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(71) Applicant *(for all designated States except US)*: **SERROL INGREDIENTS PTY LIMITED** [AU/AU]; Level 1, Building A, 11 Talavera Road, North Ryde, New South Wales 2113 (AU).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **POINTING, Gregory James** [AU/AU]; 9 Bernard Avenue, Gladesville, New South Wales 2111 (AU).

(74) Agent: **FREEHILLS PATENT & TRADE MARK ATTORNEYS**; Level 43, 101 Collins Street, Melbourne, Victoria 3000 (AU).

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(54) **Title**: EMULSIFIER COMPOSITION

(57) **Abstract**: Described is a liquid dough conditioner including a preservative forming aqueous phase and an emulsifier dissolved or dispersed in the conditioner. The liquid dough conditioner can either, not substantially include an oil in an amount for forming an oil phase in the conditioner or, can include an oil forming an oil phase in the conditioner. There is also a process for producing dough using the liquid dough conditioners.

Emulsifier composition

Field of the invention

The invention relates to dough conditioners, in particular to liquid dough conditioners.

Background of the invention

Reference to any prior art in the specification is not, and should not be taken as an acknowledgment or any form of suggestion that this prior art forms part of the common general knowledge in Australia or any other jurisdiction or that this prior art could reasonably be expected to be ascertained, understood and regarded as relevant by a person skilled in the art.

Dough conditioners (also known as "dough improvers" and "bread improvers") are compositions that are commonly purchased by large scale commercial baking operations involved in the mass production of bread and other baked goods. These conditioners add desirable characteristics such as flavour, colour, tenderness and volume to bread and other baked goods.

Dough conditioners typically include the following types of ingredients:

- oxidizing agents which strengthen the dough. These can lead to economies with shortened makeup times or by compensation for low protein in the flour;
- reducing agents, which serve to encourage the development of gluten, thus shortening the mixing time and decreasing the amount of mixing energy that is needed;
- enzymes which can enhance gas production by yeasts and can help control the strength of the dough and impart a range of other quality attributes to the finished bread quality;

- emulsifiers which strengthen the dough, give improved mixing and handling tolerance, increase loaf volume and improve colour, improve mechanical slicing characteristics and retard staling. Some emulsifiers are understood to effectively strengthen the dough and make it more extensible. This may result in trapping more gas in smaller bubbles, reducing proofing time and giving a softer, more even-textured bread. The added "stretch" also makes the dough more tolerant to over- or under-mixing. Some other emulsifiers combine with starch in the flour in ways that prevent over-firming and staling so that the bread remains softer for a longer period of time. Some have an effect of producing a crust that retains its crispness qualities longer. Examples of emulsifiers include DMG (distilled monoglycerides); mono- and diglycerides, esters of mono- and diglycerides; polyglycerol esters of fatty acids; polyglycerol polyrincinoleate; propylene glycerol esters of fatty acids; sorbitan monostearates; sorbitan tristerates; SSL (sodium stearoyl lactylate); calcium stearoyl lactylates; and DATEM (diacetyl tartaric esters of mono/diglycerides);

- full fat soy flour which enhances crumb brightness due to the presence of lipoxygenase enzymes. Soy has also been reported to have mild oxidising effects on gluten and is useful in the control of dust in the formulation due to its considerable oil content;

- fillers which can be added to enhance flow and handling characteristics and in some instances prevent the solidification of powdered improvers after exposure to high storage temperatures.

Many of the customers of dough conditioner manufacturers are large scale plant baking operations that produce massive volumes of bread and other baked goods. These bakeries are becoming increasingly automated with regard to most aspects of production, including the use of dosing systems which attempt to minimise the need for manual intervention. What this means for manufacturers of dough conditioners is that they are under pressure to produce dough conditioners that can be accurately, easily and efficiently automated at their customer's bakery.

Dough conditioner manufacturers produce conditioners in both dry and liquid formulations. Liquid formulations are particularly advantageous because they can enhance the distribution of the dough conditioner components in the dough, leading to more cost effective usage of the ingredients and more consistent baking results. They are also quite simple to automate.

However, one problem with liquid dough conditioners is that they are difficult to pump. Liquid conditioners, in particular those containing higher levels of emulsifiers, tend to be excessively viscous at low temperatures.

Water based liquid dough compositions have been devised to address the viscosity issue. One problem with these is that they can be unstable due to denaturation/decomposition. WO2004/105494 (CEREFORM LTD) discusses an aqueous stabilization of a liquid dough composition in which additives, such as antioxidants, are used to address the denaturation/decomposition problem. (See also WO1996/13980 (BURNS PHILP FOOD HOLDINGS PTY LIMITED and US Patent no. 3,502,482 BIRNBAUM H)). The use of these additives is not ideal in circumstances where consumers prefer minimal use of additives in manufacture of baked goods. Other limitations of water based compositions are that the water must be sterile, otherwise the emulsifier becomes susceptible to microbial spoilage. Further, water increases the volume of the dough conditioner which in turn increases transport costs making the conditioner more expensive for commercial bakeries, and yet water does not provide any additional functionality to the conditioner.

