air coolers. Each is equipped with a fan to pull air from the cold room through the boxed produce. The illustration below shows the recommended pattern of vents for cartons used to hold produce that is to be forced-air cooled. A few large vents 1. Commercial cooling of fruits and vegetables. Hydro-cooling Hydro-cooling provides fast, uniform cooling for some commodities. The commodity as well its packaging materials must be tolerant of wetting, chlorine used to sanitize the hydro-cooling water and water beating damage Mitchell in Kader, The simplest version of a hydro-cooler is a tank of cold water in which produce is immersed. The type shown below showers a batch of produce with icy water as the produce moves along a conveyor. A batch-type hydro-cooler can be constructed to hold entire palletloads of produce Thompson in Kader, Conveyors can be added to help control the time produce stays in contact with the cold water.

Chapter 7 : Crush Tester - Manufacturers, Suppliers & Exporters in India

The book Complete Manufacturing Technology Book on Corrugated Boxes, Folding Cartons, Lined Cartons, Corrugating Starch Adhesives and Glueing Systems with project Profiles covers Corrugated Containers, Types of Paper Board, Composition of Multiply Paperboard, Rotogravure Printing of Paperboard, Cutting and Creasing with Glueing and Sealing, Types of Paper and Containerboard Grades and Tests.

Woodworking â€" Woodworking is the activity or skill of making items from wood, and includes cabinet making, wood carving, joinery, carpentry, and woodturning. Along with stone, clay and animal parts, wood was one of the first materials worked by early humans, microwear analysis of the Mousterian stone tools used by the Neanderthals show that many were used to work wood. The development of civilization was closely tied to the development of increasingly greater degrees of skill in working these materials, among early finds of wooden tools are the worked sticks from Kalambo Falls, Clacton-on-Sea and Lehringen. Examples of Bronze Age wood-carving include tree trunks worked into coffins from northern Germany and Denmark, there is significant evidence of advanced woodworking in Ancient Egypt. Woodworking is depicted in extant ancient Egyptian drawings, and a considerable amount of ancient Egyptian furniture has been preserved. Tombs represent a collection of these artefacts and the inner coffins found in the tombs were also made of wood. The metal used by the Egyptians for woodworking tools was originally copper and eventually, commonly used woodworking tools included axes, adzes, chisels, pull saws, and bow drills. Mortise and tenon joints are attested from the earliest Predynastic period and these joints were strengthened using pegs, dowels and leather or cord lashings. Animal glue came to be used only in the New Kingdom period, Ancient Egyptians invented the art of veneering and used varnishes for finishing, though the composition of these varnishes is unknown. Woodworking was essential to the Romans and it provided, sometimes the only, material for buildings, transportation, tools, and household items. Vitruvius dedicates a chapter of his De architectura to timber. Pliny, while not a botanist, dedicated six books of his Natural History to trees and woody plants which provides a wealth of information on trees, the progenitors of Chinese woodworking are considered to be Lu Ban and his wife Lady Yun, from the Spring and Autumn period. Lu Ban is said to have introduced the plane, chalk-line and his teachings were supposedly left behind in the book Lu Ban Jing. Despite this, it is believed that the text was written some years after his death. This book is filled largely with descriptions of dimensions for use in building various items such as pots, tables, altars, etc. It mentions almost nothing of the intricate glue-less and nail-less joinery for which Chinese furniture was so famous, with the advances in modern technology and the demands of industry, woodwork as a field has changed 2. Container â€" A container is a basic tool, consisting of any device creating a partially or fully enclosed space that can be used to contain, store, and transport objects or materials. In commerce, it includes any receptacle or enclosure for holding a product used in packaging and shipping, things kept inside of a container are protected by being inside of its structure. The term is most frequently applied to devices made from materials that are durable, humans have used containers for at least , years, and possibly for millions of years. The first containers were probably invented for storing food, allowing humans to preserve more of their food for a longer time, to carry it more easily. The development of storage containers was of immense importance to the evolving human populations. These were followed by woven baskets, carved wood, and pottery, containers thereafter continued to develop along with related advances in human technology, and with the development of new materials and new means of manufacture. These Phoenician examples from the first millennium BC were thought to have used to contain perfume. The Romans learned glass-making from the Phoenicians and produced many extant examples of glass bottles. By the beginning of the century, sizes for retail containers such as glass bottles had become standardized for their markets. In , Frenchman Philippe de Girard came to London and used British merchant Peter Durand as an agent to patent his own idea for a process for making tin cans. The canning concept was based on food preservation work in glass containers the year before by the

