

DESCRIPTION

TITLE OF INVENTION

EEL-LIKE FOOD USING NO ANIMAL-DERIVED RAW MATERIALS, AND METHOD
5 FOR PRODUCING THE SAME

TECHNICAL FIELD

[0001]

10 The present invention relates to eel-like food using no animal-derived raw materials,
and a method for producing the same.

BACKGROUND ART

[0002]

15 In recent years, eel price is increasing due to reduction of the number of eels, and as
substitute food, cut open catfish or sardine cooked like spitcocked eel, and eel-like food
obtained by shaping fish minced meat and fish meat and cooking the resultant are known (see,
for example, Patent Literatures 1 and 2).

[0003]

20 In recent years, food using no meat or fish, such as vegetarian food and Buddhist
food, and vegan food completely free from animal-derived raw materials attract attention.
As such food, imitation food is often produced from raw materials limited in use, and hence it
is difficult to reproduce a taste and a texture similar to those of real food.

CITATION LIST

25 PATENT LITERATURE

[0004]

Patent Literature 1: Japanese Patent No. 6237044

Patent Literature 2: Japanese Patent No. 6240436

30 SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005]

An object of the present invention is to provide eel-like food using no animal-derived raw materials having excellent texture and flavor similar to those of eel.

SOLUTION TO PROBLEM

[0006]

The inventors made earnest studies on a method for producing eel-like food using no animal-derived raw materials having excellent texture and flavor similar to those of eel, resulting in accomplishing the present invention.

[0007]

Specifically, the present invention provides eel-like food, using no animal-derived raw materials, including a meat layer, an intermediate layer, and a skin layer, the meat layer is a layer containing a textured vegetable protein, methylcellulose, an isolated soy protein powder, and a fat or oil, the intermediate layer is a layer containing a fat or oil, and gelled with a thickener containing xanthan gum and HA gellan gum, and the skin layer is a layer obtained by gelling sodium alginate with a calcium salt, or by gelling methylcellulose.

[0008]

The meat layer of the eel-like food using no animal-derived raw materials according to the present invention preferably contains 6 to 14% by weight of a solid content derived from the textured vegetable protein, 0.7 to 1.3% by weight of the methylcellulose, 3.5 to 6.5% by weight of the isolated soy protein powder, and 10 to 20% by weight of the fat or oil with respect to a weight of the meat layer.

[0009]

The intermediate layer of the eel-like food using no animal-derived raw materials according to the present invention preferably contains 20 to 40% by weight of the fat or oil, 1 to 2% by weight of the xanthan gum, and 1 to 2% by weight of the HA gellan gum with respect to a weight of the intermediate layer.

[0010]

The skin layer of the eel-like food using no animal-derived raw materials according to the present invention preferably contains 1.5 to 4% by weight of sodium alginate, or 1 to 2% by weight of methylcellulose with respect to a weight of the skin layer.

[0011]

When the skin layer of the eel-like food using no animal-derived raw materials according to the present invention is a layer obtained by gelling sodium alginate with a

calcium salt, a production method preferably includes a step of producing a meat layer dough by mixing a textured vegetable protein that has been rehydrated, dewatered and then deep fried, with a meat layer slurry that has been produced by stirring, under cooling, methylcellulose, an isolated soy protein powder, a fat or oil, and water; a step of producing a meat layer by filling and heating the meat layer dough in a mold; a step of producing an intermediate layer by flattening out, into the shape of a sheet, an intermediate layer slurry that has been obtained by mixing a thickener containing xanthan gum and HA gellan gum, with a fat or oil, and heating the intermediate layer slurry for gelling; a step of producing a skin layer by flattening out a skin layer slurry that has been obtained by dissolving sodium alginate in water, into the shape of a sheet, and dipping the skin layer slurry in an aqueous solution containing a calcium salt for gelling; a step of adhering the meat layer to the intermediate layer, and the intermediate layer to the skin layer by spraying a powder containing sodium alginate and a calcium salt, or a methylcellulose powder; and a step of roasting surfaces of the meat layer and the skin layer.

[0012]

When the skin layer of the eel-like food using no animal-derived raw materials according to the present invention is a layer obtained by gelling methylcellulose, a production method preferably includes a step of producing a meat layer dough by mixing a textured vegetable protein that has been rehydrated, dewatered and then deep fried, with a slurry that has been produced by stirring, under cooling, methylcellulose, an isolated soy protein powder, a fat or oil, and water; a step of producing an intermediate layer slurry by mixing a thickener containing xanthan gum and HA gellan gum with a fat or oil; a step of producing a skin layer slurry by dissolving methylcellulose in water under cooling; a step of producing a three layer structure including a meat layer, an intermediate layer, and a skin layer by filling the meat layer dough in a mold, and applying the intermediate layer slurry and the skin layer slurry on the filled meat layer dough in a stated order; a step of integrating the three layer structure by heating; and a step of roasting surfaces of the meat layer and the skin layer of the integrated three layer structure.

[0013]

In the method for producing the eel-like food using no animal-derived raw materials according to the present invention, it is preferable that the meat layer dough contains 6 to 14% by weight of a solid content derived from the textured vegetable protein, 0.7 to 1.3% by weight of the methylcellulose, 3.5 to 6.5% by weight of the isolated soy protein powder, and

10 to 20% by weight of the fat or oil with respect to a weight of the meat layer dough, that the intermediate layer slurry contains 20 to 40% by weight of the fat or oil, 1 to 2% by weight of the xanthan gum, and 1 to 2% by weight of the HA gellan gum with respect to a weight of the intermediate layer slurry, and that the skin layer slurry contains 1.5 to 4% by weight of sodium alginate, or 1 to 2% by weight of methylcellulose with respect to a weight of the skin layer slurry.

ADVANTAGEOUS EFFECT OF INVENTION

[0014]

10 According to the present invention, eel-like food using no animal-derived raw materials having excellent texture and flavor similar to those of eel can be provided.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

15 FIG. 1 is a photograph of a mold for producing a meat layer of eel-like food using no animal-derived raw materials according to the present invention.

FIG. 2 is a photograph of the meat layer of the eel-like food using no animal-derived raw materials according to the present invention.

20 FIG. 3 is a photograph of an intermediate layer of the eel-like food using no animal-derived raw materials according to the present invention.

FIG. 4 is a photograph of a skin layer (layer obtained by gelling sodium alginate with a calcium salt) of the eel-like food using no animal-derived raw materials according to the present invention.

25 FIG. 5 is a photograph of the eel-like food using no animal-derived raw materials according to the present invention obtained after molding three layers.

FIG. 6 illustrates photographs of the eel-like food using no animal-derived raw materials according to the present invention obtained during molding processes performed using a skin layer using methylcellulose.

30 DESCRIPTION OF EMBODIMENT

[0016]

Now, the present invention will be described in detail. It is noted that the present invention is not limited to the following description.

[0017]

1. Production of Meat Layer

Main raw materials used in a meat layer of the present invention are a textured vegetable protein, methylcellulose, an isolated soy protein powder, and a fat or oil. The textured vegetable protein of the present invention is produced by extruding, with an extruder, a vegetable derived protein powder, such as a soy protein powder, a wheat protein powder, or a pea protein powder, under pressure and heating, and a puffed protein in the shape of a puffed granule, or a fibrous protein obtained with a cooling die for attaining fiber alignment with puffing suppressed can be used. Examples of the puffed protein include Apex(R) 650 available from Fuji Oil Co., Ltd., Response 4400 available from Du Pont, and New Soimi(R) S10 available from The Nisshin OilliO Group, Ltd., and an example of the fibrous protein includes Earth Meat(R) available from Harada Corporation.

[0018]

The textured vegetable protein is dried, or frozen with a small amount of a moisture contained therein, and hence is used after being rehydrated through water absorption with water or hot water. The textured vegetable protein is used preferably after being dewatered for removing a raw material derived flavor and adjusting a moisture. Besides, the textured vegetable protein having been dewatered is preferably deep fried with the fat or oil of the present invention. An odor of the textured vegetable protein is masked through deep frying, and a juicy texture can be provided. A temperature in the deep frying is preferably 100°C or less, and a moisture contained in the textured vegetable protein is preferably thus reduced.