Oil based liquid dough conditioners are more common (see for example WO2003/039261 (DANISCO A/S)) These conditioners tend to include a lipid carrier for the emulsifier in the conditioner. As the amount of oil increases in the liquid dough conditioner, the viscosity of the conditioner decreases making the conditioner easier to pump. However, conditioners having higher oil content impart unhealthy characteristics to a baked product such as a higher calorific content. Additionally, oil based systems are subject to significant changes in viscosity depending on the temperature. This may lead to possible separation of components at higher temperatures or difficulties in pumping at lower temperatures. Further, additional oil which may not be needed for all

products, increases the expense of the dough conditioner. On the other hand, as the amount of oil is decreased, viscosity of the conditioner increases making the dough conditioner more difficult to pump.

Liquid dough conditioners have also been provided in the form of emulsions including water and oil. These enable oil to be kept at a minimum level while providing a dough conditioner having a lower viscosity than would otherwise be possible if the dough conditioner had been provided in the form of an oil based conditioner (i.e. without water). However, these emulsions have the same limitations that apply to water based liquid compositions, namely increased transport costs with no improved functionality, and need for additives to prevent microbial spoilage of emulsifiers. Other conditioners include components that may be undesirable in some circumstances such as egg (see JP 11-346643A (TSUKISHIMA FOODS INDUSTRY CO LTD)).

Summary of the invention

The invention seeks to at least minimise or address one or more of the above problems or limitations and in one embodiment provides a liquid dough conditioner including:

- a solution of a preservative forming an aqueous phase, the preservative for at least minimising the microbial spoilage of a dough or baked product formed from the use of the conditioner;

- an emulsifier useful as a component of a dough conditioner dissolved or dispersed in the solution in an amount of about 1 to 20% w/w conditioner;

wherein the conditioner does not substantially include an oil in an amount for forming an oil phase in the conditioner.

In another embodiment there is provided a liquid dough conditioner including:

- a vinegar forming an aqueous phase;

- an emulsifier useful as a component of a dough conditioner dissolved or dispersed in the aqueous phase in an amount of about 1 to 20% w/w conditioner.

In other embodiments there is provided a liquid dough conditioner including:

- a vinegar forming an aqueous phase;

- an oil forming an oil phase;

wherein the conditioner has an emulsifier useful as a component of a dough conditioner dissolved or dispersed therein in an amount of about 1 to 20% w/w conditioner.

Preferably the emulsifier is dissolved or dispersed in the aqueous phase.

In certain embodiments the emulsifier or portions thereof may be dissolved or dispersed in the oil phase where an oil is provided.

In other embodiments there is provided a process for producing a liquid dough conditioner of the invention including the steps of combining an oil, a vinegar and an emulsifier useful as a component of a dough conditioner, thereby producing the liquid dough conditioner of the invention. Preferably the emulsifier is first dissolved or dispersed in the vinegar to form an aqueous dispersion or solution, followed by combination of the aqueous dispersion or solution with the oil.

In other embodiments there is provided a use of a liquid dough conditioner of the invention in the manufacture of a dough or baked good.

In another embodiment there is provided a dough or baked good made according to the process of the invention.

Detailed description of the embodiments

The conditioner of the invention has a number of advantages over other liquid formulations. In particular, as shown herein, an addition of a given volume of solution of

preservative, such as vinegar, calcium propionate or other preservative described herein provides a liquid dough conditioner having a viscosity that is less than a conditioner formed from the addition of the same volume of water. Hence, comparably speaking, at a given volume the conditioner of the invention is easier to pump in a commercial baking operation.

Further, a liquid dough conditioner having a higher concentration of emulsifier can be provided which has the same viscosity as a water based liquid dough conditioner having a lower concentration of emulsifier.

Further, functionality is provided to the conditioner in the sense that the conditioner essentially functions as a partial or complete preservative that would otherwise be required by a commercial baking operation to minimise microbial spoilage of baked goods caused by mould and other micro-organisms. More specifically, with use of this conditioner, the commercial baking operation does not need to separately add preservative such as vinegar, calcium propionate or other preservative described herein to a dough. This functionality may be provided without the need for other additives that a dough conditioner manufacturer might normally add to stabilise, or to prevent denaturation, or spoilage of the emulsifier in the conditioner.

