

Paper And Paper Based Packaging Materials



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DIU

PAPER

- In the papermaking process, utilizing purchased pulps and waste paper, which are received as dry sheets, the first step is the separation of all the fibers from one another, and their dispersion in water with a minimum of mechanical work to avoid altering the fiber properties.
- This process is known as slushing or repulping, and is carried out in a machine such as the hydrapulper (Figure 2), thus named because of the hydraulic forces that are developed

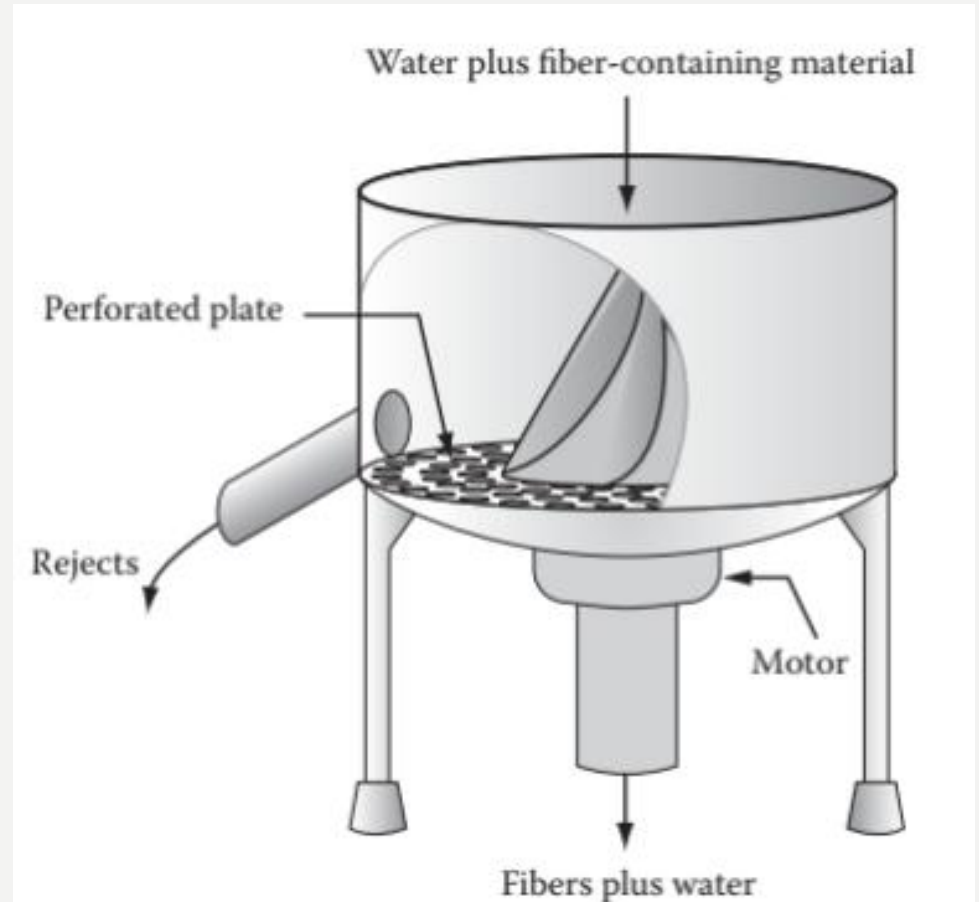


Fig 2: Hydrapulper

PAPER

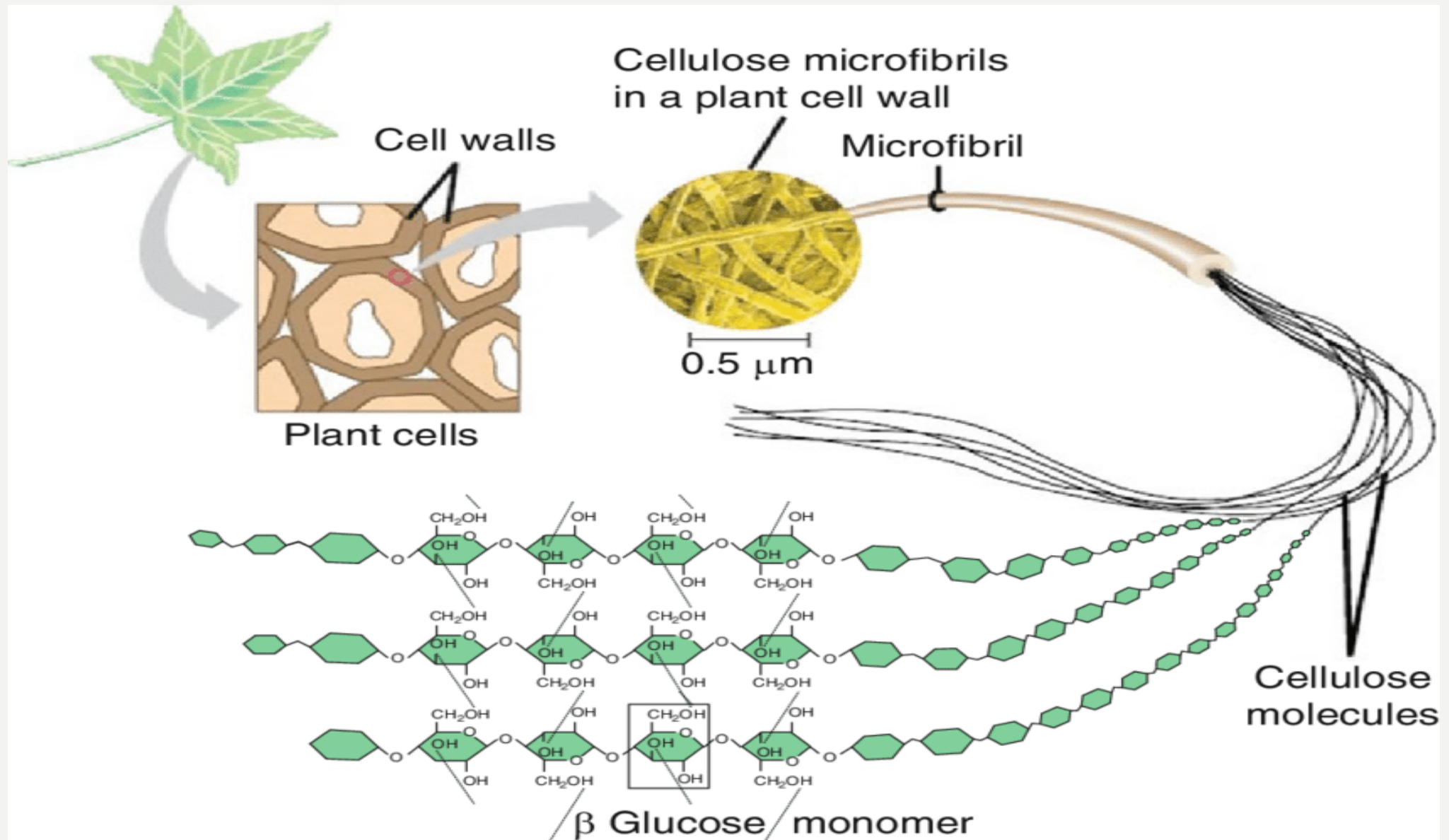
- Paper is a thin sheet material produced by mechanically or chemically processing cellulose fibers derived from wood, rags, grasses or other vegetable sources.
- Paper and paperboard are sheet materials produced from an **interlaced network of cellulose fibers** derived from wood by using sulfate and sulfite.
- The fibers are then **pulped, bleached, and treated** with chemicals and strengthening agents to produce the paper product.

FUNCTION OF SULFATE AND SULFITE IN PAPER MAKING?