[0019]

The deep fried textured vegetable protein is added to the meat layer preferably in an amount of 30 to 60% by weight. Besides, a deep fried puffed protein can cause a fluffy texture like meat, and a deep fried fibrous protein can express a fibrous texture and hardness of meat. The deep fried puffed protein and the deep fried fibrous protein are used preferably with their rates adjusted in accordance with a desired texture. When the deep fried fibrous protein alone is used, however, the resultant texture is hard, and hence, the deep fried puffed protein is preferably contained, and the deep fried puffed protein is contained in the deep fried textured vegetable protein preferably in an amount of 17% by weight or more. Besides, the amount of the deep fried fibrous protein is preferably 40% by weight or less in the meat layer.

[0020]

In addition, a content of a solid content derived from the textured vegetable protein in the meat layer is preferably 6 to 14% by weight. A content of a solid content derived from the fibrous protein is preferably 10% by weight or less.

[0021]

5 The fat or oil of the present invention may be a vegetable-derived cooking fat or oil, and a fat or oil in a liquid form at ordinary temperature, or a fat or oil in a semi-solid state or a solid state at ordinary temperature having been melted into a liquid form by heating may be used. Examples of the type of the fat or oil include soybean oil, refined rice oil, rapeseed oil, palm oil, corn oil, olive oil, sunflower oil, sesame oil, perilla oil, and linseed oil. Among
10 these, perilla oil and linseed oil contain a large amount of ω 3 fatty acid contained in fish oil, and hence are preferably used for imparting a fish-like flavor. These fats and oils can be used singly or in a mixture of two or more thereof. An amount of the fat or oil to be added is preferably 10 to 20% by weight with respect to the weight of the meat layer. When the amount is less than 10% by weight, an eel-like juicy texture or flavor is weak, and on the
15 other hand, when the amount is more than 20% by weight, the resultant is greasy, and is deteriorated in shape retention. The oil or fat is added more preferably in an amount of 15 to 17% by weight with respect to the weight of the meat layer. As a method for adding the fat or oil, it can be contained in the deep fried textured vegetable protein as described above, and in addition, it can be added to a meat layer slurry described below. The amount of the fat or
20 oil to be added in the meat layer slurry is preferably 5 to 20% by weight with respect to the weight of the meat layer slurry.

[0022]

As the methylcellulose of the present invention, methylcellulose or hydroxypropyl methylcellulose can be used without problems. Properties are varied depending on the
25 viscosity, and a substituent such as a methoxy group or a hydroxypropoxy group, and one having a gelling temperature of 50°C or more and a gel melting temperature of about 20°C to 50°C may be used, and the methylcellulose may be contained in an amount of 1 to 3% by weight in the meat layer slurry, and in an amount of 0.7 to 1.3% by weight in a meat layer dough. When it is contained in an amount less than 1% by weight in the meat layer slurry,
30 the meat layer cannot retain the shape, and releasability from a mold is also poor. On the contrary, when the amount is larger than 3% by weight, the meat layer becomes too hard.

[0023]

The isolated soy protein powder of the present invention may be any isolated soy protein having gelling ability. When the isolated soy protein powder is contained in the meat layer slurry, a smooth texture and a water retaining property that methylcellulose does not have can be imparted, and hence, the shape of the meat layer can be retained. An amount of the isolated soy protein powder to be added is varied depending on the type of the isolated soy protein powder to be used, and it may be contained in an amount of 5 to 15% by weight with respect to the weight of the meat layer slurry, and in an amount of 3.5 to 6.5% by weight in the meat layer (dough).

[0024]

As other sub materials, seasoning ingredients such as a starch, sugar, salt, a monosodium glutamate, and mirin (sweet cooking sake), flavoring ingredients such as a flavor, and materials not derived from an animal such as a pigment, and an antioxidant can be added. As a method for the addition, a powder may be added after obtaining a powder mixture, and a liquid may be directly added. An amount of the sub materials to be added is preferably 10% by weight or less with respect to the weight of the meat layer dough.

[0025]

As a method for producing the meat layer dough, the textured vegetable protein is first rehydrated and dewatered as described above, and the resultant is deep fried to produce the deep fried textured vegetable protein. The rehydration may be performed with ordinary water, or may be performed by boiling in hot water. The rehydration is performed until a moisture permeates in the whole textured vegetable protein, and then, the resultant is dewatered. In using the fibrous protein, since a moisture is difficult to permeate, the rehydration/dewatering process may be repeated several times.

[0026]

The dewatered textured vegetable protein is deep fried. The deep frying is performed at a temperature of 100°C or lower to an extent that a moisture is rather reduced, and thus, the oil is caused to permeate surface and inside portions of the textured vegetable protein. The deep frying is performed preferably at 80 to 100°C for about 1 to 10 minutes.

[0027]

Next, the meat layer slurry is produced. As a production method, the methylcellulose and the isolated soy protein powder are dispersed in an oil, cool water is added thereto, and the resultant is stirred at a high speed with a silent cutter, a mixer or the

like for the production. When the used methylcellulose has a low melting temperature, the slurry is cooled for about 1 hour in a refrigerator.

[0028]

Next, powders such as starch, salt, granulated sugar, and sodium glutamate for seasoning are mixed to produce a powder mixture.

[0029]

The deep fried textured vegetable protein, the meat layer slurry, the powder mixture, and a liquid material if necessary, are stirred and mixed with a kneader or manually to produce the meat layer dough. At this point, if the amount of the deep fried textured vegetable protein is too small, the amount of the meat layer slurry in the dough is large, resulting in a fish cake-like texture. On the contrary, if the amount of the deep fried textured vegetable protein is too large, the amount of the meat layer slurry in the meat layer dough is small, resulting in poor shape retention. The deep fried textured vegetable protein is contained in the meat layer dough in an amount of preferably 30 to 60% by weight, and the meat layer slurry is contained in the meat layer dough in an amount of preferably 35 to 65% by weight.

[0030]

When a skin layer described below is a layer obtained by gelling sodium alginate with a calcium salt, the meat layer dough is put in a mold to be molded, and the resultant is heated with steam or the like to produce the meat layer. At this point, the mold has a thickness of preferably about 5 to 20 mm. Heating conditions may be set so that the whole meat layer is heated and the meat layer dough sufficiently hardens to be shaped. Specifically, heating may be performed till the core temperature of the meat layer is 85°C for 3 minutes or more, and in using a metal mold, a method for producing the meat layer by heating in a steam oven at 90 to 120°C for about 5 to 20 minutes can be employed. Besides, if necessary, the surface of the meat layer can be roasted with a gas burner to be burned after the heating, or can be seasoned by applying a sauce thereto. The thus produced meat layer can be refrigerated or frozen for storage.

[0031]

2. Intermediate Layer

In the present invention, an intermediate layer obtained by gelling a fat or oil with a thickener containing HA gellan gum and xanthan gum is provided between the meat layer and

the skin layer. Since the intermediate layer is provided, eel-like texture and flavor can be more definitely obtained.

[0032]

HA gellan gum has freeze resistance, and is adequately melted by heating again after gelation, and hence is preferably used as a gelling agent for the intermediate layer. Besides, when xanthan gum is added, a slimy texture of a soft gelatinous portion present between the meat and the skin of an eel can be expressed. An amount of the HA gellan gum to be added is varied depending on the amount of the oil to be added, and is preferably 1 to 2% by weight with respect to the weight of an intermediate layer slurry. When the amount is less than 1% by weight, the resultant is difficult to be gelled, and when the amount is more than 2% by weight, the resultant gel is too hard. Besides, an amount of the xanthan gum to be added is preferably 1 to 2% by weight with respect to the weight of the intermediate layer slurry. When the amount is less than 1% by weight, the thickening effect of the xanthan gum is difficult to obtain, and when it is more than 2% by weight, the resultant is too thick.

[0033]

The fat or oil used in the intermediate layer of the present invention may be a vegetable fat or oil similarly to that used in the meat layer of the present invention. For preventing oxidation of the oil, an antioxidant such as a tocopherol preparation can be added. Besides, a seasoning or a flavor similar to that used in the meat layer can be also added for seasoning. The fat or oil is preferably emulsified by adding an emulsifier, or an emulsified fat or oil is used. As the emulsifier, polyglycerin fatty acid ester or the like may be used. The fat or oil is contained in an amount of preferably 20 to 40% by weight with respect to the weight of the intermediate layer slurry. When the amount is less than 20% by weight, oily feeling cannot be obtained, and when the amount is more than 40% by weight, the resultant is difficult to be gelled. An amount of the emulsifier to be added is varied depending on the amount of the fat or oil, and the emulsifier is added in an amount of preferably 0.5 to 2% by weight with respect to the weight of the intermediate layer slurry.