Thus in one embodiment there is provided a liquid dough conditioner including:

- a solution of a preservative forming an aqueous phase, the preservative for at least minimising the microbial spoilage of a dough or baked product formed from the use of the conditioner;

- an emulsifier useful as a component of a dough conditioner dissolved or dispersed in the solution in an amount of about 1 to 20% w/w conditioner;

wherein the conditioner does not substantially include an oil in an amount for forming an oil phase in the conditioner.

By 'does not substantially include' is generally meant that oil has not been added to the conditioner for the purpose of modifying a function of the conditioner, or for the purpose

of providing functionality not already inherent in the conditioner. Therefore, in certain embodiments the condition may include residual or trace amounts of oil, including amounts that inadvertently arise in the manufacture of the conditioner.

The preservative may be calcium propionate. As described further herein, other preservatives include sodium benzoate, calcium benzoate, potassium benzoate, sodium diacetate, paraben, niacin, calcium acetate, calcium diacetate, sodium sorbate, calcium sorbate, potassium sorbate, sodium propionate, potassium propionate or sorbic acid.

Further, as described herein, where the preservative is calcium propionate, the calcium propionate is provided in an amount of about 2.5 to 50% w/w of the conditioner, or from 2.5 to 25%, or from 5 to 10%, or from 25 to 50% or from 30 to 40 % w/w of the conditioner.

Vinegar, as described herein, may also form the solution of preservative. Vinegar may be provided in an amount of about 50 to 95% w/w conditioner. Vinegar may be 10% strength, as described herein.

Examples of emulsifier are described further herein and include those selected from the group consisting of: DMG (distilled monoglycerides); mono- and diglycerides, esters of mono- and diglycerides; polyglycerol esters of fatty acids; polyglycerol polyrincinoleate; propylene glycerol esters of fatty acids; sorbitan monostearates; sorbitan tristerates; SSL (sodium stearoyl lactylate); calcium stearoyl lactylates; and DATEM (diacetyl tartaric esters of mono/diglycerides).

In one preferred form, the conditioner may consist of the solution of preservative and the emulsifier. In particular, the conditioner may consist of:

- a solution of calcium propionate, preferably in an amount of about 2.5 to 50% w/w of the conditioner;

- an emulsifier such as one or more of DMG; mono- and diglycerides, esters of mono- and diglycerides; polyglycerol esters of fatty acids; polyglycerol polyrincinoleate; propylene glycerol esters of fatty acids; sorbitan monostearates; sorbitan tristerates;

SSL; calcium stearoyl lactylates; and DATEM, dissolved or dispersed in the solution in an amount of about 1 to 20% w/w conditioner.

In one embodiment, the amount of emulsifier is from 1 to 20% (i.e. from 1g emulsifier per 99g solution of preservative, to 20g emulsifier to 80g solution of preservative (or less preservative where other components are added in the conditioner)), or from 1 to 10%, or from 3 to 10%, or from 1 to 5%, or from 3 to 5% w/w of the conditioner.

In one embodiment, the conditioner has a pH in the range of 3 to 5.5, or from 3 to 4.5 or from 3.5 to 5.0.

In other embodiments there is provided a liquid dough conditioner including:

- a vinegar forming an aqueous phase; and

- an emulsifier useful as a component of a dough conditioner dissolved or dispersed in the aqueous phase.

In these embodiments, the liquid dough conditioner may or may not include an oil or fat, such as an oil forming an oil phase.

In certain embodiments, the vinegar is provided in the dough conditioner in an amount to at least minimise microbial spoilage of a baked product formed from the use of the conditioner. These moulds include *Aspergillus niger*, *A. fumigatus*, *Neurospora sitophila*, *Rhizopus nigricans*. In this amount the commercial baking operation does not have to add additional vinegar or other preservatives to control microbial growth.

In other embodiments, the amount of vinegar in the conditioner according to the invention is from 50 to 95% w/w of the conditioner (i.e. from 50g vinegar per 50g emulsifier, to 95g vinegar per 5g emulsifier (or less emulsifier where other components added in the conditioner)), or from 80 to 95%, preferably 90 to 95% w/w of the conditioner. This range applies especially where the addition rate of conditioner to flour is from 1 to 4% w/w (i.e. from 1g conditioner per 100g flour, to 4g conditioner per 100g flour) and where the vinegar is 10% strength (i.e. 10g vinegar per 90g water).

In certain embodiments, the amount of vinegar may be less than 50% w/w of the conditioner, i.e. from 30 to 50% or 40 to 50% w/w of the conditioner, especially where another preservative is used together with the vinegar.

In one embodiment, the amount of emulsifier is from 1 to 20% (i.e. from 1g emulsifier per 99g vinegar, to 20g emulsifier to 80g vinegar) (or less vinegar where other components are added in the conditioner)), or from 1 to 10%, or from 3 to 10%, or from 1 to 5%, or from 3 to 5% w/w of the conditioner.

