ECOSIGN

Ecodesign for food packaging

UNIT 7: GLASS CONTAINERS

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Content unit 6, Ecodesign for food packaging

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After learning this unit, the student will be able to:

After learning this unit, the student will be able to:

- To know the properties and the technological process of the glass containers
- Be informed about the features and possibilities of Ecodesigning glass food packaging containers.
- Be informed about the possibilities of recovery, recycling and the life cycle of glass packaging

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7.1. Glass, definition of types, properties

- A mixture of purified sand is heated, at temperatures above 1000 ° C, with sodium and calcium carbonate together with sodium sulphate. Emitted gases help to mix the melt. Addition of calcium is required to make water-insoluble glass.
- The American Society for Testing Materials defined the glass as "an inorganic fusion substance that cooled in a rigid state without crystallizing" (ASTM, 1965). It is therefore an amorphous structure.
- Silico glass (60-70%) - calco (13%) - sodium (12%) is the basis for manufacturing the vast majority of food packaging containers with the cheapest raw materials, sand, limestone and soda (neutral carbonate sodium crystallized Na2CO3).
- Glass is the packaging material preferred by consumers concerned with their own health and the environment. Consumers prefer glass packaging because it preserves the taste and smell of food and preserves its integrity.
- The bottle is 100% recyclable and can be reused indefinitely without loss of quality or purity.

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7.1. Glass, definition of types, properties II

- Advantages: water insoluble and resistant to acids and bases; chemical inert matter in contact with food; impermeable to gases, liquids, vapors, flavors, microorganisms; cheap; transparent, allows viewing of the product; easy to clean; rigid.
- Disadvantages: transparency, light can contribute to changing quality; brittle, resists shock, vibration, shock; fragility, cracks under the influence of thermal shocks if the temperature exceeds 30-35 ° C and also mechanical shocks; has a relatively high density, 2500 kg / mc; requires special handling, transport, storage conditions.

A wide range of foods is packed in glass containers.

- Examples: instant coffee, dry mixes, spices, baby foods, dairy products, sugar, canned foods (jams and marmalades), spirits, syrups, processed fruits, vegetables, fish and meat products, mustard and spices etc.
- In these categories of foods and beverages, the products range from dry powders and granules to liquids (some of which are carbonated and pressurized) and products that are heat-sterilized.

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7.2 The technological process of obtaining glass containers.

7.2.1 Making glass containers

Fig. 2 Formation of cylinders (bottles)

