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(54) METHOD FOR MANUFACTURING HIGH PRESSURE PROCESSED FOOD PRODUCTS

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(57) **ABSTRACT**

The present invention is directed to the high pressure processing of food products after packaging in order to extend the shelf life and eliminate bacteria and microorganisms. Fresh food products that can be processed according to the present invention include, for example, beef, chicken, pork, lamb, seafood, vegetables, sauces and starches. The method for processing food products involves vacuum sealing a food product within plastic film to form a vacuum sealed package. The vacuum sealed package is then placed in a pressurizing apparatus and the pressurizing apparatus is then loaded with water. The water is then pressurized inside the pressurizing apparatus to exert hydrostatic pressure on the vacuum sealed package.

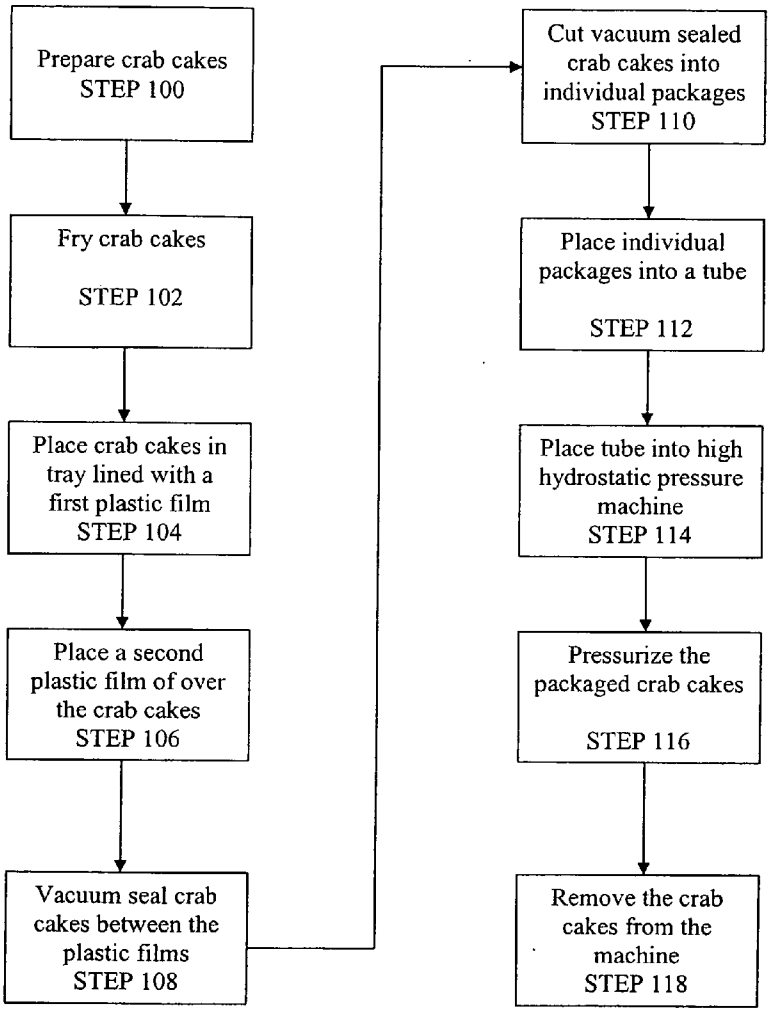


FIG. 1

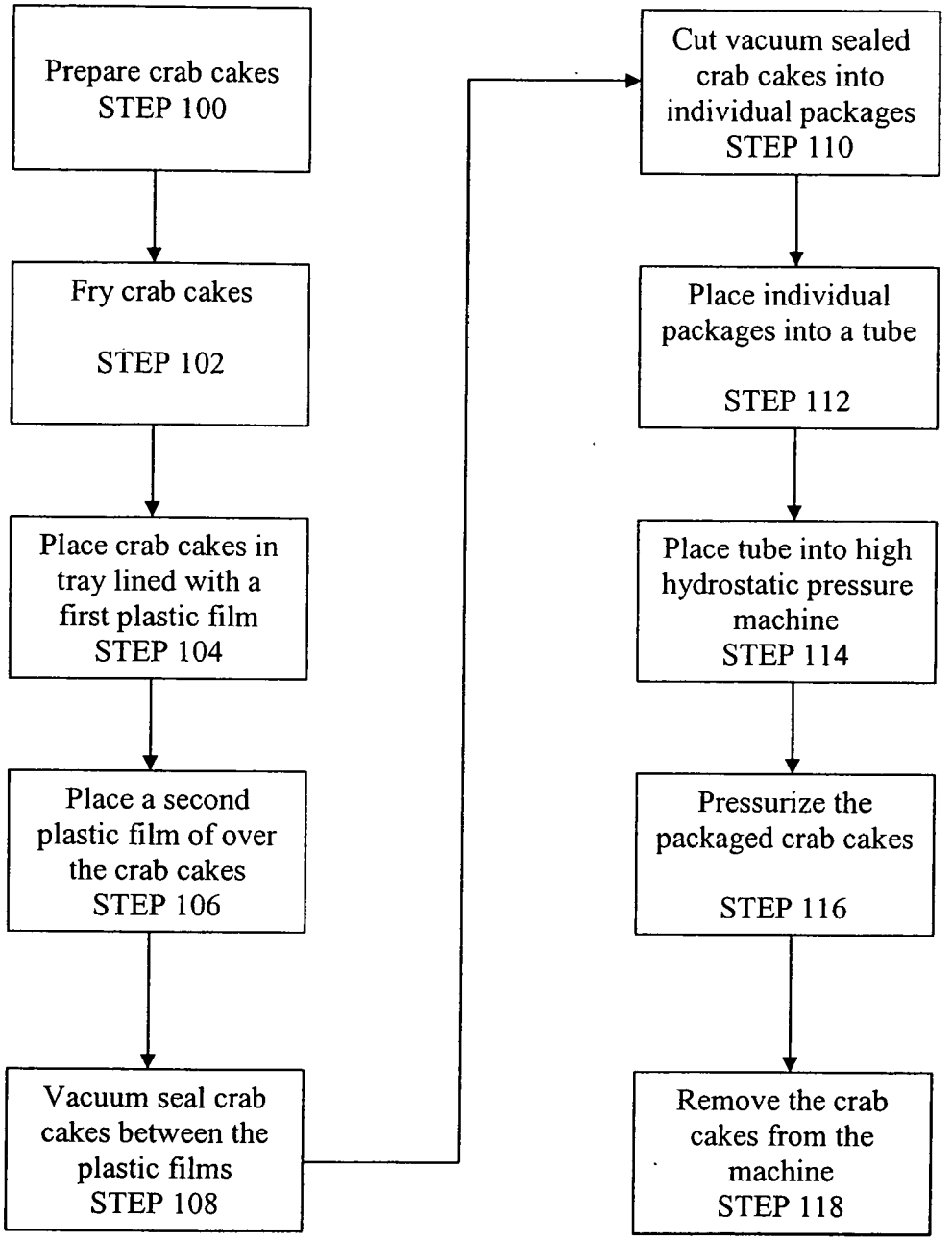

Prepare crab cakes
STEP 100
Fry crab cakes
STEP 102
Place crab cakes in tray lined with a first plastic film
STEP 104
Place a second plastic film of over the crab cakes
STEP 106
Vacuum seal crab cakes between the plastic films
STEP 108
Cut vacuum sealed crab cakes into individual packages
STEP 110
Place individual packages into a tube
STEP 112
Place tube into high hydrostatic pressure machine
STEP 114
Pressurize the packaged crab cakes
STEP 116
Remove the crab cakes from the machine
STEP 118

