METHOD OF MANUFACTURING A FOOD PRODUCTTECHNICAL FIELD OF INVENTION

5 The present invention relates to a method of manufacturing meat products, particularly white meat products, having highly desirable appearance, texture, taste and cooking performance characteristics.

10 BACKGROUND TO THE INVENTION AND PRIOR ART

The advantages of marinading to impart flavour and to tenderise meat are well known. However, in the case of meat which is already tender (especially for example white
15 meat or fish), the influence of marinading on the textural properties of the meat can be detrimental. This disadvantage of marination is particularly apparent with manufactured meat products consisting of discrete pieces or sections of meat together with other food ingredients,
20 because such muscle when size reduced is more prone either to mechanical damage or the influence of solutes. Such food products can be considered as composite or multiphase systems which consist of a particulate or meat phase and a more continuous or matrix phase.

25 A further disadvantage associated with marinading the meat particles of manufactured meat products is that it may interfere with the requirements for a matrix or continuous phase which provides a coherent, stable product.

30 Therefore there is a problem in achieving the advantages that marination can provide in manufactured meat products without also achieving the disadvantage of alteration of the intrinsic fibrous texture of muscle.



We have now solved the above mentioned problem and are able to obtain the benefit of marinading whilst creating an adhesive matrix in a manufactured meat product, without the detrimental effects on the intrinsic fibrous structure of delicate meat.

DESCRIPTION OF THE INVENTION

Accordingly the present invention relates to a method of manufacturing a food product which includes a meat particulate phase and a continuous phase, involving a marination process which simultaneously forms an adhesive matrix, wherein the penetration of the marinade into the meat particulate phase is restricted, comprising:

- (i) provision of meat particles
- (ii) optional addition of a carrier material;
- (iii) addition of a marinade;
- (iv) mixing; and
- (v) optionally increasing the viscosity of the mixture;

wherein at least two of the following conditions are fulfilled;

(a) the meat particles are provided at a temperature such that at least a proportion of the water in the meat particles is present as ice,

(b) addition of a carrier material,

(c) mixing for a time sufficient only to disperse all the added ingredients.

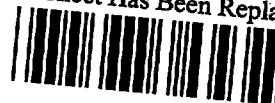
The particulate phase comprises discrete meat pieces and the continuous phase provides both flavour and juiciness by the addition of a marinade which simultaneously forms an adhesive matrix to produce coherent, stable products. A particular object of the invention is to generate and assemble these two phase constituents under conditions which protect the intrinsic fibrous structure of the muscle pieces from adverse textural change.

In order to achieve this objective two or more of the following conditions are essential and preferably all three will be utilised:

(a) the temperature of the meat particles must be low, such that at least a proportion of the water in the meat particles is present as ice. A suitable temperature is accordingly from -2°C to -20°C , preferably -4°C to -6°C . This low temperature restricts the mobility of the marinade, reducing its diffusion into meat pieces. Preferably the proportion of total water present as ice will be approximately 35%.

(b) a carrier material is added to the meat particles to dilute the action on meat of the marinade by the carrier material competing for the available moisture. Suitable carrier materials are any substance capable of absorbing the marinade which is compatible with the food product, for example a collagen source, such as chopped skin, or a prepared algin dough; pre-comminuted muscle material, vegetable fibre; soya derivatives; protein such as caseinate, whey proteins; polysaccharide material such as marine hydrocolloids, pectins; and mixtures thereof.

(c) mixing times are short, such that they are only for a time sufficient to disperse the ingredients. The total mixing time is typically for from 4 to 15 minutes depending on batch size. This reduces the time available



for the marinade to diffuse into the muscle and minimise the effect on meat of mechanical action and the friction effect due to dissolved salts.

5 These three conditions result in a deliberate limitation of the marinade onto the surface of the meat particle hence restricting the extent of solubilisation of the protein within the meat particle by the marinade.

10 Preferably, when only two of the above-mentioned conditions are utilised, one of the conditions fulfilled is the addition of a carrier material.

15 A further condition may optionally be applied. This is that the viscosity of the mixture may advantageously be increased. This increase in viscosity will restrict penetration of the marinade into the meat particle and can also assist the subsequent assembly of the meat product.

20 This increase in viscosity is particularly required when the starting temperature of the meat particles is from -2°C to -4°C or above.

25 Viscosity may be increased by a number of suitable methods, for example:

(1) The mixture may be cooled after mixing, preferably by addition of a coolant such as CO_2 . The temperature of the mixture is preferably lowered to between 30 -6°C and -8°C .