Where the strength of the vinegar and/or the addition rate of conditioner to flour is higher or lower than as stated above, the skilled worker can determine the appropriate amount of vinegar using the teaching herein to provide a dough conditioner of the invention having the specified viscosity and/or preservative function described herein.

Generally the vinegar addition provides the liquid conditioner with a pH in the range of about 3 to 4.5, for example from 3.5 to 4.0 or otherwise within these ranges.

Any type of vinegar may be used. Examples include White, Malt, Wine, Apple cider, Fruit, Balsamic and Rice Vinegars. Organic acids, examples of which include acetic, lactic or other acids may in certain embodiments be used instead of, or together with vinegar. In certain embodiments, organic acids are not used.

The commercial vinegar is typically 10% strength, i.e. a solution weighing 100 grams includes about 10 grams of acetic acid. Although more dilute concentrations can be used, the level of viscosity reduction may subsequently be reduced. Higher strengths of vinegar i.e. greater than 10% and generally less than 25% and amounts within this range may be used in certain embodiments. Further, in certain embodiments the vinegar may be a concentrate. In these embodiments it may be necessary for a commercial baking operation to add water to the dough conditioner before it is added to ingredients for formation of a dough.

In some embodiments the emulsifier is at least partially hydrated by the aqueous phase. In these embodiments the emulsifier may be dispersed in the vinegar or it may be dissolved in the vinegar, or both dispersed and dissolved.

The emulsifier may be selected from the group consisting of: DMG (distilled monoglycerides); mono- and diglycerides, esters of mono- and diglycerides; polyglycerol esters of fatty acids; polyglycerol polyrincinoleate; propylene glycerol esters of fatty acids; sorbitan monostearates; sorbitan tristerates; SSL (sodium stearoyl lactylate); calcium stearoyl lactylates; and DATEM (diacetyl tartaric esters of mono/diglycerides) or a mixture of these emulsifiers. Preferably, the emulsifier is SSL, or combinations of SSL with other emulsifiers, in particular DATEM.

In certain embodiments, the aqueous phase consists of vinegar, preferably 10% strength vinegar (i.e. 10 g vinegar per 90g water).

In one embodiment, the aqueous phase may include vinegar and an additional component, for example another compound that is partially or completely soluble in water.

In one embodiment, the conditioner does not substantially include egg or a component thereof. By 'does not substantially include' is generally meant that egg or a component thereof has not been added to the conditioner for the purpose of modifying a function of the conditioner, or for the purpose of providing functionality not already inherent in the conditioner. Therefore, in certain embodiments the condition may include residual or trace amounts of these components, including amounts that inadvertently arise in the manufacture of the conditioner.

Typically the condition does not include a leavening agent, such as yeast.

In certain embodiments the conditioner does not include triglycerides forming a vegetable shortening.

In certain embodiments, other preservatives such as calcium propionate can be added to the vinegar-based conditioner at levels which provide for the otherwise required addition rates to the dough. The reduction in pH afforded by the vinegar also assists in enhancing the functionality of the calcium propionate. Other examples of preservatives include sodium benzoate, calcium benzoate, potassium benzoate, sodium diacetate, paraben, niacin, calcium acetate, calcium diacetate, sodium sorbate, calcium sorbate,

potassium sorbate, sodium propionate, potassium propionate, sorbic acid, and acetic acid. Other preservative include a bacteriocin, nisin and natamycin. In preferred embodiments, combinations of preservatives are used, including combinations of the previous list of preservatives, to provide a synergistic effect.

Where the preservative is calcium propionate, preferably, the calcium propionate is provided in an amount of from 0.1-1%, 0.15-0.75% or 0.2-0.5% on a flour weight basis.

In one embodiment the calcium propionate is provided in amount of from 2.5 to 50 % w/w of the conditioner (i.e. from 2.5g calcium propionate per 97.5g of conditioner, to 50g calcium propionate per 50g conditioner) or from 2.5 to 25%, or from 5 to 10%, or from 25 to 50% or from 30 to 40 % w/w of the conditioner.

In one embodiment there is provided a liquid dough conditioner including:

- a solution of a preservative forming an aqueous phase, the preservative for at least minimising the microbial spoilage of a dough or baked product formed from the use of the conditioner;

wherein the conditioner has an emulsifier useful as a component of a dough conditioner dissolved or dispersed therein.

In this embodiment, the conditioner may consist of the solution of preservative forming an aqueous phase (where the solution may be sodium benzoate, calcium benzoate, potassium benzoate, sodium diacetate, paraben, niacin, calcium acetate, calcium diacetate, sodium sorbate, calcium sorbate, potassium sorbate, sodium propionate, calcium propionate, potassium propionate, calcium propionate, sorbic acid, and acetic acid, a bacteriocin, nisin or natamycin) and the emulsifier useful as a component of a dough condition dissolved or dispersed in the aqueous phase.