FIG. 2

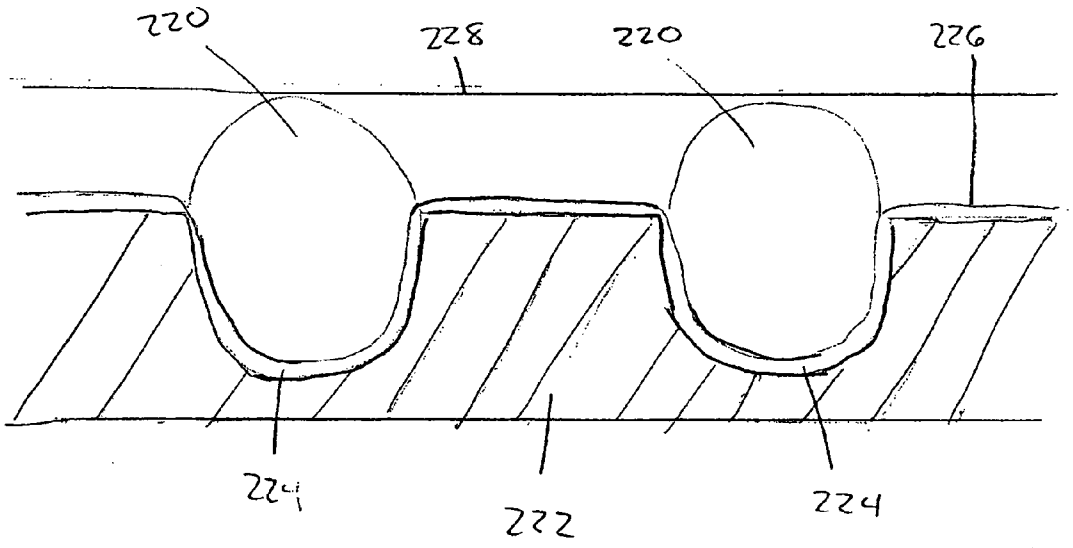


FIG. 3A

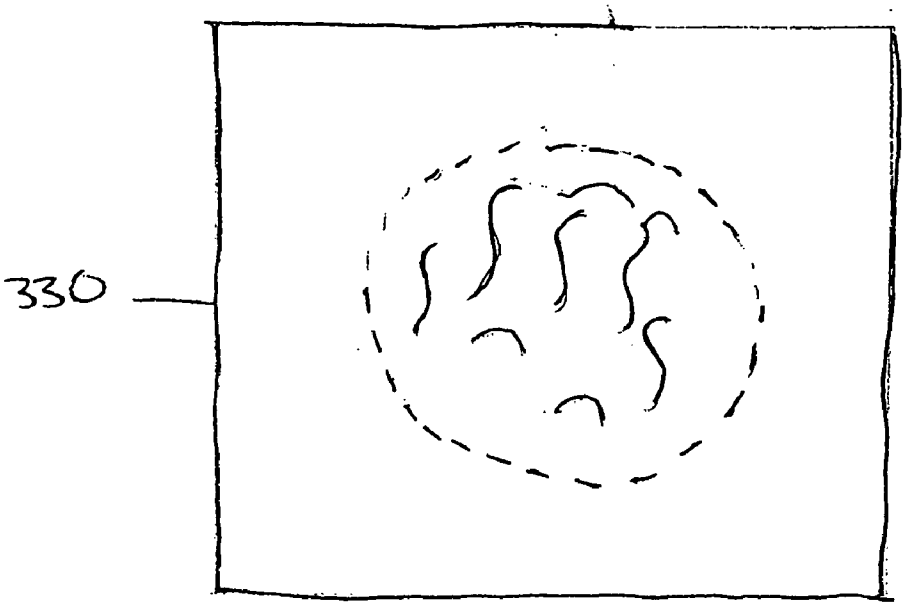
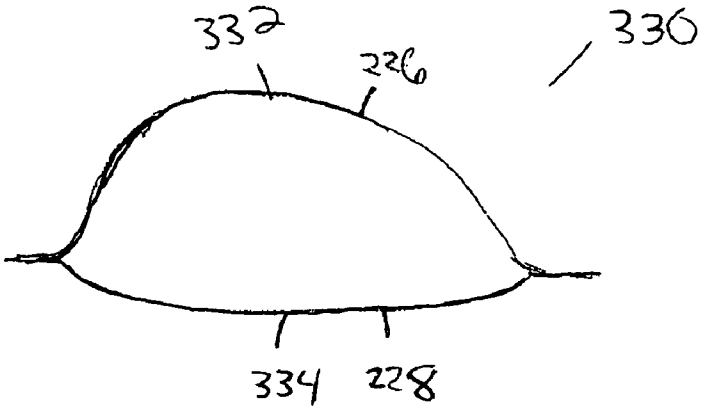