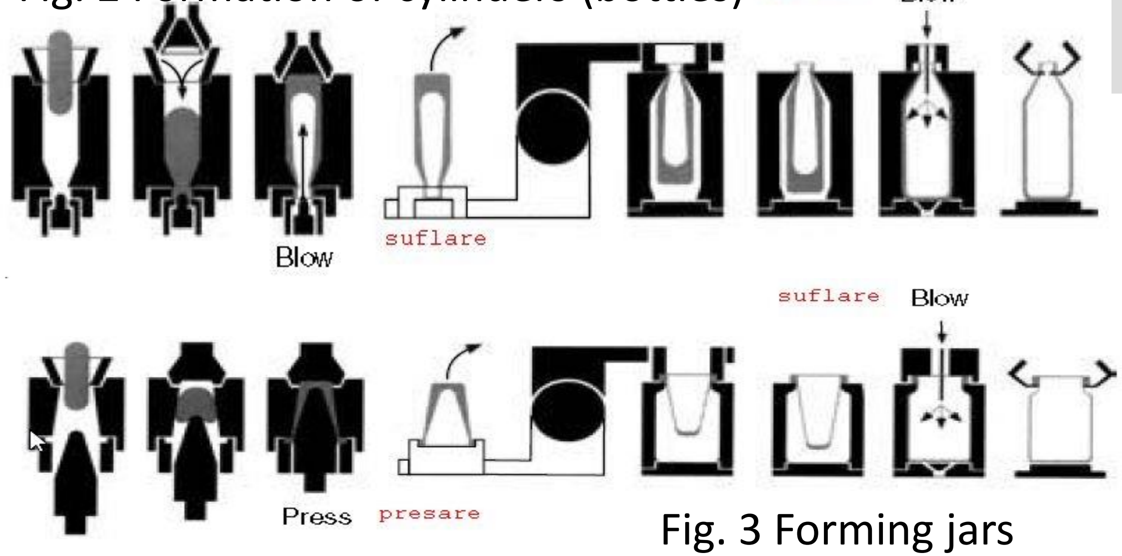

Fig. 3 Forming jars

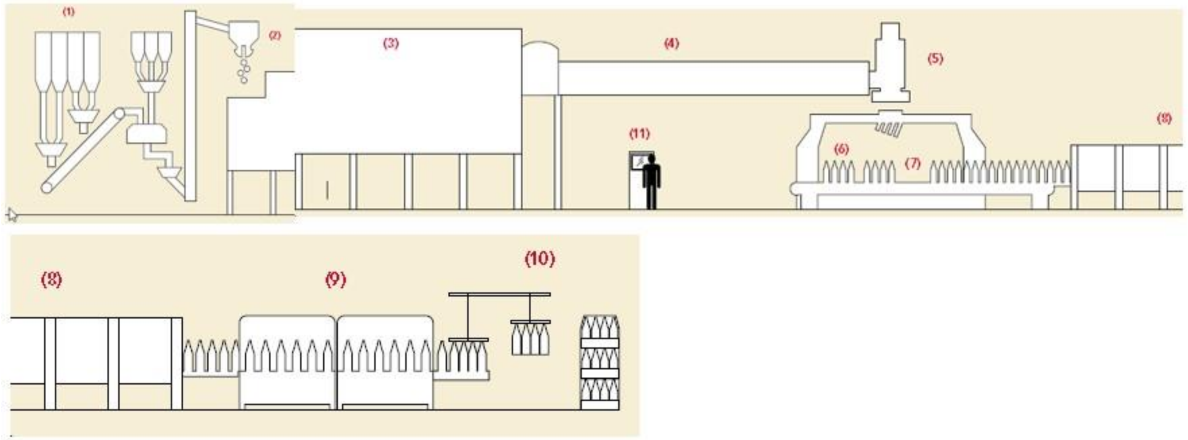

Fig.1 Technological process of glass containers according to http://www.bucheremhartglass.com/node/22765

1 - Storage and supply of raw material, glass fragments (recycled glass 20-30% to 60-90% at performance facilities), sand, soda, ores: calcit (CaCO3), dolomite (CaMg) 2) and feldspar (a silicate, very widespread ore). 2 - batch dispenser, 3 - melting furnace (1050-1200 oC), 4 - conditioning coil (uniform transport and heating) of molten glass, 5 - piston feeder for forming the glass drop,

6 - container formation, 7 - storage, 8 - annealing furnace (850 oC), 9 - container control, 10 - packing containers on pallets, 11 - machine control (electronic or computerized)

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7.2.2 Surface coatings

a) **Exterior coatings.** Two layers. The first called, "hot-end" (hot end), consisting of a tin oxide applied after annealing before formation. The second, called "cold" layer, is applied after molding and consists of a layer of oleic acid or polyethylene wax. The first layer ensures the adhesion between the glass and the cold layer. The cold coat reduces friction between glass containers during transport and reduces the risk of breaking them.

b) **Inner coating** consists of injecting sulfur or fluoride salts to reduce the alkalinity of the glass by replacing sodium ions with hydrogen ions. This coating is rarely applied to food containers that have a natural resistance to becoming alkaline, it is applied to containers of beverages, such as liqueur, and to pharmaceutical containers where they replace expensive boron glass.

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7.3 Ecodesign of glass containers used as packaging

