



Food Packaging methods



Why is food packaging important?

The main goal of food packaging is to provide a practical means to contain a portion of food. However, there are other essential functions of food packages including:

Preservation and protection from contamination

- Food items that are not consumed immediately can rot quickly if they come in contact with air, heat, and moisture. So they need to be preserved in containers that keep them free of contamination and damage at all points in the retail process. Packaging ensures food safety and prevents physical damage.
- On the other hand, faulty packaging can affect the quality and taste of food, thus reducing the shelf life of the product. This is why food businesses conduct extensive research to find the best packaging solutions that can protect the food from dust, chemical reactions, and light.

Traceability

- With modern packaging, the ability to track products from their point of origin is becoming more and more critical. Information about where products originated from, how they were harvested, and even packaging material details should be included to maintain transparency with the consumer.



Display product information

- Packaging labels on food products help brands communicate important information to customers. This includes the brand name, food type, ingredients, and the expiry date of the product.
- The food label is also used to display crucial health and safety information. This is particularly important for consumers with allergies and skin conditions who must avoid specific ingredients to remain healthy. The Centers for Disease Control and Prevention (CDC) requires all such products to display the list of ingredients used in the food item on the package.

Convenience for customers

- Food containers can be designed to have features that make the handling, consumption, and preservation of food items easier for customers.
- For example, aseptic cartons are used for liquid food like soup, dairy products, and beverages. These are sterilized packages that are designed to prevent microorganisms from entering the container. This keeps the product fresh and ensures a longer shelf life.

Brand awareness and customer attraction

- Food packaging plays a huge role in helping to differentiate your brand from similar products on the same shelf. Customers often make their purchase decisions based on the appearance of the product, and the logo, colors, and style of food packaging are a bigger marketing tool than most business owners realize.
- Packaging builds brand recognition and ensures customers can distinguish your product the next time they visit the supermarket.



Types of Food Packaging


Packaging materials come in different shapes with various functions relative to their properties. It is essential for the packaging material to have a balance between its shape and its function. Given the packaging's main purpose of preservation, containment, and protection of food, the packaging material can be rigid, flexible, or semi-flexible [3].

- **Rigid packages** include bottles, trays, cans, jars, and caps.
- **Flexible packages** include bags, cling wraps, bubble wraps, shrink wraps, squeezable tubes, foam trays, stand-up packets, and vacuum bags.
- **Semi-flexible packages** include caps and closures, boxes, and tetra packs.

Food packaging types differ in various ways, such as weight, size, durability, and barrier properties



Food Packaging Materials

- Selecting the suitable material for packaging a certain type of food depends on the functions that the package is supposed to fulfil.
 - These functions include shielding the foods against moisture, temperature variations, oxygen, light, and biological microorganisms.
 - Also, damage protection, permeability, food identification, and chemical and optical properties play a significant role in material selection
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Packaging Materials

Conventional food packaging materials currently used vary between metals, paper, glass, and plastics

Metals

- There are various forms of metal food packaging, such as cans, tubes, containers, films, caps and closures. Cans are generally made of aluminium or steel, and they are the most commonly used metal packages of food and beverages. They are highly recyclable and are usually coated with a layer of organic material to prevent any interaction between the food and the metal



Aluminium

- Aluminium is generally used for beverage cans, foils, tubes, trays, pouches, and coffee capsules. It has good resistance to temperature fluctuations and acts as an excellent gas barrier, which extends the food's shelf-life. It has outstanding malleability and formability and can be easily embossed. It is relatively harmless, lightweight, and can be recycled indefinitely.
- Alloying elements, such as magnesium and manganese, are sometimes added to aluminium to enhance its strength. Aluminium can be used in rigid, flexible, and semi-flexible packaging. It helps maintain the freshness and aroma of the foods and is good for protection from radiation, oxygen, moisture, oils, and microorganisms. Soft drinks, seafood, and pet food are commonly enclosed by aluminium packages.
- Some aluminium grades used in food packaging include AA 3003 (O, H22, H24), AA 8006, AA 8011, AA 8079, and AA 1235



