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(54) **Pouch for containing retort food**

(57) A retort pouch in which proliferation of heat-resistant bacteria is inhibited is provided according to the present invention. The proliferation is preferably inhibited

ed by electron beam irradiation onto a food material or food. The retort pouch according to the present invention can be preserved under warm conditions for a long time.

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Description

BACKGROUND OF THE INVENTION

(1) Field of the Invention

[0001] This invention relates to a retort pouch technology.

(2) Description of the Related Art

[0002] The retort pouch (boil-in-the-bag food) is generally produced by steps of: bagging a food using a special wrapping (prepared by sticking foil such as aluminum foil and plastic together layer by layer) which is well preserved withstanding high pressure and temperature; filling the food into a container (normally a bag) which is sterilized by applying pressure and heat; and heat-sterilization. It is known that the retort pouch can be preserved at room temperature over a year and has an advantage in that the taste is as good as an ordinary food since the time of heating is short.

[0003] As is often the case, spore-forming bacteria such as bacillus group and clostridium group (hereinafter, spore bacteria) are attached on food materials. The spore bacteria withstand a normal sterilization process including a step such as high temperature and pressure step, step of ultraviolet rays irradiation, and drying step, then begins to grow and multiply under a preferable condition. Consequently, a normal sterilization process of applying high temperature and pressure does not bring about a complete sterilization for the retort pouch.

[0004] It has been actually impossible to preserve foods, which might have these spore bacteria therein, under warm condition so that a customer can impromptu drink and eat after buying from a vending machine. Some retort pouches have been marketed without considering the effect of heat-resistant bacteria, resulting in withdrawal from the market caused by problems accompanied with the heat-resistant bacteria.

[0005] It is therefore the object of the present invention to solve the above-mentioned problem and to provide a retort pouch which withstands a long term preservation under warm condition as well as a method for producing thereof.

SUMMARY OF THE INVENTION

[0006] In order to accomplish the above object, a first aspect of the present invention is to provide a retort pouch wherein a proliferation of heat-resistant bacteria is inhibited.

[0007] A second aspect of the present invention is to provide the retort pouch, wherein the proliferation of heat-resistant bacteria is inhibited by an electron beam irradiation process.

[0008] A third aspect of the present invention is to provide the retort pouch, wherein the electron beam energy

for the irradiation process is lower than 1 MeV.

[0009] A fourth aspect of the present invention is to provide a method for producing a retort pouch comprising a step of inhibiting a proliferation of heat-resistant bacteria.

[0010] The retort pouch according to the present invention is an excellent food which can be preserved under warm condition for a long time, so that a customer can impromptu drink and eat after buying from a vending machine, even if the food is composed of food materials possibly containing heat-resistant bacteria such as spore bacteria therein.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] The retort pouch according to the present invention includes such as canned food and bottled food other than usual retort pouch packed in a multilayer film.

[0012] The heat-resistant bacteria in the present invention refers to such as spore-forming bacteria, the sterilization of which is difficult to perform by usual sterilization process at 121°C, for example, bacillus group and clostridium group.

[0013] As a method for inhibiting proliferation of heat-resistant bacteria, the electron beam irradiation is a significantly rapid and reliable method, and seems to exert a minimal influence on taste of food materials. However, there might be an adverse effect on taste caused by the electron beam irradiation.

[0014] In the present invention, it has been found that heat-resistant bacteria normally survive on the surface of the food material and scarcely proliferate inside the food material, so that low energy electron beam (sometimes called soft electron) having lower than 1 MeV can inhibit the proliferation of the bacteria without causing any undesirable effect on a taste of the food material, preventing an activation (start of proliferation) of the bacteria.

[0015] The electron beam energy is preferably about 100 KeV or lower from the viewpoint of maintaining the food taste, and also preferably 50 KeV or higher to obtain sufficient effect on inhibition of the proliferation of the bacteria. The low energy electron beam having energy lower than 1 MeV is not included in "radiation" provided by the Atomic Energy Act (related to definition of radiation), Government ordinance No. 325, Art. 4, thereby has an advantage of the legal control being comparatively lax and the apparatus thereof being easy to handle.

[0016] The radiation dose of the electron beam needed to inhibit the proliferation of heat-resistant bacteria is preferably 1 to 50 kGy in order to obtain a sufficient effect without damage the quality of the food material, and more preferably 5 to 10 kGy. A uniform irradiation of the electron beam on the food material is needed from the viewpoint of obtaining the maximum effect with the minimum dose of irradiation.

[0017] As a tool for the electron beam irradiation, suitably used is a low energy electron beam irradiation apparatus, commercially available from such as Ion Beam Applications, S. A. (Belgium), Titan Corporation (U.S.), Biosterile Technology, Inc. (U.S.), Iwasaki Electric Co., Ltd., Nissin High Voltage Co., Ltd., Sumitomo Heavy Industries, Ltd., Mitsubishi Heavy Industries, Ltd or Denki Kogyo Co., Ltd.

