



Packaging materials, Characteristics of basic packaging materials: Paper (paper board, corrugated paper, fibre board)

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Types of Packaging Materials

Sl no	Materials	% Consumption		Examples of Use
		India	Global	
1	Paper and paper board	40	29	Bags, boxes, cartons
2	Glass	16	8	Bottles, jars
3	Metal	5	19	Cans, aluminum foil
4	Plastics	15	39	Overwraps, bags, cups, bottles
5	Wood	-	-	Crates, pallets
6	Cloth			Sacks
7	Laminates			Multilayered plastics, cartons
8	Others	24	5	-

Need for selection of packaging material

1. Composition of the food (solid or liquid)
2. Physical, chemical, and microbiological and deteriorative reactions that might occur
3. Storage conditions and time of storage
4. Socioeconomic situation of the anticipated customer or market
5. Desired package attractiveness
6. Cost of the packaging material
7. Packaging technology selected
8. Specific functional properties of the packaging material

Reasons for selection and rejection of specific packaging materials

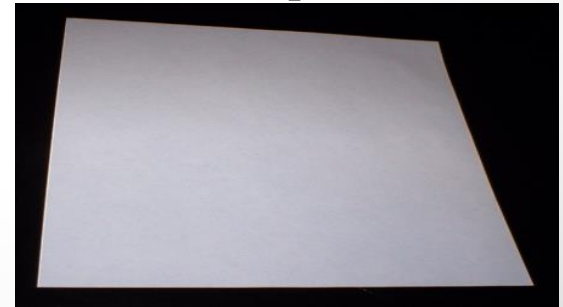
Paperboard	Glass	Steel	Plastics
Selection			
Easily machined and folded	Product visibility	Strong, stiff	Fabricability
Easy to bond	Impervious, inert	Malleable	Variety of forms
Composites well	Image of high quality	Retortable	Tough, lightweight
Printability	Ovenable, Reusability	Permanence, Reusability	Wide range of properties
Rejection			
Chances of water absorption	Shatters, Scratability	Corrodes	Thermal limit
Penetrable	High weight-to strength ratio	Limits shapes	Permeable
Image	Limited shapes	Appearance	Absorbs flavors
Tears, punctures	Large sizes	Flavor distortion	Distortion and creep

Characteristic of an Ideal Package

- Compatible with product.
- Protection from hazards
- Fit into a production line.
- Advertising potential.
- Attractive appearance.
- Easy to handle during...Production, storage and Distribution
- Moisture proof/resistance.
- Sufficient mechanical strength to withstand drop, vibration, compression etc.
- Resistant to acid, alkali resistance, grease & oil resistance, photo-chemical changes in product.
- Resistance to insects and rodents.
- Fire proof resistant to smoke, fume and water.
- Pilfer proof (malpractice).
- Inert: No effect on flavour/aroma.
- Not injurious to health.
- Economic.
- Easy availability.
- Protect against climatic hazards.
- Protect against microorganisms. It should not harbour microbes rather restrict their growth by controlling growth factor like.

Characteristics of paper

- Paper and board are very popular packaging materials.
- Paper is thin material mainly used for writing upon, printing upon or for packaging.
- Paper pulp is produced from wood chips by acid or alkaline hydrolysis.
- Alkaline hydrolysis produces sulphate pulp and acid hydrolysis produces sulfite pulp.
- The thickness of paper is often measured by caliper, which is typically given in thousandths of an inch.
- Paper may be between 0.07 millimetres (0.0028 in) and 0.18 millimetres (0.0071 in) thick.
- Paper is often characterized by weight. In using the ISO 216 paper sizing system, the weight is expressed in grammes per square metre (g/m² or usually just gsm or grammage) of the paper.
- Printing paper is generally between 60 and 120 gsm. Anything heavier than 160 gsm is considered card. The weight of a ream therefore depends on the dimensions of the paper and its thickness.



Paperboard

- Paperboard is material with a higher thickness than paper, usually over 0.25 mm or 10 points or grammage over 150 g/cm².
- It can be either single or multi-ply and is most often used in packaging and graphic printing.
- It is sturdier than paper but is thinner than corrugated board.
- Paperboard is widely used in today's society and is used to package many popular items, most notably food products and cigarette, ice-cream packaging.
- It can be easily cut and formed, is lightweight, and is strong; paperboard is popular in many industries as a packaging option.



Production of paper board

Pulp (virgin or recycled) is used to create one or more layers of board which can be coated for a better surface and/or improved visual appearance.

