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Method of making coloured moulded fish paste products,
and the products obtained thereby.

The present invention is concerned with a method of making coloured moulded ground fish meat products and with the coloured moulded products so obtained.

Current methods for browning ground fish meat
5 (also referred to herein as "fish paste") products comprise adding a colour-forming agent, such as a sugar or a sugar-aminoacid mixture, to ground fish meat (seasoned if desired), moulding the material into a desired shape such as a tube, a thick sheet, a bar of elliptical cross
10 section, or a ball, and then heating the moulded material by oil heating, burner heating, high frequency heating or similar means, whereby the surfaces of the products are coloured as a result of the so-called Maillard reaction.

However, there are several drawbacks with such
15 conventional colouring methods. One of these is that the amount of colour-forming agent which must be added in order to achieve colouration of the product is often limited by the resulting taste, because the sugar or sugar-aminoacid mixture used as the colour-forming agent is also a
20 seasoning agent.

The other drawbacks generally observed using conventional colouring methods are related to heating. One of these is non-uniform colouring because fish paste products are generally subjected to multi-stage heating
25 during the course of processing, the sugar and/or the amino-

acid may be partially removed or destroyed in the first heating and the resulting product is likely to be non-uniformly browned in the second or third heating. Another drawback is that not only the surface, but also the
5 inside of the product is coloured. For example, when conventional canned fish paste products are subjected to retort heating, the inside of the product is browned as far as the centre of the can and its commercial value is markedly impaired.

10 We have now found that the above drawbacks can be reduced or eliminated by applying the colour-forming agents (sugars or sugar-aminoacid mixtures) only to the surface of the product after it has been moulded, while ensuring that the ground fish meat used to form the moulded
15 product does not contain sufficient colour-forming agents to cause colouration of the interior of the products on heating.

According to the present invention, therefore, there is provided a method of making a surface-coloured
20 fish paste product, which comprises preparing a moulded product of ground fish meat which is free of sugar or sugar-aminoacid mixtures in a quantity sufficient to cause the fish meat to become coloured due to the Maillard reaction upon retort heating, applying to the surface of
25 the moulded product a colour-forming agent which is a sugar or a sugar-aminoacid mixture, the colour-forming agent being in the form of a solution or a powder, and subjecting the moulded product to retort heating whereby colour is developed on the surface of the moulded product by the
30 Maillard reaction, without any significant colouring of the interior of the moulded product.

The present invention also comprises surface-coloured moulded ground fish meat products when made by the method according to the invention.

35 The method of the present invention requires one

more step than the conventional colouring method, but this step, the application of the colour-forming agent, to the moulded product, can be carried out simply, for example by immersion of the moulded product in a solution
5 of the colour-forming agent, so that the addition of this step does not significantly complicate the known method.

1. Production of moulded ground fish meat product

The moulded ground fish meat product whose surface is to be coloured by the method of the invention
10 is, in principle, the same as that of conventional products except that the sugar or sugar-aminoacid colouring agent is omitted therefrom.

The conventional method of making such moulded products comprises cutting raw fish, such as cod, Alaska
15 pollack, bonito, croaker, shark, mackerel, sardine or Atka mackerel, into fillets, chopping the fillets into flakes, optionally washing the flakes, and then grinding the flakes to a paste-like material. This fish paste as such or after the addition thereto of auxiliary materials
20 is the material which is moulded to form moulded products.

Suitable auxiliary materials for addition to the ground fish meat include, for example, seasoning agents, such as aminoacids and natural seasoners derived from nucleic acids of animal or vegetable origin; colouring
25 matters, such as carotenoids, annato, caramel, and chlorophyll; flavouring agents, such as pepper, nutmeg and cinnamon; modifiers, such as polyphosphates; and water. Insofar as any modifier used is a sugar or an aminoacid, the amount used should, of course, be less than the amount
30 which will cause colouration of the interior of the moulded product upon subsequent heating due to the Maillard reaction.

The resulting ground fish meat mixture is then moulded into the desired shapes of the final products, for
35 example conventional fish cake shapes, balls, strips or

tubes.

2. Colour-forming agent

The colour-forming agent used in the present invention is an agent which is capable of browning fish proteins via the Maillard reaction, that is a sugar or
5 a combination of a sugar and an aminoacid.

