Title: METHOD FOR PACKING FISH PRODUCT, FISH PRODUCT PACKAGE

Abstract: A method for packing a fish product (39), and a fish product package. The method comprises packing the fish product (39) in a vacuum package, arranging in said vacuum package an empty space (43), forming in the vacuum package by means of empty space (43) an underpressure, and maintaining the empty space (43) in the package, the underpressure generating pressure on the fish product (39).
Method for packing fish product, and fish product package

Background

The invention relates to a method for packing a fish product, the method comprising packing the fish product in a vacuum package.

The invention further relates to a fish product package comprising an airtight, vacuumizable interior for receiving the fish product.

Today, the problem is that fish are produced quite elsewhere than where they are consumed. Consequently, transport distances are long and time-consuming. A yet more disadvantageous situation occurs when fish are cultured for instance in Norway and transported for further processing to Poland and only then delivered to a target country, such as France. The transport distance may easily take 4 to 10 days from a fish farm to a further processing plant wherein for instance a graving work process is only first begun. The graving work process itself may take 4 days if the method used is a dry salting method.

The problem is thus that with the current methods, a fish fillet may be of poor quality already before being delivered to an end customer.

Brief description

The method and package according to the invention are characterized by what is disclosed in the characterizing parts of the independent claims. Other embodiments of the invention are characterised by what is disclosed in the other claims.

Inventive embodiments are also disclosed in the specification and drawings of this application. The inventive contents of the application may also be defined in ways other than those described in the following claims. The inventive contents may also consist of several separate inventions, particularly if the invention is examined in the light of expressed or implicit sub-tasks or in view of obtained benefits or benefit groups. In such a case, some of the definitions contained in the following claims may be unnecessary in view of the separate inventive ideas. Features of the different embodiments of the invention may be applied to other embodiments within the scope of the basic inventive idea.

The new method provides a solution to the problem of how to get a fresh processed fish product, such as fish products involving a graving work
process, graved salmon, cold or hot smoked fish products, delivered to the
destination as fresh as possible and still avoid excess salinity of the fish prod-
uct being delivered to the customer.

According to an idea, the new method minimizes a time loss caused
by the transporting work process by combining two most time-consuming work
processes; 1) the graving work process and 2) the transporting work process. Most advantageously, this enables the fish product, such as a fillet of graved salmon, to reach the customer even 7 days earlier.

A further advantage may be that production capacity can be in-
creased at early phases of a fish processing process since it is now unnec-
sary to store up the fish fillets for 4 days in the graving work process but they can be directly packed in a package manufactured for the purpose and sent on to transport immediately.

The end product may be for instance a graved fish fillet, a hot
smoked fish fillet or a cold smoked fish fillet. Optional smoking is preferably
carried out after transport, at the destination.

The graving work process referred to herein may be dry salting, wet
salting or any work process wherein the fish product has been subjected to the
influence of salt and wherein salt affects the composition, texture, taste or the
like of the fish flesh in the end product.

In the preparation of graved fish, such as graved salmon, dry salting
is carried out for instance using sea salt, and the liquid generated is removed
so as not to affect the fish flesh. This is also the procedure in connection with a
graved fish fillet, such as a graved salmon fillet, to be used at the destination, i.e. after a combined transporting/graving work process, for cold smoking. Other-
wise the amount of salt and the composition of the flesh would be wrong.

A fish fillet meant for hot smoking may first be subjected to a wet
salting work process, which may take up to a whole day. After the wet salting
work process, the fish fillet is removed from the solution, cleaned and optional-
ly seasoned prior to being placed in a fish product package, where it is left to
cook for a necessary period of time. This time period is typically at least one
day. In this case, some of the salt is absorbed in the fish flesh while some of it
remains on the surface of the fish product, whereby bacterial growth is non-
existent. Transporting can be commenced once the fish fillet has been re-
moved from the brine and packed.
In a third embodiment, the brine is left in the package where it is allowed to be in contact with the fish flesh, but then the concentration of the brine is accurately limited to be between 2% and 6%.

In the graving work process, spices, such as dill, pepper, etc., may be added to the fish product. Sugar, honey or, say, maple syrup may also be added. Alcohol, such as whiskey, cognac, gin or the like, may also be used.

According to an idea, a combined graving and transporting work process is carried out as refrigerated transport for instance at a temperature of +3°C such that the work process itself is performed in a sealed space, which may be for instance a vacuum package, a gas atmosphere package, an EPS box with a lid, or any package which enables atmospheric air to be prevented from affecting the work process in question.

According to an idea, the fish fillets are packed such that the appropriate graving work process can be carried out during transport, and that the product can also be stored in the package in question for 30 days, for instance, so that no undesired changes, such as in the form of too high salinity, occur in the composition of the flesh, etc. The graving work process is thus carried out in a desired time, but yet the product can be stored in the same package for long time periods without having to open the package or carry out re-packing.

Salt has two important functions in fish use; it changes the composition of the flesh into the appropriate one, opens up aromas and flavours as well as prevents progression of bacterial growth and putrefaction. As to the shelf-life and flavour of fish, it is thus essential that the fish product can be subjected as early as possible to the graving work process, as now is disclosed in the new method.

In an embodiment, the method is based on a dry salting method. In a second embodiment, the method is based on a wet salting method where liquid is removed prior to packing and transport. In a third embodiment, the brine is left in the package but its salinity is limited to be between 2% and 6%.

