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The Use of Polymeric Types of Packaging Technology Food Production

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Abstract

On the world market there are a large number of different types of packaging for food packaging, including plastic packaging. But when using polymer packaging in food technologies, it is necessary to take into account various chemical, mechanical, physical, marketing factors) that may affect the quality of the final product and packaging. The proposed optimization of technological parameters when using polymer PET containers, which will allow to obtain high-quality finished product.

Keywords: Polymer packaging; Technological parameters; Homogeneous food products

Abbreviations: PET: Polyethylene Terephthalate.

Introduction

Formulation of the Problem. Goal of the Work

Today, food packaging is carried out in various types of packaging, including packaging from polymeric materials. For its production using cost-effective materials with aesthetic properties, inertness, ease of manufacture, low cost, durability, ease, such containers can be made in any shape and color. The polymer packaging is available in the following types:

a. Of polyethylene, polypropylene, polyvinyl chloride, polycarbonate, polyethylene terephthalate (trays, cups, cans, etc.);
b. Packaging from lamister;
c. Bags of aluminized foil and plastic;
d. Packagings from multi-layer composite materials, the basis of which consists of polyvinyl acetate copolymer, polyethylene, etc. (soft packagings, packages, film bags).

Boxes, bags, cups, jars with a capacity of up to 250 cm3 from a thermostable film of vinyl plastic or plastic compound are widely used for the production of canned small packaging. The product is heated to a temperature of 70-75°C, packed in a container, covered with a covering polymer film or aluminum foil, hermetically welded to the body. Such packaging isused for packing jam, jam, jam, marmalade without pasteurization, preservation is carried out due to the high concentration of osmotically active substances.

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Products for the preservation of which aseptic preserving or preservatives are used are packed in containers made : on the basis of paper or cardboard ; rectangular or tetrahedra; semi-rigid cardboard packaging with polymer coating and aluminum foil (Tetra–Brik , Kombiblok packages) polymer, metal, cardboard barrels, drums, containers, etc. with bags liners, bags of polymeric or combined materials (for fruit and vegetable puree, tomato paste) [1-4]. For the preservation of food by pasteurization or sterilization, there is a polymer soft or semi-rigid container.

Semi-rigid polymer packaging - this is lamister (steralcon), the material is varnish - foil - polypropylene. This semi-rigid container can be full- stamped or welded with a conventional or easy-open lid. When using containers from lamister (steralcon) for the manufacture of canned food, the preservation of which is ensured by thermal sterilization, special attention is paid to the strength of the welds and measures that allow to maximally remove air from the container during packaging, in order to prevent overpressure during sterilization.The process of sterilization of canned food in the mentioned container is complicated by the back pressure mode in autoclaves, since the pressure in the apparatus, during the whole cycle, must prevail over the pressure in the container, preventing the bags from inflating.

Soft packaging is any packaging that can change its shape and volume depending on the type of filling. Soft packaging is made from one and multilayer polymer films and composite materials. Types of soft packaging: with the body in the form of a sleeve, with a bottom of various configurations, solid or seam, with a valve, etc.; methods of making packages - welding, gluing, stitching. This type of packaging includes ϕ flow-type packaging (application of polymer melt on the packaged products), skin-type packaging using shrink films (second skin), when the cardboard base with the product is covered with shrink film, subjected to heat, the film is compressed and fits the product tightly.Soft packaging includes stand-up “doy-pack” packages, classic, with a straw, doy -pack packages with a zip lock, with a central or side fitting, figured, with 3- x or 4 x third-party sealing.

The sterilization process in a soft container has its own characteristics, since it is necessary to maintain the back pressure in the apparatus during sterilization at the level equal to the excessive pressure in the soft container with the product, otherwise a leakage of the soft packaging may occur. To preserve the integrity of this container during sterilization, it is important to vacuum the container during packing, which allows you to keep the package with the product in a flat, not swollen state during the whole sterilization process [5-7].

Soft and semi-rigid sterilized containers have significant technical and economic advantages: saving of scarce materials in the manufacture of containers; energy saving due to reduction of sterilization time due to high thermophysical characteristics and ensuring higher product quality; low weight (5 times lighter than tin and 1.5 times of aluminum packaging) is easily formed in various sizes; possesses high corrosion resistance; ease of opening and recycling, low cost. Doi-Pak bags (flat, standing packs) belong to soft polymer containers, the preservation of food products in which grows every year. Flat packages can be made of conventional film material with four or three welds, of tubular material - with two transverse welds or two transverse seams and one longitudinal. Tara can withstand high packaging temperatures, pasteurization temperatures, and is easy to use and transport. Doy-pak bags of various capacity are used in the production of ketchup, mayonnaise, mustard, jams, marmalades and other products [8-10].

Appearing relatively recently, in the practice of the food industry, retort packages allow combining the advantages of “soft” packaging with the advantages of sterilized food products, since the packaging material of which they are made not only occupies no more than 5% of the mass of the finished product, but also allows for the final heat treatment - sterilization of products at high temperature in both steam and water [11,12]. It should be noted that the type of consumer food packaging used also influences the energy performance of the production technology of this product. This applies not only to the value share of the package itself in the total value of the goods, but also to the energy costs that are necessary for the implementation of direct technological processes, allowing to obtain a specific product ready for sale and consumption. For example, thermal regimes for canning clearly illustrate this for a wide range of products manufactured by canneries.