Suitable sugars for this purpose include natural or synthetic sugars, particularly reducing sugars, such as xylose, glucose, or a "mirin" (a sweet Japanese wine
10 for seasoning). Particularly preferred sugars are xylose and a mixture of xylose and glucose.

Examples of aminoacids which may be used with such sugars are sodium glutamate, glycine, alanine and aspartic acid. There are no particular limits on the
15 relative proportions of sugar and aminoacid when both are used and suitable proportions may be determined empirically.

The amount and type of these colouring agents which are used are determined solely by the desired surface
20 colouration of the product and not by their effect as seasoning agents.

3. Application of the colour-forming agent

The application of these colour-forming agents to the surface of the moulded fish paste product may be
25 carried out in any convenient way.

One such method is to immerse the moulded product in a solution of the colour-forming agent one or more times. The immersion bath is typically an aqueous solution having a suitable concentration of the colour-
30 forming agent, for example, a sugar concentration of 0.1 to 2.0%, preferably 0.2 to 1.5%, by weight and an amino-acid concentration of 0 to 0.8% by weight. The immersion time is generally 1 to 80 seconds.

Another method of applying the colour-forming
35 agent is to spray a solution of colour-forming agent as

described above, onto the surface of the moulded product one or more times.

The colour-forming agent may also be applied by mixing it with a powdered diluent and applying the mixture to the surface of the moulded product one or more times.

The colour-forming agent can be applied by any of the above methods to either an unheated or previously heated moulded product (in the latter case, further heating for colour development is, of course, still necessary).

An example of a previously heated product is a moulded product which is steam heated or gelation heated at low temperature, then coated with the colour-forming agent before final heating.

4. Colour developing treatment

The moulded product to which the colour-forming agent has been applied is then subjected to heating to develop the colour on the surface.

Heating is effected by retort heating, that is wet heating in an autoclave (i.e. retort) at a temperature of at least 100°C; it will be appreciated that under these conditions heating will be effected under a super-atmospheric pressure. It is preferred to use heating conditions, that is combinations of temperature and time, which will cause complete sterilisation of the moulded products (as well as browning of their surfaces). Suitable conditions are described in "Retort Shokuhin no Subete (All about retort food products)" published by Nihon Eiseigijutsu Kenkyukai, Japan, and include, for example, heating at about 120°C for about 4 minutes and other combinations of temperature and time equivalent thereto.

In general, temperatures of 300°C or more should not be used.

Other forms of heat treatment, for example frying, may be carried out primarily with a view to developing a particular surface texture, for example crisp-

ness, in the moulded products, but such other heat treatments are effected additionally to the retort heating and not in place thereof.

Prior to the retort heating, and after the
5 application of the colouring agent(s) to the surface of the moulded products, they may be placed in a container, such as a can or a pouch made of plastics film and/or metal foil, and sealed therein.

In order that the invention may be more fully
10 understood, the following examples, in which all parts and percentages are by weight, are given by way of illustration only:

Example 1

100 parts of ground Alaska pollack meat, 3
15 parts of sodium chloride, 0.5 parts of sodium glutamate and 30 parts of water were thoroughly mixed and the resulting mixture was moulded into strip-like pieces.

The pieces were placed on a conveyor belt and moved through a station in which they were sprayed with a
20 1% aqueous solution of a mixture (5:1) of glucose and glycine. After spraying, the pieces were heated in a low temperature oil pan (110°C) for 2 minutes and then in a high temperature oil pan (180°C) for 50 seconds to obtain fried moulded pieces. The surface of the resulting fried
25 product was brown and uniformly coloured.

The fried product was then packaged in a pouch and subjected to retort heating at 125°C for 40 minutes, followed by cooling. The heated fried product was cut and the degree of browning in the centre was checked; no
30 browning in the centre was observed.

Example 2

100 parts of ground Alaska pollack meat, 2.6
parts of sodium chloride, 10 parts of starch, 0.5 parts of sodium glutamate and 18 parts of water were thoroughly
35 mixed and 0.3 parts of xylose and 1 part of an alcohol-

fermentation seasoning agent were then added to the mixture with agitation. The mixture was moulded into balls which were heated in a low temperature pan (90°C) for 7 minutes and then in a high temperature oil pan (180°C) for 40 seconds to obtain fried balls (this product - not in accordance with the invention - served as a control).