(2) The marinade may comprise starch or other ingredients to raise viscosity. Preferably the starch has a gelatinisation temperature similar to that at which the 35 meat protein denatures (approximately from 55°C to 75°C), examples of suitable starches are native starches such as farina or other root starches. The addition of starch is



particularly advantageous because the starch is able to absorb the meat juices released during cooking. Furthermore when the meat particles are white meat (for example fish or poultry), the starch assists the whiteness properties of the matrix.

The carrier material may be added to the meat particles either before or after the addition of the marinade, or part of the marinade.

The marinade may be added either:

(a) initially as a dry mix, with fluid being added later; or

(b) as a solution.

When the marinade is added as a dry mix to the meat particles and carrier material, the ingredients are initially mixed for a time sufficient only to disperse the dry mix. Some components of the marinade may be added individually to enhance their effect. For example, salt may be added first and mixed, followed by the addition of the other marinade ingredients and again mixed. The fluid is then added and the mixture again mixed for a time sufficient to disperse the ingredients. Each mixing step is typically from 1 to 9 minutes with a total mixing time of from 4 to 15 minutes.

This method particularly allows for a local concentrated action of the dry mix marinade on the surface of the meat particles.

The fluid will generally be water, however this may be other fluids such as milk, whey, fruit juices and the like.

The marinade comprises salt and other typical marinade



ingredients.

The salt component is preferably sodium chloride but other salts may also be used such as a phosphate salt, for example sodium tripolyphosphate, sodium hexametaphosphate, tetrasodium pyrophosphate, tetrapotassium pyrophosphate, potassium tripolyphosphate, and mixtures thereof. Salt is included to solubilise the meat protein. This protein solubilisation is restricted to the meat particle surface because of the conditions used.

The particulate phase comprises pieces or slices of animal tissue, or substitutes therefor. Any suitable particle size may be used, providing that such particles are substantially intact and of a size greater than that of a fibre bundle. There is no upper limit to particle size, indeed whole chicken breast or fish fillets for example may be used. However, typically the particle size used will be 20 x 10 x 10 mm. The animal tissue is preferably chosen from poultry meat, fish meat and mixtures thereof. Meat substitutes can for example be structured vegetable proteins such as soy protein or myco-protein, having a similar food function as animal tissue.

The particulate phase may comprise, in addition to animal tissue or a substitute, any ingredient which may be present in meat products such as salt, spices, fat, preservatives, colouring, flavouring and water.

Preferably the level of animal tissue in the product is 10 to 90 wt%, more preferably 20 wt% to 80 wt%, most preferably 30 to 70 wt%.

Preferably the particulate phase and the continuous phase are used in a weight ratio of about 20:1 to 1:10, more preferably 15:1 to 1:2, most preferably 8:1 to 1:1.



The invention is especially relevant to food products comprising white meat, for example poultry and/or fish meat. This is because white meat are generally soft and tender and therefore particularly susceptible to structural damage due to the mechanical action of processing and the action of dissolved salts. Furthermore the method of the invention provides a matrix which may be white in colour.

The invention also has the further advantages:

(a) the meat particles may be marinated with minimum preparation of ingredients and avoidance of marinade methods such as pre-injection, tumbling, massaging and the like, which promote change within the intrinsic fibrous structure of muscle, either by their mechanical effects or by their effect in promoting diffusion of solutes;

(b) the rapid marination and low temperatures assist in the speed of processing and in hygiene.

EXAMPLES

The following examples further illustrate the invention:

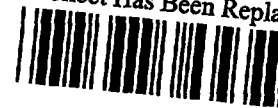
Example 1

A chicken product having the following composition was manufactured as described below:

Chicken product composition

w/w % in
total product

Chicken breast meat (particle size = 20x20x10mm)	71
Finely chopped chicken skin	10
Marinade	19

Marinade composition

w/w % of
marinade

	Dextrose	16.2
5	Milk protein	13.5
	Phosphate salts E450A & E450B	2.7
	NaCl	4.3
	Citric acid	0.3
	Flavouring	0.3
10	Water	to 100

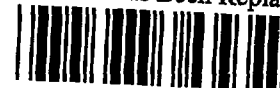
The chicken breast particles (size = 20x20x10mm) were placed in a twin intermeshing paddle mixer. The chicken particles were at a temperature of -2°C to -4°C. The marinade was then added and the ingredients mixed for 4 minutes. Finely chopped skin was added as a carrier and the ingredients mixed for 2 minutes. The mixture was then cooled to -6°C via injection of CO₂ for 90 seconds.

The chicken product was then moulded into a product shape, coated with batter and breadcrumbs, prefried at 175°C for 90 seconds then cooked in an oven at 215°C for 3.3 minutes to ensure that the chicken core reached 75°C. The product was stored frozen at -20°C. The product when cooked from frozen at 220°C for 15 minutes provide a succulent product having the appearance of intact meat and having a natural fibrous structure and a positive marinated flavour.

