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(54) Titre : ALIMENTS TRANSFORMES A BASE DE CREVETTE ET METHODE POUR LEUR PRODUCTION
(54) Title: PROCESSED FOODS OF SHRIMP AND MANUFACTURING METHOD OF THE SAME

ASPECT OF RAW MATERIAL SHRIMP FOR PROCESSED FOOD

SYMBOL OF MATERIAL	MATERIAL AND PRETREATMENT OF MATERIAL	ELASTICITY STRENGTH OF TAIL PART MUSCLE (N/cm^2)	ANALYTICAL VALUE OF TAIL PART MUSCLE (%)					Gl + Pr / P	Pr / Gl + Pr	TASTE
			MOISTURE	P	Gl	Pr	Gl + Pr			
a	LIVE RED SHRIMP	12	80.0	18.1	0.97	0.24	1.21	0.067	0.198	EXCELLENT
b_1	97°C 1 MINUTE HEAT-TREATING OF a	21	76.7	21.8	0.96	0.45	1.41	0.065	0.314	EXCELLENT
b_2	97°C 2 MINUTES HEAT-TREATING OF a	29	78.4	20.0	0.71	0.55	1.26	0.069	0.436	PREMINENT
b_4	97°C 4 MINUTES HEAT-TREATING OF a	43	73.3	25.5	0.54	0.32	0.86	0.034	0.372	GOOD
b_8	97°C 8 MINUTES HEAT-TREATING OF a	59	71.2	27.0	0.30	0.18	0.48	0.018	0.380	FAILURE
c_1	FROZEN STORAGE OF b_1	17	78.2	19.5	0.84	0.45	1.29	0.066	0.350	EXCELLENT
c_2	FROZEN STORAGE OF b_2	25	76.2	19.8	0.72	0.53	1.25	0.063	0.424	PREMINENT
c_4	FROZEN STORAGE OF b_4	37	75.8	22.5	0.53	0.34	0.87	0.039	0.391	GOOD
c_8	FROZEN STORAGE OF b_8	50	70.9	25.8	0.17	0.08	0.25	0.010	0.320	FAILURE
d	FROZEN STORAGE OF a	9	78.2	19.7	1.10	0.44	1.54	0.078	0.286	GOOD
e_2	97°C 2 MINUTES HEAT-TREATING OF d AFTER DEFROSTING	38	76.0	19.5	1.28	0.34	1.60	0.084	0.207	AVERAGE
f_2	FROZEN STORAGE OF e_2	27	78.0	19.1	1.25	0.31	1.56	0.082	0.199	FAILURE
g	97°C 2 MINUTES HEAT-TREATING OF BLACK TAIGER	–	77.6	19.1	0.45	0.22	0.67	0.035	0.328	GOOD
h	97°C 2 MINUTES HEAT-TREATING OF HOKKAI SHRIMP	–	78.0	16.2	0.66	0.28	0.94	0.058	0.298	AVERAGE

P : TOTAL PROTEIN MATERIAL CONTENT
Gl : FREE GLYSIN CONTENT
Pr : FREE PROLINE CONTENT

(57) Abrégé/Abstract:
The manufacturing method of the processed food of the shrimps of the present invention enables a new processed food of the shrimps to be created, in which there is an especially fine eating quality in comparison with the conventional processed food of the shrimps and degradation in quality does not occur over the long term. The processed food of the shrimps of the present invention

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(57) **Abrégé(suite)/Abstract(continued)**:
contains tail part muscle mainly, in which protein content P, free glycine content Gl, and free proline content Pr satisfy the respective conditions of below-described A and B simultaneously. The manufacturing method provides that the heat-treated shrimps are obtained in such a way that the fresh shrimps are subjected to the heat-treating while bringing the fresh shrimps into contact with hot water at 85°C or higher, or saturated steam, then, cooled so that the lengthwise direction elasticity strength (N/cm^2) of a specimen of the tail part muscle of the shrimp, whose size is 5±0.2 mm thick taken in such a way that the tail part muscle is cut in lateral direction in parallel, falls within the range of 15 N/cm^2 to 35 N/cm^2, upon being measured by a parallel-plate type pressure-testing machine, in which the elasticity strength in the lengthwise direction is tested at room temperature.
A: $0.05 \leqq (Gl+Pr)/P \leqq 0.09$
B: $0.3 \leqq Pr/(Gl+Pr) \leqq 0.5$

ABSTRACT OF THE DISCLOSURE

The manufacturing method of the processed food of the shrimps of the present invention enables a new processed food of the shrimps to be created, in which there is an especially fine eating quality in comparison with the conventional processed food of the shrimps and degradation in quality does not occur over the long term. The processed food of the shrimps of the present invention contains tail part muscle mainly, in which protein content **P**, free glycine content **Gl**, and free proline content **Pr** satisfy the respective conditions of below-described A and B simultaneously. The manufacturing method provides that the heat-treated shrimps are obtained in such a way that the fresh shrimps are subjected to the heat-treating while bringing the fresh shrimps into contact with hot water at 85℃ or higher, or saturated steam, then, cooled so that the lengthwise direction elasticity strength (N/cm^2) of a specimen of the tail part muscle of the shrimp, whose size is 5±0.2 mm thick taken in such a way that the tail part muscle is cut in lateral direction in parallel, falls within the range of 15 N/cm^2 to 35 N/cm^2, upon being measured by a parallel-plate type pressure-testing machine, in which the elasticity strength in the lengthwise direction is tested at room temperature.

A: $0.05 \leqq (\mathbf{Gl}+\mathbf{Pr})/\mathbf{P} \leqq 0.09$

B: $0.3 \leqq \mathbf{Pr}/(\mathbf{Gl}+\mathbf{Pr}) \leqq 0.5$

PROCESSED FOOD OF SHRIMPS

AND MANUFACTURING METHOD OF THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a processed food with good preservability made with fresh shrimps as the ingredients, and particularly relates to a new processed food of the shrimps with a good taste and its manufacturing method, which makes it possible to inhibit the deterioration in the original eating quality of the shrimps over a period of time, caused by the deterioration of the protein component in the fresh shrimps.