[0018] The inhibition process of proliferation of heat-resistant bacteria according to the present invention may be performed on the food material such as grain, meat and vegetable before cooking. The process may be performed during or after cooking as well. The process may be performed after sealing up the food into a container as a case of usual retort pouch. Taking a metal used in such as container of a retort pouch, cap of a bottle or can into consideration, the inhibition process of proliferation of heat-resistant bacteria is preferably performed before putting the food or food material into these airtight containers. After sealing up the food or food material in this manner, a normal sterilization process at 121°C, for example, can be further applied so as to thereby obtain a retort pouch which can be completely preserved for a long time.

[0019] In the present invention, the inhibition process of proliferation of heat-resistant bacteria should be applied only to the food material that possibly has the heat-resistant bacteria therein in order to minimize the producing cost of the food.

[0020] The inhibition process according to the present invention is performed upon fixed food or food material by the irradiation of electron beam thereon. When the food or food material is fluid, the irradiation of electron beam can be continuously performed by flowing the food or food material.

[0021] The preferable food material for the inhibition process of proliferation of heat-resistant bacteria according to the present invention is, for example, grain such as rice, wheat, buckwheat and bean, staple food such as potato and granular chicken bouillon, vegetable such as carrot, spinach, mushroom, burdock, leek, cabbage, cucumber and radish, dried vegetable thereof, natural spice such as ginger, garlic and pepper, meat, seafood, seasoning such as soybean paste, soy sauce, salt, tangle and bonito stock, dried seasoning thereof, and artificial seasoning such as glutamate. The food made from the above food material is also preferable for the inhibition process of proliferation of heat-resistant bacteria according to the present invention.

[0022] It should be taken into consideration that the amount of water contained in the food material is preferably as little as possible in order to raise a throughput of the inhibition process according to the present invention.

[0023] In the following, examples of the present invention are explained in detail.

EXAMPLE 1

[0024] The electron beam irradiation onto a commercially available granular chicken bone (chicken bouillon) of 0.1 to 1 mm grain size as received was performed under a condition of 990 KeV, 5 mA and dose of 9 kGy using an electron beam irradiation apparatus Model ES600I made by Denki Kogyo Co., Ltd. As a result, the proliferation of heat-resistant bacteria was completely inhibited.

[0025] A chicken soup obtained using thus irradiated chicken bone was put into a retort container made of multilayer film composed of aluminum foil and resin film, sealed and then heated at 121°C under pressure for 30 minutes to obtain several retort pouches (hereinafter, Example No. 1).

[0026] On the other hand, another chicken soup obtained using the chicken bone without the irradiation of electron beam was similarly packed and then heated under pressure as above to obtain several retort pouches (hereinafter, Comparative Example No. 1).

[0027] A part of Comparative Example No. 1 was left standing at 20°C for 5 days and then opened to carry out a bacteriological examination thereof. As a result, the heat-resistant bacteria was not activated, the number of bacteria was less than a detection limit (according to a standard method using agar plate; hereinafter the same), and no rot was observed.

[0028] Another part of Comparative Example No. 1 and Example No. 1 were preserved at 55°C for 2 days. As a result, the activation of heat-resistant bacteria was observed for Comparative Example No. 1, while no activation was observed for Example No. 1. As for Example No. 1, it was observed that an additional preservation at 55°C for 3 days caused neither activation of heat-resistant bacteria therein nor any abnormality in the taste. Further, Example No. 1 was preserved at 55°C for 180 days after the production thereof and then the quality check was executed revealing that no change in the quality as a food was observed.

[0029] As for Example No. 1 and Comparative Example No. 1, number of the activated spore bacteria was counted according to a standard method of counting bacteria on plate, both right after each production and after reservation under warm condition at 55°C for 50 hours. As a result, the activated spore bacteria were not detected for Example No. 1, while the activated spore bacteria of 1.5×10^3 in number per 1 g were detected for Comparative Example No. 1.

EXAMPLE 2

[0030] Similarly to Example 1, the electron beam irradiation onto a prepared dry curry was performed under a condition of 990 KeV, 5 mA and 9 kGy. The irradiated dry curry was put into a retort container, sealed and then heated at 120°C under pressure for 40 minutes to obtain several retort pouches (hereinafter, Example No. 2).

[0031] On the other hand, another dry curry without the irradiation of electron beam was similarly packed and then heated under pressure as above to obtain several retort pouches (hereinafter, Comparative Example No. 2).

