Aseptic Packaging and Milk

Preserving Quality and Nutrition

Thanks to a unique packaging process, aseptic drink boxes protect the quality and nutrients of milk for months without refrigeration or artificial preservatives. The aseptic packaging process is so revolutionary it was named “the most significant food science innovation of the last 50 years” by the prestigious U.S. Institute of Food Technologists.

Nutrition

One significant aspect of aseptic packaging is its contribution to good health. Because the aseptic packaging process exposes milk to high temperatures for significantly less time than traditional packaging techniques, milk in aseptic cartons retains more of its original nutrients, such as thiamin and pyridoxine (a vitamin B₆ derivative). Also, aseptic cartons prevent milk from losing riboflavin because a thin layer of aluminum foil keeps ultraviolet light from contacting the milk. The combined result of less overall heat and more riboflavin is a better-tasting, healthier product.

The Process

Prior to the commercial development of aseptic packaging, processed milk was kept fresh primarily through a combination of pasteurization and refrigeration. Most pasteurization today heats liquid foods to 161 degrees Fahrenheit for 15 seconds, which kills vegetative bacteria. But conventional pasteurization does not kill spores—dormant microorganisms that are more resistant to heat. These spores may remain dormant for varying lengths of time but eventually “awaken” to produce vegetative bacteria that multiplies and spoils milk.

To slow this process, pasteurized milk is refrigerated. Refrigeration slows microbiological growth and also limits chemical, physical and biochemical changes in food, resulting in increased shelf life. But refrigeration does not stop these processes from taking place. Today, under optimal conditions, milk has a refrigerated shelf life of 20 days.

PROCESSING CURVE
Pasteurization vs. UHT aseptic processing

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The aseptic packaging process eliminates the need for refrigeration because it eliminates bacterial spores and thus prevents bacterial spoilage.

In the aseptic process, milk is sterilized instead of pasteurized. Through ultra-high temperature (UHT) treatment, milk is rapidly heated to a temperature of 275-301°F for 2-4 seconds, then rapidly cooled. This intense heat kills bacteria and bacteria-producing spores in milk. Because the process happens so quickly, nutrition and taste are left intact.

To ensure that the milk remains sterile, the packaging material surface that contacts milk also must be sterilized, and the packages must be hermetically sealed so that airborne bacteria cannot enter the milk from outside once the package leaves the sterile package production area.

In aseptic packaging, the food contact surface is sterilized by exposure to heated hydrogen peroxide. Between exposure and the package filling station, the hydrogen peroxide is evaporated by hot, sterile air that is blown onto the packaging material surface. This eliminates residues of hydrogen peroxide from the sterilized surface.

The filling process takes place in a pre-sterilized filling chamber. This chamber is sterilized before production by a jet of incinerated air (approximately 540°F) and an injection of liquid hydrogen peroxide (30% concentration). The hydrogen peroxide evaporates immediately, forming gaseous hydrogen peroxide which, together with the hot air, sterilizes the entire filling area. Once the filling chamber is sterilized, contamination is prevented by maintaining a pressure of sterile air inside the chamber that exceeds pressure outside.

To ensure that the UHT-treated milk inside the aseptic packaging material stays sterile once it leaves the sterilized packaging environment, it must be sealed “airtight.” The design of the aseptic package itself makes this possible.

Aseptic cartons are composed of 70% paper, 24% polyethylene and 6% aluminum foil. The paper provides structure and shape, and aluminum provides an excellent barrier against entry of gas (oxygen) and light. Polyethylene on the interior provides an inert food contact surface and serves as an excellent bonding material for the seal. On the outside, a thin layer of polyethylene keeps packages from getting wet.

There are two types of seals on aseptic packages — longitudinal (a single seam that goes up the back of the box) and transversal (a closure at each end). The longitudinal seal is made from an overlap of material that is firmly sealed by a plastic strip using sterile hot air and pressure. The hot air melts the plastic on the strip and on the package, forming a strong, bonded seal when cooled.

The transverse seal is created through “induction heating” and pressure. Using radio waves, a current is induced in the aluminum foil layer, which becomes heated. This heat is transferred to the inner polyethylene coating. Through pressure and heat the seam is formed as the inner polyethylene layers contact each other, melt and bond in cooling.

The result is a sterile package that keeps milk dairy-fresh without refrigeration or added preservatives.

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