[0034]

As a method for producing the intermediate layer, first, the emulsifier (or emulsified fat or oil), the xanthan gum, the HA gellan gum, the antioxidant, and a seasoning material are put in the fat or oil to be well dispersed therein, and then water is put therein, and the resultant is stirred at a high speed with a silent cutter, a mixer or the like to produce the intermediate layer slurry in which the fat or oil is homogeneously dispersed.

[0035]

When the skin layer described below is a layer obtained by gelling sodium alginate with a calcium salt, the intermediate layer slurry is flattened out into a small thickness of about 0.5 to 1.5 mm, and the resultant is heated with steam and then cooled to produce the intermediate layer. Heating conditions may be set so that the HA gellan gum is completely melted, and specifically, a method of performing heating at 80 to 100°C for about 3 to 10 minutes can be employed. After the heating, the resultant is left to cool, and then gelled by cooling in a refrigerator to obtain the intermediate layer, and the thus produced intermediate layer can be refrigerated or frozen for storage until use. Since the intermediate layer is a weak gel, it is easily handled when frozen, and hence is preferably frozen for storage.

[0036]

2. Skin Layer

The skin layer of the present invention is a layer obtained by gelling sodium alginate with a calcium salt, or a layer obtained by gelling methylcellulose. To the skin layer of the present invention, in addition to the raw material, materials not derived from an animal, such as a powder cellulose, starch, a starch degradation product, dextrin, an isolated soy protein powder, a fat or oil, an eel-like flavor, an amino acid, and a pigment such as bamboo charcoal can be added. When a powder cellulose, starch, a starch degradation product or dextrin is added, an appearance like a natural uneven skin or a burned surface can be easily obtained when the skin layer is roasted, and thus, a better texture can be obtained. Besides, when a fat or oil, an amino acid, or a pigment is added, the flavor and appearance of the skin itself can be made better.

[0037]

When the skin layer of the present invention is a layer obtained by gelling sodium alginate with a calcium salt, it is produced by dipping, in a calcium salt aqueous solution, a skin layer slurry containing sodium alginate dissolved therein, a portion thus gelled is peeled off in a small thickness like yuba, and the portion is molded into the shape of a sheet. An amount of sodium alginate is preferably 1.5 to 4% by weight in the skin layer slurry. The calcium salt may be one that can be dissolved in water, and examples include calcium sulfate and calcium lactate. As a concentration of the aqueous solution, the calcium salt may be dissolved in a concentration of about 1 to 2% by weight.

[0038]

As a production method employed when the skin layer of the present invention is a layer obtained by gelling sodium alginate with a calcium salt, first, sodium alginate and powders, such as starch, a starch degradation product, dextrin, and an isolated soy protein powder, and a material such as a pigment are dispersed in a fat or oil, thereafter, water is added thereto, and the resultant is stirred with a silent cutter or the like to produce the skin layer slurry. When a fat or oil is added, the amount is preferably 5 to 40% by weight with respect to the weight of the skin layer slurry. When the amount is more than 40% by weight, the resultant is not gelled. Besides, when powders such as starch, a starch degradation product, dextrin, and a soy protein powder are used, the amount is preferably 10% by weight or less. When the amount is too large, a solid content is large and gel strength is lowered, and hence the resultant is easily torn off.

[0039]

The thus produced skin layer slurry is flattened out on a plate into a thickness of about 0.5 to 1.5 mm. At this point, if a white skin layer slurry and a black skin layer slurry are prepared as illustrated in FIG. 4 so as to express color difference between the back and belly of an eel, and these slurries are flattened out in two colors in the shape of a sheet, the appearance becomes closer to that of an eel skin. The skin layer slurry thus flattened out into the shape of a sheet is dipped in a calcium salt aqueous solution together with the plate for about 3 minutes to be gelled, and then, a gelled surface layer alone is peeled off from the plate. The thus separated gel is heated with steam or the like, and sterilized to be used as the skin layer. The thus produced skin layer can be refrigerated or frozen for storage until use, and if necessary, can be refrigerated or frozen for storage after performing a process of roasting the surface. The skin layer is a weak gel similarly to the intermediate layer, it is easily handled when frozen, and hence is preferably frozen for storage.

[0040]

When the skin layer of the present invention is a layer obtained by gelling methylcellulose, methylcellulose, starch, a starch degradation product, dextrin, an isolated soy protein powder, and a material such as a pigment are dispersed in a fat or oil, cool water is then added thereto, and the resultant is stirred at a high speed with a silent cutter or a mixer to produce the skin layer slurry. When the methylcellulose used has a low melting temperature, the skin layer slurry needs to be cooled at a prescribed temperature. An amount of the methylcellulose to be added is preferably 1 to 2% by weight with respect to the weight of the skin layer slurry. The type of the methylcellulose to be used in the skin layer of the present

invention is the same as that usable in the meat layer of the present invention. When the amount is less than 1% by weight, the resultant is not gelled, and when the amount is more than 2% by weight, the gel becomes too strong.

[0041]

5 When the oil or fat is added, the amount is preferably 5 to 40% by weight or less with respect to the weight of the skin layer slurry. When the amount is more than 40% by weight, the skin layer slurry is so hard that it is difficult to shape. Besides, when powders such as starch, a starch degradation product, dextrin, and a soy protein powder are used, the amount is preferably 10% by weight or less. When the amount is too large, a solid content is
10 large and gel strength is lowered, and hence the resultant is easily torn off.

[0042]

The thus produced skin layer slurry is flattened out into a thickness of 1 to 3 mm, and heated to be used as the skin layer.

[0043]

15 4. Three Layer Formation

When the skin layer of the present invention is a layer obtained by gelling sodium alginate with a calcium salt, a binding agent is applied between the meat layer and the intermediate layer and between the intermediate layer and the skin layer to adhere these layers in the order of the meat layer, the intermediate layer, and the skin layer, and thus, a three layer
20 structure is obtained. Examples of the binding agent include a powder preparation containing sodium alginate and a calcium salt, and a methylcellulose powder. An amount of the binder agent, such as a powder preparation of sodium alginate and a calcium salt, or a methylcellulose powder, to be applied may be an amount sufficient for binding these layers so as not to be easily separated from one another, and the binder agent is applied preferably in an
25 amount of about 0.02 g/cm². The thus produced three layer structure may be thermally bound with steam, or may be directly frozen without thermally binding to the meat layer and the skin layer, so as to be thermally bound in an adhered state by microwave cooking, double-boiling, or oven cooking at the time of eating. Steaming may be performed at 80 to 100°C for about 5 to 10 minutes. Microwave cooking may be performed for 1 minute to 2 minutes
30 at 500 W, double-boiling may be performed in boiling water for about 5 minutes, and oven cooking may be performed at 200 to 250°C for about 5 to 10 minutes.

[0044]

When the skin layer of the present invention is a layer obtained by gelling methylcellulose, a binding agent is not used, but the meat layer dough is filled in a mold, the intermediate layer slurry is applied thereon in a thickness of about 0.5 to 1.5 mm, and the skin layer slurry is further applied thereon in a thickness of about 1 to 3 mm to obtain a three layer structure, which is heated in a steam oven at 90 to 120°C for about 5 to 20 minutes to produce a three layer structure.

[0045]

5. Roast of Surface

The surfaces of the meat layer and the skin layer of the thus produced three layer structure are roasted with a burner or the like to obtain eel-like food using no animal-derived raw materials. When the skin layer of the present invention is a layer obtained by gelling sodium alginate with a calcium salt, the meat layer alone or the skin layer alone may be roasted in advance, and in such a case, the binding agent is used for obtaining the three layer structure, which is directly provided as eel-like food using no animal-derived raw materials. Besides, the three layer structure having the surface roasted may be further roasted with a sauce for eel applied thereon. Thus, eel-like food having a roasting smell like spitchcocked eel is obtained. The eel-like food using no animal-derived raw materials thus produced can be refrigerated or frozen for storage, and can be eaten after microwave cooking, double-boiling, or oven cooking performed at the time of eating.