The polymer packaging industry is constantly looking for lighter and more stable materials in order to meet the various and varied requirements emanating from legislation and marketing research. Plastics manufacturers have responded to these requests with a multitude of potential solutions, which are based, for the most part, on the basis of polyethylene terephthalate, which attracts consumers with its technical and cost indicators. However, now in the development of new types of polymer packaging, in its production, it is necessary to take into account a huge number of various factors, primarily technological(chemical, mechanical,

physical, marketing), which can affect the quality of the final product and packaging [13]. The purpose of this work was to determine the parameters of technological operations, the input control of polymer containers such as PET and the use of this type of packaging in food production technologies.

Polymer consumer packaging made of polyethylene terephthalate (PET) is very widely used at food enterprises for packaging alcoholic, non-alcoholic beverages and vegetable oils. This type of packaging is used for canning juices and beverages with the help of:

i. Method of heat sterilization (PET packaging is used, which withstands high temperatures);
ii. Aseptic canning;
iii. Chemical preservatives.

The manufacturer of food products, which uses for packing even non-hot products in this type of container, has a problem associated with the vacuum deformation of the container, which occurs when technology parameters are violated.The presence of vacuum deformation in a polymer container with a product leads to its non-commodity appearance (the lateral surface of the container can be drawn in, the bottom of the bottle becomes convex and the container loses stability), and the manufacturer has problems with the sale of finished products, storage and transportation. Production studies were conducted, as a result of which technological methods were proposed to eliminate the phenomenon of vacuum deformation of polymer consumer containers.

Results

The vacuum deformation of polymeric PET containers, when packing up liquid, not hot, homogeneous, calm products causes several reasons:

i. Use in the manufacture of thin-walled polymer bottles (insufficient thickness of the bottle wall);
ii. The discrepancy between the container body relief and technological conditions (the required number of stiffeners on the surface of the bottles);
iii. Temperature difference between the product and the conditions of its packing;
iv. No overpressure or non-critical vacuum in a hermetically sealed bottle;
v. Insufficient degree of filling of the container with the product.

Upon receipt of the polymer container at the enterprise, it is necessary to control the wall thickness, the mass of the bottles. The value of these indicators must comply with the normative values in accordance with the current technological documentation. If an enterprise produces polymer containers from a preform, it is necessary to control the mass of the preform itself, the weight of the preform is determined mainly by the final capacity of the finished bottle, which will be made of this preform, as well as the thickness of the bottle walls. The thickness of the walls of the finished bottle, should prevent the occurrence of vacuum deformation of the container. The surface relief of a polymer bottle depends on the design of the mold for blowing bottles in the appropriate equipment. Therefore, this issue should be monitored when purchasing this equipment. The shape of the bottles, the surface relief must initially meet the necessary technological requirements for packaging in production, since the replacement of the mold for blowing bottles will lead to an increase in the cost of finished products.

When packing a product in this type of container, it is necessary to control the difference between the temperature of the product and the temperature conditions during packing (temperature in the process shop, bottle temperature, temperature in the storage room of the product, product packaging temperature. The temperature difference should not exceed the standard value, therefore technically control the required values of this parameter and use technological methods to maintain it (heating or cooling the product, supported ie the desired temperature in the workplace, etc.). To prevent vacuum deformation, you can apply an inert gas to the bottle with the product and create an overpressure inside the sealed package, which will not change the shape of the container negatively - the process of displacing oxygen from the container and replacing it with an inert gas (nitrogen). This technology reduces the level of oxygen in containers, thereby reducing the degree of oxidation of the product by oxygen in the air, which contributes to the improvement of its consumer properties (taste, color, texture), extension of shelf life, and improvement of presentation. Excessive pressure in the container contributes to:

a. To increase its rigidity, which makes it possible to form transport packages with more overall height, with products in PET bottles, without fear of deformation of the lower product layer;
b. Reduce logistics costs;
c. Prevent vacuum deformation of PET packaging when packing products - a calm product is packed in a PET bottle and immediately sealed, while the pressure in the hermetically sealed bottle with the product is above atmospheric, which prevents the vacuum deformation of the container, if the pressure in the container is significantly less than atmospheric, then the side the surface of the bottle is drawn in, the shape of the

container becomes non-standard and vacuum deformation occurs.

Controlling the value of the degree of filling of the container with the product will prevent the packaging from deforming. This is the most effective factor in solving this problem. The degree of filling of a container with a product is the difference between the full volume of the bottle and the volume of the empty space of the container. Calculations and studies have shown that the relationship between the degree of filling and the occurrence of bottle deformations is the following: the higher the degree of filling of a container with product, the smaller the amount of empty space, the smaller the vacuum value and less likelihood of vacuum deformation. But this figureaffects the net mass of the product in the container, so between these indicators should be a correlation [14-18].

Conclusion

Production studies have shown that there are a number of technological parameters that need to be controlled when using polymer PET containers for packaging liquid foods: the quality of polymer containers, the temperature difference between the product and the conditions of packaging, the amount of vacuum in the sealed container, the degree of filling of the container with product. The target industrial consumers of this technology are food enterprises that use PET polymer consumer packaging for packaging homogeneous, not hot products.

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