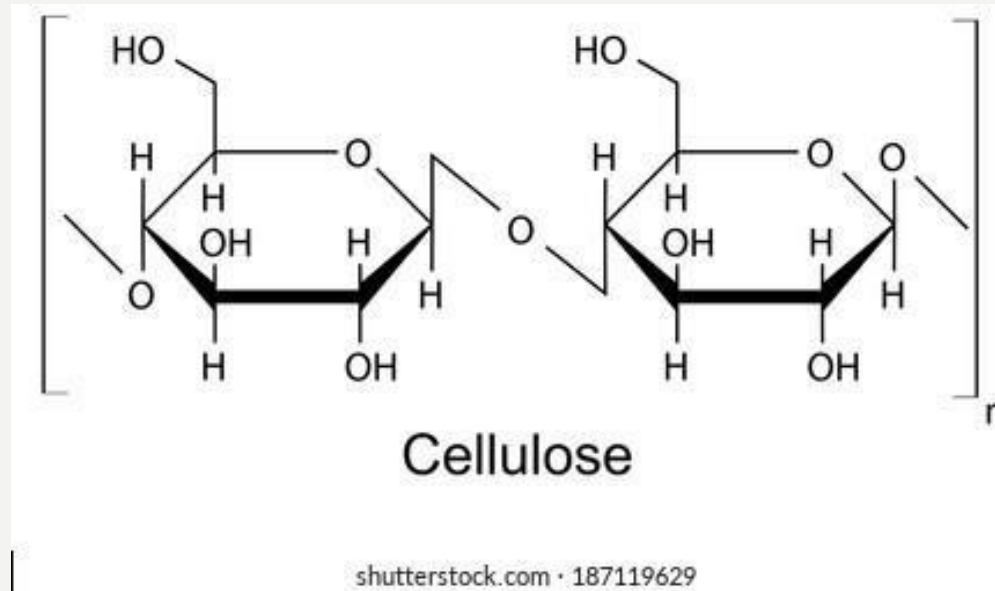
- Sulfate and Sulfite are used to cleave the bonds between the cellulose and lignin components of the lignocellulose

CELLULOSE



CELLULOSE?

- Cellulose is an organic compound with the formula $(C_6H_{10}O_5)_n$, a polysaccharide consisting of a linear chain of several hundred to many thousands of $\beta(1\rightarrow4)$ linked D-glucose units.
- Cellulose is an important structural component of the primary cell wall of green plants, many forms of algae.



BEATING AND REFINING

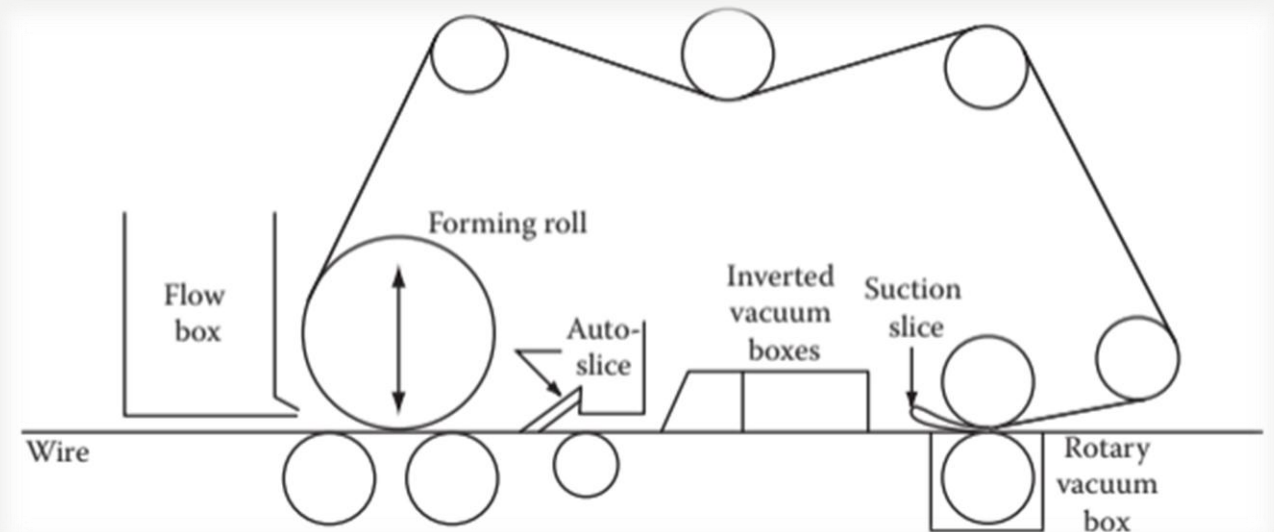
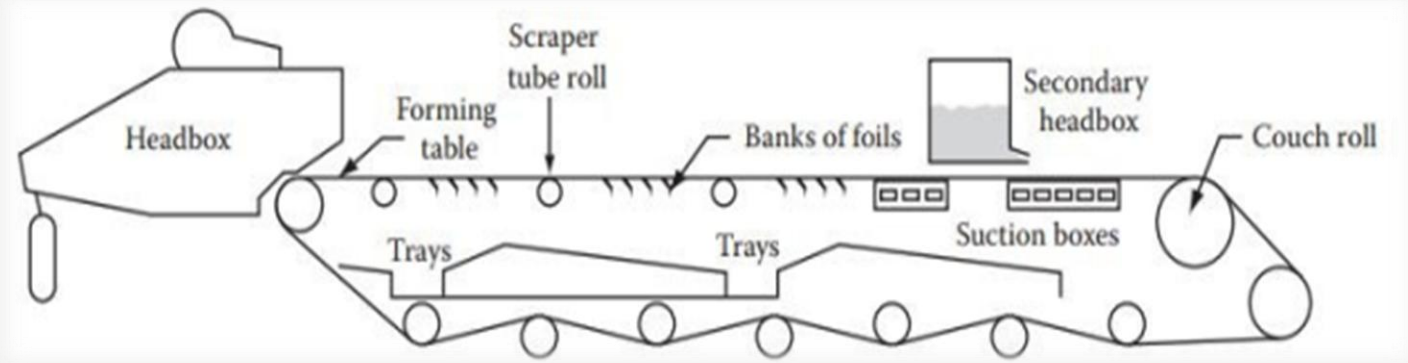
- Stock - as fibrous material is commonly called - is prepared through two main processes commonly referred to as beating and refining. Both operations are fundamentally the same.
- Beating and refining are used to improve the strength and other physical properties of the finished sheet.
- The object of beating is to increase the surface area of the fibers by assisting them to imbibe water. The beating makes the fibers more flexible, causing them to become relatively mobile and to deform plastically on the paper machine.
- In many paper mills, beaters have been replaced by continuous refiners, including disc refiners (where rotary discs rotate against a working surface) and conical refiners