In such a case, the time for instance a fillet is to be kept in the package is preferably no more than one week and at a very low temperature at that, for instance below +8°C, most preferably at a temperature below +4°C.

In some cases, the packages may contain brine whose salinity is higher than the aforementioned one, for instance 7% to 15%. It is then preferable to limit the time the fish product, for instance a fillet, is to be kept in the package to 24 hours or even less.
According to an idea, the temperature during the combined graving and transporting work process may be different from the storage temperature of the fish product, for instance +4°C during transport for five days and about 0°C in post-transport storage if the fish product is to be stored before use, for instance for one week in intermediate storage. According to an idea, the temperature is accurately limited to be between -5°C and +8°C, for instance about +3°C during the graving work process itself, and thereafter the storage temperature may be -5°C, for instance. It is to be noted herein that a temperature below 0°C can only be applied after the graving process. An example: if the fish flesh contains 2% of salt, the freezing point is about -5°C, and if the amount of salt is 3%, the freezing point is about -8°C.

When the transport of the fish fillet takes about 6 days to 8 days, according to an idea the transport/graving temperature is for instance only 0°C or no more than +2°C since the salt has time to absorb into the fish fillet during the transport. If the fish fillet is to be transported at a temperature below 0°C, the salt has to be left to absorb into the fish fillet prior to transport, because otherwise the fish fillet will freeze up completely. For example, if the salt is left to affect the fish fillet for instance for 24 hours in, say, a tub under pressure or in brine, and after this the fish fillet is packed in the fish product package described in this description before it has substantially entered an in rigor condition, the fish fillet may be transported at a temperature of -2°C.

According to a preferred embodiment, the fish product is packed in a fish product package before it has from a pre rigor condition entered the in rigor condition, i.e. before the fish product is in rigor mortis. Said transition is a phenomenon highly dependent on the temperature. If the temperature is for instance +2°C, the pre rigor condition may last for 3 to 4 days, but if the temperature is, say, 0°C or -1°C, the pre rigor condition may last even for a week, i.e. 7 days.

Further, according to another preferred embodiment, the fish fillets, which are preferably also skin-free, are brought shortly after slaughter into brine having for instance a temperature of -1°C to +1°C, say 0°C. A temperature this low makes the fish fillet less prone to shrinkage.

According to an idea, after slaughter, an intermediate work phase is performed for filleting, skinning and preferably also removing the root of the bones, as well as subjecting the fillets to a salting process which may comprise a dry salting, wet salting, injection salting process or a combination of the
aforementioned ones. In the salting process, the fish fillets are disposed under weight or pressure so that the shrinkage of the fish fillet can be controlled during the salting. According to an idea, this phase is implemented in the fish product package described in the present description. The intermediate work phase alleviates the subsequent removal of the bones: cutting off the root of the bones from the actual hard bone part reduces the pulling power necessary for removing a bone even by 50%. In addition, the salting reduces the pulling power necessary for removing the bones even by further 50%. The intermediate work phase may take for instance 12 to 24 hours, after which the bones can be removed from the fillet, when necessary. After the intermediate work phase, the fish fillet is placed in a fish product package - or in the new fish product package - wherein it is subjected to pressure, and at the same time salt and spices may be added to the fish product package. Even if the packing in the fish product package takes place for instance only after the intermediate work phase that took 24 hours, the end user will receive a much higher-quality fish product whose quality remains high for instance for 30 days particularly because the fish product can be transported and stored at a temperature that is colder than conventionally.

The intermediate work phase described above mainly serves the removal of bones. According to an idea, the actual graving work process itself takes at least a week and is implemented in the fish product package described in the present description. The pressure caused by the fish product package prevents the fish flesh product from breaking up into parts. In addition, the pressure reduces the amount of water draining from the fish product.

An idea for preparing graved fish has been shown above. This can be further varied, depending on whether or not salt is added to the fish product after the intermediate work phase.

According to another idea, graved fish is prepared by injecting brine into the fish fillet, and the bones are removed or left unremoved; in any case, the fish fillet is placed in the fish product package.

In any case, the graving, i.e. cooking, of the fish product takes place in the fish product package, preferably during transport.

In the present description, the fish product derives from a fish which is wild or cultured and slaughtered. The fish may be skinned or not, the bones may have been removed or left unremoved. Further, the fish is optionally filleted either pre rigor or in rigor.
In other words, the fish product may be of *pre rigor* quality but its bones may necessarily not have been removed. The combined graving work process and transporting work process may also be carried out such that the bones are included in the fish product.

According to an idea, the fish is skinned and the dark flesh underlying the skin is removed all the way to a depth of 2 to 9 mm. The nerve ends of the bones are then cut, after which the fish fillets are put aside or subjected to a combined graving work process and transporting work process, which may take for instance 8 to 24 hours, after which the bones are very easy to remove.

