

Aseptic packaging system

Sachet and pouch system:

1. Form-fill-seal system: In this system a vertical form-fill-seal machine operated in a sterile chamber. The packaging material is passed through H₂O₂ and the drained and then drained and dried with hot air. The film used is typically a laminate of LLDPE with a centre layer of EVOH (ethylene vinyl alcohol) copolymer and carbon black to give the pouch the required shelf life. Pouches typically have fin seals on all four sides.

2. Lay-flat tubing: This system uses a blown film polymer in the form of lay-flat tubing so that only a transverse seal is required to form the bag. The assumption is made that the inside the tubing is sterile due to the temperature achieved during the extrusion process. Either a single film or a co extrusion can be used. The tubing is fed from the reel into a sterile chamber in which an overpressure of air is maintained. The sachets are at bottom and cut and moved to a filling section. They are sealed at the top after filling and exit the chamber through a water seal.

Carton system

1. Form-fill-seal cartons: The packaging material is supplied in rolls that have been printed and creased, the latter being necessary to ease the forming process. A plastic strip is sealed to one edge and the packaging material sterilized using a wetting system or a deep bath system.

In the wetting system a thin H₂O₂ film containing a wetting agent to improve the formation of a liquid film is applied to the inner packaging material surface. The material then passes through a pair of rollers to remove excess liquid under a tubular electric heater, which heats the inside surface to about 120°C to evaporate the peroxide.

In the deep bath system, the packaging material is fed through a deep bath containing H₂O₂ at a minimum temperature of 70°C, the residence time being 6sec. After squeezing rollers have removed much of the peroxide, both sides of the material are heated with air at a temperature of 125°C to evaporate the peroxide.

The sterilized packaging is fed into a machine where it is formed into a tube and closed at a longitudinal seal by a heat sealing element. In the process, the strip that was added prior to sterilization is heat sealed across the inner surface of the longitudinal seal to prevent contact between the outside and the inside of the carton. It also provides protection of the aluminum and paperboard layers from the product, which could corrode or swell the layers if such a strip were absent.

The tube is then filled with the product and a transverse seal made below the level of the product, thus ensuring that the package is completely filled. Alternatively, the packages may be produced with headspace of upto 30% of the total filling volume by injection of either sterile air or other inert gas. The sterilization, filling and sealing processes are all performed inside a chamber maintained at an overpressure of 0.5atm with sterile air.

2. Prefabricated cartons: In systems of this type, prefabricated carton blanks are used, with the cartons being die-cut, creased and longitudinal seam completed at the factory of origin skiving the inner layer of

board and folding it back. The cartons are delivered to the processor in lay-flat form ready to be finally shaped in the filler and the top seam formed and bonded. Although the above operations take place under nonsterile conditions, steps are taken to avoid recontamination.

Bottle system

1. Glass bottle system: The bottles are sterilized either by saturated steam under pressure or by dry heat. When the latter process was used, extended cooling with sterile air was required to minimize the risk of breakage from thermal shock when cool product was filled into the bottle. Dry heat sterilization and hydrogen peroxide bath or spray followed by drying with hot air are two most common sterilizing process used for glass bottles.

2. Plastic bottles: Three different types of systems are used

i. Non-sterile bottles: After blowing the plastic bottles are conveyed into a sterile chamber which is kept at a slight overpressure with sterile air. The bottles are inverted and sprayed inside and outside with sterile air. The bottles are inverted and sprayed with a solution of H_2O_2 . The peroxide is then evaporated by passing the bottled through a hot air tunnel, after which the bottled are rinsed with sterile water and filled. Typical container size range from 250ml to 3.8L.

ii. Sterile blown bottles: Bottles are extruded, blown with sterile air and sealed under conditions that ensure internal sterility of the container. The sealed bottles are then introduced into a sterile chamber where the outside surfaces are sterilized with H_2O_2 sprays. The closed top of the bottle is cut away, the neck trimmed, the bottle filled and a foil cap or heat sealable closure which has been sterilized outside the chamber is applied.