2. Description of the Related Art

Generally, Crustacean such as shrimps or crabs display rigor mortis when caught caused by the cessation of vital functions. Then, oxidization of tissue sets in and a browning phenomenon progresses by an occurrence of hydrogen sulphide. Further, decomposition of tissue progresses through softening. In order to delay or prevent the occurrence of such undesirable degradation in aquatic food, freezing is generally adopted. However, in the case of eating raw shrimps such as Red Shrimp (Nomenclature: *Pandalus borealis;* Trade name in America: Red Shrimp or Cold Water Shrimp; Trade name in Europe: Red Shrimp, North Atlantic Prawn or Cold Water Shrimp; hereinafter referred to as "Red Shrimp") or Sakura shrimp (Nomenclature:

Sergia lucens; Trade name in America: Sakura shrimp, Spotted Shrimp; hereinafter referred to as "Sakura Shrimp") or so forth after defrosting, the bound water element contained in the muscular tissue of the shrimps drips, and then, softening of the muscular tissue progresses. Therefore, freezing is not necessarily effective in preventing the degradation of eating quality.

Further, although raw shrimps such as Red Shrimp are refrigerated in order to prevent the decomposition, there is no effective method for preventing the progressive deterioration in the taste.

On the other hand, if heat is applied to the raw shrimps in order to fix the bound water to the cellular structure, the flavor is lost because the process spoils the raw taste. Thus, preservation management of raw shrimps was extremely difficult.

Accordingly, the inventors apply heat-treatment to the shrimps, which are maintained in fresh condition immediately just after capture, in such a way as to bring them into brief contact with hot water at 85℃ or higher, or brief exposure to saturated steam. Next, the heat is taken out of the shrimps immediately after the heat-treating in order to make the tail part muscle of the shrimps opaque. Then, the elasticity strength of a specimen of the tail part muscle is measured. The specimen is one whose size is 5 ± 0.2 mm thick taken in such a way that the tail part muscle is cut in lateral direction in parallel. The process is tested by means of a parallel-plate type pressure-testing machine. The testing is to measure the elasticity strength in the lengthwise

direction at a room temperature. The inventors have found out that it is possible to suppress the quality degradation of the shrimps by means of the process described above, upon making the specimen with the elasticity strength of 15N to 30N per 1cm^2 of the cross section area. The inventors have made a patent application concerning the heat-treated shrimps, which are capable of retaining good taste (Japanese Patent Application Laid-Open 2002-253177).

However, according to the prior invention mentioned above, there is a further problem in that the heat-treated shrimps have poor preservability. From the preservability viewpoint, the processed food of the shrimps such as dried shrimps is capable of being preserved for a long term, however, which is quite different from the raw taste of the fresh shrimps.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a new processed food of the shrimps which has an especially fine eating quality in comparison with conventional processed food of the shrimps and which has a good preservability by utilizing the manufacturing method of heat-treated shrimps described above.

More specifically, it is an object of the present invention to provide a manufacturing method of processed food of shrimp comprising:

subjecting fresh shrimps to heat treatment by contacting said fresh shrimp with hot water or saturated steam at a temperature equal or above 85°C to obtain heat-treated shrimp;

cooling said heat-treated shrimp to obtain a tail part muscle having a lengthwise direction crush strength between 15 and 35 N/cm2, said tail part muscle being 5 ± 0.2 mm thick;

removing head and parts unsuitable for eating from said heat-treated shrimp;

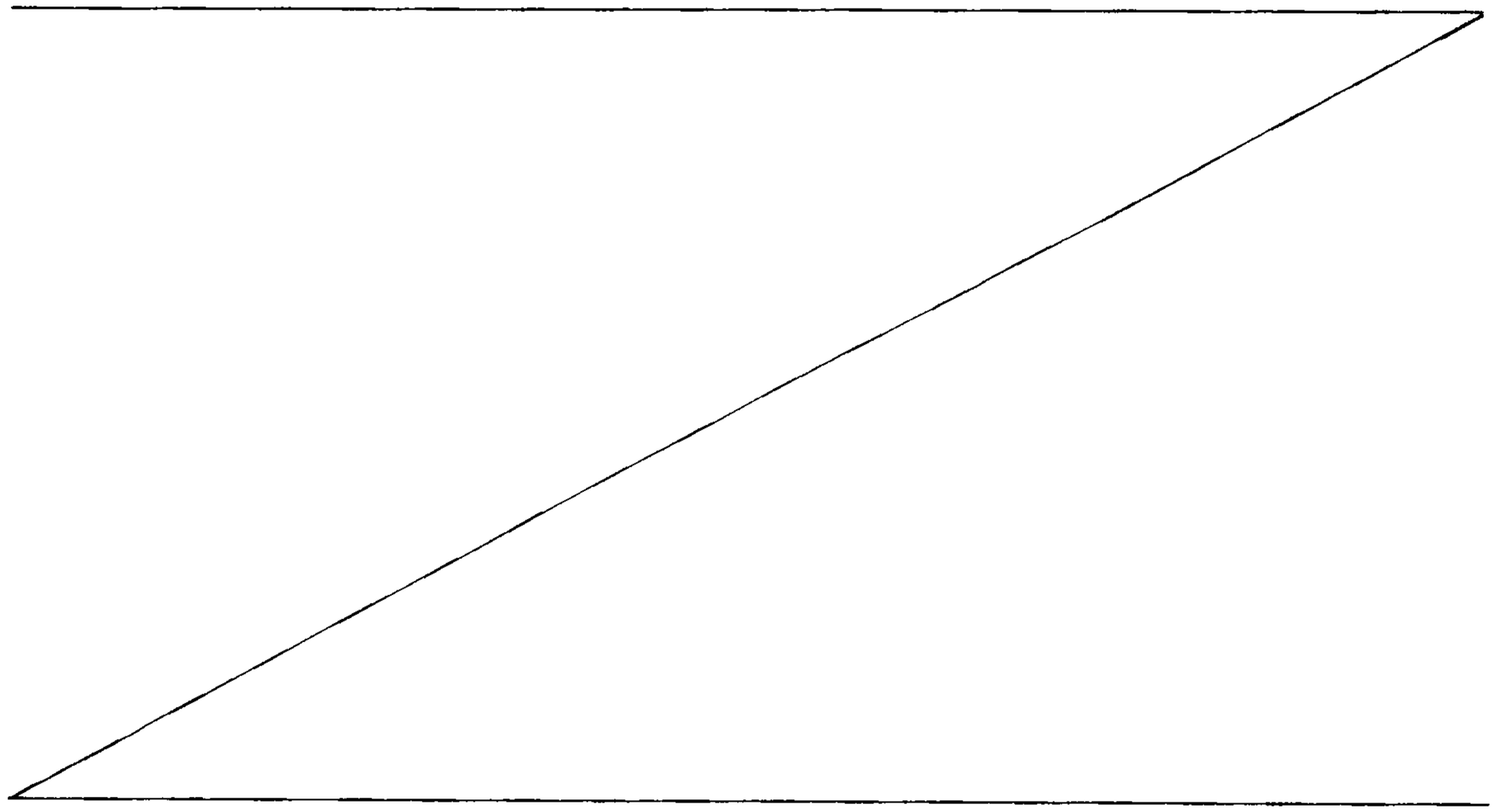
treating said heat-treated shrimp to obtain a protein content P, a free-glycine content Gl, and free proline content Pr, wherein said P, Gl and Pr satisfying A and B simultaneously:

A: $0.05 \leq (Gl + Pr) / P \leq 0.09$

B: $0.3 \leq Pr / (Gl + Pr) \leq 0.5$.

According to a first aspect of the present invention, there is provided a processed food of shrimps which contains a tail part muscle mainly, in which the protein content **P**, the free glycine content **Gl**, and the free proline content **Pr** satisfy the respective conditions of the below-described A and B simultaneously.

A: $0.05 \leqq (\mathbf{Gl}+\mathbf{Pr})/\mathbf{P} \leqq 0.09$



B: 0.3 ≦**Pr**/(**Gl**+**Pr**) ≦ 0.5

According to a second aspect of the present invention, a manufacturing method for the processed food of the shrimps is provided whereby, heat-treated shrimps are obtained in such a way that the fresh shrimps are subjected to heat-treating by bringing the fresh shrimps into contact with hot water at 85℃ or higher, or saturated steam. The shrimps are then, cooled and so that the lengthwise direction elasticity strength (N/cm^2) of the specimen of the tail part muscle of the shrimps, whose size is 5±0.2 mm thick taken in such a way that the tail part muscle is cut in the lateral direction in parallel, falls within the range of 15 N/cm^2 to 35 N/cm^2, upon being measured by a parallel-plate type pressure testing machine, in which the elasticity strength in the lengthwise direction is tested at room temperature, and the processed food of the shrimps containing mainly muscle part is obtained in such a way that the processing includes treatment for removing from the heat-treated shrimps parts such as the head that are unsuitable for eating. A further treatment in the form of the heating or cooling is applied to ensure that the protein content **P**, the free glycine content **Gl**, and the free proline content **Pr** satisfy the respective conditions A and B described below simultaneously.

A: 0.05 ≦ (**Gl**+**Pr**)/**P**≦ 0.09

B: 0.3 ≦**Pr**/(**Gl**+**Pr**) ≦ 0.5

It is preferable that Red Shrimps are used as the ingredients for manufacturing the processed food of the shrimps in connection with the present invention. However, it is possible to combine Red Shrimps with other shrimps with

a fine eating quality such as Botan Shrimp (Nomenclature: Pandalus nipponensis), Coon Stripe Shrimp (Nomenclature: Pandalus hypsinotus) or Kuruma Prawn (Nomenclature: Penaeus japonicus) as the ingredients.

Furthermore, it is necessary that the shrimps used as the ingredients described above are fresh shrimps, however it is preferable that heat-treatment is performed to the shrimps whose muscle tissue does not lose its vital function.

Further, the processing of the heat-treated shrimps includes treatment for removing from the shrimp parts such as the head that are unsuitable for eating and treatment in the form of heating or cooling. Furthermore, it is possible to include a treatment by means of drying or grinding. Thus, it is possible to obtain the processed food of the shrimps in various forms described later by processing the shrimps combining various kinds of treatment.

The form of the processed food of the shrimps using the present invention can be classified from the perspective of shape of the shrimps as the ingredients. It is possible to separate the form into, a substance which uses the muscle part of the tail portion in conjunction with a part of the tail or the shell with no head, a substance obtained in such a way that only the shell is removed from the shrimp with no head, or a substance which is of only the muscle part while removing the shell and the tail from the shrimp with no head.

Furthermore, a form of the processed food of the shrimps can be classified from the perspective of the shape of the food after processing. It is possible to separate the form into shrimps which maintain a shrimp shape, lump shaped pieces in

which the muscle part is cut to separate largely, minced pieces or grain shaped pieces, and ground shrimp muscle shaped pieces.

Furthermore, processed food may be obtained combining these various ingredients and shapes. When the product is used as a frozen food, it is possible to utilize as a fresh food after defrosting, or as the ingredients of a cooked meal after secondary cooking. The processed food may be subjected to heat-drying while utilizing warm air or infrared radiation. It may be utilized as a dried food with either a lump shape or dried grain shape. It is also possible to utilize preferably the dried variety as a dried food with a fine grain shape or powder shapes for seasoning, or as the ingredient of ordinary temperature preservation type of instant cooked food.

Further, the ground shrimp muscle shaped food obtained by a grinding treatment is capable of being used as the ingredients of food such as shrimp cake, after being kept in a freezer. It can be used as a cooked food by roasting or steaming the ingredients while forming them in appropriate shapes. However, the form of the processed food of the shrimps utilizing the present invention is not limited to exemplary forms, but can be manufactured in various forms.

Furthermore, it is preferable that when the processed food of the shrimps using the present invention is preserved or distributed, it is refrigerated or frozen.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a table indicating certain aspects of the shrimps used for the processed food.

Fig. 2 is a table indicating certain aspects of the processed food.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

There now follows a description of the manufacturing method of the processed food of the shrimps utilizing the present invention. The manufacturing method of the processed food of the shrimps is comprised of two stages, firstly the manufacturing of the heat-treated shrimps and secondly the processing of the heat-treated shrimps. Firstly, the manufacturing steps will be described. These are based on the method described in the description of Japanese Patent Application Laid-Open No.2002-253177. The steps of the first stage comprise the selection of the fresh shrimps, heat-treatment using the heat treating apparatus including measuring, heating, and cooling sections, and finally the refrigeration or freezing of the heat-treated shrimps prior to temporary storage or transportation.

