

# Aseptic Packaging (AP), Scope of AP and pre-requisite conditions for AP

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# Introduction

- **Aseptic packaging** is a packaging concept where product is **packed** under **aseptic conditions**.
- The most significant development in this field is the **Tetra Pak system** and **UHT process** for milk.
- The production of a commercially sterile product by continuous UHT processing requires a means of packing which will ensure continued product sterility with the attainment of expected shelf-life.
- Such a requirement is fulfilled by aseptic packing.
- Aseptic processing and packaging denotes the filling commercially sterilized and cooled product into pre-sterilized containers under aseptic conditions and sealing in an atmosphere free of microorganisms.

## The basic operation in aseptic packaging consists of:

- Heating the product to sterilization temperatures (140-150°C for few seconds).
- Maintaining the sterility of the products till they are cooled/packed.
- Filling into sterile containers and sealing aseptically.

# Characteristics of aseptic packing

1. Low water-vapour transmission rate.
2. Low gas transmission rates, especially to oxygen
3. Good physical or mechanical strength.
4. Good sealing characteristics to prevent entrance of external contaminants.
5. Capability to fit into automatic fabricating and filling equipment.
6. Resistance to withstand the temperatures encountered during filling of the product as well as during storage and distribution.
7. Chemically resistant to the product packed and ability to withstand sterilisation packing material with gas, liquid radiation.
8. Resistance to microbes, insects and other types of biological hazards.
9. Compatibility with the milk packed.
10. Economical and readily available in the market.

## Packaging Materials used in Aseptic Packaging

- a. **1st generation material:** Paper board/plastic /foil/plastic laminates.
- b. **2nd generation:** plastic containers.

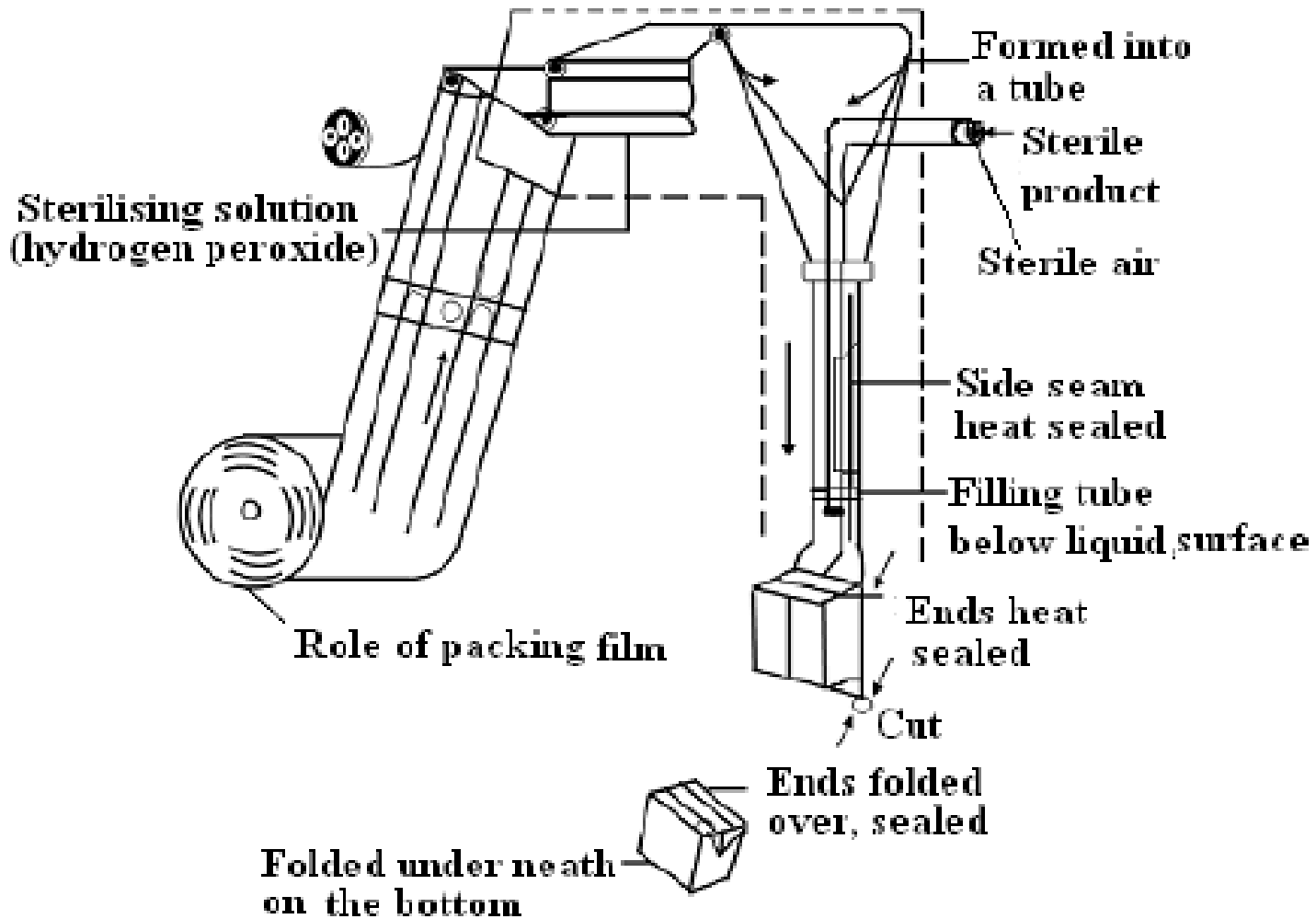
## Properties sought in laminate for aseptic packaging