[0032] As a result of their bacteriological examination, the heat-resistant bacteria were not detected for Example No. 2, while the heat-resistant bacteria of 4 in number per 1 g were detected for Comparative Example No. 2. Neither colon bacillus group (examined by a propagation method using BGLB medium) nor general bacteria (examined by a standard method of counting bacteria on plate) were detected for Comparative Example No. 2.

[0033] The heat-resistant bacteria was not activated for Comparative Example No. 2 preserved at room temperature, while an activation of heat-resistant bacteria and an rotting were observed for Comparative Example No. 2 after preserved at 55°C for 64 days.

[0034] On the other hand, no abnormality was observed for Example No. 2 after preserved under warm condition at 55°C for 64 days. Further, Example No. 2 was preserved at 55°C for 180 days after the production thereof and then the quality check was executed revealing that neither activation of heat-resistant bacteria nor abnormality in the quality as a food was observed.

EXAMPLE 3

[0035] Similarly to Example 1, the electron beam irradiation onto a prepared Japanese pilaf was performed under a condition of 990 KeV, 5 mA and 9 kGy. The irradiated Japanese pilaf was put into a retort container, sealed and then heated at 120°C under pressure for 40 minutes to obtain several retort pouches (hereinafter, Example No. 3).

[0036] On the other hand, another Japanese pilaf without the irradiation of electron beam was similarly packed and then heated under pressure as above to obtain several retort pouches (hereinafter, Comparative Example No. 3).

[0037] As a result of their bacteriological examination, the heat-resistant bacteria were not detected for Example No. 3, while the heat-resistant bacteria of 130 in number per 1 g were detected for Comparative Example No. 3. Neither colon bacillus group nor normal bacteria were detected for Comparative Example No. 3.

[0038] The heat-resistant bacteria was not activated for Comparative Example No. 3 preserved at room temperature, while an activation of heat-resistant bacteria and an rotting were observed for Comparative Example No. 3 after preserved at 55°C for 60 days.

[0039] On the other hand, no abnormality was observed for Example No. 3 after preserved under warm condition at 55°C for 64 days. Further, Example No. 3 was preserved at 55°C for 180 days after the production thereof and then the quality check was executed revealing that neither activation of heat-resistant bacteria nor

abnormality in the quality as a Japanese pilaf was observed.

EXAMPLE 4

[0040] Similarly to Example 1, the electron beam irradiation onto a prepared Chinese fried rice was performed. The irradiated Chinese fried rice was put into a retort container, sealed and then heated at 120°C under pressure for 40 minutes to obtain several retort pouches (hereinafter, Example No. 4).

[0041] On the other hand, another Chinese fried rice without the irradiation of electron beam was similarly packed and then heated under pressure as above to obtain several retort pouches (hereinafter, Comparative Example No. 4).

[0042] As a result of their bacteriological examination, the heat-resistant bacteria were not detected for Example No. 4, while the heat-resistant bacteria of 170 in number per 1 g were detected for Comparative Example No. 4. Neither colon bacillus group nor normal bacteria were detected for Comparative Example No. 4.

[0043] The heat-resistant bacteria was not activated for Comparative Example No. 4 preserved at room temperature, while an activation of heat-resistant bacteria and an rotting were observed for Comparative Example No. 4 after preserved at 55°C for 64 days.

[0044] On the other hand, no abnormality was observed for Example No. 4 after preserved under warm condition at 55°C for 64 days. Further, Example No. 4 was preserved under warm condition at 55°C for 180 days after the production thereof and then the quality check was executed revealing that neither activation of heat-resistant bacteria nor abnormality in the quality as a Chinese fried rice was observed.

Claims

1. A retort pouch wherein the proliferation of heat-resistant bacteria has been inhibited.
2. The retort pouch according to claim 1, wherein the proliferation has been inhibited by an electron beam irradiation process.
3. The retort pouch according to claim 2, wherein the electron beam energy is lower than 1 MeV.
4. A retort pouch according to any preceding claim in which the heat-resistant bacteria comprise spore-forming bacteria, preferably bacillus and/or clostridium bacteria.
5. A method for producing a retort pouch comprising a step of inhibiting the proliferation of heat-resistant bacteria.

6. The method according to claim 5 in which the proliferation is inhibited by an electron beam irradiation process.
7. A method according to claim 6 comprising providing a food material and a retort pouch, subjecting the food material to an electron beam irradiation process and placing the irradiated food material in the retort pouch and sealing the retort pouch.
8. A process according to claim 7 comprising heating the sealed retort pouch so as to heat-sterilise it, the heating preferably being carried out under pressure.
9. A method according to any of claims 6 to 8 wherein the electron beam energy is lower than 1 MeV, and is preferably at least 50 KeV.
10. Use of electron beam irradiation to inhibit the proliferation of heat-resistant bacteria, preferably spore bacteria, more preferably bacillus and/or clostridium bacteria.

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