It was clear that no adverse change had occurred to the fibrous structure of the breast meat.

Example 2

Frozen blocks of skinless raw broiler chicken breast meat measuring 200 x 100 x 50 mm were tempered to between -4°C and -6°C in a conditioning cold store and then cut into slices measuring 200 x 100 x 5 mm.



At this temperature range the ice content of the meat, as determined by calorimetry, was 35% total water content.

5 The cold ice containing slices of meat were blended immediately with a dry mix marinade consisting of the following ingredients:

	<u>% by weight</u>
Native farina extra (Rochelle)	72.43
10 Sodium caseinate EMHV (DMV)	11.14
Sodium chloride	8.32
Dextrose and flavouring	8.11

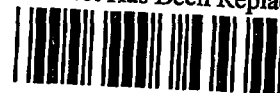
15 These dry ingredients were blended with the cold meat slices in a laboratory scale orbital mixer fitted with a paddle type mixer blade for 45 seconds at 60 rpm.

20 During this time the dry ingredients were evenly contacted on the moist surfaces of the muscle slices to form an adhering network of starch, caseinate, dextrose/flavour and solubilised muscle proteins derived from the immediate surfaces of muscle.

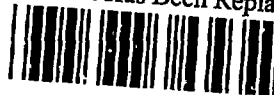
25 The solubilised muscle proteins were promoted by a high effective salt concentration on the available water at the immediate muscle surfaces and limited to surface effects by the short duration of mixing, negligible change in temperature and subsequent dilution of salt concentration by addition of water.

30 Chilled water at +2°C was added to the meat slices plus adhering network formed by the marinade ingredients during a mixing period of 30 seconds followed by mixing for a further 30 seconds.

35 The addition of water provided the following final formulation of the marinated meat mixture: % by

weight

	Sliced broiler breast meat	80.00
	Water	16.30
5	Farina	2.68
	Sodium caseinate	0.41
	Sodium chloride	0.31
	Dextrose and flavouring	0.30
10	The addition of water partially hydrated the marinade network and formed a white continuous matrix phase which adsorbed all of the available fluid.	
15	At this stage the meat and marinade mixture was in a free flowing state with muscle sections remaining substantially intact and the hydrated continuous matrix providing a plastic consistency of moderate viscosity which did not confer frictional damage to muscle during mixing. This is in contrast to the highly viscous nature of conventional	
20	binders or fillers such as those based on cereal materials eg rusk, or the typical frictional effects of extensive extraction of soluble muscle proteins.	
25	The marinated meat mixture was moulded into patty shapes and coated with a conventional batter and breadcrumbs. The coated products were pre-fried in vegetable oil for 3 to 4 minutes at 180°C to achieve a centre temperature of 75°C.	
30	Pre-fried products were blast frozen at -30°C, packaged and stored frozen at -20°C for a two week equilibration period prior to evaluation.	
35	Products were cooked from frozen by grilling to a centre temperature of 75°C and evaluated by a range of methods including formal Sensory Evaluation by trained panellists using 27 defined sensory parameters and under controlled conditions of sample replication and tasting procedures.	



The analysis of sensory data showed that the products were juicier and higher in fibrous characteristics, and less firm, dense and resilient than products containing similar amounts and types of meat together with non-meat ingredients applied in conventional ways.

The overall texture of the marinated products was less gelatinous than when farina alone was used as the marinade carrier, and less gelled or rubbery than samples produced by a marinade consisting of salts, flavours and sodium caseinate.

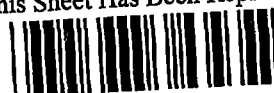
Similarly, the products were far less satisfactory when the meat temperatures were above -1°C or when conventional marinading was carried out such that the marinade diffused into the muscle tissue, or when marinades were used without immobilising carriers.

The appearance of the meat based core of the marinated products was highly fibrous and an excellent white colour with very little contrast between the intact muscle and the moist continuous phase at the interface of the muscle sections. The marinade constituents did not permeate the muscle tissue other than at the immediate surfaces.

The products exhibited very little free fluid but moisture was easily expressible by compression.

Examples 3-6; Comparative Examples A-D

A chicken product having the same composition as Example 1 was manufactured using a number of different conditions as follows:



Example No	Temperature of Meat particles	Carrier	Mixing Time
3	Low	Present	Short
4	Low	Absent	Short
5	Low	Present	Long
6	High	Present	Short
A	Low	Absent	Long
B	High	Absent	Short
C	High	Present	Long
D	High	Absent	Long

Thus in Examples 4, A, B & D there was no finely chopped chicken skin (carrier) in the chicken product composition, the chicken product composition comprised 81% chicken breast meat and 19% marinade.