For example, the liquid dough conditioner may consist of:

- a solution of calcium propionate in amount of from 2.5 to 50 % w/w of the conditioner (i.e. from 2.5g calcium propionate per 97.5g of conditioner, to 50g calcium propionate

per 50g conditioner) or from 2.5 to 25%, or from 5 to 10%, or from 25 to 50% or from 30 to 40 % w/w of the conditioner; and

an emulsifier useful as a component of a dough conditioner dissolved or dispersed therein.

The liquid dough conditioner of the invention may further include an oil or fat forming an oil phase. One advantage of this embodiment is that the oil adds a further level of functionality to the conditioner in the sense that a commercial baking operation that purchases the conditioner from a conditioner manufacturer may not then need to separately add an oil to the dough mixture as would normally be added with use of known dough conditioners. Further, the oil decreases the viscosity of the dough conditioner further improving dosing and pumping capacity of the conditioner.

Where the conditioner includes an oil, the conditioner may take the form of an emulsion of the aqueous and oil phases. In these embodiments, the conditioner forms an oil in water emulsion. The emulsion may be a stabilised emulsion. In this form the liquid dough conditioner of the invention may be provided as a stabilised emulsion immediately before use and when in storage. In other embodiments, the liquid dough conditioner of the invention is provided as a stabilised emulsion immediately before use, in which case it may form a biphasic solution during storage.

Typically the oil is selected to at least partially dilute the emulsifier as such oils further decrease the viscosity of the dough conditioner. Examples of particular oils and fats include canola, sunflower, soy, cottonseed, palm oils and animal fats and mixtures thereof. Preferably the oil is a vegetable oil such as canola oil.

In one embodiment, the oil forming the oil phase is selected for at least partial solubilisation or dispersion of the emulsifier therein.

The oil may be provided in an amount of about 10 to 60% w/w of the conditioner, for example about 40 to 60%, about 50%, or from about 10 to 50%, for example about 20 to 30%.

Typically the liquid dough conditioner of the invention has a viscosity of less than about 2,500cP, or less than about 2,250cP, or less than about 2,000 cP, or less than about 1,500cP, or about 700 to 1,200cP at 22°C.

Where the emulsifier is SSL, the viscosity of the conditioner at 22°C may be from about 1,200cP to 1,500cP, preferably about 1,250cP.

Viscosity may be measured using a Brookfield DVI+ Viscometer fitted with a #64 spindle running at 60rpm (Brookfield Engineering Laboratories, Inc. 11 Commerce Boulevard Middleboro, Massachusetts, USA, 02346).

These viscosities at 22°C ideally suit the conditioners of the invention to use in the temperatures at which dough manufacture occurs in a commercial baking operation. In certain embodiments, at these temperatures the conditioner is not a thick plastic composition. Rather, given its composition, it tends to be free flowing.

The liquid dough conditioner of the invention may further include other components including oxidizing agents for strengthening the dough, reducing agents for development of gluten and enzymes for enhancing gas production by yeast and for controlling the strength of the dough. These components may be provided in the aqueous phase, or when an oil forming an oil phase is provided, in the oil phase.

In other embodiments there is provided a process for producing a liquid dough conditioner according to the invention including the step of combining a vinegar and an emulsifier useful as a component of a dough conditioner, thereby producing the liquid dough conditioner. In a further embodiment, the process further includes the step of combining an oil with a vinegar and an emulsifier useful as a component of a dough conditioner.

In other embodiments there is provided a process for producing a dough including the steps of:

- providing a mixture including flour, water, yeast and salt in amounts for forming a dough;

- contacting the mixture with a liquid dough conditioner according to the invention.

In some embodiments the conditioner may not of itself be sufficient to provide for the preservative function required in a dough. In these embodiments it may be necessary for a commercial baking operation to add further vinegar or other preservatives to the dough. On the other hand, it may be necessary for the baking operation to add more water to dilute the preservative effect of the conditioner, or to add more oil to the dough to supplement the oil provided in the conditioner.

In some embodiments where the liquid dough conditioner of the invention is a partial conditioner, it may not have the complete attributes of an improver system in which case in use, it may be necessary to add enzymes, oxidants, soy flour or other components to the conditioner or the dough mixture.

Example 1 Production of a liquid dough conditioner of the invention

Production of the conditioner can be done in a number of ways, but typically methods used in the manufacture of food emulsions are employed. Functional bakery emulsifiers, preferably SSL and/or DATEM at levels of 2.0 to 10 w/w % are dispersed in vinegar either continuously or on a batch basis. In one example, the liquid is then passed through a colloid mill, emulsifying pump or other means of high intensity dispersion to form a smooth, stable hydrate having a viscosity that is greater than the vinegar before addition of the emulsifier.