BEATING AND REFINING

- In papermaking, chemicals such as strength additives, adhesives, mineral fillers, and sizing agents may be added at the beater stage prior to sheet formation (i.e., internal addition) to the resulting sheet after complete or partial drying, depending primarily on the desired effects.
- Strength additives are usually added internally if uniform strength throughout the sheet is desired, but they are applied to the surface if increased surface strength is needed.
- Fillers can improve brightness, opacity, softness, smoothness and ink receptivity.
- Sizing is the process of adding materials to the paper in order to render the sheet more resistant to penetration by liquids, particularly water. Rosin is the most widely used sizing agent, but starches, glues, caseins, synthetic resins, and cellulose derivatives are also used.

PAPER MAKING

- Fourdriner Machine
- Cylinder Machine
- Twin wire former



PRESSES AND DRYERS

- After leaving the forming fabric of the papermaking machine, the sheet (which has a moisture content of 75 to 90) passes to the press and dryer sections for further water removal. Rotary presses (which may have solid or perforated rollers, often with internal suction) receive the sheets on continuous felts, which act as conveyers and porous receptors of water. On leaving the press, the moisture content is typically 60 to 70%, again depending on type.
- The paper is then passed through a series of steam-heated rollers and dried to a final moisture content of between 4 and 10%.

CONVERTING

- The paper is converted by undergoing further treatment after manufacture, such as embossing, impregnating, saturating, laminating and the forming of special shapes and sizes such as bags and boxes. Further surface treatment involving the application of adhesives, functional products and pigments are common, depending on the end use of the paper.

- **Calendering**

- Calendering, a process that reorients the surface fibers in the base sheet of paper (or the coating applied to the surface) through the use of pressure. This serves to smooth the surface, control surface texture and develop a glossy finish. Such papers are known as machine finished (MF).

- **Sizing**

- Surface treatments such as sizing and coating are extensively applied to improve the appearance of products.
- Surface-sizing agents prevent excess water penetration and improve the strength of the paper. The most commonly used materials for surface sizing are starches, usually chemically modified (e.g., oxidized starches, cationic starches and hydroxy-ethylated derivatives).