For Examples 3, 4, 5 & A the chicken particles were provided at a temperature of -4°C

For Examples 6, B, C & D the chicken particles were provided at a temperature of from 1 to 5°C

For Examples 3, 4, 6 & B the mixing time was 12.5 minutes

For Examples 5, A, C & D the mixing time was 25 minutes

After the chicken products were prepared, they were enrobed with a conventional batter and breadcrumbs pre-fried in vegetable oil for 4.5 minutes at 180°C to achieve a centre temperature of 75°C, and frozen for a minimum of 2 weeks storage prior to assessment.

The products were tasted (blind) by a small panel of experts.

No product could be prepared in comparative examples B & D because they were impossible to mould into the required product form.

The products made in Comparative Examples A & C had a poor fibrous meat texture compared with Examples 3-6.

5 In Examples 3-6 it was clear that no adverse change had occurred to the fibrous structure of the breast meat. The products were juicy and had an excellent white colour with little contrast between the intact muscle and the moist continuous phase at the interface of the muscle sections.

This Sheet Has Been Replaced



CLAIMS

1. A method of manufacturing a food product which includes a meat particulate phase and a continuous phase, involving a marination process which simultaneously forms an adhesive matrix, wherein the penetration of the marinade into the meat particulate phase is restricted, comprising:

- (i) provision of meat particles;
- (ii) optional addition of a carrier material;
- (iii) addition of a marinade;
- (iv) mixing; and
- (v) optionally increasing the viscosity of the mixture;

wherein at least two of the following conditions are fulfilled;

(a) the meat particles are provided at a temperature such that at least a proportion of the water in the meat particles is present as ice; and

(b) addition of a carrier material.

(c) mixing for a ^{total of from 4 to 5 minutes, such that} ~~sufficient only to disperse~~ all the added ingredients ~~are dispersed~~.

2. A method according to claim 1 wherein a carrier material is added.

3. A method according to claim 1 or 2 wherein in all 3 of conditions (a) to (c) are fulfilled.



34. A method according to any preceding claim wherein the meat particles are at a temperature of from -2°C to -20°C .
- 4/5. A method according to any preceding claim wherein the meat particles are at a temperature of from -4°C to -6°C .
- 5
- 5/6. A method according to any preceding claim wherein the carrier material is selected from a suitable collagen source, pre-comminuted muscle material, vegetable fibre, soya derivatives, a suitable protein, polysaccharide material, and mixtures thereof.
- 10
- 6/7. A method according to any preceding claim wherein the marinade is initially added as a dry mix which is mixed for a time sufficient to disperse the dry mix with the meat particles and carrier; fluid is then added and the mixture is again mixed for a time sufficient to disperse the ingredients.
- 15
- 7/8. A method according to claim 7 wherein each mixing step is for from 1 to 9 minutes with a total mixing time of from 4 to 15 minutes.
- 20
- 8/9. A method according to any one of claims 1 to ⁵/₈ wherein the marinade is added as a solution.
- 25
- ~~10. A method according to claim 9 wherein the mixing step is from 4 to 15 minutes.~~
- 30
- 9/11. A method according to any preceding claim wherein the marinade comprises salt.
- 10
12. A method according to any preceding claim wherein the viscosity of the mixture is increased by cooling.
- 35
- 10
- 11/13. A method according to claim ¹⁰/₁₂ wherein the mixture is cooled by injection of CO_2 .



3

10

11

12/14. A method according to claim 12 or claim 13 wherein the mixture is cooled to a temperature of between -6°C and -8°C.

9

5 13/15. A method according to any one of claims 1 to 11 wherein the viscosity of the mixture is increased by the addition of starch to the marinade.

12

10 14/16. A method according to claim 15 wherein the starch is a native starch.

15 15/17. A method according to any preceding claim wherein the food product is a white meat product.

15 16/18. A method according to any preceding claim wherein the particulate phase comprises meat particles selected from particles of fish, poultry and mixtures thereof.

20 17/19. A food product which includes a meat particulate phase and a continuous phase obtainable by a process which involves a marination process which simultaneously forms an adhesive matrix, wherein the penetration of the marinade into the meat particulate phase is restricted, said process comprising;

25

- (i) provision of meat particles;
- (ii) optional addition of a carrier material;
- (iii) addition of a marinade;
- (iv) mixing; and
- 30 (v) optionally increasing the viscosity of the mixture;

wherein ~~at least two of~~ the following conditions are fulfilled;

35

(a) the meat particles are provided at a temperature such that at least a proportion of the water in the meat

particles is present as ice; and

~~(b) addition of a carrier material;~~

- 5 (b) mixing for a ^{total} time sufficient ~~only to disperse all the~~
added ingredients. of from 4 to 15 minutes, such
that all the added ingredients are dispersed.