The viscosity achieved may be determined by the type of emulsifier used, the amount present and the intensity of the mixing used. If other emulsifiers are used, the same end-point with respect to smoothness may be achieved, but the level of viscosity may be different. In these circumstances, a higher or lower concentration of emulsifier may be required to achieve a desired viscosity within the ranges described herein.

As a further step, oil can be added to this mixture at an amount from 10 to 60% w/w to create a stable emulsion. This step can be achieved by the use of relatively low intensity mixing, however higher intensity mixing is also possible. The inclusion of oil acts to decrease the viscosity of the mixture.

While it is possible to add other components to either mixture, such as salts, sugars, enzymes, oxidants, in certain embodiments these components are best delivered to a bread dough or other baked product by other means which may include powders, granules, tablets, liquids etc.

In one embodiment the liquid dough conditioner of the invention is 'a complete conditioner' in the sense that it includes all components such as oxidising agents, reducing agents, enzymes, emulsifiers, full fat soy flour and fillers.

In another embodiment, the liquid dough conditioner of the invention is a 'partial conditioner' in the sense that it contains an emulsifier but does not contain all other components that may be found in a conditioner including oxidizing agents, reducing agents, enzymes, full fat soy flour and fillers.

Example 2 Viscosity of liquid dough conditioners

Table 1 is a comparison of water -based liquid dough conditioners with the vinegar - based liquid dough conditioners of the invention.

Table 1:

	Viscosity in Centipoise (cP)	
	22 °C	4°C
SSL water -based conditioners in triplicate		
SSL @ 5% w/w water –based conditioner	2495	3400
SSL @ 5% w/w water –based conditioner	2335	3165
SSL @ 5% w/w water –based conditioner	3175	3750
Datem water -based conditioners		
Datem @ 5% w/w water –based conditioner	85	45
SSL/Datem water –based		

conditioners in duplicate		
SSL @ 5% + Datem @ 2.5% w/w water –based conditioner	4655	5225
SSL @ 5% + Datem @ 2.5% w/w water –based conditioner	5105	6100
SSL vinegar –based conditioners in triplicate		
SSL @ 5% w/w vinegar –based conditioner	1280	1525
SSL @ 5% w/w vinegar –based conditioner	1130	1275
SSL @ 5% w/w vinegar –based conditioner	1450	1725
Datem vinegar –based conditioners		
Datem @ 5% w/w vinegar –based conditioner	755	85
SSL/Datem vinegar –based conditioners in duplicate		
SSL @ 5% + Datem @ 2.5% w/w water –based conditioner	2295	2765
SSL @ 5% + Datem @ 2.5% w/w water –based conditioner	2360	1010

Viscosity was measured using a Brookfield DVI$^+$ Viscometer fitted with a #64 spindle running at 60rpm.

Vinegar was used at 10% strength. The data from Table 1 shows that irrespective of the type of conditioner used, temperature and time, the viscosity of the liquid dough conditioner that is vinegar -based is lower than water -based conditioners. As an example, the SSL @ 5% w/w vinegar –based conditioner reproducibly has a viscosity that is about 50% lower than of the control water –based conditioner containing the same amount of SSL. While not wanting to be bound by hypothesis, it is believed that emulsifiers useful as dough conditioners are more solvent, or are better dispersed in vinegar than in water.

Table 2 is a comparison of water -based liquid dough conditioners with the calcium -based liquid dough conditioners of the invention

The following trials were done to measure the relative viscosities of emulsified mixtures of SSL in water, with and without the addition of calcium propionate added to 30% w/w.

Measurements were made at 28°C and were measured on a Brookfield Viscometer running at 60rpm.

SSL was mixed in water first and then mixed with CP.

Table 2:

5% SSL + Water	1700cP
10% SSL + Water	3220cP
5% SSL + Water + CP	150cP
10% SSL + Water + CP	230cP

Example 3 Use of the liquid dough conditioner in the manufacture of dough or baked good

The degree of automation applied to the dosage of minor ingredients varies significantly between bakeries. Generally oil addition is automated, however the addition of vinegar is often done manually. Emulsifier addition is most commonly done through inclusion in a powdered improver which needs to be manually weighed. By incorporating up to three components in a single product, it becomes possible to automatically dose all three components using a single system which is currently only used for oil. Not only does this simplify bakery operations, but it reduces the risk of error and removes the potentially hazardous manual addition of vinegar.