The separation of the fresh shrimps during the first step is performed in order to secure the quality of the processed food of the shrimps used in the present invention and to make treatment more efficient. During the separation process, at first, only available shrimps are selected from the other marine products. Secondly, poor quality shrimps such as un-fresh shrimps or shrimps with black heads are removed because these shrimps as ingredients have a low property modification effect regardless of the heat-treating. Thirdly,

selection is made according to the size of the shrimps to secure uniformity of the heat-treating effect of the shrimps. In addition, it is preferable that such separation should be executed in subsequent respective steps of the stages if required.

The measuring section in the heat-treating apparatus for executing the second step measures the amount of shrimps to be processed at one time, because the heating section of the next stage preferably adopts the batch-wise processing system. The measuring section is an effective means for increasing the uniformity of the heat-treating effect upon measuring stock amount of the shrimps to be processed at one time. The heating section heats hot water, either as fresh or salt water in such a way as to supply steam into the heat-treating tank in which the hot water is contained to heat to 85℃ to 99℃. The hot water is then stirred. Especially, it is preferable that the configuration circulates the hot water using a circulating pump and circulating pipe to make the temperature of the hot water in the tank even. Further, it is preferable that a basket is formed with a perforated plate for submerging in the heat-treating tank beforehand in order to scoop up all the shrimps thrown into the tank at once after the heat-treating is performed during a predetermined period of time.

Further, the cooling section provided after the heating section comprises a cooling tank containing chilled water, either as fresh or salt water. It is preferable that the chilled water is circulated by means of a circulating pump and circulating pipe to maintain an even temperature of the

chilled water within the tank. A cooling tank temperature of 30℃ or lower is suitable, a temperature of 20℃ or lower is particularly desirable, and a temperature of 10℃ or lower is even better. However, when there are limitations in quantity of chilled water, two cooling tanks are provided at the cooling section and they are arranged in series. The temperature of the initial stage of the cooling tank is set at, for example, 30℃ to 40℃. The temperature of the next stage of the cooling tank is set at, for example, 20℃ or lower. By this means, it is possible to economize in the quantity of chilled water consumed. Further, it is preferable that the basket formed with a perforated plate is submerged into the cooling tank beforehand as in the heat-treating tank, and it is preferable that all the heat-treated shrimps thrown into the cooling tank are scooped up at once.

The muscle tissue of the shrimps is subjected to property modification while undergoing the heat-treatment described above. However, the degree of the property modification is determined by the treatment temperature and time. Therefore, the time taken to bring the shrimps into contact with the heating medium such as hot water or steam must be adjusted, based on their form, the temperature of the heating medium, the size of the shrimps, the ratio between amount of the heating medium and amount of the shrimps and so forth.

Especially, it is preferable that the shrimps are in contact with the heating medium for the time necessary for the elasticity strength in the lengthwise direction at a room temperature of 22℃ to 27℃ to become 15N to 35N per $1cm^2$ of cross section area of the specimen whose size is 5±0.2mm thick

taken in such a way that the tail part muscle is cut in a lateral direction in parallel. Usually, such contact time is between one and five minutes. Furthermore, it is preferable that the heating medium is selected in such a way that the temperature of the muscle tissue of the shrimps reaches at least 70℃ to 75℃.

Thus, the heat-treated shrimps are cooled immediately by chilled water after processing. In the cooling step, the temperature of the muscle tissue of the shrimps drops rapidly to 65℃ or lower, preferably to 55℃ or lower, and it is desirable that the property modification of the muscle tissue does not proceed more than necessary. However, it is preferable that after the heat-treating the shrimps are cooled down perfectly prior to preservation, accordingly, it is desirable that the temperature of the chilled water is 25℃ or lower, preferably 20℃ or lower, or 10℃ or lower. Then, it is possible to maintain the property of the muscle tissue undergoing the property modification over a long term upon freezing the shrimps, after cooling perfectly.

Heat-treated shrimps obtained in the way described above demonstrate a more pleasant taste than that of raw shrimps in that the muscle tissue is subjected to the property modification and the composition of free amino acid included in the muscle tissue is changed. For this reason in the present invention, the following additional processing treatment is added to the manufacturing process. Namely, there are added additional processing including a treatment for removing parts such as inedible shrimp heads, a treatment involving additional heating, cooling, drying, and grinding down by

friction to the heat-treated shrimps described above. Thus, various sorts of the processed food of the shrimps, which are well suited for various uses, can be obtained.

[Embodiment]

Hereinafter, there will be described the processed food of the shrimps of the present invention based on embodiments.

(Reference Example)

Live Red Shrimps **a** are caught to select into the size of 90 to 120 per 1kg and then putting them into a water tank. There is prepared the live Red Shrimp **a** put in the water tank. The other live Red Shrimps **a** scooped from the water tank are made to throw into 2% salt solution at 97℃ immediately. There is scooped the shrimps immediately after approximately 1 minute heat-treatment. The heat-treated Red Shrimps $\mathbf{b}_1$ are manufactured in such a way as to throw them for cooling into chilled water at 10℃ after the heat-treatment described above. Also, heat-treated Red Shrimps $\mathbf{b}_2$, $\mathbf{b}_4$, and $\mathbf{b}_8$ are manufactured in such a way as to heat them with the heat-treating time of 2, 4, and 8 minutes respectively and another treatments are the same as those of $\mathbf{b}_1$. And further, approximately half are taken to separate from these heat-treated shrimps $\mathbf{b}_1$, $\mathbf{b}_2$, $\mathbf{b}_4$, and $\mathbf{b}_8$, and there are frozen them by the freezer at -30℃ immediately, thus there are manufactured the respective frozen heat-treated Red Shrimps $\mathbf{c}_1$, $\mathbf{c}_2$, $\mathbf{c}_4$, and $\mathbf{c}_8$. While, there are manufactured frozen Red Shrimps **d** in such a way as to freeze the live Red Shrimps **a** scooped from the water tank immediately by the freezer at -30℃. Then, these are kept in the freezer.