[0046]

It is noted that conventional technique can be applied to freezing means employed in the present invention. For example, an air blast tunnel freezer, a spiral freezer, a wagon freezer, a flash freezer, a flexible freezer of brine system or the like can be applied. For example, the freezing can be performed rapidly by utilizing a prefabricated flash freezer at about -30°C, or an ordinary household freezer at -18°C can be used. The freezing method is not especially limited, but it is preferable that the food is definitely frozen to a product central temperature of -15°C or less.

[0047]

As described so far, since the three layer structure including the meat layer containing the textured vegetable protein, the starch, the methylcellulose, the isolated soy protein powder, and the fat or oil; the intermediate layer containing the fat or oil, and gelled with the thickener containing the xanthan gum and the HA gellan gum; and the skin layer obtained by gelling sodium alginate with a calcium salt or gelling methylcellulose is

employed, eel-like food using no animal-derived raw materials excellent in texture and flavor like those of eel can be provided.

[0048]

The present embodiment will now be described in more detail by way of examples.

5

EXAMPLES

[0049]

<Experiment 1> Study of Meat Layer

(Experiment 1-1) Study of Textured Vegetable Protein

10

(Test Example 1-1-1)

A deep fried puffed protein was prepared by boiling 100 g of puffed protein (Response 4400 manufactured by Du Pont) in boiling water for 5 minutes, dewatering the resultant with a centrifuge at 1000 rpm for 4 minutes, then deep frying the resultant in rapeseed oil at 90°C for 5 minutes, and draining off the oil through a metal strainer (solid content derived from puffed protein in deep fried puffed protein: 17% by weight, oil content: 11% by weight).

15

[0050]

(Test Example 1-1-2)

A puffed protein was prepared by performing a dewatering treatment in the same manner as in Test Example 1-1-1 except that the deep frying treatment was not performed.

20

[0051]

(Test Example 1-1-3)

A puffed protein was prepared by performing a dehydrating treatment in the same manner as in Test Example 1-1-2 except that the dewatering treatment was not performed.

25

[0052]

(Test Example 1-1-4)

100 g of a fibrous protein (Earth Meat manufactured by Harada Corporation) was boiled in boiling water for 5 minutes, the resultant was dewatered with a centrifuge at 1000 rpm for 4 minutes, and further boiled in boiling water for 5 minutes, and dewatered with a centrifuge at 1000 rpm for 4 minutes again, then, the resultant was crushed with a cutter mixer to obtain a textured vegetable protein having a size of 8 mesh or less. The textured vegetable protein was deep fried in rapeseed oil at 90°C for 5 minutes, and the oil was drained

30

off through a metal strainer (solid content derived from fibrous protein in deep fried textured vegetable protein: 25% by weight, oil content: 15% by weight).

[0053]

(Test Example 1-1-5)

- 5 A fibrous protein was prepared by performing a dewatering treatment in the same manner as in Test Example 1-1-4 except that it was prepared to a size of 8 mesh or less without performing the deep frying treatment.

[0054]

(Test Example 1-1-6)

- 10 A fibrous protein was prepared by performing a dehydrating treatment in the same manner as in Test Example 1-1-5 except that it was prepared to a size of 8 mesh or less without performing the dewatering treatment.

[0055]

Samples of Test Examples 1-1-1 to 1-1-6 were evaluated for flavor and texture.

- 15 The evaluation was performed by five experienced panelists, and the flavor was evaluated as excellent when a soybean smell was not felt, as good when a soybean smell was slightly felt, as fair when it was inferior because a soybean smell was felt, and as poor when it was inferior because a soybean smell was strongly felt. Regarding the texture, comments were provided. Evaluation results are shown in Table 1.

[0056]

[Table 1]

Test Example	Textured Protein	Dewatering Treatment	Deep Frying Treatment	Flavor	Texture
1-1-1	Puffed Protein	Yes	Yes	Excellent	Soft and juicy
1-1-2	Puffed Protein	Yes	No	Good	Soft but rough
1-1-3	Puffed Protein	No	No	Fair	Hard and rough
1-1-4	Fibrous Protein	Yes	Yes	Excellent	Fibrous and moderately moist texture
1-1-5	Fibrous Protein	Yes	No	Good	Fibrous but dry texture
1-1-6	Fibrous Protein	No	No	Fair	Fibrous but dry texture

[0057]

- 25 When the deep frying treatment was performed after the dewatering treatment as described in Test Example 1-1-1 and Test Example 1-1-4, a soybean smell derived from the raw material was not felt, and in addition, roughness and dryness of the textured vegetable protein itself were suppressed, and a juicy texture and a moist texture were imparted. Regarding the textured vegetable protein, if a soft texture is desired in accordance with the texture of eel-like food to be obtained, it is preferable to compound a large amount of the

puffed protein, and if a stiff texture is desired, it is preferable to compound a large amount of the fibrous protein.

[0058]

(Experiment 1-2) Meat Layer Slurry (Study of Binding Agent)

5 (Test Example 1-2-1)

As a meat layer slurry for binding and shaping a textured vegetable protein used as a control, 5 g of egg white powder (Sunkirara(R) SHG, Taiyo Kagaku Co., Ltd.), 15 g of rapeseed oil, and 80 g of water were stirred to produce a meat layer slurry, and the slurry was subjected to a steam treatment at 98°C for 6 minutes to produce a heated meat layer slurry.

10 [0059]

(Test Example 1-2-2)

A heated meat layer slurry was produced in accordance with Test Example 1-2-1 except that the egg white powder was changed to 14 g of an isolated soy protein powder (New Fujipro(R) SEH, Fuji Oil Co., Ltd.), 15 g of rapeseed oil, and 71 g of water.

15 [0060]

(Test Example 1-2-3)

A heated meat layer slurry was produced in accordance with Test Example 1-2-2 except that the isolated soy protein powder was changed to a pea protein powder (PP-CS, Organo Food Tech Corporation).

20 [0061]

(Test Example 1-2-4)

10 g of an isolated soy protein powder (New Fujipro(R) SEH, Fuji Oil Co., Ltd.) and 2 g of methylcellulose (MC-400, Shin-Etsu Chemical Co., Ltd.) were dispersed in 15 g of rapeseed oil, 73 g of cool water was added thereto, the resultant was stirred at a high speed with a mixer, and then the resultant was cooled in a refrigerator at 5°C for 30 minutes to produce a meat layer slurry. The meat layer slurry was subjected to a steam treatment at 98°C for 6 minutes to produce a heated meat layer slurry.

[0062]

(Test Example 1-2-5)

30 A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the methylcellulose was changed to hydroxypropyl methylcellulose (SFE-4000, Shin-Etsu Chemical Co., Ltd.).

[0063]

(Test Example 1-2-6)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the methylcellulose was changed to methylcellulose (MCE-100TS, Shin-Etsu Chemical Co., Ltd.).

5 [0064]

(Test Example 1-2-7)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the methylcellulose was changed to methylcellulose (MCE-4000, Shin-Etsu Chemical Co., Ltd.).

10 [0065]

(Test Example 1-2-8)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the amount of the methylcellulose to be added was changed to 1 g and that the amount of water was changed to 74 g.

15 [0066]

(Test Example 1-2-9)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the amount of the methylcellulose to be added was changed to 3 g and that the amount of water was changed to 72 g.

20 [0067]

(Test Example 1-2-10)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the amount of the isolated soy protein powder was changed to 5 g and that the amount of water was changed to 78 g.

25 [0068]

(Test Example 1-2-11)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the amount of the isolated soy protein powder to be added was changed to 15 g and that the amount of water was changed to 68 g.

30 [0069]

(Test Example 1-2-12)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the amount of the rapeseed oil to be added was changed to 5 g and that the amount of water was changed to 83 g.

[0070]

5 (Test Example 1-2-13)

A heated meat layer slurry was produced in the same manner as in Test Example 1-2-4 except that the amount of the rapeseed oil to be added was changed to 20 g and that the amount of water was changed to 68 g.

[0071]

10 Each of the meat layer slurries of Test Examples 1-2-1 to 1-2-13 was put in a mold having a thickness of about 8 mm, the resultant was subjected to a steam treatment at 98°C for 5 minutes, and the shape retention of the resultant was checked. The shape retention was marked as excellent when the slurry was sufficiently gelled to attain very good shape retention, as good when the slurry was gelled to substantially attain shape retention, as fair
15 when the slurry was gelled but the shape retention was weak, and as poor when the slurry was not gelled and lack of the shape retention. Regarding the texture of the gels, five experienced panelists provided comments as evaluation results. Evaluation results are shown in Table 2 below.