FIG. 3B



METHOD FOR MANUFACTURING HIGH PRESSURE PROCESSED FOOD PRODUCTS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention is directed to the high pressure processing of food products after packaging in order to extend the shelf life and eliminate bacteria and microorganisms.

[0003] 2. Background Art

[0004] There are several competing concerns in the sale and packaging of food products, particularly seafood: fresh vs. frozen, extending the shelf life to the maximum extent possible, and the elimination of bacteria and microorganisms, such as *Clostridium botulinum.*

[0005] Fresh seafood is a highly perishable product with a short shelf life. For instance, fresh seafood bought at a grocery store should typically be eaten within two to three days. One method for extending the shelf life of seafood is to freeze the seafood. However, the energy costs associated with freezing and frozen storage are high. Also there is a high demand for fresh seafood products as consumers prefer fresh seafood over frozen seafood, as the freezing process can change the taste and texture of the seafood in a negative manner.

[0006] Another concern with the sale of seafood is preventing the growth of bacteria or microorganisms, such as *Clostridium botulinum*, also known as *C. botulinum*. It is known to package seafood in reduced oxygen packaging (ROP) including vacuum packaging and modified or controlled atmospheric packaging (MAP or CAP) in order to extend the shelf life. ROP also results in preventing the growth of spoilage bacteria that require normal air levels of oxygen to grow. However, the reduced oxygen in the packaging creates an anaerobic environment that can allow for the growth of *C. botulinum.*

[0007] Other known methods for eliminating bacteria and microorganisms, such as *C. botulinum*, include heating or irradiation treatments. However, such treatments involve high temperatures, which can affect the freshness, flavor, texture, appearance and color of the seafood.

[0008] A new technology that has emerged in recent years is high pressure processing (HPP). High pressure processing involves placing a food product in a pressure vessel and surrounding it with a pressure medium, such as water. The vessel is pressurized to uniformly apply pressure to all surfaces of the food product. U.S. Pat. No. 6,537,601 to Voisin discloses a process of treating shellfish to eliminate bacteria utilizing high pressure processing. However, this process does not address treating fresh, packaged food products to eliminate bacteria and extend the shelf life of the food product.

[0009] Currently there are no available solutions for processing with high hydrostatic pressure to prevent the growth of *C. botulinum* in seafood other than the use of external time temperature integrators. Therefore, the need exists for a method of packaging fresh food products, such as seafood, that extends the shelf life and prevents the growth of bacteria and microorganisms, such as *C. botulinum*. To this end, the present invention is directed to a method of high hydrostatic pressure processing, which solves the problems of the prior art by processing fresh food products after they have been vacuum sealed in oxygen permeable plastic. The process extends the shelf life of the packaged fresh food products and allows for the retention of the freshness, flavor, texture, appearance and color of the food product. The high hydrostatic pressure processing is also quicker and more energy efficient than other methods known in the prior art.

BRIEF SUMMARY OF THE INVENTION

[0010] It is an object of the present invention to provide a process for high hydrostatic pressure processing of food products after packaging in order to extend the shelf life and eliminate bacteria and microorganisms.

[0011] This objective of the present invention is achieved through a method for processing food products comprising vacuum sealing a food product within a plastic material to form a vacuum sealed package; placing said vacuum sealed package into a pressurizing apparatus; loading water into said pressurizing apparatus; and pressurizing said water inside said pressurizing apparatus to exert hydrostatic pressure on said vacuum sealed package for at least 60 seconds at pressure greater than or equal to 25,000 psi.