Next, the respective 10 shrimps are taken out among these live Red Shrimps **a** and the heat-treated Red Shrimps $\mathbf{b}_1$, $\mathbf{b}_2$, $\mathbf{b}_4$, and $\mathbf{b}_8$. The respective shells are removed. The tail part muscle is cut in the approximately right angle direction against axis. The muscle specimen with thickness of 5 ± 0.2mm is formed and its diameter is measured. Continuously, this muscle specimen sets on the parallel-plate type pressure-testing machine (SAN science, COMPAC-100 using the discoid adaptor). There is obtained maximum load value (N) during which the shrimp specimen is compressed in the lengthwise direction until the thickness thereof becomes 50%. Next, there is measured the lengthwise direction elasticity strength (N/cm^2) per 1 cm^2 cross-area of the muscle specimen. The average value of the elasticity strength obtained with respect to 10 muscle specimens is calculated. Then, its test result is illustrated in table of Fig.1.

On the other hand, the frozen Red Shrimps **d**, are put in the freezer, in polyethylene bags. The frozen Red Shrimps **d** are defrosted while being subjected to maceration of approximately 10 minutes in the running water at 5℃ to 10℃, after that, about 20 shrimps are separated for use as test specimens. The rest are heat-treated for approximately 2 minutes by throwing them into a 2% salt solution at 97℃, that is the same as above, to manufacture heat-treated frozen Red Shrimps $\mathbf{e}_2$. Approximately half of these heat-treated frozen Red Shrimps $\mathbf{e}_2$ are separated immediately after manufacturing. The re-frozen heat-treated Red Shrimps $\mathbf{f}_2$ are made to manufacture while freezing half of the heat-treated frozen Red Shrimps $\mathbf{e}_2$ in the freezer at -30℃. These are then kept

in the freezer. Further, the muscle specimen is made to prepare from the tail part muscle in the same way as above, while gathering from both of the defrosted frozen Red Shrimps **d** and the heat-treated frozen Red Shrimps $\mathbf{e}_2$. The elasticity strength is measured and its test result is indicated in Fig. 1.

Furthermore, the respective 10 shrimps are taken out from the frozen heat-treated Red Shrimps $\mathbf{c}_1$, $\mathbf{c}_2$, $\mathbf{c}_4$, and $\mathbf{c}_8$, which are kept in the freezer, and the above re-frozen heat-treated Red Shrimps $\mathbf{f}_2$. There is prepared the muscle specimen from the tail part muscle of the shrimps, after being defrosted in the same way as above. The elasticity strength is measured and its test result is indicated in Fig. 1.

Furthermore, a componential analysis as the food product is measured with the respective tail part muscles as the specimens with respect to the above described each of the Red Shrimps **a**, $\mathbf{b}_1$, $\mathbf{b}_2$, $\mathbf{b}_4$, $\mathbf{b}_8$, $\mathbf{c}_1$, $\mathbf{c}_2$, $\mathbf{c}_4$, $\mathbf{c}_8$, **d**, $\mathbf{e}_2$, and $\mathbf{f}_2$. The following measurements are taken. The protein content **P**, the free glycine content **Gl**, and the free proline content **Pr**. There has been calculated the value of **(Gl+Pr)/P** and the value of **Pr/(Gl+Pr)**. On the other hand, 5 valuators evaluate the taste of the respective tail part muscles. The results are put in each grade of preeminent, excellent, good, average, and failure while averaging the results. These results are indicated in the table of Fig.1.

Furthermore, for a comparison, there are manufactured the heat-treated shrimps **g** and the heat-treated shrimps **h** in such a way that fresh Black Tiger (Nomenclature: Penaeus monodon) and Morotoge Shrimp (Nomenclature: *Pandalopsis japonica*) are

made to perform approximately 2-minute heat-treating within 2%-salt solution at 97°C in the same way as above. A componential analysis of the tail part muscle is carried out in the same way as above. Then an evaluation of the taste is performed and the results are graded in 5 stages of preeminent, excellent, good, average, and failure while averaging the results. These results are indicated in table of Fig.1.

According to Fig. 1, when compared to the un-treated live shrimps **a**, the heat-treated Red Shrimps $\mathbf{b}_1$, $\mathbf{b}_2$, and $\mathbf{b}_4$ obtained in such a way as to give the heating treatment to the live Red Shrimps **a**, and the frozen heat-treated Red Shrimp $\mathbf{c}_1$, $\mathbf{c}_2$, and $\mathbf{c}_4$ obtained in such a way as to give the freezing-treatment after the heating-treatment to the live Red Shrimps **a** have a distinctive feature in that the content of the glycine to be the free amino acid within the muscle tissue decreases and content of the proline increases. And these shrimps $\mathbf{b}_1$, $\mathbf{b}_2$, $\mathbf{b}_4$, $\mathbf{c}_1$, $\mathbf{c}_2$, and $\mathbf{c}_4$, which have the lengthwise direction elasticity strength (N/cm^2) of the tail part muscle of the shrimp fall within the range of 15 N/cm^2 to 35 N/cm^2, particularly the range of 20 N/cm^2 to 30 N/cm^2, have the most delicious taste. Thus, there is found that the shrimps $\mathbf{b}_1$, $\mathbf{b}_2$, $\mathbf{b}_4$, $\mathbf{c}_1$, $\mathbf{c}_2$, and $\mathbf{c}_4$, are best suited as the ingredients of the processed food of the shrimps. On the other hand, the heat-treated frozen Red Shrimps $\mathbf{e}_2$ obtained in such a way that the frozen Red Shrimps **d** are heat-treated after defrosting, and the re-frozen heat-treated Red Shrimps $\mathbf{f}_2$ obtained in such a way that the heat-treated frozen Red Shrimps $\mathbf{e}_2$ are subjected to the re-freezing treatment have the property that, although the content of the free amino acid increases, the content of

the proline decreases to the increase of the content of the glycine, resulting in a poor taste. It has been found that live Red Shrimps, after undergoing the heat-treating, have a specific improvement effect of a delicious taste. In the meanwhile, Red Shrimps, which are subjected to the freezing-treatment at the beginning, have no effect from heat-treating. It has been also found that the effect due to the heat-treating is immune to the subsequent freezing and/or defrosting.

(First Embodiment)

The live Red Shrimps **a** used in the reference example, the frozen Red Shrimps **d**, and the frozen heat-treated Red Shrimps $\mathbf{c}_2$ are taken as the ingredients. There is added processing so as to leave only the muscle of the tail part upon removing each of the head, the shell and the tail from the shrimp. There is manufactured the respective processed food of the shrimps **A***, **B*** of the contrastive goods and the processed food of the shrimps **C** of the present invention. Aspects of above-described processed food of the shrimps are indicated in FIG. 2. The processed food of the shrimps **C** of the present invention has a more delicious taste in comparison with the processed food of the shrimps **A***, **B*** of the contrastive goods. Further, when preserving over the long term, it is possible to perform freezing processing as secondary processing. Thus, it is possible to utilize the shrimps **C** as the cooking ingredients in various dishes.

