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Process for aseptically packaging a multi-component food product.

A process for aseptically packaging a food product containing discrete pieces of a solid food component and a fluid food component comprises: depositing solid food component into an open container; contacting the open container and its contents with steam for a period of time sufficient to sterilize both; depositing a sterilized fluid food component into the container; and sealing the container under aseptic conditions. In a preferred embodiment, fully-cooked pasta is placed in a plastic container and sterilized therein prior to depositing a sterilized, cooled cheese sauce thereover and aseptically sealing.
Technical Field

The invention relates to aseptic packaging, and especially to an improved process for aseptically packaging a food having solid as well as fluid components.

To be stable against spoilage during room-temperature storage, foods must be sterilized. This usually entails retorting or otherwise treating a food to kill essentially all microorganisms. For retorting to provide effective protection for a packaged food, the whole package must be retorted until the entire contents is raised to at least a minimum temperature and held there for a designated period of time. This assures not only complete processing of all portions of the product, but overprocessing of a significant portion of it.

To overcome the problem of overprocessed food, the art has identified a number of techniques such as aseptic packaging. In aseptic packaging, the food is typically sterilized prior to sealing in the container. This enables cooking the food uniformly to near the optimum degree and avoids the gross overcooking so common to "canned goods". However, these problems have not been fully overcome for multi-component food products, e.g. those comprised of fluid and solid components. These products will often require different cooking conditions for each of the various components. Sometimes, cooking the components in the presence of each other will adversely affect one or more of the components.

Background Art

The art of aseptic canning has improved the quality of a wide range of food products, especially those having a relatively homogeneous consistency. Processing large quantities of foods having both liquid and solid components has posed problems in retaining the quality of the solid food components.

In U.S. Patent No. 3,437,495, M. R. Jeppson discloses separately sterilizing liquid and solid components before packaging them together in a sterile container under aseptic conditions. The solid component is subjected to microwave heat while the liquid is separately sterilized in a heat exchanger. The cans are sterilized unfilled. As disclosed by D. W. Pohorski in U.S. Patents No. 4,415,539 and No. 4,495,974, both steam and hot air are effective for this purpose. In U.S. Patent No. 4,522,015, W. M. Hildebolt discloses an aseptic sterilization and packaging process wherein solid and liquid components of a food product are sterilized separately. The solid component is sterilized by placing it in the can, temporarily sealing the can, heating, opening the can, adding cooled sterilized liquid to the solids in the can, and finally sealing the can. In U.S. Patent No. 5,085,882, H. Rausing discloses an aseptic packaging method wherein a combined particulate and liquid stream is heated, and a stream with a high liquid content is separated, cooled and admixed with the remainder which is high in particulates. The combined stream is then fed to a packaging machine.

It would be desirable to have a process which would simplify the aseptic packaging of multi-component foods while maintaining high quality for each of the components.

Disclosure of Invention

It is an object of the invention to provide an improved process for aseptically packaging a multi-component food product while maintaining high quality for each of the components.

It is another object of the invention to provide an improved process for aseptically packaging a multi-component food product comprising a starch-based solid component and a fluid component.

It is another object of the invention to provide an improved process for aseptically packaging a multi-component food product having a solid component and a congealable fluid component.

These and other objectives are accomplished by the present invention which provides a process for aseptically packaging a food product containing discrete pieces of a solid food component and a fluid food component, the process comprising: depositing at least a portion of, and typically all of, the solid food into an open container; contacting the open container and its contents with steam for a period of time sufficient to sterilize both; depositing a sterilized fluid food component into the container; and sealing the container under aseptic conditions.

Brief Description of the Drawing

The invention will be better understood and its advantages will be more fully appreciated from the following detailed description, especially when read in light of the accompanying drawing wherein:

The Figure is a schematic representation of a preferred process scheme.

Detailed Description

The description which follows will center on the processing of a multi-component food product, macaroni and cheese, which is particularly in need of the improvement of the invention. The cheese component must be processed within a rather narrow range of conditions to assure sterilization without overcooking which can cause color and flavor changes. The macaroni product should be cooked to a desired texture and not overcooked to become flacid with starch loss to the cooking liquid. It is important to cook the pasta separately from the cheese sauce to achieve
the desired degree of cooking while preserving the distinct flavors of the two components and preventing starch from the macaroni from being incorporated into the sauce. It will be understood, however, that the invention contemplates the processing of any two or more food components and aseptically packaging them.