General steps of paper making process

1. Pulping
2. Washing
3. Settling
4. Squeezing of slurry
5. Pressing
6. Drying, Calendaring and Sizing

Raw materials

1. **Hard wood:** 0.05 inches (length) e.g. Birch which has short fibres. It is generally more difficult to work with however does provide higher strength.
2. **Soft wood:** 0.13 inches (length) e.g. Pine and spruce which have typically long fibres.
3. **Recycled:** Recycled material is collected and sorted and usually mixed with virgin fibres in order to make new material. This is necessary as the recycled fibre often loses strength when reused and gets this from the added virgin fibres. Mixed waste paper is not usually deinked for paperboard manufacture and hence the pulp may contain traces of inks, adhesives, and other residues which together give it a grey colour.
4. **Others:** Straw, Hemp, Cotton, Flax

Pulping

1. **Mechanical Pulping:** Mechanical pulping is a two stage process which results in a very high yield of the wood being converted.
2. **Chemical Pulping:** Chemical pulping uses chemical solutions to convert wood into pulp but yields around 30% less than mechanical pulping. It involves different processes like Soda process, Sulfate/Kraft process, Sulfite process, Semi chemical or Combination process.

Bleaching

- Pulp used in the manufacture of paperboard can be bleached to increase colour and purity.
- Virgin pulp is naturally **brown in colour** because of the presence of **lignin**.
- Recycled paperboard may contain traces of inks, bonding agents and other residue which causes a grey colouration.
- Although bleaching is not necessary for all end uses, it is vital for many graphical and packaging purposes

Plies

- Multi ply paperboard generally has higher creasing and folding performance than single ply as a result of layering different types of pulp in a single product.
- In cases, where the same kind of pulp is being used in several layers, each separate layer is treated and shaped individually in order to create the highest possible quality.
- The benefits of multi ply paperboard are for example its higher creasing and folding performance.

Coating

- In order to improve whiteness, smoothness and gloss of paperboard, one or more layers of coating are applied.
- Coatings are usually made up of: a pigment, which could be china clay, calcium carbonate or titanium dioxide, an adhesive or binder and water.

Grades of paper board

First letter (surface treatment)	Second letter (main furnish)	Number
A = cast-coated G = pigment Coated U = uncoated	Z = bleached virgin chemical pulp C = virgin mechanical pulp N = unbleached virgin chemical pulp T = recycled/secondary fibre with white, cream or brown reverse D = recycled/secondary fibre with grey back	(all except D grades): 1 = white reverse side 2 = cream reverse side 3 = brown reverse side (D grades only): 1 = bulk ≥ 1.45 cm ³ /g 2 = bulk < 1.45 cm ³ /g, > 1.3 cm ³ /g 3 = bulk ≤ 1.3 cm ³ /g

Example: GC1 would be a "pigment coated", "virgin mechanical pulp" board with a "white reverse side". Often the used paperboard type would be FBB, which is coated on both sides.

Classifications of paper board

Based on the production process and the source of the pulp, different types of paperboard are produced. The common industry abbreviations are:

1. FBB (Folding Box Board)
2. SBB (Solid Bleached Board)
3. SUB (Solid Unbleached Board)
4. WLC (White Lined Chipboard)

Types of paper commonly used as packaging material

No.	Product	Characteristics	Example
1	Kraft paper	Brown, unbleached paper. Good strength and resistant to bursting	Heavy duty bags and sacks A layer in multilayer paper board for increased strength. Viz. Aseptic packaging material in India
2	Bleached paper	White paper, may be glossy. Less strength Than un bleached paper	White bags, wrapping paper

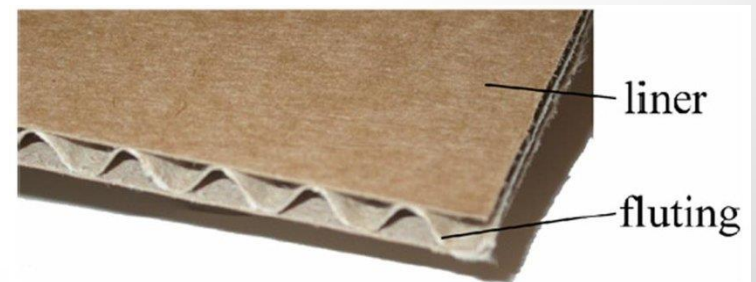
No.	Product	Characteristics	Example
3	Vegetable Parchment paper	Translucent paper treated with H ₂ SO ₄ to gelatinize surface layers	Butter and margarine wrap
4	Greaseproof paper	High-density paper, very smooth surface	Wrapping paper requiring high resistance to grease
5	Glassine	High-density, greaseproof paper. brittle	Over wraps on candy
6	Tissue	Light weight paper produced from most pulps	Light weight and used to protect soft products from dust and bruising
7	Paperboard or cardboard	Compacted paper pulp	Cartons, boxes, trays, separators
8	Corrugated paper board	Paperboard sheets interspersed with paper corrugations	Secondary boxes of many kinds