7.3.1 Design elements of glass containers

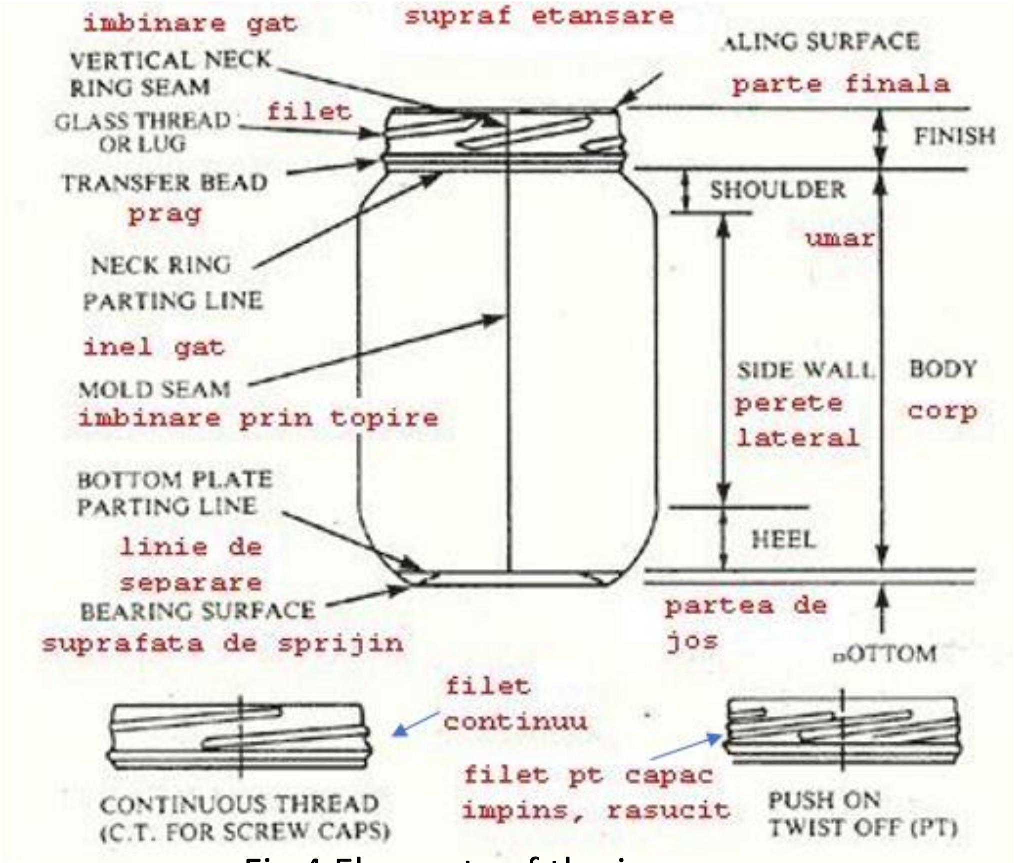

Fig 4 Elements of the jar.

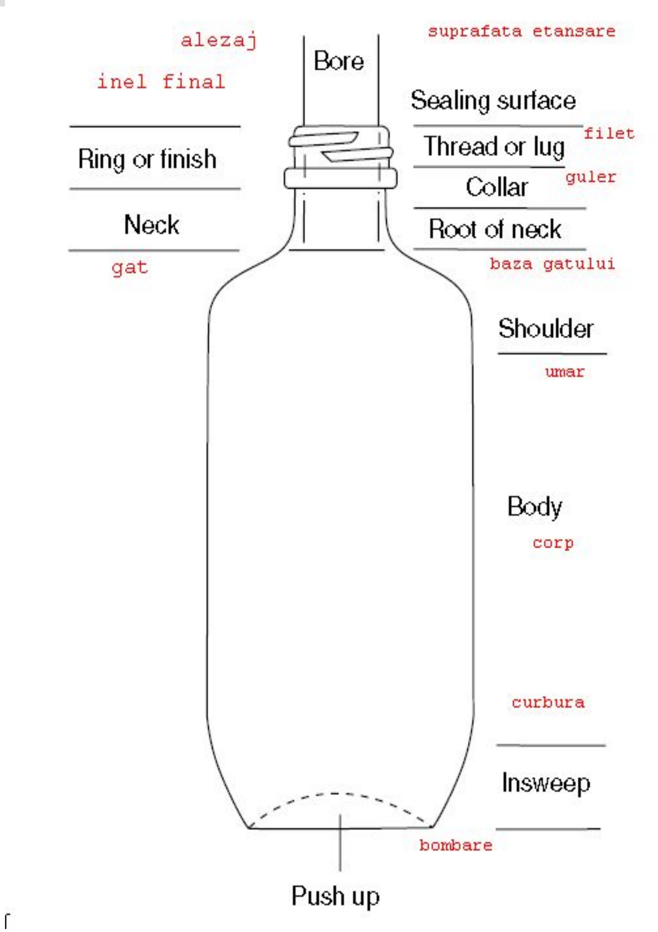

Fig 5. Components of a glass bottle. According to RICHARD COLES, DEREK MCDOWELL, MARK J. KIRWAN FOOD PACKAGING TECHNOLOGY, Blackwell Publishing Ltd, 2003