French inventor Nicholas Appert. By they were producing their first tin canned goods for the Royal Navy, the standardized steel shipping container was developed in the s, and quickly became ubiquitous. The introduction of computer-aided design made it possible to highly specialized containers and container arrangements. A well-designed container will also ease of use, that is, it is easy for the worker to open or close, to insert or extract the contents. In addition, a container will have convenient and legible labeling locations, a shape that is conducive to efficient stacking and storing. Wood â€" Wood is a porous and fibrous structural tissue found in the stems and roots of trees, and other woody plants. It is a material, a natural composite of cellulose fibers which are strong in tension embedded in a matrix of lignin which resists compression. Wood is sometimes defined as only the secondary xylem in the stems of trees, in a living tree it performs a support function, enabling woody plants to grow large or to stand up by themselves. It also conveys water and nutrients between the leaves, other growing tissues, and the roots, Wood may also refer to other plant materials with comparable properties, and to material engineered from wood, or wood chips or fiber. In , the stock of forests worldwide was about billion cubic meters. As an abundant, carbon-neutral renewable resource, woody materials have been of intense interest as a source of renewable energy, in approximately 3. Dominant uses were for furniture and building construction, a discovery in the Canadian province of New Brunswick discovered the earliest known plants to have grown wood, approximately to million years ago. Wood can be dated by carbon dating and in species by dendrochronology to make inferences about when a wooden object was created. 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Where there is little seasonal difference growth rings are likely to be indistinct or absent, if the bark of the tree has been removed in a particular area, the rings will likely be deformed as the plant overgrows the scar. It is usually lighter in color than that near the portion of the ring. The outer portion formed later in the season is known as the latewood or summerwood. However, there are differences, depending on the kind of wood 4. Metal â€" A metal is a material that is typically hard, opaque, shiny, and has good electrical and thermal conductivity. Metals are generally malleableâ€"that is, they can be hammered or pressed permanently out of shape without breaking or crackingâ€"as well as fusible and ductile, about 91 of the elements in the periodic table are metals, the others are nonmetals or metalloids. Some elements appear in both metallic and non-metallic forms, astrophysicists use the term metal to collectively describe all elements other than hydrogen and helium, the simplest two, in a star. The star fuses smaller atoms, mostly hydrogen and helium, to larger ones over its lifetime. In that sense, the metallicity of an object is the proportion of its matter made up of all chemical elements. Many elements and compounds that are not normally classified as metals become metallic under high pressures, the atoms of metallic substances are typically arranged in one of three common crystal structures, namely body-centered cubic, face-centered cubic, and hexagonal close-packed. In bcc, each atom is positioned at the center of a cube of eight others, in fcc and hcp, each atom is surrounded by twelve others, but the stacking of the layers differs. Some metals adopt different structures depending on the temperature, atoms of metals readily lose their outer shell electrons, resulting in a free flowing cloud of electrons within their otherwise solid arrangement. This provides the ability of metallic substances to easily transmit heat, while this flow of electrons occurs, the solid characteristic of the metal is produced by electrostatic interactions between each atom and the electron cloud. This type of bond is called a metallic bond, Metals are usually inclined to form cations through electron loss, reacting with oxygen in the air to form oxides over various timescales. Others, like palladium, platinum and gold, do not react with the atmosphere at all, some metals form a barrier layer of oxide on their surface which cannot be penetrated by further oxygen