The solid food component can be any particulate food which is cut, shaped or naturally occurs in pieces which can fit loosely within a container, and as such are capable of sterilization with the application of steam. The solid food can be a member selected from the group consisting of pasta, vegetables, meat, fruit and combinations of two or more of these. Within the pasta category are noodles, as well as spaghetti, linguine, lasagna, macaroni, and the like. Among the fruits and vegetables are those which are whole, sectioned, or cut up, whether peeled or unpeeled. The meat can be seafood, fowl, red meat, sausage, meatballs, meat loaf, mixtures of these, and the like pieces. In each case, the pieces may be the whole article where small enough, like peas, rice, or tiny shrimp, or can be any sized portion, like split peas, macaroni or cubes of ham.

The fluid food component will typically be what is known as a broth or a sauce. It can be truly homogeneous or can include suspended particulates, globules or the like. Typical of the broths are those prepared from meats and/or vegetables including those from meats such as beef, pork, lamb, chicken, and the like. Typical of the sauces are those prepared from ingredients selected from the group consisting of tomato, cheese, vegetable puree, and the like. The broths and sauces can include thickeners such as starch or the like. Finely-divided vegetable fat or meat material can be suspended in the fluid component for body, mouthfeel or flavor.

Reference is now made to the Figure to aid in describing a preferred process scheme according to the invention. The drawing shows empty containers 10 being fed to an aseptic packaging line 20 and being discharged from it as sealed containers 12 at the end of the line. The process of the invention is highly simplified yet results in products of very high quality.

The solid ingredient is prepared in vessel 22. This typically entails cooking, such as in the case of pasta, vegetables, meat, or the like, or simply blanching in the case of some vegetables. The preparation is usually intended to cook the solid food component to near the desired degree, with the remaining cooking to be accomplished during sterilization as will be described later. Most preferably, this component is fully cooked and/or hydrated at this stage with little or no hydration occurring later.

The prepared solid food can be delivered by suitable conduit or other transport means to a container 10 which is delivered to and supported on conveyor 24, here shown as a belt. Any means effective to convey the containers can be employed. They can be indexed or fed continuously as dictated by the particular production circumstances. Devices of the type described in the above-referenced patents to Pohorski (James Dole Corporation) can be employed, but steam or humidified air are preferred to dry air as disclosed therein to avoid drying of the solid component. The preferred process will employ superheated culinary steam to effectively supply the necessary heat to achieve the target sterilization temperature.

The containers can be glass, metal, plastic, coated fiberboard, or any suitable combination of these. Preferred for many purposes are plastic containers of co-extruded stock, e.g. having a material such as polypropylene on the surface in contact with the food, a barrier layer of a material such as ethyl vinyl alcohol, and an external surface layer of a material such as polypropylene (regrind). One especially suitable container comprises polypropylene/tielayer/barrier/tielayer/virgin polypropylene.

Following depositing the solid food component pieces into the containers 10 via line 26, the containers are passed into pressurized chamber 28 wherein steam with or without heated air is injected by suitable inlets 30 to increase the temperature to a level effective when held for a time effective to sterilize the open containers and their contents. Where desired, the steam or mixture of steam and air can be directed at the container contents to force unsterile air out and create turbulence to assure effective heat transfer. Typically, in the case of culinary steam (made with FDA approved boiler chemicals, free of dirt, metals and other contaminants), a product such as cooked macaroni is heated to from about 220° to about 250°F (about 104.4° to about 121.1°C) and held there for about 10 to 15 minutes, preferably about 12 minutes. Essentially complete kill of pathogenic as well as spoilage organisms is achieved. Shelf-temperature-stable storage for at least one month and preferably at least three is preferred. Typical commercial storage times are in the range of three to eighteen months. A preferred level of kill will be a 5 D (5 log cycle) reduction. Here D value is 1.5 minutes for commercial sterility.

After sufficient processing, a sterile fluid food component is fed from vessel 32, through conduit 34 and into sterilized container 10. To avoid further cooking of the solid food ingredient and to achieve efficient product cooling, the fluid food component is preferably cooled by passage through heat exchanger 36. The degree of cooling will be consistent with process requirements and should not be so extreme as to unduly increase the viscosity of the fluid component.

The fluid component will typically have a major amount of water with enough other liquid materials to make it fluid under conditions of processing and consumption. Fillers and thickeners can also be employed. In the case of cheese sauces, they will typi-
cally contain from 20 to 60% water, from 8 to 25% cheese solids (e.g. cheddar), from 2 to 4% starch, salt, sugar, monosodium glutamate and seasonings. Tomato sauces can be employed such as those prepared from pureed whole tomatoes with seeds removed and spices added.

From filler 34, the containers are passed to a sealing station where a sterile lid 38, from stack 40, is employed to cover the open, filled container. Sealing means 42 effects a complete seal of the lid to the container, the nature of the seal depending on the construction of both the lid and the container. An adhesive can be employed as necessary. In the case of polypropylene containers and metal lids, sealing is effected by double seam crimp action.