angle of inclination; for a wide-mouth jar must be ≥22 ° and for a bottle ≥16 °

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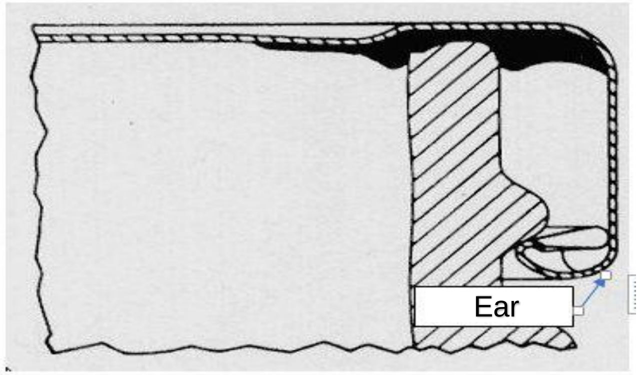
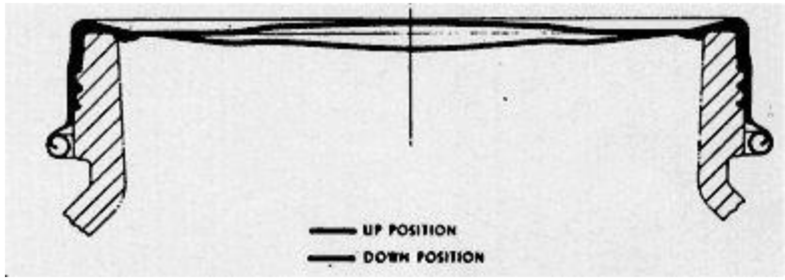
7.3 Ecodesign of glass containers used as packaging II

7.3.2 Jars closing devices

The continuous thread cap FIG. 6 consists of a steel housing and may have three to six ears depending on the diameter; It normally contains a plastic gasket. The jar top is cleaned with steam as with other closing modes. Cover the screw cap at the end of the jar. The seal will be hot soaked to facilitate sealing.

Pressure and twist opening cap Fig. 7 (PT-Press-on Twist-on Cap) consists of a non-ear steel case. The seal is made of molded plastic that covers a sealing area extending from the top outer edge of the lid to the curvature of the cap, forming the primary top seal and a secondary seal on the side.





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7.3 Ecodesign of glass containers used as packaging III

7.3.3 Sealing devices for glass bottles https://sha.org/bottle/closures.htm

The cork stopper is the most common and most traditional glass bottle sealing device. It comes from the bark of the cork tree that grows in SE Europe and Africa. Cork elasticity
the ability to keep its normal size after compression - was the basic property of the stopper, allowing it to be squeezed into a bottle's bore and create a gasket. In addition, its chemical inertia has made it ideal for sealing almost any type of bottled product - liquid or solid - without giving it a flavor.

Fig. 8 Example of applied cork stopper

Fig. 9 Example of interior and exterior threaded plugs

Plug a crown cap. This closure consists of a simple metal cover with a corrugated side and a compressible lining (originally cork and now plastic). Standard crown size or top finishing is 1 ", outer diameter (~ 2.5 cm).

Fig. 10 Applied bottle and crown plug.

Fig11 Capsule with breaking ring

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7.4 End-of-life options

7.4.1 Reuse of glass packaging

- It is the highest end-of-life scenario according to the waste hierarchy, but glass packaging is currently only reused in a limited way, mostly for small dairy factories.

Closed Loop Recycling System of Glass Packages

- The use of shards in glass production is now the most beneficial scenario for the end of shelf life of the glass package.
- To be used as raw material in new glass production, recovered glass must be sufficiently free of small fragments and contaminants.
- In a single flow collection system, only 40% of recovered glass maintains this required level of quality, while 60% is stored or sold for lower value uses, e.g. road aggregates.
- In a double-flow system in which the glass is collected separately, 90% of the recovered glass is of high quality and in the container storage systems, 98% of the recovered glass is of high quality.

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7.4 End-of-life options II

7.4.3 The results of an LCA assessment for glass containers

- The Glass Packaging Institute (GPI www.gpi.org) has developed an LCA for the production of glass containers in North America of the cradle-to-cradle type (includes the entire life cycle of the product with the addition of product recycling, back to the original purpose). The LCA cradle-to-cradle, made for the glass container, addresses all inputs and outputs for production and end-of-life management for 1kg of container glass.
- The 50% Recycled Shards Scenario in the raw material shows a nearly 10% decrease in the Global Warming Potential (GWP) in the cradle - to cradle scenario, compared to the cradle - to - gate scenario (from extraction to disposal) that does not use recycled glass shards.
- With energy consumption up to a recycling rate of 50%, there are no substantial savings, but with increased recycling rates, these savings become substantial. It is pointed out that at the performance facilities the recycling percentage reached 90%.

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