**Brief description of the figures**

The invention will be described in closer detail in the accompanying drawings, in which

- Figure 1 is a schematic side view showing a fish product package,
- Figure 2 is a schematic side view showing a second fish product package,
- Figure 3 is a schematic side view showing a third fish product package,
- Figure 4 schematically shows a method for treating a fish product;
- Figure 5 schematically shows another method for treating a fish product;
- Figure 6 schematically shows a step of a method for treating a fish product;
- Figure 7 is a schematic side view showing a fourth fish product package,
- Figure 8 is a schematic, cross-sectional side view showing a method for treating a fish product, adapted to the fish product package according to Figure 7,
- Figure 9 is a schematic, cross-sectional side view showing a fifth fish product package,
- Figure 10 is a schematic top view showing the fish product package according to Figure 9,
- Figure 11 is a schematic, cross-sectional side view showing a sixth fish product package,
- Figure 12 schematically shows a detail of the fish product package according to Figure 11,
Figure 13 is a schematic, cross-sectional side view showing a seventh fish product package,
Figure 14 is a schematic, cross-sectional side view showing an eighth fish product package, and
Figures 15a, 15b, and 15c are schematic, cross-sectional side views showing a ninth, tenth, and eleventh fish product package.

For the sake of clarity, the figures show the invention in a simplified manner.

Detailed description

The present method combines two most time-consuming work processes, transport to destination and a graving work process. Both may typically take 4 to 10 days separately, such that the process encompasses one or more fillets, and that the amount of salt in the end product, for instance in a salmon fillet, is constant, irrespective of how long the refrigerated transport or storage work process takes.

According to an idea, the method is a dry salting method suitable for preparing graved fish and cold smoked fish. The method comprises recovering the generated water/brine so that its effect on the fillet itself is eliminated. In such a case, the salinity level of the fish fillet is controllable and the composition, flavour, colour, aroma of the flesh remain excellent and the same as those of products prepared in an authentic environment.

The graving work process is always carried out in a sealed space, such as a vacuum package, a gas atmosphere package, an EPS or another cold insulation package. In any case, the graving process is carried out in a sealed system which prevents atmospheric air from entering the package itself.

Figure 1 shows how the fish product, such as a fish fillet 1, which preferably is at least skin-free and from which the dark flesh is removed all the way to a depth of 2 to 9 mm and from which most preferably the bones have also been removed, is placed on a substructure 2. The substructure 2 enables the generated liquid to drain through or around the substructure 2 to an underlying space, preferably provided with a liquid recovery system by means of an absorbing element, for instance a liquid absorbing substructure 3.

The absorbing substructure 3 is rigid, so that an empty space arranged therein will remain for the time taken to form a vacuum and, furthermore and most importantly, the empty space will remain in the package as well. Of course, the empty space may also be filled at least partly with liquid
originating from the fish product during the combined graving and transporting process.

Preferably, the substructure 2 is rigid so that channels running through or around it for allowing said liquid to move from the fish product to the absorbing substructure 3 remain open in the sealed package.

According to an idea, the empty space of the absorbing substructure 3 may comprise one space or, alternatively, it may be divided into two or more spaces. The empty space may be provided with a liquid absorbing element, in which case liquid binds to the element in question. However, no liquid absorbing element is necessary since liquid typically remains in the empty space due to the influence of the underpressure therein, even if the package were turned upside down.

The entire system is sealed in an air or gas tight package 4, from which air may have been removed by a vacuum packing method known per se.

The composition, colour, flavour, smell or the like of the fish fillet 1 remain extremely high in quality but at the same time bacterial growth is eliminated since no bacteria can enter the package 4 and, again, the vacuum packing method is a known bacterial growth inhibitor. Air containing oxygen has been removed from the package or replaced by an inert protective gas.

According to an idea, the method comprises removing air from the package by replacing it by an inert protection gas, such as carbon dioxide, nitrogen, ozone, or a mixture thereof, after which a vacuum is sucked in the package by removing at least a substantial portion of the inert protective gas that replaced the air. This enables the possibility of air remaining in the package to be minimized.

According to an idea, the package 4, the substructure 2 and/or the liquid absorbing substructure 3 or the absorbing material placed therein may be treated so as to make them antibacterial. For this purpose, they may comprise for instance silver ions, silver oxide or another corresponding coating for inhibiting bacterial growth. Another alternative is to mix a substance component inhibiting bacterial growth directly with the manufacturing material, for instance a thermoplastic.

The transport and storage temperature may be -5°C to +8°C but, preferably, 0°C to +4°C degrees. This low temperature substantially reduces possibilities for bacterial growth.
Figure 2 shows how the fish fillet 1 is placed between two planes 5 and 6 such that pressure 7 is generated towards the fillet 1. According to an idea, the pressure 7 corresponds to a weight typically used in dry salting methods.

According to an idea, a pressure difference is generated in the fish product by means of a vacuum package over the pressure surrounding the package, the magnitude of the pressure difference being at least 0.1 kPa, preferably at least 1 kPa, more preferably at least 10 kPa, most preferably at least 50 kPa. The significance of the pressure difference is particularly great when the packed fish product is of the pre rigor quality. The pressure difference produces a force pressing the fish product, shown in Figure 1 by means of partial forces $F_i \ldots F_n$. A total force is the sum of the partial forces exerted on the surface area of the fish product.

First, the pressure difference enables shrinkage of the fish product taking place in the pre rigor phase to be prevented or at least reduced. The shrinkage of a fillet made of cod, for instance, in a free condition may be more than 30% without the effect of salt, and even 50% after salting. Surprisingly, the inventors have found that the pressure difference enables the shrinkage of the fish product to be reduced.

Second, the inventors have unexpectedly discovered that the pressure difference enables the amount of water draining from the fish product to be reduced. Consequently, the fish product remains juicier and its weight higher, so the fish product holds its value better both for the seller and the end user as well.

The pressure difference may be adjusted according to the desired fish product to be prepared.