[0072]

[Table 2]

Test Example	Protein Material		Methylcellulose		Fat or Oil		Water		Total (g)	Shape Retention	Texture
	Material	(g)	Material	(g)	(g)	(g)	(g)				
1-2-1	Egg White	5	–	0	15	80	100	100	Excellent	Moderately hard and juicy	
1-2-2	Isolated Soy Protein Powder	14	–	0	15	71	100	100	Fair	Strongly elastic	
1-2-3	Pea Protein Powder	14	–	0	15	71	100	100	Poor	Too soft	
1-2-4	Isolated Soy Protein Powder	10	MCE-400	2	15	73	100	100	Excellent	Gathered texture close to egg white	
1-2-5	Isolated Soy Protein Powder	10	SFE-4000	2	15	73	100	100	Excellent	Good but rather slimy relative to Test Example 1-2-4	
1-2-6	Isolated Soy Protein Powder	10	MCE-100TS	2	15	73	100	100	Good	Rather hard and poor in shape retention relative to Test Example 1-2-4	
1-2-7	Isolated Soy Protein Powder	10	MCE-4000	2	15	73	100	100	Excellent	Similar to fish cake relative to Test Example 1-2-4	
1-2-8	Isolated Soy Protein Powder	10	MCE-400	1	15	74	100	100	Good	Rather soft relative to Test Example 1-2-4	
1-2-9	Isolated Soy Protein Powder	10	MCE-400	3	15	72	100	100	Good	Rather brittle relative to Test Example 1-2-4	
1-2-10	Isolated Soy Protein Powder	5	MCE-400	2	15	78	100	100	Good	Rather gel-like relative to Test Example 1-2-4	
1-2-11	Isolated Soy Protein Powder	15	MCE-400	2	15	68	100	100	Good	Rather crumbly relative to Test Example 1-2-4	
1-2-12	Isolated Soy Protein Powder	10	MCE-400	2	5	83	100	100	Good	Less juicy and rather hard relative to Test Example 1-2-4	
1-2-13	Isolated Soy Protein Powder	10	MCE-400	2	20	68	100	100	Good	Greasy and rather soft relative to Test Example 1-2-4	

[0073]

Although egg white was suitably used as the material for binding and shaping a textured vegetable protein as described in Test Example 1-2-1, since it is an animal-derived protein, vegetable protein powders were used as described in Test Examples 1-2-2 and 1-2-3 as substitutes, but the shape retention and the texture thus obtained were insufficient. Therefore, as described in Test Examples 1-2-4 to 1-2-7, several types of methylcelluloses (including hydroxypropyl methylcellulose) were used in addition to the isolated soy protein powder, and thus, the shape retention became good. As described in Test Examples 1-2-8 and 1-2-9, the amount of the methylcellulose to be added was preferably 1 to 3% by weight in the meat layer slurry, and as described in Test Example 1-2-10 and 1-2-11, the amount of the isolated soy protein powder in the meat layer slurry was preferably 5 to 15% by weight, and as described in Test Examples 1-2-12 and 1-2-13, the amount of the fat or oil was preferably 5 to 20% by weight.

[0074]

(Experiment 1-3 Study of Meat Layer)

(Test Example 1-3-1 to Test Example 1-3-8)

The deep fried textured vegetable proteins (puffed protein and fibrous protein) used in Test Example 1-1-1 and Test Example 1-1-4, the meat layer slurry produced in Test Example 1-2-4, and a powder mixture for seasoning and the like were used to produce a meat layer. The powder mixture for seasoning and the like was added, to 100 g of a meat layer dough, in an amount of 5 g (sweet potato starch: 1.3 g, salt: 0.8 g, monosodium glutamate: 2.1 g, caster sugar: 0.7 g, and tocopherol preparation: 0.1 g). First, the deep fried textured vegetable protein, the meat layer slurry, and the powder mixture in a ratio shown in Table 3 were well stirred to produce a meat layer dough. The dough was put in an eel-like mold as illustrated in FIG. 1, and the resultant was heated with steam at 99°C for 6 minutes to produce a meat layer. The meat layer was evaluated for shapability and texture. Regarding the shapability, the meat layer firmly solidified and shaped was marked as excellent, the meat layer solidified and difficult to cut with chopsticks was marked as good, the meat layer solidified weakly and easily cut with chopsticks was marked as fair, and the meat layer not solidified and easily cut with chopsticks was marked as poor. Regarding the texture, five experienced panelists provided comments as evaluation results. Evaluation results are shown in Table 3 below.

[0075]

[Table 3]

Test Example	Deep Fried Textured Protein		Meat Layer Slurry (wt%)	Powder Mixture (wt%)	Content in Meat Layer					Shapability	Texture
	Puffed Protein (wt%)	Fibrous Protein (wt%)			Puffed Protein (wt%)	Fibrous Protein (wt%)	Fat or Oil (wt%)	Methylcellulose (wt%)	Isolated Soy Protein Powder (wt%)		
1-3-1	0	45	50	5	0.0	11.3	14.3	1.0	5.0	Excellent	Strongly fibrous and rather hard texture as a whole
1-3-2	7.5	37.5	50	5	1.3	9.4	14.0	1.0	5.0	Excellent	Rather fibrous like tuna and elastic texture
1-3-3	15	30	50	5	2.6	7.5	13.7	1.0	5.0	Excellent	Appropriate softness and elasticity when bitten
1-3-4	30	15	50	5	5.1	3.8	13.1	1.0	5.0	Excellent	Slightly soft but elastic
1-3-5	45	0	50	5	7.7	0.0	12.5	1.0	5.0	Excellent	Considerably soft and fluffy
1-3-6	10	20	65	5	1.7	5.0	13.9	1.3	6.5	Excellent	Rather strong gel-like feeling of meat layer slurry
1-3-7	20	40	35	5	3.4	10.0	13.5	0.7	3.5	Good	Rather easily crumbled in mouth
1-3-8	25	50	20	5	4.3	12.5	13.3	0.4	2.0	Fair	Crumbled because of low shape retention

[0076]

Regarding the ratio between the puffed protein and the fibrous protein in the deep fried textured vegetable protein, as described in Test Examples 1-3-1 to 1-3-5, the texture was softer as the ratio of the puffed protein was larger, and a fibrous and elastic texture like that of tuna was obtained as the ratio of the fibrous protein was larger. When the deep fried fibrous protein alone was used, the fibrous texture like tuna was too strong, and hence the deep fried puffed protein is preferably added, and the amount to be added is preferably 17% by weight or more with respect to the weight of the deep fried textured vegetable protein. Besides, as described in Test Examples 1-3-6 to 1-3-8, the amount of the deep fried textured vegetable protein in the meat layer dough was preferably 30 to 60% by weight. When the amount was too small, the amount of the meat layer slurry was so large that the texture of the meat layer slurry was stronger. On the contrary, when the amount was too large, the amount of the meat layer slurry was so small that the shapability was deteriorated. Besides, a solid content in the textured vegetable protein was preferably 6 to 14% by weight in the meat layer. Furthermore, a solid content in the fibrous protein was preferably 10% by weight or less in the meat layer.

[0077]

The amount of the meat layer slurry to be added was preferably 35 to 65% by weight in the meat layer dough from the viewpoint of the shapability as described in Test Examples 1-3-6 to 1-3-8. It was preferable that the methylcellulose was contained in an amount of 0.7 to 1.3% by weight in the meat layer, and that the soy protein powder was contained in an amount of 3.5 to 6.5% by weight.

[0078]

The fat or oil was contained in both the deep fried textured vegetable protein and the meat layer slurry, and was contained, in the whole meat layer, in an amount of preferably about 12 to 15% by weight. Although not described as a test, when the amount of the fat or oil is less than 10% by weight, a juicy texture is weakened, and when it is more than 20% by weight, the resultant becomes greasy and is deteriorated in the shape retention.