[0012] Another object of the present invention is to provide a process for high hydrostatic pressure processing of food products that are vulnerable to the growth of *C. botulinum* by utilizing a plastic material for the packaging that has an oxygen transmission rate greater than 10,000 $cc/m^2/24$ hrs.

BRIEF DESCRIPTION OF THE DRAWINGS/FIGURES

[0013] FIG. **1** is a flow chart showing a process of treating crab cakes according to the present invention.

[0014] FIG. **2** is a cross-sectional view of the crab cakes in the tray between two plastic films before vacuum sealing.

[0015] FIG. **3**A is a top view of an individual crab cake package after being treated according to the present invention.

[0016] FIG. **3**B is a side view of an individual crab cake package after being treated according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] The present invention is directed to the high pressure processing of food products after packaging in order to extend the shelf life and eliminate bacteria and microorganisms.

[0018] Preferred embodiments of the present invention are now described. While specific configurations and arrangements are discussed, it should be understood that this is done for illustrative purposes only. A person skilled in the relevant art will recognize that other configurations and arrangements can be used without departing from the spirit and scope of the invention. It will also be apparent to a person skilled in the relevant art that this invention can be employed in a variety of other devices and applications.

[0019] Fresh food products that can be processed according to the present invention include, for example, protein, vegetables, sauces and starches. Protein can include beef, chicken, pork, lamb and seafood. Seafood can include, for example, seafood cakes, raw fish, sub-par cooked fish, marinated fish, seafood dips, shellfish, seafood soups, and other food products with seafood ingredients or stocks. Starches can include, for example, pastas and rice. When a food product is processed according to the present invention, the shelf life of a food product is extended if refrigerated, without having ever frozen the food product. The length of the increase in shelf life depends on the particular product. Also, safe food additives may be added to reduce the growth of lactic acid bacteria and to further extend the shelf life of the food product.

[0020] The process of the present invention involves first preparing the food item, for example, such as by grilling, baking, frying, boiling, steaming or marinating. The prepared food product is then vacuum sealed in a plastic package of suitable plastic material utilizing settings appropriate to the application. The plastic material can comprise a plastic bag, a single plastic film or substrate, or two plastic films or substrates sealed together or a tray sealed with a plastic lidding material. The vacuum sealing process comprises surrounding the food product with the plastic material. A vacuum is created and the plastic is sealed forming a vacuum sealed food product. For example, the Koch Intact™ Vacuum Skin Packaging Machine, Model RM571 is utilized for the vacuum sealing process.

[0021] In a preferred embodiment the plastic material is flexible and can withstand a compression rate of up to 15%. The high pressure processing can cause an item to shrink by 15% and the plastic material must be able to withstand such a compression rate or risk compromising the integrity of the package and/or seal.

[0022] In a preferred embodiment, when the food product being packaged is vulnerable to the growth of *C. botulinum*, the plastic material utilized to form the packaging has an oxygen transmission rate suitable to allow sufficient amounts of oxygen into the package to prevent the anaerobic growth of bacteria and microorganisms, such as *C. botulinum*. If *C. botulinum* is not a concern, the plastic material for packaging the food product may be a suitable plastic barrier film.

[0023] Seafood products are an example of such a food product that requires the plastic material of the package to have a suitable oxygen transmission rate. The vacuum sealing process creates an anaerobic environment by reducing the amount of oxygen. In order to prevent the anaerobic growth of bacteria and microorganisms, such as *C. botulinum*, the packaging material preferably has an oxygen transmission rate greater than 10,000 $cc/m^2/24$ hrs. The Cryovac® HP2700 plastic bag, is preferred, as it has a guaranteed oxygen transmission rate of greater than 10,000 $cc/ m^2/24$ hrs. The package also must have an appropriate thickness in order to eliminate the risk of *C. botulinum* growth.