It is further to be noted that none of the prior art utilizes pre rigor fish products, mainly because of the extensive shrinkage after the addition of salt in particular.

Figure 3 shows how the fish fillet 1 is placed between two rigid and/or hard planes 8 and 9. An edge area of the planes is provided with a liquid absorbing material 10, 11. When a package 12 is tightened, for instance by a vacuum packaging film or a shrink wrap, liquid drains to the edge area, where the liquid is sucked off or absorbed into the absorbing material 10, 11.

If it is known that the fish fillet always lies in the package with the correct side up, it is possible that the generated liquid/brine is simply recovered.
in a tank. However, for one reason or another, the position of the package may vary during transport, in which case the liquid may flow back onto the fish product. This is not desirable. This can be at least essentially prevented by means of the absorbing material 10, 11.

The absorbing material 10, 11 may be placed in a hollow empty space, such as an interior of a core. The core in question may be manufactured for instance from plastic, food board or another substantially water-insoluble material. The core may be open at least at its one end, and it may alternatively or additionally be provided with openings, for instance holes of 0.01 to 10 mm, at least in surfaces substantially facing the fish product.

In the combined transporting and dry salting work process of a pre rigor fish fillet in particular, both the transport distances and the storage times may be long. When, after this, the end product should correspond to the original conventionally prepared product, such as a graved salmon fillet, or a cold smoked fish fillet, which is further smoked, it is preferable that the water/brine drained from the fish fillet is recovered so as to enable its long-term effect on the fish to be mainly prevented.

Figure 4 shows a prior art method. A fish, for instance a salmon, is slaughtered 13 for instance in Norway, and placed whole but gutted 14 in an EPS refrigerated transport box, among pieces of ice. The next day starts transporting 15, typically taking 3 to 6 days for instance to Central Europe.

At the destination, the load is unloaded, the fish is filleted, the bones are removed, optionally the skin as well, and the fish is subjected to a dry salt graving work process 16, which takes 4 days. Only after this the product, a graved salmon fillet, is delivered to a customer 17. The product is thus typically already 10 days old before it reaches the customer 17.

Even if the slaughtering 13 is carried out in the pre rigor condition and the bones are removed before transporting 15 and only after that the fillets are placed in the EPS transport boxes and the transport 15 started, the delivery of the fish takes exactly as long as transporting 15 the whole fish disclosed above. Herein as well, the graving work process 16 itself takes 4 days, i.e. the duration of both the transporting work process and the graving work process is equally long, irrespective of the fish being delivered to the destination whole (gutted) or as a pre rigor fillet. Thus, no pre rigor fillet is on the market or at the customer 17 any sooner than any other fish product. This means that the freshness benefit achieved by the pre rigor process is lost.
Figure 5 shows a method according to the invention wherein slaughtering 18 is first carried out in an ordinary per se manner. A fish fillet, such as a salmon fillet, preferably skin-free and yet more preferably also having the bones removed therefrom, is placed into a graving work process, i.e. subjected to a dry salting process 19. Only after this is transporting 20 to a destination started. The fish fillet is completely graved during the transport, which means that the completely graved fish fillets can be delivered directly or immediately to a customer 21. This method is at least one-and-a-half times, i.e. 50%, quicker than the known methods shown in Figure 4, which is also why the fish product reaches the customer much fresher.

Figure 6 shows the method according to the invention in a simplified manner. Herein, the dry salting process 19, i.e. the graving work process, is combined with the transporting 20, i.e. the transporting work process, such that they take place simultaneously. Since both are very time-consuming processes, time is saved at least by the duration of the shorter process; for instance by the duration of the graving work process, which takes 4 days.

Figure 7 shows an embodiment of the method according to the invention. Herein, the fish fillets 29 are placed preferably longitudinally in accordance with the box in a vertical position in an EPS insulation box 22 which preferably also comprises a lid 23. When the lid 23 and the box 22 itself are joined with one another, a sealed space 24 is formed which may be further secured by an extra seal 28, which may be for instance a tape or another seal. It is also possible to provide the EPS box 22 with an internal plastic box or plastic sheeting 25 comprising for instance a polythene, polystyrene, polyamide, propene material or some such material whose thickness may vary from 0.001 mm up to 4 mm.

According to an idea, a separate plastic sheeting 27 may be fastened for instance by welding directly to the plastic box/sheeting 25, enabling the entire package to be made into a hermetically sealed gas atmosphere package. It may be advantageous to provide the EPS box 22 with liquid absorbing elements, such as absorbing substructures 26. The material provided with an absorbing property may even be a material which produces CC\(^n\) gas or another protective gas due to the influence of liquid or water. Typically, however, it will suffice that the box 22 itself is provided with at least a lid 23, making it a sealed space. In this sealed space, the graving work process may be carried
out during transport at a temperature of -5°C to +4°C, most preferably at a temperature below +3°C.

The box 22 may preferably be provided with a data system for measuring the temperature, time management, humidity level and for instance salinity of the fish product. Data collected by the data system are most preferably remotely readable by a customer’s mobile terminal device, for instance.

Figure 8 shows a situation in a box 22 of the type of Figure 7, wherein a dry salting work process is carried out. Herein, the fish fillets 30, 31, 32, with the large flesh surfaces facing one another, are arranged so as to form some kind of a pack preferably to be pressed 33, 34 from opposite directions. This is how the dry salting work process can be made to work most preferably. Draining water/brine 35 is recovered by means of absorbing pads 36, for instance. Alternatively, water/brine 37 is left on the bottom of the EPS box 22, or it is recovered in a tank or space of its own.