[0079]

<Experiment 2 Study of Intermediate Layer>

(Experiment 2-1 Study of Gelling Agent)

(Test Example 2-1-1) to (Test Example 2-1-10)

A slurry obtained by stirring a gelling agent shown in Table 4 below, rapeseed oil, an emulsifier (Ryoto(R) Polyglyester O-50D, Mitsubishi-Chemical Foods Corporation), and water (balance) was heated to 80°C for dissolution, and the resultant was gelled by cooling, or the slurry was dipped in an aqueous solution containing 1% by weight of calcium lactate to be gelled, and gelation and texture thus obtained were studied. The gelation was marked as excellent when the slurry were very satisfactorily gelled with the fat or oil contained therein, as good when the slurry were gelled although the gel was soft, as fair when the slurry was not gelled but could contain the fat or oil in a sol state, and as poor when the slurry was not gelled and could not contain the fat or oil. Regarding the texture, five experienced panelists provided comments as evaluation results. Test results are also shown in Table 4.

[0080]

[Table 4]

Test Example	Gelling Agent	Addition Concentration (wt%)	Rapeseed Oil (wt%)	Emulsifier (wt%)	Gelling Factor	Gelation	Texture
2-1-1	Xanthan Gum	2	30	1	Heating	Fair	Sliminess similar to gelatinous layer close to eel skin
2-1-2	Guar Gum	2	30	1	Heating	Poor	Not gelled
2-1-3	HM Pectin	3	30	1	Dipped in Ca	Poor	Not gelled
2-1-4	HA Gellan Gum	1	30	1	Heating	Good	Soft like jelly
2-1-5	Methylcellulose	1	30	1	Heating	Good	Poorly melt in mouth
2-1-6	Curdlan	4	30	1	Heating	Good	Hard texture
2-1-7	Alginic Acid	5	30	1	Dipped in Ca	Excellent	Too hard texture
2-1-8	Agar	2	30	1	Heating	Poor	Not gelled
2-1-9	Konjac Powder	1	30	1	Dipped in Ca	Good	Too elastic
2-1-10	HA Gellan Gum + Xanthan Gum	1 2	30	1	Heating	Good	Similar to gelatinous layer close to eel skin

[0081]

As the gelling agent for the intermediate layer, HA gellan gum was favorable because an appropriately soft gel can be formed as described in Test Example 2-1-4, and xanthan gum was preferable in the texture as described in Test Example 2-1-1, and therefore, when xanthan gum and HA gellan gum were combined as described in Test Example 2-1-10, a gel having a good texture was formed.

[0082]

(Experiment 2-2 Study of Intermediate Layer)

(Test Example 2-2-1) to (Test Example 2-2-13)

In accordance with compounds shown in Table 5 below, the gelling agent, rapeseed oil, the emulsifier (Ryoto(R) Polyglyester O-50D, Mitsubishi-Chemical Foods Corporation), and water (balance) were stirred to produce an intermediate layer slurry, and the slurry was heated to 80°C, and then cooled for gelation, and thus, an intermediate layer having a thickness of 1 mm was produced. The thus produced intermediate layer was evaluated for texture. The evaluation was performed by five experienced panelists, and one having a very good texture was marked as excellent, one having a good texture was marked as good, one having an inferior texture was marked as fair, and one having a very inferior texture was marked as poor. Evaluation results are also shown in Table 5 below.

[0083]

[Table 5]

Test Example	Gellan Gum (wt%)	Xanthan Gum (wt%)	Rapeseed Oil (wt%)	Emulsifier (wt%)	Evaluation	Comments
2-2-1	0.5	2	30	1	Poor	Not solidified
2-2-2	1	2	30	1	Good	Slightly slimy gel
2-2-3	1.5	2	30	1	Good	Slightly hard gel
2-2-4	2	2	30	1	Good	Rather hard gel
2-2-5	1	0.5	30	1	Fair	Jelly like gel
2-2-6	1	1	30	1	Good	Not jelly like but soft gel
2-2-7	1	1.5	30	1	Good	Slightly slimy gel
2-2-8	1	2.5	30	1	Fair	Strongly slimy
2-2-9	1.2	1.8	10	1	Poor	No greasiness
2-2-10	1.2	1.8	20	1	Good	Rather weak greasiness
2-2-11	1.2	1.8	30	1	Excellent	Very good gel texture and greasiness
2-2-12	1.2	1.8	40	1	Good	Rather greasy
2-2-13	1.2	1.8	50	1	Poor	Not gelled

[0084]

As described in Test Examples 2-2-1 to 2-2-4, the amount of the HA gellan gum to be added as the gelling agent for the intermediate layer was preferably 1 to 2% by weight in the intermediate layer slurry. Besides, as described in Test Examples 2-2-5 to 2-2-8, the amount of the xanthan gum to be added was preferably 1 to 2% by weight in the intermediate layer slurry. Furthermore, the amount of the fat or oil to be added was preferably 20 to 40% by weight in the intermediate layer slurry.

[0085]

<Experiment 3 Study of Skin Layer>

(Experiment 3-1 Study of Skin Layer obtained by Gelling Sodium Alginate with Calcium Salt)

(Test Example 3-1-1) to (Test Example 3-1-14)

Materials shown in Table 6 below were stirred to produce a skin layer slurry, then the slurry was flattened out into a thickness of about 1 mm on a plastic plate, and the resultant was dipped in a solution containing 1.5% by weight of calcium lactate for gelation.

Thereafter, a resultant gel was peeled off from the plate in the solution, the gel was subjected to a steam treatment at 99°C for 3 minutes, and the surface thereof was slightly roasted with a burner to produce a skin layer. It is noted that potato starch was used as the starch, and that the same isolated soy protein powder as that used in the meat layer (New Fujipro(R) SEH, Fuji Oil Co., Ltd.) was used.

[0086]

The thus produced skin layer was evaluated. The evaluation was performed by five experienced panelists, and regarding each of gelation, burnability, gel flavor, and gel texture, very good one was marked as excellent, good one was marked as good, an inferior one was marked as fair, and very inferior one was marked as poor. Evaluation results are also shown in Table 6 below.

[0087]

[Table 6]

Test Example	Na Alginate (wt%)	Rapeseed Oil (wt%)	Starch (wt%)	Isolated Soy Protein Powder (wt%)	Water (wt%)	Gelation	Roast Resistance	Flavor	Overall Evaluation	Comments
3-1-1	1	10	0	0	89	Fair	Good	Excellent	Good	Gel is weak and difficult to peel
3-1-2	1.5	10	0	0	88.5	Good	Good	Excellent	Good	Gel is rather weak and easily deformed
3-1-3	2	10	0	0	88	Excellent	Good	Excellent	Good	Ductile and thin gel can be stably molded
3-1-4	3	10	0	0	87	Excellent	Good	Excellent	Good	Ductile and thin gel can be stably molded
3-1-5	4	10	0	0	86	Excellent	Good	Good	Good	Stably molded but rather bitter
3-1-6	5	10	0	0	85	Excellent	Good	Fair	Fair	Gel is bitter and sticky
3-1-7	2	0	0	0	98	Excellent	Good	Excellent	Fair	Dry texture
3-1-8	2	5	0	0	93	Excellent	Good	Excellent	Good	Ductile texture relative to 3-1-7
3-1-9	2	20	0	0	78	Excellent	Good	Excellent	Good	Equivalent to 3-1-3
3-1-10	2	30	0	0	68	Excellent	Good	Excellent	Good	Rather soft relative to 3-1-9
3-1-11	2	40	0	0	58	Good	Good	Excellent	Good	Gel is soft and greasy
3-1-12	2	10	5	0	83	Excellent	Good	Excellent	Excellent	Surface roughened and gel being ductile
3-1-13	2	10	0	5	83	Excellent	Excellent	Excellent	Good	Easily burned
3-1-14	2	10	2.5	2.5	83	Excellent	Excellent	Excellent	Excellent	Very good because of good appearance of surface roughness and burned surface, and ductile texture

[0088]

As described in Test Examples 3-1-1 to 3-1-6, as the amount of sodium alginate to be added was larger, the flavor was deteriorated, and as the amount was less, the resultant gel was weaker, and therefore, the amount of sodium alginate to be added in the skin layer was preferably 1.5 to 4% by weight. Besides, as described in Test Examples 3-1-7 to 3-1-11, the gel texture was made ductile by adding the fat or oil, but when it was added in a too large amount, the gel became soft, and hence the amount of the fat or oil to be added was preferably 5 to 40% by weight. Besides, as described in Test Examples 3-1-12 and 3-1-14, when the starch was added, the surface of the skin layer became rough (uneven) after roasting the surface of the skin layer, which resulted in a natural skin-like appearance, and in addition, the texture became ductile. Besides, as described in Test Example 3-1-13, when the isolated soy protein powder was added, the surface were easily burned when roasted.

