

MICROWAVEABLE BATTER

This invention relates to a coating for foodstuffs, which is cookable or reheatable using a microwave oven, combination microwave oven or by radiant heat by any means. The invention relates particularly but not exclusively to microwaveable cookable or reheatable batters or breaded coatings.

Microwave ovens are commonly used for heating food products, which have been pre-prepared by a foodstuff manufacturer. Pre-prepared products include batter coated foodstuffs in which the basic foodstuff, for example meat, fish, poultry, vegetables, fruit or dairy products, has been coated in a batter optionally coated with crumbs, deep fried and then frozen for supply to a consumer.

Heating in a microwaveable oven may complete the cooking process or simply reheat a previously cooked product. Microwave cookable coatings have particular requirements. Microwave energy penetrates throughout a food product. Steam released from the core of a food product can cause the batter coating to become soggy. This impairs the texture and taste of the product.

WO 88/06007 disclosed a batter composition and method of preparation wherein the foodstuff is pre-dusted with high amylose starch and methylcellulose. The batter included high enzyme soya flour. WO93/003634 disclosed an improved pre-dust composition including a mixture of particulate starch and particulate cellulose gum, which gelled on heating in the presence of moisture. Such a pre-dust can form a dense, high viscosity barrier to absorption of oil and migration of moisture. The barrier also provides a stable environment for any seasoning and can enhance bonding with the batter. Although high enzyme soya flours generally afford acceptable products, variations in their enzyme content have given rise to inconsistent and occasionally undesirable flavours. WO96/032026 disclosed a microwaveable batter comprising starch, flour, a gelling agent, an enzyme, additive and further ingredients. An exemplified formulation comprised genetically modified high amylose maize flour.

It is the object of the present invention to provide a batter coating having improved properties during manufacture, storage and upon consumption.

Batter or breaded coatings in accordance with this invention are preferably cookable or reheatable using conventional ovens or fryers in addition to microwave ovens and combination microwave ovens.

According to a first aspect of the present invention, a microwave cookable or reheatable foodstuff coating composition comprises an aqueous mixture including the following ingredients:

- a) starch;
- b) a flour component comprising a mixture of two or more gluten free flours including maize flour;
- c) a gelling agent;
- d) an enzyme additive comprising alpha amylase; and
- e) optional further ingredients.

The amount of the starch component, excluding any starch which may be present in the flour, may comprise about 20-35% more preferably about 28.8% by weight of the dry ingredients.

The starch may comprise high amylose starch, preferably maize starch, for example as manufactured under trademark HYLON 7 of National Starch. An amylose content of 60% to 80%, preferably 70%, is preferred. Use of a hot swell starch is preferred.

The flour component may comprise about 40% to about 55% preferably about 48.2% by weight of the dry ingredients.

The weight ratio of flour to starch components, that is non-flour starch, may be in the range of about 36% to about 87%, preferably about 50% to about 63%.

The flour component comprises a mixture of at least one first gluten free flour, preferably soya flour for example HiSoy supplied by Bake Mark UK manufactured from soya beans of Canadian origin and maize flour for example French maize flour YF36 manufactured by Smiths Flour Mills. Maize flour is gluten free. Gluten free flour referred to in this specification may contain less than 1% gluten, preferably less than 0.1% gluten. In particularly preferred flours, gluten is completely absent.

The flour component may contain from about 25% to about 70% of maize flour and from about 30% to about 75% of one or more other gluten free flours.

The flour mixture preferably has a fat content of about 15-33%, more preferably about 20-28%, especially about 24%. Full fat soya flour may be employed.

A reducing sugar or mixture of reducing sugars may be used to give colour to the cooked coating. D-xylose is preferred although fructose, maltose or mixtures of these reducing sugars may be used. An amount of about 1-3% preferably about 2% is preferred.