- **Adhesives**

- The primary function of the adhesive in pigment coating is to bind the pigment particles together and to the raw stock. The type and proportion of the adhesive controls many of the characteristics of the finished paper, such as surface strength, gloss, brightness, opacity, smoothness, ink receptivity, and firmness of the surface. Starches are used in many coated papers. Acrylic based emulsions are used mostly on paperboard, and their odor-free quality makes them ideally suited for use in food packaging.

- **Barrier Coating**

- In many packaging applications, a barrier may be needed against water vapor or gases such as oxygen. A water barrier can be formed by changing the wettability of the paper surface with sizing agents. Coating the paper with a continuous film of a suitable material will confer gas or vapor barrier properties. Paraffin wax applied in a molten form was commonly used to produce a water vapor barrier, but polyethylene applied by extrusion gives a more durable and flexible coating.

- **Pigments**

- Pigments change the appearance of the base stock, improve opacity, impart a smooth and receptive surface for printing or provide special properties for particular purposes.

TYPES OF PAPER

- Paper is divided into two broad categories:
- (1) Fine papers, generally made of bleached pulp, and typically used for writing paper, bond, ledger, book, and cover papers, and
- (2) Coarse papers, generally made of unbleached kraft softwood pulps and used for packaging.

THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- Kraft paper—Produced by a sulfate treatment process, kraft paper is available in several forms: **natural brown, unbleached, heavy duty,** and **bleached white**. The natural kraft is the strongest of all paper and is commonly used for bags and wrapping. It is also used to package flour, sugar, and dried fruits and vegetables.



THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- **Sulfite paper**—Lighter and weaker than kraft paper, sulfite paper is glazed to improve its appearance and to increase its wet strength and oil resistance. It can be coated for higher print quality and is also used in laminates with plastic or foil. It is used to make small bags or wrappers for packaging biscuits and confectionary.



THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- **Greaseproof paper**—Greaseproof paper is made through a process known as beating, in which the cellulose fibers undergo a longer than normal hydration period that causes the fibers to break up and become gelatinous. These fine fibers then pack densely to provide a surface that is resistant to oils but not wet agents. Greaseproof paper is used to wrap snack foods, cookies, candy bars, and other oily foods, a use that is being replaced by plastic films.



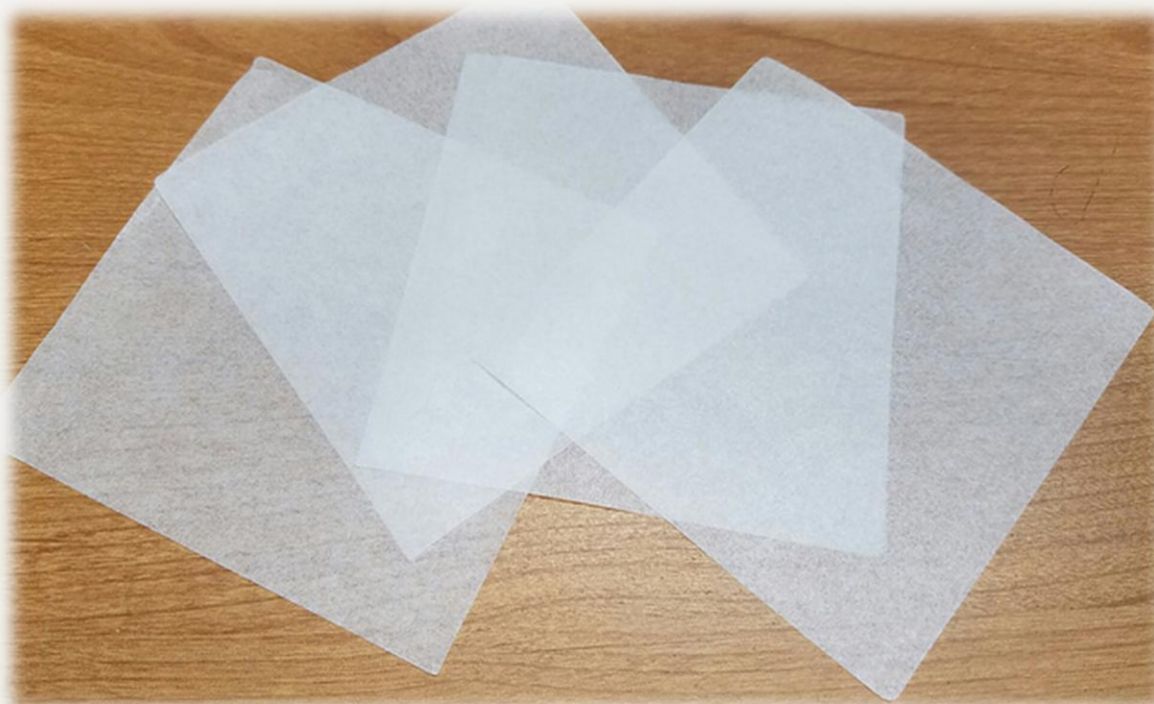
THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- **Glassine**—Glassine is greaseproof paper taken to an extreme (further hydration) to produce a very dense sheet with a highly smooth and glossy finish. It is used as a liner for biscuits, cooking fats, fast foods, and baked goods.



THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- **Parchment paper**—Parchment paper is made from acid-treated pulp (passed through a sulfuric acid bath). The acid modifies the cellulose to make it smoother and impervious to water and oil, which adds some wet strength. It does not provide a good barrier to air and moisture, is not heat sealable, and is used to package fats such as butter and lard.



THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- **Tissue paper:** is an open-structured paper used to protect delicate products and provide some cushioning protection.
- **Wet-strength papers:** are obtained by the addition of resins to the pulp. These retain more of their strength when wet as compared with untreated papers.



THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- **Coated papers:** papers of various types may be coated with a variety of substances to improve their protective properties. Wax-coated papers are heat sealable and offer a moderate resistance to water and water-vapor transfer. Plastic coated papers are available which feature various characteristics, i.e. barriers to water vapor, gases, volatiles, greases and oils, depending on the type of plastic coating used.



THE MOST COMMON TYPES OF PACKAGING PAPERS ARE

- **Paper laminates.** Paper laminates are coated or uncoated papers based on kraft and sulfite pulp. They can be laminated with plastic or aluminum to improve various properties. For example, paper can be laminated with polyethylene to make it heat sealable and to improve gas and moisture barrier properties. However, lamination substantially increases the cost of paper. Laminated paper is used to package dried products such as soups, herbs, and spices.



PAPERBOARD.

- Paperboard (folding boxboard) is made from similar raw materials as paper on the cylinder machine and in thickness in excess of 0.30mm. Paperboard is thicker than paper with a higher weight per unit area and often made in multiple layers.
- Typically, paperboard has the following structure:
 1. A top layer of white material to give surface strength and printability.
 2. Middle layers of grey/brown lower grade material.
 3. An under-layer of white material to stop the color of the middle layer showing through.
 4. A back layer if strength or printability are required.

All layers are glued together with adhesive.

- It is commonly used to make containers for shipping—such as boxes, cartons, and trays—and seldom used for direct food contact.



The Various Types of Paperboard

- **White board**—made from several thin layers of bleached chemical pulp, white board is typically used as the inner layer of a carton. White board may be coated with wax or laminated with polyethylene for heat sealability, and it is the only form of paperboard recommended for direct food contact.



The Various Types of Paperboard are

- **Solid board**—Possessing strength and durability, solid board has multiple layers of bleached sulfate board. When laminated with polyethylene, it is used to create liquid cartons (known as milk board). Solid board is also used to package fruit juices and soft drinks.



The Various Types of Paperboard are

- **Chipboard**—Chipboard is made from recycled paper and often contains blemishes and impurities from the original paper, which makes it unsuitable for direct contact with food, printing, and folding. It is often lined with white board to improve both appearance and strength. The least expensive form of paperboard, chipboard is used to make the outer layers of cartons for foods such as tea and cereals



The Various Types of Paperboard

- **Fiberboard**—Fiberboard can be solid or corrugated. The solid type has an inner white board layer and outer kraft layer and provides good protection against impact and compression. When laminated with plastics or aluminum, solid fiberboard can improve barrier properties and is used to package dry products such as coffee and milk powder.
- The corrugated type, also known as corrugated board, is made with 2 layers of kraft paper with a central corrugating (or fluting) material. Fiberboard's resistance to impact abrasion and crushing damage makes it widely used for shipping bulk food and case packing of retail food products.