[0024] The vacuum sealed package is placed in the chamber of a pressurizing apparatus, such as a pressure vessel and the vessel is filled with water. The water in the pressure vessel is pressurized so that it exerts a hydrostatic pressure on the packaged food product. This process is referred to as hydrostatic high pressure processing (HPP). U.S. Pat. No. 6,217,435 to Voisin, which is incorporated by reference in its entirety herein, describes HPP machinery that can be utilized in the present invention. The HPP machinery is set for both cycle of time and amount of pressure according to the specific food product being treated. The hydrostatic pressure is in a range from 25,000 psi to 120,000 psi, depending upon the food product being treated, with a preferred range of 35,000 psi to 87,000 psi. The duration of the pressure is in a range from one minute to 30 minutes, depending upon the food product being treated, with a preferred duration of about 3 minutes. The temperature may be adjusted within a range from 40° F. to 170° F., with a preferred range of 40° F. to 70° F., to assist the high pressure and also to ensure optimal quality.

[0025] The hydrostatic pressure is transmitted through the water to the packaged food product in equal and uniform amounts instantaneously to the entire surface of the packaged food product. These effects are independent of the packaged food product's size or shape. HPP is beneficial because it reduces and/or destroys pathogens in the food product, the food product does not need to be frozen, nothing is added to the food product, it is a non-thermal process and the food product retains its organoleptic and nutritional qualities. Another advantage of HPP is that marinated packaged food products, such as beef, lamb, poultry, pork and seafood, receive superior marination when subjected to the HPP as the pressure creates a greater saturation of the food product with the marinade. Thus this process allows for flavor infusion and increased food safety.

[0026] In a preferred embodiment, the packaged food product is loaded into a tube or other machine device, which is subsequently placed inside the pressure vessel. The packaged food products may be loaded into the tube or device from the top or side. In addition, the tube or device may be compartmentalized such that each packaged food product is separated from the others in order to fully benefit from the hydrostatic pressure.

[0027] After pressurization the food product is removed from the HPP machinery and is refrigerated. This process extends the shelf life of the food product as much as several months depending on the particular food product.

[0028] Having now generally described the invention, the same will be more readily understood through reference to the following examples which are provided by way of illustration, and are not intended to be limiting of the present invention.

EXAMPLES

Example 1

[0029] FIGS. **1**, **2**, **3**A and **3**B describe a process for preparing seafood cakes, such as crab cakes. The crab cakes **220** are prepared (STEP **100**) and are then pan fried for approximately 3 minutes at approximately 350° F. (STEP **102**). A tray **222** is provided with a plurality of cavities **224**. The tray **222** may be pre-formed or formed in-line. While pan frying is utilized in this example, the crab cake may be prepared through other methods, for example, such as by broiling or baking. A first plastic film **226** is placed over the tray **222** and each of the cavities **224** is filled with a prepared crab cake **220** (STEP **104**). The first plastic film **226** is preferably a 3 to 12 mil durable plastic, more preferably a 10 ml durable plastic, and functions as the top surface **332** of the ultimate vacuum sealed package **330**. A second plastic film **228** is placed over the crab cakes **220** (STEP **106**). The second plastic film **228** can be either a perforated durable plastic, of preferably 10 mil, or an oxygen permeable film

with an oxygen transmission rate greater than 10,000 cc/m^2/24 hrs, for example one available from Cyrovac. In a preferred embodiment the second plastic film **228** is thinner than the first plastic film **226**. The second plastic film **228** serves as the bottom surface **334** of the ultimate vacuum sealed package **330**. The crab cakes **220** are then vacuum sealed between the first and second plastic films **226**, **228** utilizing, for example, a Koch Intact™ Vacuum Skin Packaging Machine, Model RM571 (STEP **108**).

[**0030**] After the crab cakes **220** are vacuum sealed, the crab cakes **220** are cut into individual sealed packages **330** (STEP **110**). The individual packages **330** are loaded into a tube (STEP **112**) and the tube is placed into the pressure chamber of a pressurizing apparatus, such as a high hydrostatic pressure vessel (STEP **114**). The pressure vessel is loaded with water and the water is pressurized to 60,000 psi for 180 seconds (STEP **116**). The individual packages **330** of crab cakes are then removed from the tube and the vessel and refrigerated (STEP **118**). The treated crab cakes have a shelf life of up to 70 days.