The gelling agent or thickener (referred to for convenience as a gelling agent) is employed in an amount sufficient to stabilise the coating as an emulsion. One or more of the following may be employed: collagen, alginate, xanthan gum, gelatine, guar gum, agar gum, gum arabic, locust bean gum, or carrageenan gum. Use of guar gum or mixtures containing guar gum is preferred. Alternatively mixtures of guar and xanthan gums may be used. An amount of the gelling agent which is effective to provide a thickened composition may be used. An amount of about 0.1% to about 5%, preferably about 0.5% – to about 3% more preferably about 1 % may be employed. The gelling agent is preferably present in an amount sufficient to give long-term stability, for example to allow the batter to be stored before use.

The further ingredients may include whole egg. An amount of about 10-18%, preferably about 14% may be employed. The egg may comprise dried egg. This may comprise dried whole egg or a blend of egg white and egg yolk.

Glyceryl monostearate may be used as an emulsifier. Alternative emulsifiers may be used. An amount of 1% to 5%, preferably about 2% may be employed.

A phosphate may be employed in an amount of about 0.7 to 3% to adjust the pH for optimum enzyme activity. Monosodium phosphate in an amount of about 1.87% is preferred.

The further ingredients preferably include ammonium bicarbonate used as an aid to formulation. An amount of about 0.7% is preferred.

Glucono-D-lactone may be used as a slow release pH adjuster. An amount of about 0.67% may be employed.

Sodium acid pyrophosphate may be used to regulate pH. An amount of about 0.37% may be employed.

5 A thickener, for example methylcellulose, Methocel A4M may be used in an amount of about 0.1-1%, preferably about 0.25%.

10 Use of a coating composition in accordance with the first aspect of this invention confers several advantages. The coating adheres well to a substrate and to subsequently applied crumb. The coating allows escape of moisture during frying but does not give a high a degree of fat pickup from the frying oil. A shell-like coating is formed to give a desirably crisp bite.

The gel, batter and crumb form an integral, consolidated layer after cooking.

15 The enzyme additive is preferably a concentrated enzyme preparation. Enzyme containing conventional ingredients used in batter, for example high enzyme flours are inconsistent and are not preferred. However, the concentrated enzyme preparation may be blended with a further ingredient such as starch or flour to facilitate mixing into the composition. The enzyme preparation may contain buffers or stabilizers.

20 Preferred enzyme additives include bacterial amylases, for example, Novamyl BG10000.

25 The additive preferably contains only the enzymes required for the coating composition. Lipoxigenases or other enzymes, which may be present in commercial high enzyme flours are avoided since these may give rise to adverse flavours.

30 The viscosity of the coating composition before use is preferably in the range of about 400 to 700 cp, preferably about 550 cp measured using a Brookfield viscometer with a No 3 spindle at 60 rpm.

The freshly mixed composition in the ratio of about 2 parts water and about 1 part batter may have a viscosity about 1500 to 1700 cp preferably about 1600 cp. After mixing in a high shear mixer, the temperature may be raised to 42°C. Following mixing the batter is stored and

allowed to ferment. After storage, the mixture is diluted with water to give a final ratio of 2.4 parts of water to 1 part of batter mix to give a viscosity of about 550 cP.

The batter ingredients may be mixed in starter batches in the ratio of 2 parts of water to 1 of batter, and stored overnight, for example, in a chill room. The batter continues to ferment for about 24 hours at a decreasing rate until the temperature of the batch reaches approximately 5°C. The viscosity increases overnight to a value between about 1000 cP and about 1600 cP depending on the batch. The mixer used may be a Silverson batch mixer with a high shear slotted disintegrating head.

A pre-dust or pre-coating may be applied to the substrate before application of the batter composition. A conventional pre-dust may be used but use of an aqueous gel is preferred.

The aqueous gel may comprise, by dry weight:

starch range 28 to 40%

thickener range 18 to 30%

xanthan gum range 20 to 35%

egg albumen range 10 to 25%.

A preferred formulation is:

starch 35%

thickener 25%

xanthan gum 25%

egg albumen 15%

by dry weight.

Amounts and quantities referred to in this specification are by weight unless indicated otherwise. Percentages and other proportions are selected from ranges given to total 100%.