(Second Embodiment)

Like the first embodiment, the live Red Shrimps **a**, the frozen Red Shrimps **d**, and the frozen heat-treated Red Shrimps

c_2 are taken as the ingredients. There is added processing so as to leave only the muscle of the tail part upon removing each of the head, the shell and the tail from the shrimp. These are arranged on shelves toward which the warm air-drying machine blows in dried warm air at 40℃. By doing this, there is manufactured the respective processed food of the shrimps **D***, **E*** of the contrastive goods and the processed food of the shrimps **F** of the present invention. Fig. 2 shows the aspect of the processed food of the shrimps. The processed food of the shrimps **F** of the present invention is in no way inferior as compared to the processed food of the shrimps **D***, **E*** of the contrastive goods. This is suitable for the preservation over the long term, and it is possible to utilize the shrimps **F** as the ingredients used for various kinds of cooking and seasoning.

(Third Embodiment)

Like the second embodiment, the frozen Red Shrimps **d** and the frozen heat-treated Red Shrimps **c_2** are taken as the ingredients. Processing takes place so as to leave only the muscle of the tail part upon removing the head, the shell, and the tail from the shrimp. These are arranged on shelves towards which the hot air drying machine blows in dried hot air at 80℃. By doing this, there is manufactured the respective processed food of the shrimps **G*** of the contrastive goods and the processed food of the shrimps **H** of the present invention. Fig. 2 shows the aspect of the processed food of the shrimps. The processed food of the shrimps **H** of the present invention clearly has a better taste compared to the processed food of the shrimps **G*** of the contrastive goods. This is

suitable for preservation over the long term, and it is possible to utilize the shrimps **H** as the ingredients used for various kinds of cooking, seasoning, or something to nibble.

(Fourth Embodiment)

Like the third embodiment, the frozen Red Shrimps **d** and the frozen heat-treated Red Shrimps $\mathbf{c}_2$ are taken as the ingredients. Processing takes place so as to leave only the muscle of the tail part upon removing the head, the shell, and the tail from the shrimp. This is cut into minced shrimp with 5mm-thick slices. These are arranged on the shelves toward which the warm air-drying machine blows in dried warm air at 40℃. By doing this, there is manufactured the respective processed food of the shrimps **I*** of the contrastive goods and the processed food of the shrimps **J** of the present invention. Fig. 2 shows the aspect of the processed food of the shrimps. The processed food of the shrimps **J** of the present invention has a better taste clearly as compared to the processed food of the shrimps **I*** of the contrastive goods. This is suitable for the preservation over the long term, and it is possible to utilize the shrimps **J** as the ingredients used for various kinds of cooking, seasoning, and particularly something to nibble.

(Fifth Embodiment)

The frozen heat-treated Red Shrimps $\mathbf{c}_2$ that are shown in Fig.1 are taken as the ingredients. Processing takes place so as to leave only the muscle of the tail part with the shell upon removing the head from the shrimp. This is cut into minced shrimp with 5mm-thick slices. These are arranged on shelves towards which the warm air-drying machine blows in dried warm

air at 40℃. By doing this, there is manufactured the processed food of the shrimps **K** of the present invention. Fig. 2 shows the aspect of the processed food of the shrimps **K**. This is suitable for the preservation over the long term, and has a good taste, and it is possible to preferably utilize the shrimps **K** as the ingredients used for the various kinds of cooking and seasoning. In addition, it is effective for the supply of calcium, and particularly it is preferable to use as something to nibble, or as a snack.

(Sixth Embodiment)

Like the fifth embodiment, the frozen heat-treated Red Shrimps $\mathbf{c}_2$ that are shown in Fig.1 are taken as the ingredients. Processing takes place so as to leave only the muscle of the tail part with the shell upon removing the head from the shrimp. These are arranged on the shelves toward which the warm air-drying machine blows in dried warm air at 40℃ to dry. By doing this, there is manufactured the processed food of the shrimps **L** of the present invention. Fig. 2 shows the aspect of the processed food of the shrimps **L**. This is suitable for the preservation over the long term, and has a good taste, and it is possible to preferably utilize the shrimps **L** as the ingredients used for the various kinds of cooking and the seasoning. In addition thereto, it is effective for supply of the calcium, and particularly it is preferable to use as something to nibble, the snack and so forth.

(Seventh Embodiment)

Like the Fifth embodiment, the frozen heat-treated Red Shrimps $\mathbf{c}_2$ that are shown in Fig.1 are taken as the ingredients. Processing takes place so as to leave only the muscle of the

tail part with the shell upon removing the head from the shrimp. These are arranged on the shelves toward which the hot air-drying machine blows in dried hot air at 80℃. This is subjected to fine grinding using a grinder, producing a powdery processed food of the shrimps **M**. Fig. 2 shows the aspect of the processed food of the shrimps **M**. This is suitable for the preservation over the long term, and has a good taste, and it is possible to utilize the shrimps **M** as the ingredients used for the various kinds of cooking and particularly seasoning or as a seasoning powder for sprinkling over rice. In addition, it is an effective means supplying calcium.

(Eighth Embodiment)

Like the Seventh embodiment, the frozen heat-treated Red Shrimps $\mathbf{c}_2$ that are shown in Fig.1 are taken as the ingredients. Processing takes place so as to leave only the muscle of the tail part upon removing the head, the shell, and the tail from the shrimp. This is minced into an appropriate size, after which the ingredients are thrown into a grinder and then the processed food of the shrimps **N** of the present invention is manufactured in the form of ground shrimp muscle. Fig. 2 shows the aspect of the processed food of the shrimps **N** that has a good taste. This processed food of the shrimps **N** is rounded like a meatball, then, steamed or roasted in the shape of a boiled shrimp cake or pound cake. In particular, the shrimps **N** are not only suitable as cooking ingredients, but also it is possible to utilize them in the manufacture of various kinds of food.