Steel

- Steel is used for cans, containers, caps, and closures. Organic coatings are also required to resist corrosion. Steel cans are fabricated from *tinplate*, which is tin-coated steel, or from electrolytic chromium coated steel (ECCS), also known as *tin-free steel*. Steel, being a permanent material, can be recycled open-endedly while retaining its quality.
- Tinplate is a remarkable barrier to gases, water vapour, light, and odours. It has good ductility and formability, and is convenient for sterile products for it can undergo heat treatment and hermetic sealing. It is light with significant mechanical strength and is suitable for expressive decoration. Common applications of tinplate include drink cans, processed foods, and powdered foods.
- Tin-free steel also has good strength and formability and is slightly cheaper than tinplate. The chrome/chrome oxide in ECCS renders it a good material for coating adhesion, such as lacquers and paints. It has good resistance to heat and black sulphide stain, which makes it convenient for making fish cans. Applications of tin-free steel include food cans, trays, bottle caps, can ends, and closures.



Paper and paperboard

- Paper is one of the oldest packaging materials, dating back to the 17th century . Paper and paperboard are mostly used for packaging dry foods. Upon coating or waxing, their applications extend to the packaging and serving of wet and fatty foods [5]. They are commonly used in corrugated boxes, milk cartons, folding cartons, paper plates and cups, bags and sacks, and wrapping paper.
- **Paper** is used for temporary food containment and protection due to its high permeability and inability to be sealed with heat. When used as primary packaging, waxes, resins, and lacquers are used as coatings and laminates to enhance the paper's protective and functional properties.
- Depending on its method of production and packaging purpose, paper can be found as Kraft paper, sulphite paper, greaseproof paper, Glassine, or parchment paper.
 - **Kraft paper** is the strongest form of paper and is used in packaging flour, sugar, and dried fruits.
 - **Sulphite paper** is relatively weaker and lighter and is used to wrap biscuits and sweets.
 - **Greaseproof paper** and **Glassine** contain densely packed cellulose fibres – Glassine being further hydrated – that improve the paper's oil resistance, thus making it suitable to package snacks, biscuits, fast foods, and greasy foods.
 - **Parchment paper** is acid-treated paper, which renders it impermeable to fluids but not to air and vapour. It is used in packaging butter.
- **Paperboard** is a relatively thicker and heavier material than paper. It is widely used as secondary packaging that is not in direct contact with the food. Boxes, trays, and cartons used for shipping are the common usages of paperboard. Types of paperboard vary between whiteboard, solid board, chipboard, and fibreboard.
 - **Whiteboard** is the only paperboard advised for primary packaging.
 - **Solid board** is a strong and durable paperboard, used to package milk, fruit juices and soft drinks.
 - **Chipboard** is the cheapest form of paperboard, made of recycled paper, and is used as outer layers of food cartons, such as cereals and tea.
 - **Fibreboard** is used to ship bulk food due to its strength and resistance to impact scratching and crushing damage



Glass

- Glass is another permanent packaging material that has been used for millennia. The earliest evidence of glass making was around 7000 B.C. Yet, glassblowing of bottles was discovered by the Romans in 50 B.C. in the area of modern-day Lebanon.
- Glass is well-known for being among the most reliable and least toxic materials for packaging foods and drinks. Its advantages include:
 - Imperviousness
 - Inertness
 - Strength
 - Hygiene
 - Resistance to tampering
 - Quality colour
 - Design
 - Decoration potential
 - Transparency
 - Chemical propriety
 - Microwaveability
 - Heat treatability






Glass

- There are two types of glass packaging most widely used for foods and drinks: narrow-neck bottles and wide-opening jars and pots.
- Glass bottles are commonly used for alcoholic drinks, soft drinks, and potable water. Foods packed in glass containers range from coffee to dairy products, spices, spreads, syrups, processed vegetables and fruits, and meat and fish products. With the rise of popularity and usage of other packaging materials, such as metals and plastics, high-value products are preferred to be packed in glass containers due to their high-quality image and aroma preservation characteristics.
- Glass is basically made from soda, lime, and silica – in addition to other elements depending on the desired characteristics – and is manufactured via melting and container forming. Surface treatment, heat treatment and annealing are subsequent steps in the production process. It is reusable and infinitely recyclable through crushing, melting, and reforming without loss of quality.