No.	Properties	Example of suitable material
1	Tear resistance	PVC, PVDC/PVC, PE, PP
2	Stiffness	Paper, PS
3	Puncture resistance	Ionomer, PET
4	Printability	Paper, Al-foil, PS, PE, PET
5	Folding	Al-foil, paper
6	Heat sealing	LDPE/LDPE
7	Light barrier	Al-foil, paper, metallized film
8	H <sub>2</sub> O vapour barrier	Al-foil, PE, PVDC
9	O <sub>2</sub> barrier	Al-foil, PET, PVDC, PVA, EVA i.e. EVOH

- The packaging material or container is sterilized prior to filling and sealing in a sterile environment.
- Both the packaging material and seal are of sufficient strength and function to prevent recontamination of the product during storage and transport.
- Various packaging materials are used for milk, from paper-based laminates or carton board, to bottles made from polyethylene or polypropylene.
- The common packing is typically a combination of polyethylene, paper and aluminium foil.
- The polyethylene forms a mono-layer protective coat on the outer surface of the carton, and a co-extruded double layer on the inner food-contact surface which aids in sealing.
- Between the polyethylene layers is a paper layer which provides strength, rigidity and printability and the aluminium foil layer serves as an oxygen barrier.

- The general principle of a common aseptic packaging system is that cartons are formed from a roll of packaging material which passes through a sterilizing bath containing a 35% solution of hydrogen peroxide ( $H_2O_2$ ) at 70-80°C.
- The packaging material then passes through rollers and a curtain of air at 125°C which evaporates the solution and also serves to increase the rate of sterilization. The film is formed into a continuous tube sealed along the longitudinal edge and the base of carton is then formed by a transverse seal.
- Milk from aseptic storage tank is filled into the carton, under aseptic conditions maintained by a heater and the carton is sealed by another transverse seal which also forms the base of the next carton. An appropriate cut along the transverse seal separates the cartons.
- The complete carton forming, filling and sealing operation is carried out in a closed room, sterilized prior to use. This Aseptic packaging room is separate from other plant and supplied with a positive pressure sterilized air atmosphere.

# Aseptic packaging of UHT milk





# Packaging forms in which the UHT milk is packed

## **Tetra pack cartons**

- Tetra Pak group of Sweden had launched various types of cartons and 'Tetra Hedron' cartons were the first type introduced in fifties
- Which required the development of heavy weight paper board/aluminium/polyethylene and have proved to be quite successful for UHT milk packaging.
- The Tetra Pak Company had gradually replaced these Tetra Hedron cartons with Tetra Brick cartons.

## Scope of Aseptic Packaging

- There are number of limitations and disadvantages during actual application of this technology.
- Aseptic packaging of sterile/non sterile food and food products is the most significant innovation in the field of food science and technology and there is a big scope in this area.