Given the fact that this invention allows emulsifiers to be removed from a traditional powdered conditioner, the composition of the conditioner can be greatly simplified and concentrated. While traditional improvers have an addition rate of 0.5 – 1.5%, it is

proposed that this invention should allow addition rates of remaining conditioning components to be reduced to 0.1% or below. This reduction in required volume makes it possible to economically utilise other improver formats such as tablets, granules, capsules, gels, liquid concentrates or other similar methods of addition. Further, it is proposed that the enzymes and oxidants comprising the bulk of the 0.1% could be split into individual components which would allow different levels of softness, volume and other characteristics to be obtained in various bread products.

Example 4 Other examples of liquid dough conditioner formulations of the invention

Ingredient	**Conditioner formulation (grams)**						
	1	2	3	4	5	6	7
10%Vinegar	100	100	100	100	100	0	50
Water	0	0	0	0	0	100	50
Canola Oil	40	20	40	0	20	0	0
Emulsifier (SSL)	6	10	10	10	5	5	7
Calcium propionate	0	0	6	6	0	5	5

It will be understood that the invention disclosed and defined in this specification extends to all alternative combinations of two or more of the individual features mentioned or evident from the text or drawings. All of these different combinations constitute various alternative aspects of the invention.

CLAIMS

1. A liquid dough conditioner including:

- a solution of a preservative forming an aqueous phase, the preservative for at least minimising the microbial spoilage of a dough or baked product formed from the use of the conditioner;

- an emulsifier useful as a component of a dough conditioner dissolved or dispersed in the solution in an amount of about 1 to 20% w/w conditioner;

wherein the conditioner does not substantially include an oil in an amount for forming an oil phase in the conditioner.

2. The liquid dough conditioner of claim 1 wherein the preservative is calcium propionate.

3. The liquid dough conditioner of claim 2 wherein the calcium propionate is provided in an amount of about 2.5 to 50% w/w of the conditioner.

4. The liquid dough conditioner of claim 1 wherein the preservative is sodium benzoate, calcium benzoate, potassium benzoate, sodium diacetate, paraben, niacin, calcium acetate, calcium diacetate, sodium sorbate, calcium sorbate, potassium sorbate, sodium propionate, potassium propionate or sorbic acid.

5. The liquid dough conditioner of claim 1 wherein the solution of preservative is vinegar.

6. The conditioner of claim 5 wherein the vinegar is provided in an amount of about 50 to 95% w/w conditioner.

7. The conditioner of claim 5 wherein the vinegar includes about 10 grams of acetic acid per 100 grams of solution.

8. The conditioner of any one of the preceding claims wherein the emulsifier is selected from the group consisting of: DMG (distilled monoglycerides); mono- and diglycerides, esters of mono- and diglycerides; polyglycerol esters of fatty acids; polyglycerol polyrincinoleate; propylene glycerol esters of fatty acids; sorbitan monostearates; sorbitan tristerates; SSL (sodium stearoyl lactylate); calcium stearoyl lactylates; and DATEM (diacetyl tartaric esters of mono/diglycerides).

9. The conditioner of any one of the preceding claims wherein the conditioner consists of the solution of preservative and the emulsifier.

10. The conditioner of any one of the preceding claims wherein the conditioner has a pH in the range of 3 to 4.5.

11. A liquid dough conditioner including:

- a vinegar forming an aqueous phase;

- an oil forming an oil phase;

wherein the conditioner has an emulsifier useful as a component of a dough conditioner dissolved or dispersed therein,

and wherein the emulsifier is provided in an amount of about 1 to 20% w/w conditioner.

12. The conditioner of claim 11 wherein the conditioner contains an amount of vinegar to provide the conditioner with a viscosity of less than 2,500cP at room temperature.

13. The conditioner of claim 11 or 12 wherein the vinegar is provided in an amount of about 50 to 95% w/w conditioner.

14. The conditioner of any one of claims 11 to 13 wherein the vinegar is 10% vinegar.

15. The conditioner of any one of claims 11 to 14 wherein the emulsifier is selected from the group consisting of: DMG (distilled monoglycerides); mono- and diglycerides, esters of mono- and diglycerides; polyglycerol esters of fatty acids; polyglycerol polyrincinoleate; propylene glycerol esters of fatty acids; sorbitan monostearates; sorbitan tristerates; SSL (sodium stearoyl lactylate); calcium stearoyl lactylates; and DATEM (diacetyl tartaric esters of mono/diglycerides).

16. The conditioner of any one of claims 11 to 15 in the form of an emulsion of the aqueous and oil phases.

17. The conditioner of any one of claims 11 to 16 wherein the oil is a vegetable oil.

18. The conditioner of claim 17 wherein the vegetable oil is canola oil.

19. The conditioner of any one of claims 11 to 18 wherein the oil is provided in an amount of about 10 to 60% w/w of the conditioner.