(Ninth Embodiment)

There is combined the processed food of the shrimps **I*** of the contrastive goods made of the frozen Red Shrimps **d** as the ingredients, and the processed food of the shrimps **J** of the present invention made of the frozen heat-treated Red Shrimps $\mathbf{c}_2$ as the ingredients so that an amount of the shrimps **I*** becomes equal to the amount of the shrimps **J**. The mixtures are subjected to fine grinding using a grinder, and are mixed evenly, and then, the processed food of the shrimps **O** of the present invention is manufactured. Fig. 2 shows the aspect of this processed food of the shrimps **O**. The processed food of the shrimps **O** of the present invention has a good taste. This is suitable for preservation over the long term, and it is possible to utilize the shrimps **O** as the ingredients used in various kinds of cooking and seasoning.

The processed food of the shrimps of the present invention is made by applying additional processes to the heat-treated Red shrimps. The heat-treated Red shrimps are obtained in such a way as to bring the live Red Shrimps into contact with hot water at 85℃ or higher, or saturated steam. The above-described heat-treating is performed in such a way that the taste of the muscle of the shrimps becomes most pleasant. Such heat-treated Red shrimps with a most pleasant taste have the characteristic that the composition of free amino acid included in the muscle falls within a specific range. For this reason, the processed food of the shrimps according to the present invention is provided with a peculiar taste that is richer in flavor than the original taste of the live Red Shrimps. Furthermore, this does not deteriorate over the long term. This is superior when compared to conventional

processed food of the shrimps. Thus, it is possible to provide a new type processed food of the shrimps.

Moreover, according to the manufacturing method of the processed food of the shrimps of the present invention, it has a superior effect in that it is possible to produce the processed food with a uniform quality in large quantities. This is superior in comparison to conventional manufacturing method of the processed food of the shrimps. Thus, it is possible to provide a new manufacturing method of the processed food of the shrimps.

What is claimed is:

1. A manufacturing method of processed food of shrimp comprising:

subjecting fresh shrimps to heat treatment by contacting said fresh shrimp with hot water or saturated steam at a temperature equal or above 85°C to obtain heat-treated shrimp;

cooling said heat-treated shrimp to obtain a tail part muscle having a lengthwise direction crush strength between 15 and 35 N/cm2, said tail part muscle being 5 ± 0.2 mm thick;

removing head and parts unsuitable for eating from said heat-treated shrimp;

treating said heat-treated shrimp to obtain a protein content P, a free-glycine content Gl, and free proline content Pr, wherein said P, Gl and Pr satisfying A and B simultaneously:

A: $0.05 \leq (Gl + Pr) / P \leq 0.09$

B: $0.3 \leq Pr / (Gl + Pr) \leq 0.5$.

2. The method according to claim 1, wherein said shrimp is Red Shrimp.

3. The method according to claim 1, wherein said fresh shrimps maintain a state in which a muscle tissue does not lose vital reaction.

4. The method according to claim 1, wherein said processing includes a drying treatment.

5. The method according to claim 1, wherein said processing includes a grinding treatment.

6. A processed food of shrimp containing tail part muscle mainly,

wherein protein content P, free glycine content Gl, and free proline content Pr satisfy the conditions A and B simultaneously,

A: $0.05 \leq (Gl + Pr) / P \leq 0.09$

B: $0.3 \leq Pr / (Gl + Pr) \leq 0.5$.

7. The processed food of shrimp according to claim 6, wherein said fresh shrimps are Red Shrimps.

8. The processed food of shrimp according to claim 6, wherein said processed food of shrimps contains a shell part of said fresh shrimps.

9. The processed food of shrimp according to claim 6, wherein said processed food of shrimps is of a ground shrimp muscle shaped pieces.

10. The processed food of shrimp according to claim 9, wherein said processed food of shrimps is of food made of said ground shrimp muscle shaped pieces undergoing heat-treatment.

11. The processed food of shrimp according to claim 6, wherein said processed food of shrimps is one of a number of

shapes; lump shaped pieces or a mince piece shaped pieces or powder shaped pieces, obtained in such a way that a form of the shrimps is cut.

12. The processed food of shrimp according to claim 6, wherein said processed food of shrimps at the time of preservation or distribution is refrigerated or frozen.

13. The processed food of shrimp according to claim 11, wherein said processed food of shrimps is in dried lump shaped pieces, dried minced shaped pieces or dried said powder shaped pieces.

ASPECT OF RAW MATERIAL SHRIMP FOR PROCESSED FOOD

SYMBOL OF MATERIAL	MATERIAL AND PRETREATMENT OF MATERIAL	ELASTICITY STRENGTH OF TAIL PART MUSCLE (N/cm^2)	ANALYTICAL VALUE OF TAIL PART MUSCLE (%)					Gl + Pr / P	Pr / Gl + Pr	TASTE
			MOISTURE	P	Gl	Pr	Gl + Pr			
a	LIVE RED SHRIMP	12	80.0	18.1	0.97	0.24	1.21	0.067	0.198	EXCELLENT
b_1	97°C 1 MINUTE HEAT-TREATING OF a	21	76.7	21.8	0.96	0.45	1.41	0.065	0.314	EXCELLENT
b_2	97°C 2 MINUTES HEAT-TREATING OF a	29	78.4	20.0	0.71	0.55	1.26	0.069	0.436	PREMINENT
b_4	97°C 4 MINUTES HEAT-TREATING OF a	43	73.3	25.5	0.54	0.32	0.86	0.034	0.372	GOOD
b_8	97°C 8 MINUTES HEAT-TREATING OF a	59	71.2	27.0	0.30	0.18	0.48	0.018	0.380	FAILURE
c_1	FROZEN STORAGE OF b_1	17	78.2	19.5	0.84	0.45	1.29	0.066	0.350	EXCELLENT
c_2	FROZEN STORAGE OF b_2	25	76.2	19.8	0.72	0.53	1.25	0.063	0.424	PREMINENT
c_4	FROZEN STORAGE OF b_4	37	75.8	22.5	0.53	0.34	0.87	0.039	0.391	GOOD
c_8	FROZEN STORAGE OF b_8	50	70.9	25.8	0.17	0.08	0.25	0.010	0.320	FAILURE
d	FROZEN STORAGE OF a	9	78.2	19.7	1.10	0.44	1.54	0.078	0.286	GOOD
e_2	97°C 2 MINUTES HEAT-TREATING OF d AFTER DEFROSTING	38	76.0	19.5	1.28	0.34	1.60	0.084	0.207	AVERAGE
f_2	FROZEN STORAGE OF e_2	27	78.0	19.1	1.25	0.31	1.56	0.082	0.199	FAILURE
g	97°C 2 MINUTES HEAT-TREATING OF BLACK TAIGER	—	77.6	19.1	0.45	0.22	0.67	0.035	0.328	GOOD
h	97°C 2 MINUTES HEAT-TREATING OF HOKKAI SHRIMP	—	78.0	16.2	0.66	0.28	0.94	0.058	0.298	AVERAGE