Following sealing, the containers are further cooled and packaged. For congealable fluids such as cheese sauce, the invention includes the step of agitating the containers to effect mixing of the fluid and solid food components. This can be achieved by any movement of the container which will move the contents sufficiently to at least contact substantially all solid component exterior surfaces with the fluid component. Agitation by vibration, rotation or translation can be effective. Preferably, the containers are rotated about at least one axis extending through the container between the container top and bottom. Preferably, rotation is about at least two axes.

The following Example is provided to further illustrate and explain a preferred form of the invention and is not to be taken as limiting in any regard. Unless otherwise indicated, all parts and percentages are by weight.

**EXAMPLE**

Pasta noodles (elbow macaroni) are blanched to achieve complete hydration (e.g., at 212°F (100.0°C) for approximately 10 minutes) then drained. Drained, blanched noodles are then poured into 7-8 ounce (207.0-236.6 ml) polypropylene cups. The cups, which are lined with polypropylene and have an impervious barrier layer, containing the blanched noodles are then passed through a "Dole" type pressurized aseptic tunnel and exposed to super-saturated (culinary) steam at about 250°F (about 121.1°C) for approximately 10-15 minutes. Cheese sauce prepared from the following recipe.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Milk</td>
<td>48.00</td>
</tr>
<tr>
<td>Water</td>
<td>34.87</td>
</tr>
<tr>
<td>Margarine</td>
<td>6.25</td>
</tr>
<tr>
<td>Cheese Powder</td>
<td>4.50</td>
</tr>
<tr>
<td>Thickeners</td>
<td>3.50</td>
</tr>
<tr>
<td>Disodium Phosphate</td>
<td>0.94</td>
</tr>
<tr>
<td>Sucrose</td>
<td>0.75</td>
</tr>
<tr>
<td>Salt</td>
<td>0.65</td>
</tr>
<tr>
<td>Monosodium Glutamate</td>
<td>0.25</td>
</tr>
<tr>
<td>Sodium Hexametaphosphate</td>
<td>0.19</td>
</tr>
<tr>
<td>Color and Flavor</td>
<td>0.10</td>
</tr>
</tbody>
</table>

is sterilized through a contherm system at about 280°F (about 137.8°C) for about 15 seconds and cooled to 100°F (37.8°C). Following sterilization, the sauce is then aseptically filled into the sterilized cups containing the sterilized noodles. The sterilized cups containing sterilized noodles and cheese sauce are then aseptically sealed with a "can type" metal lid, constructed of polyolefin extrusion-coated aluminum, by Central States Co. The noodles and sauce are present at a weight ratio of about 45 to 55. Sealed cups are then removed from the sterile sealing chamber and rotated several times to mix the noodles and cheese sauce together.

The above description is for the purpose of teaching the person of ordinary skill in the art how to practice the present invention, and it is not intended to detail all of those obvious modifications and variations of it which will become apparent to the skilled worker upon reading the description. It is intended, however, that all such obvious modifications and variations be included within the scope of the present invention which is defined by the following claims. The claims are meant to cover the claimed elements and steps in any arrangement or sequence which is effective to meet the objectives there intended, unless the context specifically indicates the contrary.

**Claims**

1. A process for aseptically packaging a food product containing discrete pieces of a solid food component and a fluid food component, the process comprising:
   - depositing at least a portion of the solid food component into an open container;
   - contacting the open container and its con-
tents with steam for a period of time sufficient to sterilize both; depositing a sterile fluid food component into the container; and sealing the container under aseptic conditions.

2. A process according to claim 1 which further includes the step of placing a sterile cover over the open container after the fluid food component has been deposited therein.

3. A process according to claim 1 or claim 2, wherein the solid food is cooked prior to depositing it into the open container.

4. A process according to any one of claims 1 to 3, wherein the solid food component comprises fully hydrated pasta.

5. A process according to any one of claims 1 to 4, which further comprises the step of agitating the container to effect mixing of the fluid and solid food components.

6. A process according to claim 5, wherein the containers are agitated by rotating about at least two axes and the container is then cooled to congeal the fluid food component.

7. A process according to any one of claims 1 to 6, comprising:
   depositing the solid food component into an open container;
   contacting the open container and its contents with steam for a period of time sufficient to sterilize both;
   heating the food sauce sufficiently to render it fluid and to sterilize it;
   depositing the food sauce into the container;
   sealing the container under aseptic conditions;
   agitating the container to effect mixing of the sauce and the solid food component; and cooling the container effectively to congeal the sauce.

8. A process according to claim 7, wherein the food sauce is a cheese sauce.

9. A process according to claim 7 or claim 8, wherein the food sauce is cooled prior to depositing it into the container.

10. A process according to any one of claims 1 to 9, wherein the container comprises an inner layer of polypropylene, a barrier layer, and an outer layer of polypropylene and the lid comprises polyolefin extrusion-coated aluminium.