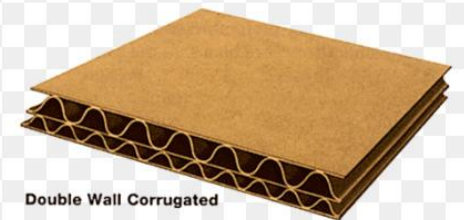
Single Face Corrugated



Triple Wall Corrugated



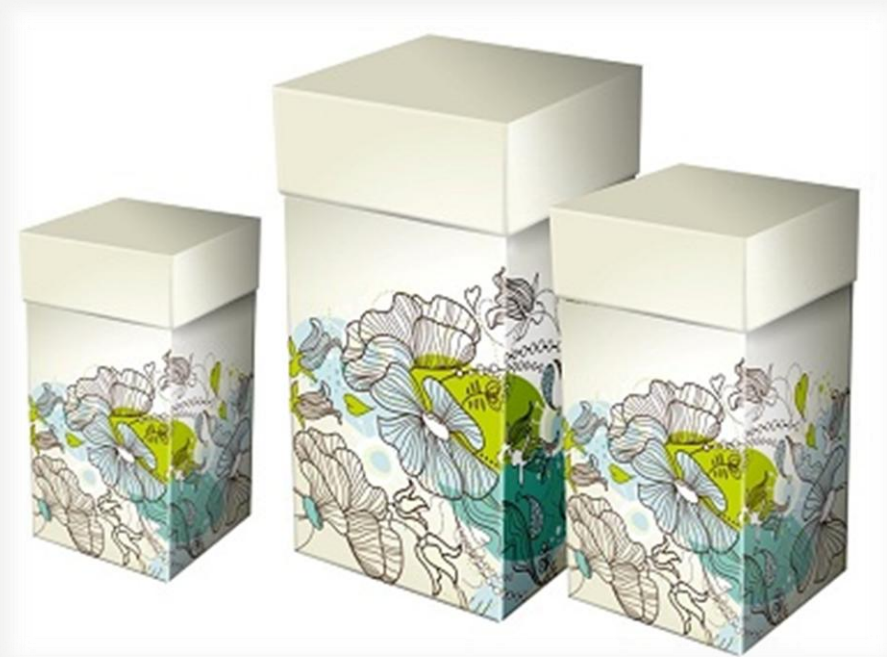
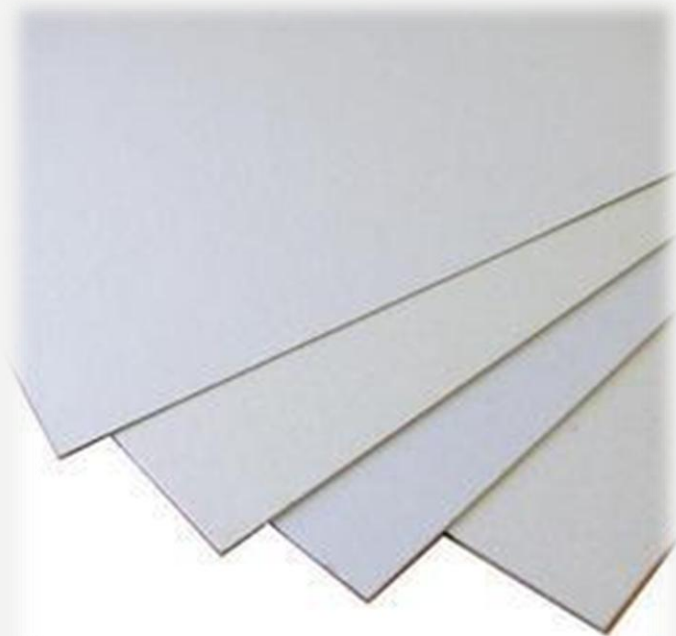
Single Wall
(Double Faced) Corrugated



Double Wall Corrugated

The Various Types of Paperboard

- **Duplex board**— Duplex board is made from a mixture of semi-bleached chemical and mechanical pulp lined on both sides with chemical pulp and is used for some frozen foods, biscuits, cakes and similar products.



THE END