The pressure force 33, 34 is freely adjustable as desired, enabling optimal conditions to be created for the dry salting work process.

According to an idea, the fish fillets 30, 31, 32 may be mutually of a different quality. They may be for instance seasoned differently, or some of the fillets may be intended for cold smoking while some are to be used for graved fish.

A protective coat or surface 38, which may be for instance board, paper or plastic, may be placed between fillets of different quality. This makes it possible to prevent seasonings or the like specific to the different fillet qualities from migrating from one fillet to another.

Figures 9, 10, and 11 show embodiments wherein the fish fillet is subjected to a pressing force by means of a vacuum film such that all the most essential parts remain inside the vacuum film, and after this a desired under-pressure is sucked inside the vacuum film.

In order to be able to generate a pressing force on the fish product itself by means of the vacuum package, some empty space has to be provided inside the vacuum package which will remain inside the sealed and sucked package, that is, after the sucking of the underpressure has been stopped and the package has been sealed.

Various dry salting processes are known, but these may be divided into two basic forms: a) the fish fillet is subjected to weight or pressure, and b) the fish fillet is subjected to no pressure, or the pressure is very low.
In the method and package according to the invention, underpressure, i.e. pressure, may be adjusted in a simple manner; the higher the underpressure, the greater the pressing force of the vacuum film on the fish product, and vice versa: the lower the underpressure, the smaller the pressing force.

Figure 9 shows how a honeycomb board 42 is used as a work substructure on which a fish fillet 39 is placed and in which empty hollows 43 serve as empty spaces maintaining the underpressure. This enables a desired pressure to be exerted on the fish product. At the same time, the hollows 43 may serve as a storage room for the graving liquid. The hollows may be provided with liquid absorbing mats and/or pads.

The honeycomb board 42 may be made from a viscous material, such as plastic, e.g. polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET). The material may also be mixed with fillers, such as calcium carbonate, chalk, wood-based materials, viscose fibres, etc.

The honeycomb board 42 may be treated with an antibacterial agent, for instance silver oxide, silver ion or the like, either mixed with the material itself or as a coating. According to an idea, only and merely parts of the honeycomb board 42 are treated that are in contact with the fish product itself, for instance an upper surface 40 of the honeycomb board.

It is known that in the dry salting work process liquid is generated during the work process. It is preferable if this liquid can be recovered such that it substantially no longer is in contact with the fish product itself. For this purpose, the package is provided with an empty space which remains in the underpressurized package and which receives the liquid. According to an idea, the empty space is provided with cellulose-based water-absorbent absorbing pads or mats 45. These may be located for instance inside the hollows 43 and/or underneath a lower surface 44 of the honeycomb board 42.

If the absorbing pad 45 is not in a rigid, i.e. incompressible, empty space, the absorbing pad itself has to be incompressible in the package so as to enable an underpressure to be generated in the package and, further, a pressing force to be generated on the fish product.

According to an idea, the thickness of the honeycomb board 42 is at least 1 mm and no more than 100 mm, preferably less than 20 mm and most preferably between 3 and 6 mm.

Figure 10 is a top view showing the honeycomb 42 of Figure 9. The fish fillet 39 is placed on the honeycomb board 42. The upper surface of the
honeycomb board 42 is provided with holes or openings 47 such that a connection is provided therethrough to the hollows 43. This ensures that it is possible to generate an extremely appropriate pressure from all sides of the fish fillet 39 and that the generated process liquid is sure to drain off.

According to an idea, only the ends of the substructure are provided with openings, as shown in Figure 10, but according to another idea, openings may be located along the entire length and width of the substructure.

Figures 11 and 12 show an embodiment of the package wherein a fish product is placed on a substructure 48. One end or both ends of the substructure 48 is provided with one or more tubes or sleeves 50 which are manufactured from a hard, i.e. stiff, material and inside which resides an empty space for recovering the process liquid. A wall of the tube 50 may comprise openings which extend through the wall. Inside the tube 50, a liquid-absorbent absorbing pad or mat may be provided. In addition, the empty space maintained by the tube 50 enables a desired underpressure to be generated inside the package since a vacuum film 41 seals said tube 50 in the same interior of the package together with the fish product.

The substructure 48 may contain hollows as already disclosed above, but this is not necessary. Consequently, the substructure 48 may be made of a solid material, for instance wood or wood composite.

Figure 12 shows the structure of a tube or a sleeve 55 wherein inside a rigid outer shell 51 is provided an empty space 52 which enables a desired underpressure to be generated. The tube 55 is provided with a liquid-absorbent material 53, 54, which may be for instance a cellulose-based material.

It is preferable if the outer shell 51 of the sleeve at least somewhere comprises holes 56 and/or that the material of the outer shell 51 is permeable to liquid.

Figure 13 is a schematic, cross-sectional side view showing a seventh fish product package. According to an idea, an empty space 130 may be formed between a plane element 132 receiving the fish product 131 and a three-dimensional surface 134 comprising depth forms and arranged on a side of the plane element 132 opposite a surface 133 included in the plane element 132 and receiving the fish product 131. The three-dimensional surface 134 may comprise for instance honeycomb-like, wavelike, lattice-like, etc. forms, and it may support the plane element 132 so that this will not collapse into the
recesses due to the influence of underpressure. The empty space 130 may be provided with a liquid-absorbent material, which may be an antibacterial material or a material treated so as to make it antibacterial. According to an idea, the liquid-absorbent material may further produce small amounts of carbon dioxide in the empty space. This of course decreases the pressure difference over the environment, but by dimensioning the carbon dioxide production capacity appropriately it is, however, possible to keep the interior of the package underpressurized, in which case the fish product is still subjected to pressure.