The invention is further described by means of example but not in any limitative sense

Example 1 Coating Composition

A coating composition was prepared by mixing the following ingredients:

Ingredient	%
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soya flour (Hisoy)	29.0
high amylose starch (Hylon 7)	28.8
maize flour	19.2
dried whole egg (Henningesen W1)	14.0
glyceryl monostearate	02.0
D-xylose	02.0
monosodium phosphate	01.9
guar gum	01.0
ammonium bicarbonate	00.7
glucono-D-lactone	00.7
sodium acid pyrophosphate	00.4
thickener (Methocel A4M)	00.2
alpha-amylase	00.1
	100.0

The batter can be mixed in batches using a Silverson DX high shear mixer on a gantry with a slotted disintegrating head. Batches were mixed in the ratio of 25 kilos water to 12.5 kilos dry batter powder in a vat with a diameter of 68 cm. Thereafter, the mix was diluted as required.

5 In full production the batter ingredients were mixed using two 200 litre stainless steel vessels linked by a pump and an inline Silverson mixer with a high shear slotted disintegrating head. One tank was fitted with a paddle and was filled with water at 15-20°C. The dry ingredients were added to the water and wetted by rotation of the paddle. The second tank was fitted with a cooling jacket and a return pipe to the first vessel. The batter mixture was circulated
10 through the high shear head until a temperature of 42°C was reached by mechanical heat transfer. External heating may be employed to avoid a tendency to over shear the starch. When 42°C was reached, the mixing and enzymolysis were complete. The batter was transferred to the second vessel and cooled. A heat exchanger may be used to cool the mixture. After cooling, the batter was pumped into a tempura type batter applicator.

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The viscosity in the batter mixture was in the range 550 – 650 cP as measured by a number 3 spindle at 60rpm. The batter was found to give a good rate of pickup and a crisp coating after frying.

Example 2 General-purpose stabiliser.

A composition of the following ingredients is used to form a semi-reversible gel

methylcellulose	15%
starch (Thermflo)	24%
egg albumen	15%
xanthan gum	6%
polydextrose	40%
100%	

The composition was dissolved in water to produce a solution with a concentration suitable to stabilising the particular substrate in use. This general purpose formula may be modified to increase its efficiency in specific substrates. The above formula may be modified by addition of citric acid (up to 1%) and ascorbic acid (up to 2%) with the polydextrose (Litesse II) being reduced accordingly. Water bonding is improved. Subject to further testing 0.5% of each could be added with corresponding reduction of the weight of polydextrose by 1%.

Example 3 – Preparation of Stabiliser

The dry powder mix was partially hydrated in a tub and then poured into a bowl chopper. The bowl chopper was then run for two to three minutes until fully hydrated. The mix can be hydrated directly in the bowl chopper if required. Alternatively, the stabiliser may be hydrated using a high shear mixer using a general purpose head.

Example 4 - Preparation of meat mixture.

A chicken mixture for chicken dippers or nuggets was prepared with the following composition.

The stabiliser of Example 2 was used.

chicken emulsion	20%
skin – 3mm	18%
chicken breast – 10mm	50%
water	2%
rusk	2%

Stabiliser (powder by dry weight)	5%
seasoning	3%
	100%

The chicken breast was chilled to -3°C and minced using a 10mm plate. After mincing, the temperature was 0-3°C. Water was added with mixing. A chicken emulsion comprising the following ingredients was added with mixing:

chicken skin	44%
water	44%
soya isolate	11%
salt	1%
	100%

5 The stabiliser in accordance to Example 2 was added and mixed thoroughly. Rusk was added with mixing following by seasoning. A colourless, solid flavouring was preferred.

A vacuum was applied to the mixture to consolidate the structure following which the chicken mixture was chilled to -3°C and formed into shaped particles.

10 A similar procedure was used for other comminuted meat products. Large particulate cores may be manufactured using a similar method.