Plastics

- Plastics are the most common and most wide-ranging materials used for food packaging. Some of their widespread uses are bottles, trays, bags, foils, cups, pots, pouches, and bowls. The volume of plastic allocated to food packaging amounts to around 40% of plastics. The convenience and widespread use of plastic in food packaging is owed to its low cost, ease of processability, formability, chemical resistance, lightweight, and a variety of physical properties. However, plastic suffers from permeability to gas, vapour, and light.
- Plastics can be classified into two main categories: thermosets and thermoplastics.
- Thermosets are polymers that irrevocably solidify upon heat and are non-reformable, which makes them unsuitable for food packaging. Thermoplastics, on the other hand, soften when heated and are able to retain their initial conditions at room temperature. This renders them perfect for food packaging. Besides, despite certain functional restrictions, thermoplastics are recyclable via melting, reproduction and reuse as new products.
- Despite the health and safety concerns regarding residual components from plastic, plastic use continues to grow compared to the aforementioned conventional materials because of its inexpensiveness, thermosealability, microwaveability, and ease of fabrication into countless shapes and sizes.





Of the plastics used for food packaging, *polyolefins* and *polyester* are the most common materials.

- Other materials include polyvinyl chloride, polyvinylidene chloride, polystyrene, polyamide, and ethylene vinyl alcohol.
- *Polyethylene* and *polypropylene* are materials from the polyolefin category. These two materials are extensively used due to their lightweight, malleability, strength, stability, processability, reusability and resistance to chemicals and moisture. Milk, juice, and water bottles, grocery, retail, and garbage bags, and bread and frozen food bags are some of the uses of polyethylene. Polypropylene is used when heat resistance is needed. Yoghurt containers and margarine tubs are applications of polypropylene.
- The most commonly used polyester in food packaging is polyethylene terephthalate, more commonly known as PETE. PETE is a resistor of heat, oils, solvents, and acids. It has good ductility, strength, and hardness. Its advantageous properties also include lightness, impermeability to gas, transparency, and resistance to breaking. It is mostly used in bottles, tubs, jars, trays, blisters, bags, and wrappers for snacks.



Why sustainable food packaging is more urgent than ever?

- Food waste is not only an economic and social problem but also a challenging environmental issue. Its environmental impacts, such as high carbon footprint and blue water footprint, are direct indications of the risks brought about by food waste.
- As of 2018, over 100 million tons of food are lost to waste every year in Europe alone. This accounts for about a third of the agri-food supply chain. It is even expected to double by 2050 with the global increase in food demand.
- A significant portion of food waste is linked to the short shelf-life, particularly that of fresh produce; not to mention the effect of erroneous or misunderstood expiry date labels, leading to premature and avoidable disposal of food.
- Packaging has been positioned as a fundamental factor in sustainable food consumption, especially in terms of quality preservation and safety. However, it has been perceived almost as a two-edged sword, having additional environmental and economic costs as compared to its value of reducing food waste.
- The United States Environmental Protection Agency (EPA) has stated that over 82 million tons of municipal solid waste (MSW) in 2018 has been accounted for by containers and packaging. This was a whopping 28.1% of the total MSW generation.
- That is why sustainability efforts such as recycling, composting, or energy recovery from combustion have been implemented to minimise the landfilled waste coming from packaging.
- Sustainable food packaging is not simply an option anymore but a necessity. No matter the packaging material, it is crucial to consider sustainability as a deciding factor in material selection from now on. From raw material extraction to processing, production, consumption, and disposal, people involved in any of the life cycle stages have to be aware of the impacts that such a material can have across all three dimensions of sustainability (environmentally, economically, and socially).

References



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