The plane element 132 and the three-dimensional surface 132 are sufficiently rigid in structure to maintain the empty space 130 in the underpressurized fish product package that has received the fish product.

The plane element 132 may be a part separate with respect to said three-dimensional surface 134. The plane element may thus be manufactured separately and optionally from a material other than that of the three-dimensional surface 134. Preferably, the plane element 132 comprises openings extending therethrough.

According to an idea, the three-dimensional surface 134 is part of a packaging vessel 135 further comprising an edge part 136 extending past the plane element 132 and arranged to frame a space 137 receiving the fish product. Such a packaging vessel may be manufactured for instance from a polymer material by a deep drawing method or injection moulding. The packaging vessel 135 is preferably designed to be stackable, in other words, empty packaging vessels may be arranged on top of and inside one another.

According to another idea, the empty space 130 is formed at least partly but even completely by the three-dimensional forms in the plane element 132. In such a case, a surface of the packaging vessel 135 settling towards the plane element 132 may be substantially flat.

An airtight packaging film 138 is attached to the packaging vessel 135 for instance by means of a weld or glue seam 139, which forms an airtight joint. From the interior sealed by the film 138 and the packaging vessel 135 as also from the empty space 130 - gases are sucked substantially off, in which case the film is in close conformity pressed against the fish product and the packaging vessel. At the same time, the fish product can be subjected to pressure.

Figure 14 is a schematic, cross-sectional side view showing an eighth fish product package. Fish products 141a, 141b may be placed on dif-
ferent sides of a substructure 142. This comprises an empty space 143 which communicates with both sides of the substructure 142 via openings or the like. By means of a film or films 144, an interior is formed into which a vacuum is sucked in a manner already previously described in the present description. This enables the substructure 142 to be utilized extremely efficiently.

Figures 15a, 15b, and 15c are schematic, cross-sectional side views showing a ninth, tenth, and eleventh fish product package. Therein, a protective coat 153 made from a plasticizer-free material is arranged between a fish product 151 and a packaging film 152. The protective coat 153 decreases the contact surface area of the fish product 151 with the packaging film 152. The protective coat 153 makes it possible to use in the manufacture of the packaging film 152 a material whose contact with the fish product itself would not be desirable. Such materials may be for instance plastic mixtures comprising plasticizers.

The protective coat 153 may be for instance paper or another cellulose-based material, plasticizer-free plastic film whose material may be for instance polypropylene or polyethylene.

The protective coat 153 shown in Figure 15a at least substantially has no holes or openings. The protective coat 153 shown in Figure 15b comprises openings extending therethrough. The protective coat 153 shown in Figure 15c is arranged not only between the packaging film 153 and the fish product but between the substructure 154 and the fish product as well.

The idea of the package according to the invention may be summed up such that the package comprises an empty space enabling a) forming an underpressure and b) recovering process liquid, and that c) the empty space being arranged inside a hermetically sealed package, for instance a vacuum package.

The idea of an embodiment of the method according to the invention may be summed up such that a work process, primarily a dry salting work process, alternatively a wet salting work process, and further, optionally at least a portion of a cooking work process, is carried out in the package. Said work processes take place at a controlled low temperature, which is -8°C to +12°C, preferably always less than +5°C but more than -5°C, and most preferably less than +4°C.
In the wet salting method, the salt concentration is typically 7% to 15%, and it is always performed as a cold process, the temperature thus typically being about +3°C and duration 3 to 16 hours, typically 4 to 8 hours.

In a method according to the invention, the procedure is as follows.

A fish is slaughtered and filleted in the pre-rigor condition and, most preferably, the fish is skinned and the dark flesh underlying the skin is removed all the way to a depth of 2 to 9 mm, the ends of the bones being cut at the same time. This reduces the pull resistance of the bones by 50% when the bones themselves are being removed.

The fish fillet may be left for 8 to 12 hours at a temperature of +2°C to +4°C to cook, which reduces the pull resistance of the bones by 50% upon bone removal.

Typically, the fish fillet spends 15 to 20 hours in the wet salting process in about 8% brine and at a temperature of +4°C. After this, the pre-rigor condition has come to an end if the skin has been removed together with the dark flesh and the ends of the bones have been cut at the same time. After this the bones are very easy to remove when the fish fillet is removed from the wet salting work process.

After the bones have been removed, possible spices and seasoning mixtures, such as various peppers, can be applied to the fish fillet together with, for instance, honey, maple syrup, sugar, alcohol or another condiment or ingredient.

Next, the fish fillet is packed in the fish product package described in the present description, which prevents air external to the package from contacting the fish product.

After the fish product has been packed, a transporting work process may start, to be performed between -5°C and +8°C, for instance at a temperature of +4°C. Thus, one work process is combined with another, in this case a graving work process is combined with a transporting work process.

The graving work process typically takes 1 to 3 days, and it thus takes place during the transporting work process. The transporting work process may of course take longer than the graving work process, but this is not detrimental.