[0089]

(Experiment 3-2 Study of Skin Layer obtained by Gelling Methylcellulose)
(Test Example 3-2-1) to (Test Example 3-2-13)

Materials shown in Table 7 below were stirred under cooling to produce a skin layer slurry, the slurry was flattened out into a thickness of about 1 mm on a plastic plate, a gel obtained after a steam treatment at 99°C for 3 minutes was peeled off from the plate, and the surface of the gel was slightly roasted with a burner to produce a skin layer. As the methylcellulose, MCE-100TS available from Shin-Etsu Chemical Co., Ltd. that can be formed into a hard gel was used. It is noted that potato starch was used as the starch, and that New Fujipro(R) SEH (Fuji Oil Co., Ltd.) was used as the isolated soy protein powder.

[0090]

The thus produced skin layer was evaluated. The evaluation was performed by five experienced panelists, and was performed regarding each of a degree of gelling, burnability (one melted when roasted was marked as poor), gel flavor, and gel texture, and very good one was marked as excellent, good one was marked as good, an inferior one was marked as fair, and very inferior one was marked as poor. Evaluation results are also shown in Table 7 below.

[0091]

[Table 7]

Test Example	Methylcellulose (wt%)	Rapeseed Oil (wt%)	Starch (wt%)	Isolated Soy Protein Powder (wt%)	Water (wt%)	Gelation	Roast Resistance	Flavor	Overall Evaluation	Comments
3-2-1	0.5	10	0	0	89.5	Fair	Poor	-	-	Not edible because weakly gelled and melted by roasting
3-2-2	1	10	0	0	89	Good	Good	Excellent	Good	Soft
3-2-3	1.5	10	0	0	88.5	Excellent	Good	Excellent	Good	One fluffy gel can be molded
3-2-4	2	10	0	0	88	Excellent	Good	Excellent	Good	Same as 3-2-3
3-2-5	1.5	0	0	0	98.5	Excellent	Good	Good	Poor	Transparent gel and jelly like texture
3-2-6	1.5	5	0	0	93.5	Excellent	Good	Fair	Good	Greasiness rather weak relative to 3-2-3
3-2-7	1.5	20	0	0	78.5	Excellent	Good	Excellent	Good	Rather soft relative to 3-2-3
3-2-8	1.5	30	0	0	68.5	Excellent	Good	Excellent	Good	Soft and easily torn relative to 3-2-3
3-2-9	1.5	40	0	0	58.5	Excellent	Good	Excellent	Good	Hamper like texture with low density
3-2-10	1.5	50	0	0	48.5	Excellent	Good	Excellent	Fair	Too hard slurry to mold
3-2-11	1.5	10	5	0	83.5	Good	Good	Excellent	Good	Texture rather dense relative to 3-2-3, uneven skin surface
3-2-12	1.5	10	0	5	83.5	Excellent	Good	Excellent	Excellent	Easily burned, and stronger gel
3-2-13	1.5	10	2.5	2.5	83.5	Excellent	Excellent	Excellent	Good	Very good because of good appearance of surface roughness and burned surface, and ductile texture

[0092]

As described in Test Examples 3-2-1 to 3-2-4, when an amount of the methylcellulose to be added was small, the gelation was weak and the texture was weak, and hence, the amount of methylcellulose to be added in the skin layer was preferably 1 to 2% by weight. Besides, as described in Test Examples 3-2-5 to 3-2-10, when the fat or oil was added, the flavor became better, but when the amount to be added was too large, the resultant gel was soft, and the skin layer slurry was so hard that it was difficult to shape, and hence the amount of the fat or oil to be added was preferably 5 to 40% by weight. Furthermore, as described in Test Examples 3-2-11 and 3-2-13, when the starch was added, the surface of the skin layer became rough (uneven) after roasting the surface of the skin layer, which resulted in a natural skin-like appearance. Besides, as described in Test Example 3-2-12, when the isolated soy protein powder was added, the surface were easily burned when roasted, and in addition, the gel became elastic, and the flavor of the methylcellulose was masked.

[0093]

<Experiment 4 Study of Binding Agent>

(Test Example 4-1) to (Test Example 4-5)

The meat layer of Test Example 1-3-3 having been frozen, the intermediate layer of Test Example 2-2-11 having been frozen, and the skin layer of Test Example 3-1-14 having been frozen were used to apply each powder shown in Table 8 below in an amount of 0.02 g/cm² between the meat layer and the intermediate layer, and between the intermediate layer and the skin layer. Thereafter, the resultant was steamed at 99°C for 5 minutes, and a level of binding was checked. It is noted that Sunkirara(R) SHG (Taiyo Kagaku Co., Ltd.) was used as the egg white, that potato starch was used as the starch, that New Fujipro(R) SEH (Fuji Oil Co., Ltd.) was used as the isolated soy protein powder, Kombu Healthy (Kimica Corporation) was used as the sodium alginate preparation containing the calcium salt, and MCE-4000 (Shin-Etsu Chemical Co., Ltd.) was used as the methylcellulose.

[0094]

The level of binding in each experimental plot was evaluated. The evaluation was performed by five experienced panelists, and one at a very good level (equivalent to egg white) was marked as excellent, one at a good level (inferior to egg white but bound) was marked as good, one at an inferior level (easily separated) was marked as fair, and one at a very inferior level (not bound) was marked as poor. Evaluation results are also shown in Table 8 below.

[0095]

[Table 8]

Test Example	Binding Agent	Meat Layer-Intermediate Layer	Intermediate Layer-Skin Layer
4-1	Egg White Powder	Excellent	Excellent
4-2	Isolated Soy Protein Powder	Excellent	Fair
4-3	Starch	Excellent	Poor
4-4	Na Alginate + Calcium Salt Preparation	Excellent	Excellent
4-5	Methylcellulose	Excellent	Excellent

[0096]

- 5 As shown in Experiment 4, as a binding agent for binding between the meat layer and the intermediate layer and between the intermediate layer and the skin layer equivalently to egg white used as a control, a sodium alginate preparation containing a calcium salt, and methylcellulose were found to be favorable.

[0097]

- 10 <Experiment 5 Production of Eel-like Food Containing No Animal-derived Raw Materials>
(Example 1)

The surface of the meat layer of Test Example 1-3-3 was roasted with a gas burner, and the resultant was frozen to produce a frozen meat layer.

[0098]

- 15 The intermediate layer produced in Test Example 2-2-11 was frozen to produce a frozen intermediate layer.

[0099]

- 20 A skin layer was produced in the same manner as in Test Example 3-1-14 except that a black skin layer slurry obtained by adding bamboo charcoal as a pigment in an amount of 0.1% by weight to the skin layer slurry of Test Example 3-1-14, and the skin layer slurry (white) of Test Example 3-1-14 were aligned into a width of about 30 mm in the order of black, white and black as illustrated in FIG. 4 to be flattened out into a thickness of 1 mm on a plate, and the resultant was frozen to produce a frozen skin layer.

[0100]

- 25 On the frozen meat layer, the frozen intermediate layer, and the frozen skin layer, a preparation containing sodium alginate and a calcium salt (Kombu Healthy, Kimica Corporation) was sprayed between the meat layer and the intermediate layer, and between the intermediate layer and the skin layer in an amount of 0.02 g/cm² to obtain a three layer

structure, then the structure was steamed at 99°C for 5 minutes for binding, and thus, eel-like food (unseasoned) was produced.

[0101]

(Example 2)

5 A spitchcock sauce was applied to the surface of the eel-like food produced in Example 1, and the surface was roasted again with a gas burner to produce eel-like food (spitchcocked).

[0102]

(Example 3)

10 Eel-like food was produced in the same manner as in Example 1 except that the three layer structure was frozen without binding through a steam treatment.

[0103]

(Example 4)

The meat layer slurry of Test Example 1-3-3 was filled in an eel-like mold as
15 illustrated in FIG. 6, then the intermediate layer slurry of Test Example 2-2-11 was spread thereon into a thickness of about 1 mm.