A product in accordance with the invention was prepared in the following way. The ground fish mixture was prepared as described above, but without the addition of the xylose and the alcohol-fermentation seasoning agent. The mixture was moulded into balls, which were heated in a hot water pan (90°C) for 7 minutes and then immersed for 20 seconds in an 0.8% aqueous solution of a mixture (1:10) of xylose and the alcohol-fermentation seasoning agent used for the control, which solution was at a temperature of 50°C. The balls were then heated in a hot temperature oil pan (180°C) for 40 seconds to obtain fried balls.

Several pieces of the control product and the product according to the invention were packed in tuna No. 2 cans and, after sealing, subjected to retort heating at 120°C for 40 minutes. The heated products were then taken out of the cans, cut in half and the degree of browning in the centres of the fried balls was checked.

The results are shown in the following table.

	<u>Control Product</u>	<u>Invention Product</u>
Sample 1	yellow-brown	no browning (white)
Sample 2	yellow-brown	no browning (white)
Sample 3	yellow-brown	no browning (white)
Sample 4	dark brown	no browning (white)

Example 3

The following components were thoroughly mixed:

	ground Alaska pollack meat	100 parts
	sodium chloride	2.6 parts
	starch	10 parts
	sodium glutamate	0.5 parts
5	water	18 parts
	xylose	0.3 parts
	"mirin" (sweet Japanese wine)	1.0 parts

The ground fish mixture was moulded into balls weighing 12g each, which were heated in a low temperature oil pan (120°C) for 2 minutes and then in a high temperature oil pan (180°C) for 40 seconds to obtain fried balls (this product - not in accordance with the invention - served as a control).

A product in accordance with the invention was made from the same mixture as the control, but omitting the xylose and the "mirin". Fish balls of 12 grams were moulded from the mixture and the balls were immersed for 20 seconds in an 0.8% aqueous solution of a mixture (1:10) of xylose and "mirin" (this solution being obtained by mixing separate solutions of xylose and "mirin"), the solution of the mixture being at a temperature of 50°C. The balls were then heated in a low temperature oil pan (120°C) for 2 minutes and then in a high temperature oil pan (180°C) for 40 seconds.

Five pieces of the control products and of the invention product were then packed into separate tuna No. 2 cans, which were then filled with water. sealed, and subjected to retort heating at 125°C for 40 minutes. After cooling, the products were taken out of the cans, cut in half, and the degree of browning of the centres of the fried balls was checked. The observed results were as follows:

Control Product

Considerable browning took place from the inner side of the surface to the centre of the ball; the balls were of low quality.

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Invention Product

Fried surface colour was pleasant. The colour of the inside of the ball was whitish and the same as that before retort heating; the balls were of good quality.



Claims:

1. A method of making a surface-coloured fish paste product, which comprises preparing a moulded product of ground fish meat which is free of sugar or sugar-aminoacid mixtures in a quantity sufficient to cause the fish meat to become coloured due to the Maillard reaction upon retort heating, applying to the surface of the moulded product a colour-forming agent which is a sugar or a sugar-aminoacid mixture, the colour-forming agent being in the form of a solution or a powder, and subjecting the moulded product to retort heating whereby colour is developed on the surface of the moulded product by the Maillard reaction, without any significant colouring of the interior of the moulded product.
2. A method according to claim 1, in which the colour-forming agent is applied to the surface of the moulded product by immersing the latter in a solution of the colour-forming agent.
3. A method according to claim 1, in which the colour-forming agent is applied to the surface of the moulded product by spraying the latter with a solution of the colour-forming agent.
4. A method according to claim 1, in which the colour-forming agent is applied to the surface of the moulded product by mixing the colour-forming agent with a powdered diluent and applying the mixture to the surface of the moulded product.
5. A method according to any of claims 1 to 4, in which the moulded product, after being coated with the colour-forming agent, is placed in a container and the



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latter is sealed, prior to retort heating.

6. A method according to claim 5, in which the sealed container is a can or a pouch made of plastics film and/or metal foil.

7. A method according to any of claims 1 to 6, in which the retort heating is effected at a temperature and for a time such that the degree of sterilisation of the moulded product obtained is at least equivalent to that obtained by heating at a temperature of 120°C for four minutes.

8. A method of making a surface-coloured moulded ground fish meat product according to claim 1, substantially as herein described in any of the Examples.

9. A surface-coloured moulded ground fish meat product when made by the method claimed in any of the preceding claims.