P : TOTAL PROTEIN MATERIAL CONTENT
Gl : FREE GLYSIN CONTENT
Pr : FREE PROLINE CONTENT

FIG. 1

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ASPECT OF PROCESSED FOOD

SYMBOL OF FOOD	SYMBOL OF MATERIAL	CONTENT OF PROCESSING	ANALYTICAL VALUE OF PROCESSED FOOD(%)					Gl + Pr / P	Pr / Gl + Pr	TASTE
			MOISTURE	P	Gl	Pr	Gl + Pr			
A*	a	MUSCLE PART(LIVE RED SHRIMP)	80.0	18.1	0.97	0.24	1.21	0.067	0.198	EXCELLENT
B*	d	SEPARATION OF MASUCLE PART(FROZEN RED SHRIMP)	78.2	19.7	1.10	0.44	1.54	0.078	0.286	GOOD
C	c 2	SEPARATION OF MASUCLE PART (FROZEN HEAT-TREATED LIVE RED SHRIMP)	76.2	19.8	0.72	0.53	1.25	0.063	0.424	PREMINENT
D*	a	40°C WARM AIR DRYING OF MUSCLE PART (LIVE RED SHRIMP)	29.6	68.3	3.72	0.86	4.58	0.068	0.188	EXCELLENT
E*	d	40°C WARM AIR DRYING OF MUSCLE PART (FROZEN RED SHRIMP)	22.5	73.9	3.67	1.01	4.68	0.063	0.216	AVERAGE
F	c 2	40°C WARM AIR DRYING OF MUSCLE PART	14.0	80.2	3.21	2.08	5.29	0.066	0.393	EXCELLENT
G*	d	80°C HEATED AIR DRYING OF MUSCLE PART	28.5	69.4	3.94	1.05	4.99	0.072	0.210	AVERAGE
H	c 2	80°C HEATED AIR DRYING OF MUSCLE PART	27.0	68.8	2.99	2.18	5.17	0.075	0.422	EXCELLENT
I*	d	40°C WARM AIR DRYING OF MINCED MUSCLE	21.0	71.8	4.15	1.46	5.61	0.078	0.260	AVERAGE
J	c 2	40°C WARM AIR DRYING OF MINCED MUSCLE	20.5	74.9	2.67	2.15	4.82	0.064	0.446	EXCELLENT
K	c 2	40°C WARM AIR DRYING OF MINCED MUSCLE WITH SHELL	22.8	73.1	3.41	1.98	5.39	0.074	0.367	EXCELLENT
L	c 2	40°C WARM AIR DRYING OF MUSCLE WITH SHELL	21.4	76.3	3.23	2.15	5.38	0.071	0.400	EXCELLENT
M	c 2	80°C HEATED AIR DRYING OF MINCED MUSCLE WITH SHELL BEFORE GRINDING	18.0	78.1	3.31	2.04	5.35	0.069	0.381	EXCELLENT
N	c 2	GRINDING OF MUSCLE PART	75.4	20.9	0.74	0.54	1.28	0.061	0.422	EXCELLENT
O	I* +J	MIXING 40°C DRIED MUSCLE PARTS I* AND J EVENLY BEFORE GRIDING	16.8	80.6	3.75	1.98	5.73	0.071	0.346	GOOD

* : CONTRASTIVE GOOD

FIG. 2

CA 02424217 2004-03-18

ASPECT OF RAW MATERIAL SHRIMP FOR PROCESSED FOOD

SYMBOL OF MATERIAL	MATERIAL AND PRETREATMENT OF MATERIAL	ELASTICITY STRENGTH OF TAIL PART MUSCLE (N/cm^2)	ANALYTICAL VALUE OF TAIL PART MUSCLE (%)					Gl + Pr / P	Pr / Gl + Pr	TASTE
			MOISTURE	P	Gl	Pr	Gl + Pr			
a	LIVE RED SHRIMP	12	80.0	18.1	0.97	0.24	1.21	0.067	0.198	EXCELLENT
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b_2	97°C 2 MINUTES HEAT-TREATING OF a	29	78.4	20.0	0.71	0.55	1.26	0.069	0.436	PREMINENT
b_4	97°C 4 MINUTES HEAT-TREATING OF a	43	73.3	25.5	0.54	0.32	0.86	0.034	0.372	GOOD
b_8	97°C 8 MINUTES HEAT-TREATING OF a	59	71.2	27.0	0.30	0.18	0.48	0.018	0.380	FAILURE
c_1	FROZEN STORAGE OF b_1	17	78.2	19.5	0.84	0.45	1.29	0.066	0.350	EXCELLENT
c_2	FROZEN STORAGE OF b_2	25	76.2	19.8	0.72	0.53	1.25	0.063	0.424	PREMINENT
c_4	FROZEN STORAGE OF b_4	37	75.8	22.5	0.53	0.34	0.87	0.039	0.391	GOOD
c_8	FROZEN STORAGE OF b_8	50	70.9	25.8	0.17	0.08	0.25	0.010	0.320	FAILURE
d	FROZEN STORAGE OF a	9	78.2	19.7	1.10	0.44	1.54	0.078	0.286	GOOD
e_2	97°C 2 MINUTES HEAT-TREATING OF d AFTER DEFROSTING	38	76.0	19.5	1.28	0.34	1.60	0.084	0.207	AVERAGE
f_2	FROZEN STORAGE OF e_2	27	78.0	19.1	1.25	0.31	1.56	0.082	0.199	FAILURE
g	97°C 2 MINUTES HEAT-TREATING OF BLACK TAIGER	—	77.6	19.1	0.45	0.22	0.67	0.035	0.328	GOOD
h	97°C 2 MINUTES HEAT-TREATING OF HOKKAI SHRIMP	—	78.0	16.2	0.66	0.28	0.94	0.058	0.298	AVERAGE

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