The salting affects the fish flesh, such as a salmon fillet, such that it is possible to transport it to the destination much colder than so-called fresh salmon, such as an unsalted pre-rigor salmon fillet. The latter may be trans-
ported only at temperatures above 0°C. Instead, in the transporting work process of the method according to the invention the temperature may be clearly lower, even as low as -7°C, without the fish product being damaged in any way.

If the transporting work process is carried out for instance at a temperature of about -5°C, the fillet may be transported even for two (2) weeks without the quality deteriorating in any way.

In some cases, features disclosed in this application may be used as such, regardless of other features. On the other hand, when necessary, features disclosed in this application may be combined in order to provide different combinations.

In summary, it may be stated that the method according to the invention is characterized by arranging in said vacuum package an empty space, forming an underpressure in the vacuum package by means of the empty space, and by maintaining the empty space in the package, the underpressure generating pressure on the fish product.

It may further be stated that the fish product package according to the invention is characterized in that it comprises a substantially rigid structure comprising an empty space, the empty space being in a gas-exchanging connection with the interior, and the strength of the rigid structure being dimensioned to maintain the empty space in the underpressurized fish product package that has received the fish product.

The drawings and the related description are only intended to illustrate the idea of the invention. It will be apparent to a person skilled in the art that the invention is not restricted to the above-described embodiments disclosing the invention through some examples, but various modifications and different applications of the invention are feasible within the inventive idea defined in the accompanying claims.
Claims

1. A method for packing a fish product, the method comprising packing the fish product in a vacuum package, characterised by
   arranging in said vacuum package an empty space,
   forming an underpressure in the vacuum package by means of the empty space, and by
   maintaining the empty space in the package, the underpressure generating pressure on the fish product.

2. A method as claimed in claim 1, characterised by recovering process liquid/brine so that it is no longer capable of affecting a work process or quality of the fish product.

3. A method as claimed in claim 1 or 2, characterised by providing the empty space with a liquid recovery system, for instance a cellulose-based material, such as absorbing substructures manufactured for the purpose.

4. A method as claimed in any one of the preceding claims, characterised by the fish product being packed individually in the vacuum package.

5. A method as claimed in any one of claims 1 to 3, characterised by placing two or more fish products in the vacuum package.

6. A method as claimed in any one of the preceding claims, characterised by the fish product being of a pre rigor quality.

7. A method as claimed in any one of the preceding claims, characterised by prior to placing the fish product in the vacuum package, skinning the fish and removing the underlying dark flesh therefrom, all the way to a depth of 2 to 9 mm, and cutting at the same time the nerve ends of the bones, leaving the rest of the bones in the fish flesh itself.
8. A method as claimed in any one of claims 1 to 6, characterised by placing in the vacuum package a fish product with the skin left un-removed but the bones removed.

9. A method as claimed in claim 8, characterised by subjecting the fish product first to a graving/transporting work process and only after this removing the bones.

10. A method as claimed in any one of the preceding claims, characterised by generating in the fish product by means of the vacuum package a pressure difference, the magnitude thereof being at least 0.1 kPa, preferably at least 1 kPa, more preferably at least 10 kPa, most preferably at least 50 kPa.

11. A method as claimed in any one of the preceding claims, characterised by the empty space of the vacuum package being at least 1 cm³, preferably more than 6 cm³.

12. A method as claimed in any one of the preceding claims, characterised by arranging said empty space in a substructure, and placing the fish product on said substructure.

13. A method as claimed in claim 12, characterised by placing fish products on different sides of the substructure.

14. A method as claimed in any one of claims 1 to 11, characterised by forming and maintaining the empty space by means of a sleeve or tube made from a separate hard material and most preferably perforated.

15. A method as claimed in any one of the preceding claims, characterised by treating, for instance with a silver oxide or silver ion treatment, the surface or material of the package so as to make it antibacterial.

16. A method as claimed in any one of the preceding claims, characterised by carrying out a fish dry salting process, i.e. a graving work process, which takes at least 12 hours, at most 6 days, preferably at most
4 days, at least partly simultaneously with a refrigerated transporting work process, in which refrigerated transporting work process transport and storage temperatures are between -5°C and +8°C, preferably between 0°C and +4°C.

17. A fish product package, comprising
an airtight, vacuumizable interior for receiving the fish product,
characterised in that the fish product package further comprises
a substantially rigid structure comprising an empty space, the empty space being in a gas-exchanging connection with the interior, and the strength of the rigid structure being dimensioned to maintain the empty space in the underpressurized fish product package that has received the fish product.

18. A fish product package as claimed in claim 17, characterised in that the empty space is arranged via at least one opening to communicate with the interior so that the interior is capable of receiving process liquid and/or brine draining from the fish product.

19. A fish product package as claimed in claim 17 or 18, characterised in that in the underpressurized fish product package, the volume of the empty space is at least 1 cm³, preferably more than 6 cm³.

20. A fish product package as claimed in any one of claims 17 to 19, characterised in that said empty space is arranged in a board-like substructure whose width and length at least equal the corresponding measurements of the fish product.

21. A fish product package as claimed in claim 20, characterised in that the substructure is a honeycomb board made from a manufacturing material comprising a polymer material.

22. A fish product package as claimed in claim 21, characterised in that a surface of the honeycomb board facing the fish product comprises substantially completely holes communicating with the empty space.
23. A fish product package as claimed in claim 21, characterised in that the surface of the honeycomb board facing the fish product comprises an opening or openings only at its edge part, and that the surface of the honeycomb board facing the fish product comprises a central part provided with no openings.