# Major Categories of Aseptic Packaging Systems

- **Can system:** It includes hermetically sealed cans.
- **Bottle systems:** Glass containers and plastics bottles fall into this category.
- **Sachet and pouch systems:** This system is classified into Form-fill-seal systems and Lay flat tubing.
- **Cup systems:** The aseptic packaging of food into cups can be into; Pre-formed plastic cups and Form-fill and seal cups.
- **Carton systems:** This type of aseptic packaging system includes Form-fill-seal cartons and Prefabricated cartons.
- **Bulk packaging systems:** This type of system classified into; Metal drum and Bag-inbox Packaging Lines for Aseptic Processing.

# Five basic types of aseptic packaging lines

1. **Film & Seal:** Pre-formed containers made up of thermoformed plastic, glass or metal are sterilized, filled in aseptic environment and sealed.
2. **Form, Fill & Seal:** Roll of material is sterilized, formed in sterile environment, filled and sealed. e.g. Ex tetra packs Erect,
3. **Fill & seal:** Using knocked, down blanks, erected, sterilized, filled sealed. e.g. Ex. Gable-top cartons, Cambri-block.
4. Thermoform, Fill, sealed roll stock, sterilized, thermoformed, filled, sealed aseptically. e.g. Ex. Creamers, plastic soup cans.
5. Blow, Mold, Fill & Seal. e.g. Different package forms used in Aseptic UHT processing are cans, paperboards/plastic/foil/plastic laminates/flexible pouches, thermoformed plastic containers, bag in box, bulk totes.

# Pre-Requisite Conditions for Aseptic Packaging

- It should **contain** the product.
- It should **prevent physical damage** to packaged product.
- It should **run smoothly** on filling lines.
- It should **withstand** packaging processes.
- It should be easy to handle throughout distribution process.
- It should **prevent dirt** and other contamination.
- It should be able to **protect** the product from **odours and taints**.
- It should be **resistant to rodent attack**.
- It should be able to **stop insect infestation**.
- It should be biologically safe i.e. **non toxic**.
- It should be **compatible to foodstuff**.

- It should provide **sterility to product**.
- It should prevent **ingress of microorganisms**.
- It should **control moisture loss or gain**.
- It should offer a **barrier to oxygen**.
- It should be **protective against the light**.
- It should **maintain gas atmospheres**, i.e. CO<sub>2</sub>/N<sub>2</sub>.
- It should communicate all the information regarding product and manufacturer.
- It should have good sales appeal.
- It should be easy to open
- It should be cost effective

## Other pack criteria

- **Product containment:** The need to contain the product in the sense that liquids or powders do not leak out.
- **Physical protection:** This is required when dealing with fragile foods like eggs or snack foods
- **Food safety:** The need to ensure that the aseptically packed food retains its sterility, through a package that prevents adventitious contamination by microorganisms.
- **Shelf-life:** A good oxygen and light barrier, as provided by tinplate or aluminum foil, is needed to ensure maximum shelf life for aseptically packed products.
- **Communication of information:** The package should need to tell the purchaser all about the food.
- **Sale-appeal:** The package must look attractive and ‘catch the eye’ of prospective purchasers, and it should also be easy to open and dispense the product.
- **Cost-effectiveness:** Value for money in packaging is more important than looking for the lowest price.

# Aseptic Tank

- The aseptic tank is used for intermediate storage of UHT treated dairy products.
- It can be used in different ways in UHT lines, depending on plant design and the capacities of the various units in the process and packaging lines.
- If one of the packaging machines incidentally stops, the aseptic tank can take care of the surplus product during the stoppage.
- Simultaneous packaging of two products. The aseptic tank is first filled with one product, sufficient to last for a full shift of packaging.
- Then the UHT plant is switched over to another product which is packed directly in the line of packaging machines.
- One or more aseptic tanks included in the production line offer flexibility in production planning.



- Direct packaging from a UHT plant requires recirculation of a minimum extra volume of 300 litres per hour to maintain a constant pressure to the filling machines.
- Products which are sensitive to overtreatment cannot tolerate this and the required overcapacity must then be fed from an aseptic tank.
- The optimum arrangement must thus be decided for each individual process with UHT plants, aseptic tanks and aseptic packaging machines.