Corrugated fiberboard

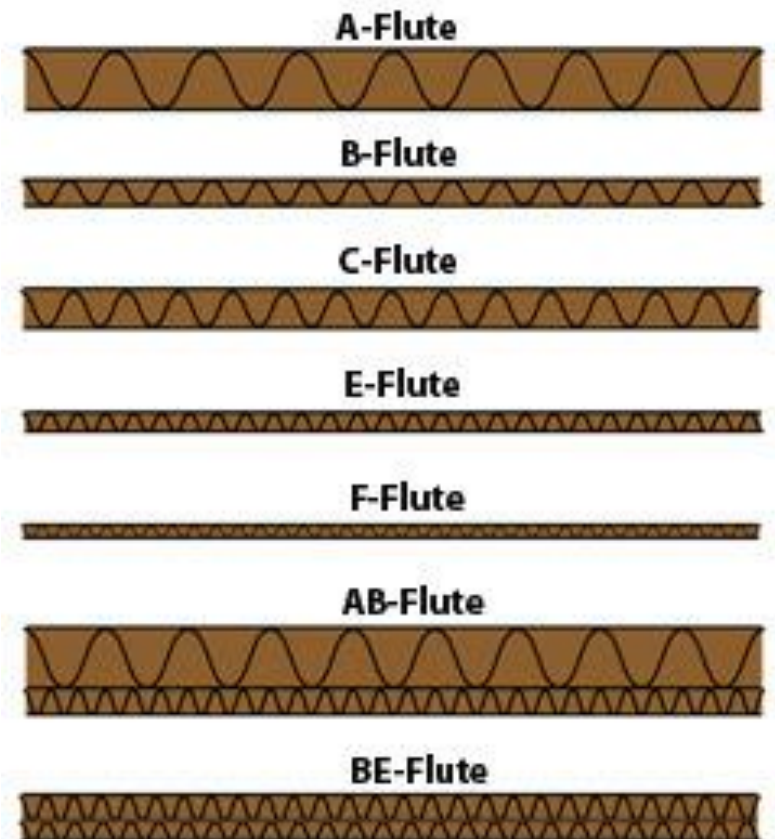
Corrugated fiberboard, also known as corrugated cardboard, is a paper-based construction material consisting of a fluted corrugated sheet and one or two flat linerboards. Corrugated board is the most common form of secondary food packaging and is used by virtually every industry in the manufacture of corrugated boxes and shipping containers.

Characteristics:

1. Corrugated board has an outer and inner lining of kraft paper with a central corrugating (or fluting) material. This is made by softening kraft paperboard with steam and passing it over corrugating rollers. The liners are then applied to each side using a suitable adhesive. The board is formed into *cutouts*, which are then assembled into cases at the filling line.



2. Common corrugation / flute sizes are "A", "B", "C", "E" and "F" or microflute. The letter designation relates to the order that the flutes were invented, not the relative sizes. These vary in height and the number of flutes per unit length of board. Flute size refers to the number of flutes per linear foot, although the actual flute dimensions for different corrugator manufacturers may vary slightly. Measuring the number of flutes per linear foot is a more reliable method of identifying flute size than measuring board thickness, which can vary due to manufacturing conditions.



3. They can be used alone or in combination with one another to give single-face, single-wall, double-wall, and triple-wall corrugated board constructions. Corrugated board has good impact abrasion and compression strength and is mainly used as secondary packaging containers. The most standard type of secondary packaging material is single wall C flute. High storage humidity may cause delamination of the corrugated material. This is prevented by lining with polyethylene or greaseproof paper or coating with microcrystalline wax and polyethylene.



Single face board



Single wall board



Double wall board



Triple wall board

Chip Board / Bogus

- Old news papers, other scrap papers, various sizing material etc are beaten and converted in to paper/ board known as chipboard. Most often it comes with two to three layers of coating on the top and one layer on the reverse side. Because of its recycled content it will be grey from the inside. It is mainly used in packaging of shoes, toys etc.



- Bogus is a paper product which is made from recycled fiber, paper or an inferior pulp to imitate higher quality grades. They are usually grey or light brownish in colour due to the raw material used. It is used as packaging material, void fill, wipes, bedding & cushioning etc.



WOOD

Advantages and Disadvantages of Wood as a packaging material:

1. With a good strength-to-weight ratio, wood is an economical structural material.
2. It does not require very sophisticated equipment to make a box or crate and for very rigid structures in small quantities it is the material of choice.
3. It has a high labour factor in relation to material costs.
4. It is also bulky and often presents a problem of storage space and shipping cubage.
5. If rigidity, stacking, strength, protection from the hazards of shipping and light weight are essential, it is difficult to find a better material than wood.
6. But if protection from moisture, rapid assembly, low cost, ready availability or attractive appearance is more important, then wooden containers may not be the best choice.

Thank you