Example 5 – Chicken Mix

15	chicken breast meat (13mm)	79%
	salt	1%
	water	12%
	stabiliser (Example 2)	5%
	inuline and seasoning	3%
20		100%

Example 6 – Fish Mix

	cod fillet blocks partially thawed	85.9%
	salt	0.9%
	water	4.6%
25	stabiliser (Example 2)	4.8%
	fish binder	3.9%

100%

5 Example 7 Pre-gel coating

A conventional pre-dust may be employed, for example as disclosed in WO9632026 the disclosure of which is incorporated herein by reference for all purposes. Use of a pre-dust has a disadvantage of formation of dust clouds. Transfer of a pre-dust to the batter affects the viscosity of the batter during prolonged use. Accordingly, use of a gel pre-coating is preferred.

10 The following mixture was prepared:

starch (Thermflo)	35%
thickener (Methocel A4M)	25%
xanthan gum	25%
egg albumen	15%
	100%

The mixture was dissolved in water to form a 1% solution using a CFS Scanbrine mixer with paddle agitation. The solution was left to stand for 24 hours to form a fully hydrated gel.

15 The gel was applied to the substrate particles using a tempura type batter applicator in which the particles were dipped.

A pump is necessary to run the machine but after a short while bubbles form in the pre-gel in the applicator. To prevent this problem food grade anti foaming agents can be used.

20 Polydimethylsiloxane is preferred but calcium alginate, methyl ethyl cellulose, methylphenylpolysiloxane or polyethylene glycol can be used.

Example 8 Crumb application

25 A crumb was prepared as disclosed in PCT/GB09/001617, published as WO 2010/001101 the disclosure of which is incorporated herein by reference for all purposes.

Following application of the pre-gel a fine crumb was applied with a mesh size less than 1% or described as a dust, using a CFS Crumbmaster breadcrumb applicator.

30 The coated particles were passed through the batter of Example 1 in a tempura batter applicator.

A 2mm crumb was applied in a second CFS Crumbmaster breadcrumb applicator with slight pressure from a roller. Particles were passed through a third CFS Crumbmaster breadcrumb applicator to infill with a 1mm crumb using light pressure from a roller.

5 Example 9 Frying and cooking

The coated substrate was fried in pure, fresh rapeseed oil for 2 minutes 20 seconds approximately at 180-188°C. The frying time can be varied depending upon the weight and size of the particles. After frying, the core temperature was 74 - 85°C. A small loss of weight was observed due to loss of water from the substrate but this is mostly compensated for by the uptake
10 of oil.

CLAIMS

1. A microwave cookable or reheatable foodstuff coating composition comprising
5 55 to 80 wt% water and 20 to 45 wt% of a mixture comprising by dry weight:

- a) 24 to 32 wt% high amylose starch
- b) 35 to 60 wt% of a flour component comprising a mixture of two or more
gluten free flours including maize flour
- c) a gelling agent
- 10 d) an enzyme additive comprising alpha amylase; and
- e) optional further ingredients.

2. A coating composition as claimed in claim 1 wherein the coating composition
comprises from about 40 to about 55% of the flour component by dry weight.
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3. A coating composition as claimed in any preceding claim wherein the flour
component comprises a mixture of soya flour and maize flour.

4. A coating composition as claimed in any preceding claim wherein the flour
mixture has a fat content from about 15% to about 33%.
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5. A coating composition as claimed in any preceding claim wherein the weight
ratio of flour to starch component is in the range from about 36:64 to about 87:13.

6. A coating composition as claimed in claim 5 wherein the weight ratio of flour to
starch component is from about 50:50 to about 63:37.
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7. A coating composition as claimed in any preceding claim wherein the flour
component contains from about 25% to about 70% by dry weight of maize flour and from
about 30% to about 75% by dry weight of one or more other gluten free flours.
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8. A coating composition as claimed in any preceding claim including D-xylose in
an amount from about 1% to about 3% by dry weight.

9. A coating composition as claimed in any preceding claim, wherein the amount of the gelling agent is from about 0.1 dry wt% to about 5 dry wt%.
- 5 10. A coating composition as claimed in any preceding claim wherein the gelling agent comprises guar gum.
- 10 11. A coating composition as claimed in any preceding claim having a viscosity of about 400 cP to about 700 cP at 10°C using a Brookfield viscometer with a number 3 spindle to 60 rpm.
12. A microwave cookable or reheatable food composition comprising a coating as claimed in any of claims 1 to 11.