Example 2

[**0031**] A salmon steak is steamed for 5 minutes at 165° F. and then vacuum sealed in a oxygen permeable plastic film with an oxygen transmission rate greater than 10,000 cc/m^2/24 hrs. The vacuum sealing process involved pulling a vacuum for 3 seconds and then sealing for 3 seconds. Afterwards, the packaged salmon steak was loaded into a pressure vessel for HPP. The water was pressurized to 45,000 psi for approximately 3 minutes.

Example 3

[**0032**] A cut of tenderloin was seared and then sauteed for 3 minutes on each side such that the core temperature of the tenderloin was 45° F. The tenderloin was then vacuum sealed between two barrier films by applying vacuum for 5 seconds and HPP was performed for 180 seconds.

Example 4

[**0033**] A rib lamb chop was sauteed on each side. The tenderloin was then vacuum sealed between two barrier films by applying vacuum for 3 seconds and then performing HPP for 180 seconds.

[**0034**] It is to be appreciated that the Detailed Description section, and not the Summary and Abstract sections, is intended to be used to interpret the claims. The Summary and Abstract sections may set forth one or more but not all exemplary embodiments of the present invention as contemplated by the inventor(s), and thus, are not intended to limit the present invention and the appended claims in any way.

What is claimed is:

1. A method for processing food products, comprising:

(a) vacuum sealing a food product within plastic material to form a vacuum sealed package;

(b) placing said vacuum sealed package into a pressurizing apparatus;

(c) loading water into said pressurizing apparatus; and

(d) pressurizing said water inside said pressurizing apparatus to exert hydrostatic pressure on said vacuum sealed package in a range from 1 minute to 30 minutes at a pressure in a range from 25,000 psi to 120,000 psi.

2. The method of claim 1, wherein said food product is selected from the group consisting of beef, chicken, pork, lamb, seafood, vegetables, sauces and starches.

3. The method of claim 1, wherein said food product is seafood and said seafood is selected from the group consisting of seafood cakes, raw fish, sub-par cooked fish, marinated fish, seafood dips, shellfish, seafood soups, and other food products with seafood ingredients or stocks.

4. The method of claim 1, wherein at least a portion of said plastic material has an oxygen transmission rate greater than 10,000 cc/m^2/24 hrs.

5. The method of claim 1, wherein said food product is a plurality of products.

6. The method of claim 5, wherein said step of vacuum sealing further comprises:

providing a tray with a plurality of cavities;

placing a first plastic film over said tray;

filling each of said plurality of cavities with one of said plurality of products after placing said first plastic film;

placing a second plastic film over said plurality of products; and

vacuum sealing said plurality of products in said tray between said first and second plastic films.

7. The method of claim 6, further comprises cutting said vacuum sealed products into individual vacuum sealed packages.

8. The method of claim 6, wherein said first plastic film is 3 to 12 mil.

9. The method of claim 6, wherein said second plastic film is oxygen permeable with an oxygen transmission rate greater than 10,000 cc/m^2/24 hrs.

10. The method of claim 6, wherein said second plastic film is perforated.

11. The method of claim 6, wherein said plurality of food products comprises seafood cakes.

12. The method of claim 11, wherein said seafood cakes are crab cakes.

13. The method of claim 1, wherein said plastic material is flexible and can withstand a compression rate of up to 15%.

14. The method of claim 1, wherein said pressurizing occurs in a range from 35,000 psi to 87,000 psi.

15. The method of claim 1, wherein said pressurizing occurs for about 3 minutes.

16. The method of claim 1, wherein said pressurizing occurs at a temperature in a range from 40° F. to 170° F.

17. The method of claim 1, wherein said plastic material is at least one barrier film.

* * * * *