24. A fish product package as claimed in any one of claims 17 to 19, characterised in that said empty space is arranged in a tube made from a hard, i.e. rigid, material and, in turn, arranged in the interior.

25. A fish product package as claimed in claim 24, characterised in that at least one end of the tube is open into the empty space, and that walls of the tube preferably comprise through-holes.

26. A fish product package as claimed in any one of claims 17 to 19, characterised in that the empty space is formed between a plane element receiving the fish product and a three-dimensional surface comprising depth forms and arranged on a side of the plane element opposite a surface receiving the fish product.

27. A fish product package as claimed in claim 26, characterised in that the plane element is a part separate with respect to said three-dimensional surface.

28. A fish product package as claimed in any one of claims 26 to 27, characterised in that the three-dimensional surface is part of a packaging vessel further comprising an edge part extending past the plane element and arranged to frame the space receiving the fish product.

29. A fish product package as claimed in claim 28, characterised in that the packaging vessel is a packaging vessel manufactured from a polymer material by a deep drawing method.

30. A fish product package as claimed in any one of claims 17 to 29, characterised in that the vacuumizable interior abuts at least partly on a packaging film.
31. A fish product package as claimed in claim 30, characterised in that a protective coat made from a plasticizer-free material is arranged between the packaging film and the fish product.

32. A fish product package as claimed in any one of claims 17 to 31, characterised in that its inner surface or material comprises an antibacterial component, for instance a silver oxide or silver ion component.

33. A fish product package as claimed in any one of claims 17 to 32, characterised in that the empty space is provided with a liquid recovery system comprising a liquid-binding absorbing element comprising for instance a cellulose-based material.

34. A fish product package as claimed in any one of claims 17 to 33, characterised in that it comprises one fish product, such as a fish fillet.

35. A fish product package as claimed in any one of claims 17 to 33, characterised in that it comprises two or more fish products.

36. A fish product package as claimed in any one of claims 17 to 35, characterised in that the fish product is arranged to be subjected to a pressure of at least 0.1 kPa, preferably at least 1 kPa, more preferably at least 10 kPa, most preferably at least 50 kPa, from the vacuum package.
Slaughtering and Filleting → Placing in Graving Process → Transporting → Customer

Fig. 5
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: A22C, A23B, A23L, B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)
EPO-Internal, WPI, BIOSIS, COMPENDEX, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 20090228577 A1 (ISHINO YUJI [JP] et al.)</td>
<td>1, 2, 4, 6-11, 15-17, 19, 30-32, 34-36</td>
</tr>
<tr>
<td></td>
<td>22 January 2009 (22.01.2009)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Figure 1; paragraphs [0020], [0034], [0035], [0038], [0042]</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>WO 2004083062 A1 (AHN JOON-YEONG [KR])</td>
<td>1, 5, 14, 17, 24, 25</td>
</tr>
<tr>
<td></td>
<td>30 September 2004 (30.09.2004)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>page 3, lines 5-12; page 6, lines 12-18; Figure 1</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>JP S61 77392 U (UNKNOWN) 24 May 1986 (24.05.1986)</td>
<td>1-36</td>
</tr>
<tr>
<td></td>
<td>Figure 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; abstract [online] EPOQUENET EPODOC</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>GB 2231 322 A (BASS NEIL) 14 November 1990 (14.11.1990)</td>
<td>1-36</td>
</tr>
<tr>
<td></td>
<td>Figures 1-3; page 5, line 11 - page 6, line 14</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>DE 2971 1265 U1 (KRAUCH ACHIM [DE]) 28 August 1997 (28.08.1 997)</td>
<td>1-36</td>
</tr>
<tr>
<td></td>
<td>page 3, line 4 - page 7, line 8; Figures 1 and 2</td>
<td></td>
</tr>
</tbody>
</table>

[X] Further documents are listed in the continuation of Box C.  
[ ] See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means of publication published prior to the international filing date but later than the priority date claimed
  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  "&" document member of the same patent family

Date of the actual completion of the international search
28 August 2015 (28.08.2015)

Date of mailing of the international search report
03 September 2015 (03.09.2015)

Name and mailing address of the ISA/FI
Finnish Patent and Registration Office
P.O. Box 1160, FI-00101 HELSINKI, Finland
Facsimile No. +358 9 6939 5328

Authorized officer
Arja Leikas
Telephone No. +358 9 6939 500

Form PCT/ISA/210 (second sheet) (January 2015)
<table>
<thead>
<tr>
<th>Category*, Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>US 2009022857 A1</td>
<td>22/01/2009</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>JP S61 77392 U</td>
<td>24/05/1986</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>DE 2971 1265 U1</td>
<td>28/08/1997</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>JP 201 42341 90 A</td>
<td>15/12/2014</td>
</tr>
</tbody>
</table>

Form PCT/ISA/210 (patent family annex) (January 2015)
<table>
<thead>
<tr>
<th>IPC</th>
<th>Number</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>B65D</td>
<td>81/20</td>
<td>(2006.01)</td>
</tr>
<tr>
<td>A23L</td>
<td>1/325</td>
<td>(2006.01)</td>
</tr>
<tr>
<td>A22C</td>
<td>25/00</td>
<td>(2006.01)</td>
</tr>
</tbody>
</table>