molecules and thus retain their shiny appearance and good conductivity for many decades. The oxides of metals are generally basic, as opposed to those of nonmetals, exceptions are largely oxides with very high oxidation states such as CrO3, Mn2O7, and OsO4, which have strictly acidic reactions. Painting, anodizing or plating metals are good ways to prevent their corrosion, however, a more reactive metal in the electrochemical series must be chosen for coating, especially when chipping of the coating is expected. Water and the two form an electrochemical cell, and if the coating is less reactive than the coatee. Metals in general have high conductivity, high thermal conductivity. Typically they are malleable and ductile, deforming under stress without cleaving, in terms of optical properties, metals are shiny and lustrous. Sheets of metal beyond a few micrometres in thickness appear opaque, although most metals have higher densities than most nonmetals, there is wide variation in their densities, lithium being the least dense solid element and osmium the densest 5. Match â€" A match is a tool for starting a fire. Typically, modern matches are made of wooden sticks or stiff paper. One end is coated with a material that can be ignited by heat generated by striking the match against a suitable surface. Wooden matches are packaged in matchboxes, and paper matches are cut into rows. The coated end of a match, known as the head, consists of a bead of active ingredients and binder. There are two types of matches, safety matches, which can be struck only against a specially prepared surface. Some match-like compositions, known as electric matches, are ignited electrically, historically, the term match referred to lengths of cord impregnated with chemicals, and allowed to burn continuously. These were used to fires and fire guns and cannons. Such matches were characterised by their burning speed i. The modern equivalent of this sort of match is the simple fuse, the original meaning of the word still persists in some pyrotechnics terms, such as black match and Bengal match. But, when friction matches became commonplace, they became the object meant by the term. At the slightest touch of fire they burst into flame, one gets a little flame like an ear of corn. This marvellous thing was called a light-bringing slave, but afterwards when it became an article of commerce its name was changed to fire inch-stick. Another text, Wu Lin Chiu Shih, dated from AD, lists sulphur matches as something that was sold in the markets of Hangzhou, the matches were known as fa chu or tshui erh. Prior to the use of matches, fires were lit using a burning glass to focus the sun on tinder. Another, more common method was igniting tinder with sparks produced by striking flint and steel, early work had been done by alchemist Hennig Brandt, who discovered the flammable nature of phosphorus in Smoking tobacco was lit a number of different ways, another was to use a striker, a tool that looked like scissors, but with flint on one blade and steel on the other 6. Circle â€" A circle is a simple closed shape in Euclidean geometry. The distance between any of the points and the centre is called the radius, a circle is a simple closed curve which divides the plane into two regions, an interior and an exterior. Annulus, the object, the region bounded by two concentric circles. Arc, any connected part of the circle, centre, the point equidistant from the points on the circle. Chord, a segment whose endpoints lie on the circle. Circumference, the length of one circuit along the circle, or the distance around the circle and it is a special case of a chord, namely the longest chord, and it is twice the radius. Disc, the region of the bounded by a circle. Lens, the intersection of two discs, passant, a coplanar straight line that does not touch the circle. Radius, a line segment joining the centre of the circle to any point on the circle itself, or the length of such a segment, sector, a region bounded by two radii and an arc lying between the radii. Segment, a region, not containing the centre, bounded by a chord, secant, an extended chord, a coplanar straight line cutting the circle at two points. Semicircle, an arc that extends from one of a diameters endpoints to the other, in non-technical common usage it may mean the diameter, arc, and its interior, a two dimensional region, that is technically called a half-disc. A half-disc is a case of a segment, namely the largest one. Tangent, a straight line that touches the circle at a single point. The circle has been known since before the beginning of recorded history, natural circles would have been observed, such as the Moon, Sun, and a short plant stalk blowing in the wind on sand, which forms a circle shape in the sand. The circle is the basis for the wheel, which, with related inventions such as gears, in mathematics, the study of the circle has helped inspire the development of geometry, astronomy and calculus. Some highlights in the history of the circle are, BCE â€" The Rhind papyrus gives a method to find the area of

a circular field.

Chapter 8 : Kambolam - Post Harvest Technology(Source:calendrierdelascience.com)

Corrugated Cardboard Boxes Manufacturing corrugated fiberboard, or paperboard. Land & Site Development Exp.

Chapter 9 : Boxes, Shipping Boxes, Cardboard Boxes, Packing Boxes in Stock - ULINE

BibTeX @MISC{Sharan08ahmedabady, author = {Girja Sharan and S. Srivastav and Kishor P. Rawale and Umang Dave and Girja Sharan and S. Srivastav}, title = {AHMEDABAD y INDIA Research and Publications Development of Corrugated Fiber Board Cartons for Long Distance Transport of Tomato in India}, year = {}}.