Effect of packaging materials on food commodities

Packaging materials for Cereals and Snack foods

Paper, Paperboard, and Printed Fiberboard

Most cereals and snack foods are packaged with paper-based materials made from wood / fibers. Microflute corrugated paperboards have unique characteristics including good strength properties, excellent shock absorbing ability, good aesthetic appearance, environmental advantages, and distinctive print properties. White board is suitable for contact with food and is often coated with low density polyethylene (LDPE), PVC (poly vinyl chloride) or wax. It is used for snack, chocolate, and frozen food cartons.

Plastic Films

Flexible plastic/films have been used for cereals in single packaging or multiserving size packages with other packaging materials. Typically, the majority of snacks are in flexible bags. Biaxially oriented /films are most widely used for snack foods. Biaxially oriented polypropylene (BOPP) has qualities of toughness (against puncture and abrasion) and clarity, and is rendered heat sealable by coextrusion or coating with polyolefin copolymers. Films are also coated with other polymers or aluminum to improve the barrier properties or to impart heat Sealability.

Metals

Metal containers have been rarely used for cereals and snack foods due to their cost, despite their perfect gas barrier properties, convenience, and extreme strength. However, composite containers are used for molded chips and nuts. The body of the container is made of LDPE-coated foil on spirally wound paperboard. The top and bottom ends of the containers may be made of metal or plastic. An aluminum pull-tab top and a reclosable plastic lid on the container form a reclosable canister.

Packaging materials for beer

Aluminum cans

The total barrier provided by a double-seamed aluminum can prevents ingress of O_2 or egress of CO_2. Any oxidation leading to off-flavors, off-colors, and haze is due to O_2 remaining in the beer after the brewing process and any O_2 added in the filling operation. Thus, the extension of shelf life of beer in cans appears to be dependent on reducing levels of O_2 exposure from these two sources.

Glass bottles

As with aluminum cans, glass bottles prevent O_2 ingress and CO_2 egress. However, unlike aluminum can double-seam closures, bottle closures provide an opportunity for gas transmission through the closure lining. If no O_2 is added to a bottle of beer during filling, the resulting shelf life for the beer would be 4–13 months for a maximum O_2 ingress of 1 ppm. In order to decrease O_2 ingress through the closure lining, with resulting increase in shelf life, various O_2 scavengers have been developed and commercialized for bottle closures. It is recognized that pry-off crown closures provide a tighter seal than do twist-off crowns.

Packaging materials for carbonated beverages

Metal cans

Metal cans for beverages have an easy-open end consisting of a scored portion in the end panel and levering tab (formed separately) that is riveted into a bubble-like structure fabricated during pressing. The aluminum alloy used to manufacture easy-open ends for beverage cans is specially developed to give the required mechanical properties but is subject to environmental stress cracking (ESC) corrosion due to reaction with moisture. The score area is particularly susceptible because of the tensile stress to which this part of the end is subjected.

Glass bottles

Glass is attractive as it allows the consumer to see the product but offers little protection against the adverse effects of visible light on the product. Some protection of the product can be achieved by using colored glass or wrap-round labels or by the application of a film to all or part of the outside of the bottle.

The principal advantages of glass include its quality image; low-cost production tooling; brand differentiation through shape, design, and texture; product compatibility; impermeability; odor resistance; good transparency; tamper resistance; resaleability; recyclability; reuse opportunity; sleeving and decorative opportunities; protection against UV light; suitability for in-pack pasteurization; and good top-load strength and rigidity.

PET bottles

The O_2 barrier performance of PET is low, but, with high levels of carbonation and the shelf life required for most carbonated beverages, it is regarded as acceptable. PET shows one of the highest CO_2 gas barriers for all plastics used for packaging and is an order of magnitude better than polyolefins or polycarbonates. PET shows less favorable retention of moisture than polyolefins and poorer resistance to heat than polycarbonates but overall has the most favorable balance of performance for carbonated beverages.

Packaging materials for milk powders

Metal cans

The main reason for using metal cans is their excellent physical strength, durability, absolute barrier properties to moisture, O_2, and light, absence of flavor or odor, and rigidity. Because bare steel is susceptible to corrosion, it is commonly electrolytically coated with a very thin layer of tin; in addition, an organic lacquer is applied to further protect the metal from corrosion and avoid metal–food contact.

Milk powder has a long shelf life when packed in metal cans due to their excellent barrier properties. The exchange of moisture and O_2 and the influx of light are not possible. Powders with a higher fat content are more susceptible to oxidation, and most powders are susceptible to deteriorative effects such as lumping and caking from moisture ingress. With adequately constructed cans, a shelf life in excess of 5 years is realistic, particularly when FMP products have been gas-flushed with N_2 to minimize the amount of available O_2.

Multilayer pouches

Commonly, a laminated multilayer pouch for milk powder must comprise a barrier to water vapor, O2 (at least for WMP products), and light. Aluminum foil is capable of providing such a barrier provided the foil does not have pin holes in it. Aluminum foil built into a flexible material provides a close-to-absolute barrier. Building into a flexible material is essential because the foil does not have any mechanical strength by itself and therefore needs protection from mechanical damage. A sandwich construction with two plastic layers—one on the inside, such as low density polyethylene (LDPE), so that the pouch can be sealed and one on the outside, such as biaxially oriented polypropylene (BOPP) or poly (ethylene terephthalate) (PET), to provide mechanical protection and also carry information is commonly practiced.

Packaging materials for Vegetables Oils

Metal

Tinplate containers have been used for a long time for oil packaging and are still well appreciated because of their many advantages. They provide total protection against light, O_2, water vapor, and microorganisms, and are resistant to several types of mechanical abuses.

Aluminum is also employed as a packaging material for edible oils as it is light and very resistant to corrosion. In order to increase its mechanical resistance, aluminum alloys with small amounts of Mg, Mn, and Si/Mg are recommended.

Glass Bottles

Glass containers are widely used for bottling olive oils and virgin olive oils in particular. Transparent glass, however, leads to photo-oxidation of olive oil and reduction of its shelf life. The use of colored glass bottles prevents or slows down the oxidation process. Metal and glass are the only packaging materials that provide a virtually total barrier to moisture and gases. The word “virtually” is used because such containers require a closure that incorporates other materials such as polymeric sealing compounds in cans and in closures, through which O_2 can easily permeate and promote oxidation.

Plastic Bottles

PET is one of the most used plastics in food packaging covering a wide range of packaging structures.PET satisfies many important requirements: good aesthetic aspect (brilliance and transparency);suitability for coloring; good mechanical, thermal, and chemical resistance; low production cost; good barrier properties against CO_2; suitability for prolonged storage, easy recyclability, and low weight with respect to glass bottles. HDPE is largely used as a packaging material because of its tensile strength and hardness and good chemical resistance. Blow-molded HDPE containers in the form of bottles, jars, and jerry cans are used for packaging edible oils. PVC is a popular packaging material for edible oils in many countries, mainly due to its transparency, adaptability to all types of closures, total compatibility with existing packaging lines, and potential for personalized design features.

Multilayer pouches

The adoption of multilayer pouches for oil storage has increased due to consumer preference for unit packages. Generally, limited quantities of edible oil are packed in flexible pouches (up to 500 g). Flexible pouches may be manufactured from laminates or multilayered films of different compositions and the pouches may be in the form of a pillow or stand-up pouch. The selection of a laminate or multilayer film is governed primarily by the compatibility of the contact layer, heat Sealability, heat seal strength, and shelf life required, together with machinability and physical strength parameters.