[0104]

A black skin layer slurry obtained by adding bamboo charcoal as a pigment in an amount of 0.1% by weight to the skin layer slurry of Test Example 3-2-13, and the skin layer
20 slurry (white) of Test Example 3-2-13 were aligned into a width of about 30 mm in the order of black, white and black, and the resultant was spread on the intermediate layer slurry into a thickness of 1 mm to obtain a three layer structure.

[0105]

The thus produced three layer structure was steamed together with the mold at 99°C
25 for 6 minutes to solidify the three layer structure, which was then taken out of the mold.

[0106]

The skin surface and the surface of the three layer structure taken out of the mold were roasted with a gas burner to produce eel-like food (unseasoned).

[0107]

30 (Comparative Example 1)

Eel-like food was produced in accordance with the method of Example 1 except that the preparation containing sodium alginate and a calcium salt (Kombu Healthy, Kimica Corporation) was sprayed between the meat layer and the skin layer in an amount of 0.02

g/cm² without using the intermediate layer to obtain a two layer structure, and that the structure was steamed at 99°C for 6 minutes for binding to produce eel-like food (unseasoned) having a two layer structure.

[0108]

- 5 Examples 1 to 4 and Comparative Example 1 were heated for 2 minutes in a microwave oven at 500 W, and the resultants were eaten. In Examples 1, 3 and 4 and Comparative Example 1, an eel sauce was applied after heating.

[0109]

- 10 Results of evaluation made by eating Examples 1 to 4 and Comparative Example 1 are shown in Table 9 below. The evaluation was performed by five experienced panelists, and was performed on the texture and the flavor, and very good eel-like food was marked as excellent, good one was marked as good, inferior one was marked as fair, and very inferior one was marked as poor. Evaluation results are shown in Table 9 below.

[0110]

[Table 9]

Test Example	Structure	Skin Layer	Previous Heating of Layers	Binding Agent	Previous Steaming for Adhering Three Layers	Roasting with Sauce	Overall Evaluation	Comments
Example 1	Three Layer	Alginic Acid Gel	done	Na Alginate+ Ca	done	not done	Excellent	Very good because of well-balanced texture when bitten, and juicy texture similar to eel. Skin being crispier than in Example 4, and close to eel cocked in Kansai Style.
Example 2	Three Layer	Alginic Acid Gel	done	Na Alginate+ Ca	done	done	Excellent	Portion of roasted sauce having roasting smell, and flavor of spitchcocked eel well reproduced.
Example 3	Three Layer	Alginic Acid Gel	done	Na Alginate+ Ca	not done	not done	Excellent	Respective layers bound by microwave cooking, and integral texture provided as in Example 1.
Example 4	Three Layer	Methylcellulose	not done	not done	done	not done	Excellent	Skin not having crispy texture but soft texture differently from Example 1. Moist texture as a whole, very good, and close to eel cocked in Kanto Style.
Comparative Example 1	Two Layer	Alginic Acid Gel	done	Na Alginate+ Ca	done	not done	Fair	Due to lack of intermediate layer, no texture of gelatinous portion close to the skin, and eel-like texture not felt. No unpleasant taste but lack of juicy texture.

[0111]

As described in Examples 1 to 4 and Comparative Example 1, when the three layer structure including the intermediate layer was employed, a texture closer to that of a real eel were imparted, and in addition, a juicy flavor of eel fat were imparted. Regarding the skin layer, one obtained by gelling sodium alginate with a calcium salt and one obtained by gelling methylcellulose had both merits and demerits, and both were very favorable for obtaining an eel-like texture.

[0112]

In addition, as described in Examples 1 to 3, when the skin layer obtained by gelling sodium alginate with a calcium salt was used, it was necessary to bind between the meat layer and the intermediate layer and between the intermediate layer and the skin layer with a binding agent or the like. At this point, it was not necessary to bind the respective layers by heating beforehand as in Example 3, but the layers might be adhered to one another in a frozen state to be bound by heat applied in cooking such as microwave cooking.

[0113]

When the skin layer obtained by gelling methylcellulose was used as in Example 4, methylcellulose was contained in the meat layer and the skin layer, and hence without using a binding agent, eel-like food including the integrated three layers were produced merely by applying doughs or slurries of the respective layers and heating the resultant.

CLAIMS

[Claim 1]

Eel-like food, using no animal-derived raw materials, comprising a meat layer, an
5 intermediate layer, and a skin layer,

wherein the meat layer is a layer containing a textured vegetable protein,
methylcellulose, an isolated soy protein powder, and a fat or oil,

wherein the intermediate layer is a layer containing a fat or oil, and gelled with a
thickener containing xanthan gum and HA gellan gum, and

10 wherein the skin layer is a layer obtained by gelling sodium alginate with a calcium
salt, or by gelling methylcellulose.

[Claim 2]

The eel-like food using no animal-derived raw materials according to claim 1,
wherein the meat layer contains 6 to 14% by weight of a solid content derived from the
15 textured vegetable protein, 0.7 to 1.3% by weight of the methylcellulose, 3.5 to 6.5% by
weight of the isolated soy protein powder, and 10 to 20% by weight of the fat or oil with
respect to a weight of the meat layer.

[Claim 3]

The eel-like food using no animal-derived raw materials according to claim 1 or 2,
20 wherein the intermediate layer contains 20 to 40% by weight of the fat or oil, 1 to 2% by
weight of the xanthan gum, and 1 to 2% by weight of the HA gellan gum with respect to a
weight of the intermediate layer.

[Claim 4]

The eel-like food using no animal-derived raw materials according to any one of
25 claims 1 to 3, wherein the skin layer contains 1.5 to 4% by weight of sodium alginate, or 1 to
2% by weight of methylcellulose with respect to a weight of the skin layer.

[Claim 5]

A method for producing eel-like food using no animal-derived raw materials,
comprising:

30 a step of producing a meat layer dough by mixing a textured vegetable protein that
has been rehydrated, dewatered and then deep fried, with a meat layer slurry that has been
produced by stirring, under cooling, methylcellulose, an isolated soy protein powder, a fat or
oil, and water;

a step of producing a meat layer by filling and heating the meat layer dough in a mold;

a step of producing an intermediate layer by flattening out, into the shape of a sheet, an intermediate layer slurry that has been obtained by mixing a thickener containing xanthan gum and HA gellan gum, with a fat or oil, and heating the intermediate layer slurry for gelling;

a step of producing a skin layer by flattening out a skin layer slurry that has been obtained by dissolving sodium alginate in water, into the shape of a sheet, and dipping the skin layer slurry in an aqueous solution containing a calcium salt for gelling;

a step of adhering the meat layer to the intermediate layer, and the intermediate layer to the skin layer by spraying a powder containing sodium alginate and a calcium salt, or a methylcellulose powder; and

a step of roasting surfaces of the meat layer and the skin layer.

[Claim 6]

A method for producing eel-like food using no animal-derived raw materials, comprising:

a step of producing a meat layer dough by mixing a textured vegetable protein that has been rehydrated, dewatered and then deep fried, with a slurry that has been produced by stirring, under cooling, methylcellulose, an isolated soy protein powder, a fat or oil, and water;

a step of producing an intermediate layer slurry by mixing a thickener containing xanthan gum and HA gellan gum with a fat or oil;

a step of producing a skin layer slurry by dissolving methylcellulose in water under cooling;

a step of producing a three layer structure including a meat layer, an intermediate layer, and a skin layer by filling the meat layer dough in a mold, and applying the intermediate layer slurry and the skin layer slurry on the filled meat layer dough in a stated order;

a step of integrating the three layer structure by heating; and

a step of roasting surfaces of the meat layer and the skin layer of the integrated three layer structure.

[Claim 7]

The method for producing eel-like food using no animal-derived raw materials according to claim 5 or 6,

wherein the meat layer dough contains 6 to 14% by weight of a solid content derived from the textured vegetable protein, 0.7 to 1.3% by weight of the methylcellulose, 3.5 to 6.5% by weight of the isolated soy protein powder, and 10 to 20% by weight of the fat or oil with respect to a weight of the meat layer dough,

wherein the intermediate layer slurry contains 20 to 40% by weight of the fat or oil, 1 to 2% by weight of the xanthan gum, and 1 to 2% by weight of the HA gellan gum with respect to a weight of the intermediate layer slurry, and

wherein the skin layer slurry contains 1.5 to 4% by weight of sodium alginate, or 1 to 2% by weight of methylcellulose with respect to a weight of the skin layer slurry.