20. A process for producing a dough including the steps of:

- providing a mixture including one or more of flour, water, yeast and salt in amounts for forming a dough;

- contacting the mixture with a liquid dough conditioner of any one of the preceding claims.

21. The process of claim 20 further including adding an oil to the liquid dough conditioner to increase the oil content of the conditioner, prior to contacting the mixture with the conditioner.

22. The process of claim 20 further including adding water to the liquid dough conditioner to increase the water content of the conditioner, prior to contacting the mixture with the conditioner.

23. The process according to claim 20 further including adding vinegar to the liquid dough conditioner to increase the acetic acid content of the conditioner, prior to contacting the mixture with the conditioner.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/001606

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A21D 2/08 (2006.01) *A21D 8/02* (2006.01)
A21D 2/00 (2006.01) *A21D 15/00* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC, WPI: DATEM, SSL, propionate, conditioner, texturiser, improver, benzoate, vinegar, acetic, IPC: A21D, strengthener, developer, enhancer, modifier, glyceride, stearoyl

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/051647 A1 (KERRY GROUP SERVICES INTERNATIONAL LIMITED) 10 May 2007 See table on p. 11, claim 1, p. 9 line 1	1, 2, 4, 8-10, 20-23
X	WO 1996/013980 A1 (BURNS PHILP FOOD HOLDINGS PTY LIMITED) 17 May 1996 See p. 1 lines 22 and 31, p. 4 lines 16-19, p. 2 item ix, p. 10 line 11	1-4, 8-10, 20-23
X	US 3,388,999 A (KUHRT ET AL.) 18 June 1968 See col. 5 lines 1, 10 and 15, col. 7 lines 42 and 72	1, 2, 4-10, 20-23
X	US 3,180,736 A (LANDFRIED) 27 April 1965 See col. 3 lines 5-19 and Examples	1, 4, 8, 9, 20-23

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 December 2010	23 DEC 2010
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **MATTHEW FISHER** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2946

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/001606

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,502,482 A (BIRNBAUM) 24 March 1970 See abstract, claims 2 and 3	1, 5-10
X	JP 11-346643 A (TSUKISHIMA FOODS INDUSTRY CO LTD) 21 December 1999 Seen as an English translation on the Patent Abstracts of Japan website See abstract, [0006] and [0012]	11-23
A	WO 2003/039261 A1 (DANISCO A/S) 15 May 2003 See whole document	
A	WO 2004/105494 A2 (CEREFORM LIMITED) 9 December 2004 See whole document	
A	WO 2002/011544 A1 (ENCAPSULATION SYSTEMS INC.) 14 February 2002 See whole document	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/001606

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

As reasoned in the Supplemental Box.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Supplemental Box
(To be used when the space in any of Boxes I to IV is not sufficient)

Continuation of Box No: III

The specification does not comply with Section 40(4) because the claims do not relate to one invention only. I have found different inventions based on the following features that distinguish the claims from each other:

- Claims 1-10 and 20-23 (partially) define a liquid dough conditioner including a solution of preservative and an emulsifier wherein the conditioner does not substantially include oil. A process for producing a dough using this conditioner is also defined. It is considered that the conditioner without the inclusion of oil comprises a first distinguishing feature.

- Claims 11-19 and 20-23 (partially) define a liquid dough conditioner including a vinegar forming aqueous phase and an oil forming oil phase. A process for producing a dough using this conditioner is also defined. It is considered that the conditioner with the inclusion of oil comprises a second distinguishing feature.

Unity of invention is only fulfilled when there is at least one "special technical feature" present in the claims. This is a feature that both:

- provides a technical relationship among all the claims; and,
- makes a contribution over the prior art.

In the above groups of claims, the identified distinguishing features may have the potential to make a contribution over the prior art but are not common to all the claims and therefore cannot provide the required technical relationship. Indeed the special technical feature (i.e. the inclusion/exclusion of oil) of each claim set is mutually exclusive. Therefore there is no special technical feature present in the claims and the requirements for unity of invention are consequently not satisfied *a priori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2010/001606

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	2007051647	AU	2006310708	CA	2628651	EP	1947951
		MX	2008005945	US	2008233240	ZA	200804180
WO	9613980	AU	37671/95	TR	960467		
US	3388999	GB	1104955				
US	3180736	NONE					
US	3502482	NONE					
JP	11346643	NONE					
WO	03039261	BR	0213914	EP	1443823	MX	PA04004315
		NZ	532995	RU	2004114838	US	2005031763
		ZA	200404089				
WO	2004105494	AU	2004243237	BR	PI0411269	CA	2527981
		CN	1802092	EP	1633195	GB	2402317
		US	2007292562	ZA	200509896		
WO	0211544	AU	84696/01	US	2002064587	US	6863917
		US	2005084586				

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX