

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(PCT Rule 71.1)

To:

Aera A/S
Niels Hemmingsens Gade 10, 5th Floor
1153 Copenhagen K
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Date of mailing
(day/month/year)

24.05.2022

Applicant's or agent's file reference
P2521WO00

IMPORTANT NOTIFICATION

International application No.
PCT/EP2021/053474

International filing date (day/month/year)
12.02.2021

Priority date (day/month/year)
14.02.2020

Applicant
LANTMÄNNEN UNIBAKE HOLDING A/S

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P2521WO00	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/EP2021/053474	International filing date (day/month/year) 12.02.2021	Priority date (day/month/year) 14.02.2020	
International Patent Classification (IPC) or national classification and IPC INV. A21D8/04			
Applicant LANTMÄNNEN UNIBAKE HOLDING AS			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>7</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ (sent to the applicant and to the International Bureau) a total of <u>17</u> sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions). ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2). ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)). b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).			
4. This report contains indications relating to the following items: ☒ Box No. I Basis of the report ☐ Box No. II Priority ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability ☐ Box No. IV Lack of unity of invention ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement ☐ Box No. VI Certain documents cited ☐ Box No. VII Certain defects in the international application ☒ Box No. VIII Certain observations on the international application			
Date of submission of the demand 16.07.2021		Date of completion of this report 24.05.2022	
Name and mailing address of the international preliminary examining authority:  European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016		Authorized officer Graham, Judith Telephone No. +31 70 340-7368	



Box No. I Basis of the report

1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-44 as originally filed

Claims, Numbers

1-39 filed in electronic form on 16-07-2021

Drawings, Sheets

1/19-19/19 as originally filed

- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☒ the claims, Nos. 38-42
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
5. ☐ This report has been established:
- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
 - ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2021/053474

6. ☒ With regard to top-up searches (Rules 66.1 *ter* and 70.2(f)):
- ☒ A top-up search was carried out by this Authority on 24.09.2021 (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
 - ☐ Additional relevant documents have been discovered during the top-up search.
 - ☐ No top-up search was carried out by this Authority because it would serve no useful purpose.
7. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded".

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-37</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>1-37</u>
	No: Claims	
Industrial applicability (IA)	Yes: Claims	<u>1-37</u>
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item I

Basis of the report

This report is based on the description and figures filed on 12.02.2021 only, since not all of the amendments filed in the submissions of 08.04.2021 are clearly and unambiguously derivable from the application as originally filed.

For example, the references to Fig. 6A and Fig. 6B on page 23 contrast with those as originally filed which do not have the reference numbers 6A and 6B. Moreover, the lower figure is referred to 6A and not the top figure. The same applies to the references to Figure 7A and 7B on page 23. Further basis for the table introduced on page 24 is unclear and the term "added" appears to have been inserted. Some of the headings appear to have been removed from the figures.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Prior Art

- D1 US 2018/177202 A1 (BLAREAU FRANÇOIS [FR] ET AL) 28 June 2018 (2018-06-28) - cited in the application
- D2 WO 2019/238423 A1 (NOVOZYMES AS [DK]) 19 December 2019 (2019-12-19) - cited in the application
- D3 WO 2016/005452 A1 (CARAVAN INGREDIENTS INC [US]; PURAC BIOCHEM BV [NL]) 14 January 2016 (2016-01-14)cited in the application
- D4 WO 2014/161876 A1 (NOVOZYMES AS [DK]) 9 October 2014 (2014-10-09)

2 D1 aims at providing pre-cooked loaves which can be stored at room temperature for up to 7 days using a bread improver [0012]. Claims 1 to 4 of D1 disclose the breadmaking improver to comprise alpha amylase, amyloglucosidase, maltogenic exoamylase and xylanase, that is a combination of 4 enzymes as opposed to the three of claim 1. Further, test 4 in table 1 comprises pregelatinised wheat flour, wheat flour, no added sugar, xylanase

and alpha amylase, amyloglucosidase and maltogenic exoamylase at a ratio of 1 : 7.6 : 5.2 respectively. This ratio is outside the ratio 1:12.2 - 100: 4.1 - 50 of claim 1 (see table 3 of the applicant's letter dated 16.07.2021). According to paragraph [0078], the ingredients are kneaded (mixed) to form the dough.

D2 discloses dough with a reduced amount of sugar. The dough for the hamburger buns of example 2, made as known in the art, comprise wheat flour, 6% sugar, 10 ppm Fungamyl 4000 SG (alpha amylase), 30ppm Novamyl 3D (maltogenic amylase) and 131 mg Gold crust (amyloglucosidase) per kg of flour, resulting in a ratio of 1 : 13.1 : 3 which is outside the ratio of claim 1. It is implicit that the added ingredients are mixed to form a dough.

In addition, example 3 in D2 discloses a dough comprising no added sugar, 7 ppm alpha-amylase and 83 mg glucoamylase. No maltogenic amylase is used in example 3.

D3 discloses the preparation of bakery products by adding a specific enzyme combination that generates sugar during baking (p. 1, lines 3-5). The enzyme combination in example 5 comprises maltogenic amylase and amyloglucosidase. No alpha-amylase is added.

D4 discloses the preparation of bakery products with no or small amounts of artificial emulsifiers comprising no sugar and the enzymes alpha amylase and maltogenic alpha amylase (p. 16, lines 4 to 9). No amyloglucosidase is added.

2.1 Art. 33(2) PCT

2.2 Claim 1 reads

"A combination consisting of an alpha-amylase (EC 3.2.1.1), which is thermo-labile and has activity in a range of from 30 to 65 °C, an amyloglucosidase (EC 3.2.1.3), which is thermo-stable and has optimum activity at about 60-65 °C, and a maltogenic amylase (EC 3.2.1.133), which has optimal activity in a range of from 50 to 75 °C, and wherein the thermo-labile alpha-amylase, the thermo-stable amyloglucoside and the maltogenic amylase are present in ratios corresponding to from 20 to 48 Fau or from 28 to 40 Fau of the thermo-labile alpha-amylase, from 578 to 1650 Agu or from 660 to 1650 Agu of the thermo-stable amyloglucosidase, and from 500 to 2500 Manu or from 1000 to 2500 Manu of the maltogenic amylase."

- 2.3 Consequently, the composition of claim 1 consisting of the three claimed enzymes and its dependent claims 2, 3, 18 to 26 and 37 are novel over D1 to D4.
- 2.4 It follows that the process of claim 4 and its dependent claims 5 to 17 and 27 to 36 and the process part of the dependent claims 18 to 26, by directly or indirectly referring back to claim 1, are also novel over D1 to D4.

3 Art. 33(3) PCT

- 3.1 According to page 1, lines 4 to 13, the application relates to baked products without any addition of sugar which still has a suitable sweetness intensity and good taste and shortened proofing time, thereby reducing the total time required to produce the baked product.

According to the applicant's letter of 29.11.2021, figure 7 of the application compares straight dough trials described in example 4. The volume index for the binary combination of alpha amylase with amyloglucosidase (Fau/Gluco) is 130. The volume index for the tertiary combination of alpha amylase, amyloglucosidase and maltogenic amylase ("All enzymes") is 135. The volume index for maltogenic amylase alone is 97.

Thus, from the above results it was not to be expected that adding maltogenic amylase to alpha amylase and amyloglucosidase would increase the volume index. An increase in specific volume allows a shortened proofing time.

Parallel trials are reported on pages 3 to 8 in the applicant's letter of 29.11.2021, based on examples 3 and 4 of D2, demonstrating the same technical effect.

- 3.2 D2 which aims to reduce the amount of sugar by either reducing the amount of added sugar or by not adding any sugar may be considered the closest prior art. D2 also teaches an increased volume of the baked bread using a raw starch degrading alpha amylase and a glucoamylase (page 3, 5th para.).
- D1 is considered less relevant since it aims at providing pre-cooked loaves which can be stored for up to 7 days by using a bread improver [0012]. Claims 1 to 4 of D1 disclose the breadmaking improver to comprising alpha amylase, amyloglucosidase, maltogenic exoamylase and xylanase, i.e. not a tertiary combination. D1 does not teach to increase the volume and / or shorten the proofing time.

Claim 1 relates to a tertiary combination of enzymes. The process of claim 4 relates to a process for producing a bakery product with no added sugar using the tertiary combination of enzymes of claim 1.

As mentioned under section 3.1, the addition of the maltogenic enzyme to the combination of alpha amylase and amyloglucosidase results in an increase in specific volume and in turn a reduction in proofing time.

D2 in example 3 discloses a Moroccan baguette recipe comprising no added sugar, 7 ppm alpha-amylase and 83 mg glucoamylase, resulting in a ratio 1 to 11.9, which is considered close to the lower level in the ratio of 12.2.

Thus the claims are considered to essentially differ from example 3 in D2 in that a maltogenic enzyme is also present / added.

The problem to be solved can thus be formulated as the provision of a composition and process for producing a bakery product with no added sugar and further reduced proofing time.

In order to solve the objective problem posed, the skilled person must not only select the third enzyme albeit also select the appropriate amount. Maltogenic enzymes are known in the field of baking for example as taught in D3 and D4 for generating sugar during baking. D1 to D4 also teach the skilled person that enzymes may be used to produce sugars in-situ in no added sugar bakery products. There is however no indication in any one D1 to D4 on how to further increase the volume and / or further reduce the proofing time.

Consequently, the product of claim 1, the process of claim 4 and their dependent claims 2, 3 and 5 to 37 are considered non-obvious in view of D2, optionally in combination with D1, D3 or D4 and to involve an inventive step.

Re Item VIII

Certain observations on the international application

The following cause a lack of clarity according to Art. 6 PCT;

- dependent claims 9 and 11 and 10 and 12 appear to be identical and
- step vi) uses the term "unbaked" whilst the previous steps use the term "pre-bake", which are not of equivalent meaning.

European Patent Office
80298 Munich
Germany

By online filing

29 November 2021

European Patent Application No. PCT/EP2021/053474

**Title: A PROCESS FOR THE PRODUCTION OF A BAKED PRODUCT WITHOUT
ADDITION OF SUGAR**

Applicant: Lantmännen Unibake Holding A/S

aera ref: P2521WO00

Dear Sirs,

In response to the Written Opinion dated 30 September 2021, please find attached an amended set of claims, wherein claims 37 and 38 have been deleted without prejudice. The wording of claim 1 has been amended to a "combination consisting of".

We are pleased to see that the Examiner acknowledges novelty of claims 1-36 and 39, now claims 1-37.

Regarding inventive step, the Examiner finds that all claims lack inventive step. The arguments are based on D1 (in relation to claims 1-3) and on D2 (in relating to claims 4-39).

We respectfully submit the amended claims to possess inventive step.

The objective technical problem is to provide a bakery product with no addition of sugar, with a suitable sweetness intensity, a good taste, a low content of fructose and wherein the proofing time of the dough is reduced and, accordingly, the volume of the bakery product is increased. The solution to the objective problem is a process as claimed in present claim 4 involving an enzymatic cocktail consisting of three different enzymes that have different activities at different temperatures as claimed in present claim 1. The



specific selection of enzymes (combination of thermo-labile alpha-amylase and thermo-stable amyloglucosidase and thermo-stable maltogenic amylase) has been found to have impact on the proofing time of the dough such that the proofing time can be reduced.

Claim 1 has now been amended to specify that the combination is a combination consisting of three enzymes in specified amounts/ratios. These amounts/ratios differ from those used in D1. D1 relates to a bread improver comprising of an enzyme composition comprising a maltogenic exoamylase, an oxidant, pregelatinized starch and malted wheat flour. The problem D1 solves is to provide bread that can be stored without freezing. D1 is totally silent regarding how the amounts/ratios should be changed in order to obtain a dough that can be proofed with decreased proofing time and a bakery product with suitable volume and sweetness intensity, good taste and low content of fructose. Therefore, we believe a person skilled in the art would not find claims 1-3 obvious in view of D3.

Regarding lack of inventive step of claims 4-39 (now claims 4-37), the main arguments of the Examiner are based on D2 optionally combined with D3 or D4. The Examiner finds that the specification and examples do not demonstrate a technical advantage over the use of an alpha-amylase and a glucoamylase, i.e. without any addition of a maltogenic enzyme. In the written opinion, the Examiner refers to Figure 7 of the present invention showing the proofing height when "all enzymes" are used versus "No sugar", "Amylase", "Maltogenic amylase", "Glucoamylase" and "Sugar ref 3%".

However, Figure 7 has two figures showing straight dough trials (described in Example 4 of the present application) and the left-hand figure of Figure 7 shows the volume index for various combinations of the enzymes:

Fau/Gluco: is alpha-amylase and amyloglucosidase (glucoamylase)

Fau/Manu: is alpha-amylase and maltogenic amylase

Gluco/Manu: is amyloglucosidase and maltogenic amylase

The index for Fau/Gluco is 130, the index for Fau/Manu is 117 and the index for Gluco/Manu is 110 compared to 135 when all enzymes are used, i.e. there is a advantage of using the three enzymes compared to only using an alpha-amylase and amyloglucosidase. Moreover, from the right-hand part of Figure 7 it can be seen that use of the maltogenic amylase (Manu) alone lead to a poorer result than when using "No sugar". Therefore, it should be expected that use of the combination Fau/Glu/Manu, i.e. using the three enzymes would lead to a poorer result than using Fau/Glu alone. However, as mentioned above, this is not the case as the Fau/Glu/Mau has a higher index than Fau/Glu.



In view of Example 3 of D2, the Applicant has conducted the following comparison experiments for Moroccan baguettes:

Ingredients % from flour	Benchmark	NZ no sugar	Only Novamyl	Combo: Amylase/Maltogenic amylase/ Gluco amylase
Wheat flour	100	100	100	100
Fresh yeast	2,5	2,5	2,5	2,5
Salt	1,5	1,5	1,5	1,5
Sugar	3	0	0	0
Water*	55	55	55	55
Enzymes solutions according to invention				
Panzea	25 ppm / pr kg flour	25 ppm / pr kg flour	25 ppm / pr kg flour	25 ppm / pr kg flour
Fungamyl 4000 SG	7 ppm / pr kg flour	7 ppm / pr kg flour	7 ppm / pr kg flour	7 ppm / pr kg flour
Glucoamylase		83 ppm/ kg flour		350 ppm / pr kg flour
Maltogenic amylase			150 ppm / pr kg flour	150 ppm / pr kg flour
Asorbic acid	40 ppm / pr kg flour	40 ppm / pr kg flour	40 ppm / pr kg flour	40 ppm / pr kg flour

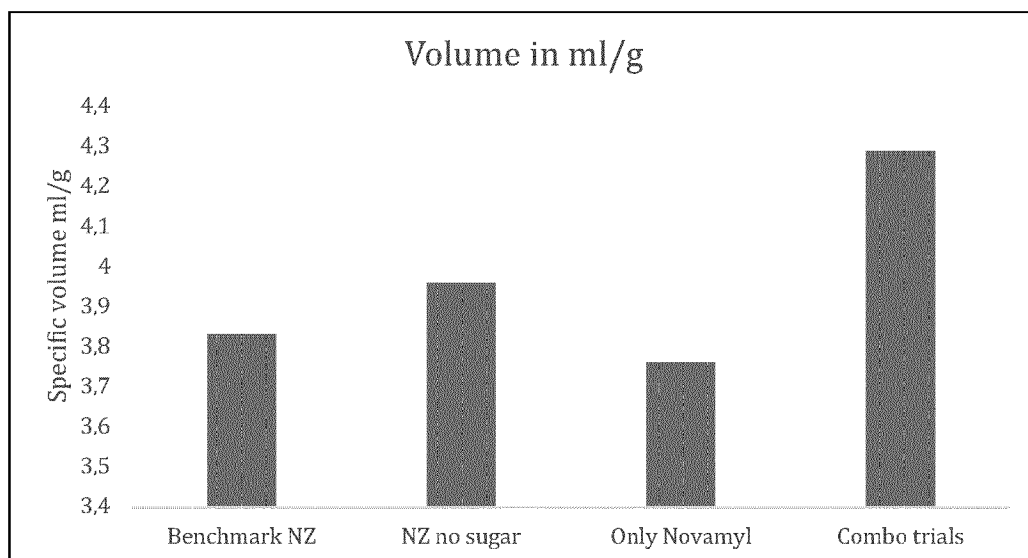
“Benchmark” includes sugar, “NZ no sugar” corresponds to Example 3 of D2, “only Novamyl” does not include glucoamylase, and “Combo” includes the enzyme cocktail according to the present invention

The process used was:



Procedure	time / min
Mixing at low speed 17 rpm/ high speed 35 rpm (Diosna)	2+5 min
Tempratur after mix	26-26,5 C
Floortime	15 min
Scaling dough 4x 300 g	5 min
Proofing 32C/ 82rh	120 min
Flour Dana+ from Cerelia mills	*Mixtime accoring to flour
Baking 220 C (deck oven)	18 min

The results obtained were:



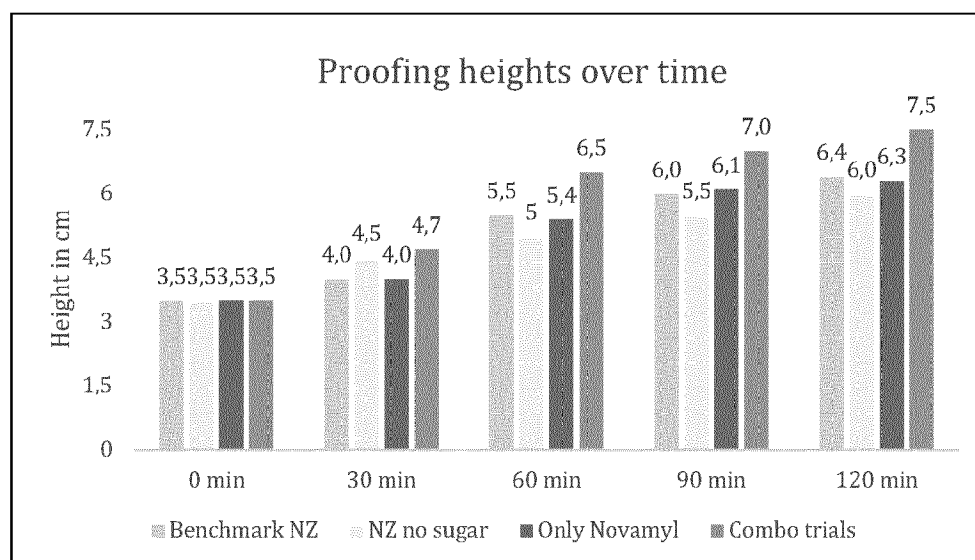
Benchmark: 3.83 ml/g (only alpha amylase) index 100
 NZ no sugar: 3.96 ml/g (alpha amylase and glucoamylase) index 103
 Only Novamyl: 3.76 ml/g (alpha amylase and maltogenic amylase) index 98
 Combo: 4.29 ml/g (alpha amylase, glucoamylase and maltogenic amylase) index 112

It is clearly seen that the dough containing the enzyme cocktail according to the invention results in a much higher volume than the other tested doughs with other combinations of enzymes. It is also seen that "Only Novamyl" is not as effective and, therefore it should have been expected that maltogenic amylase in the "Combo" trial should lead to a lower



index than the index for “NZ no sugar”. However, this is not the case as the index for “Combo” is higher.

The results obtained are in compliance with the results seen from Example 4 (Figure 7) of the present invention.



The results shown above relating to proofing heights over time show that “Combo” led to a faster proofing and the height of the dough “Combo” reached at 60 min is not reached for any of the other tested enzyme combinations at 120 min.

The Applicant has also repeated Example 4 of D2 relating to toast bread, but where sugar is omitted from Example 4 of D2. The following recipes were used:



Ingredients % from flour	Benchmark	NZ no sugar	Only Novamyl	Combo: Amylase/Maltogenic amylase/ Gluco amylase
Wheat flour	100	100	100	100
Fresh yeast	4	4	4	4
Salt	1,5	1,5	1,5	1,5
Sugar	1,5	0	0	0
Water*	57	57	57	57
Enzymes solutions according to invention				
Panzea	25 ppm / pr kg flour	25 ppm / pr kg flour	25 ppm / pr kg flour	25 ppm / pr kg flour
Fungamyl 4000 SG	7 ppm / pr kg flour	7 ppm / pr kg flour	7 ppm / pr kg flour	10 ppm / pr kg flour
Glucoamylase		83 ppm/ pr kg flour		350 ppm / pr kg flour
Maltogenic amylase			150 ppm / pr kg flour	150 ppm / pr kg flour
Asorbic acid	60 ppm / pr kg flour	60 ppm / pr kg flour	60 ppm / pr kg flour	60 ppm / pr kg flour

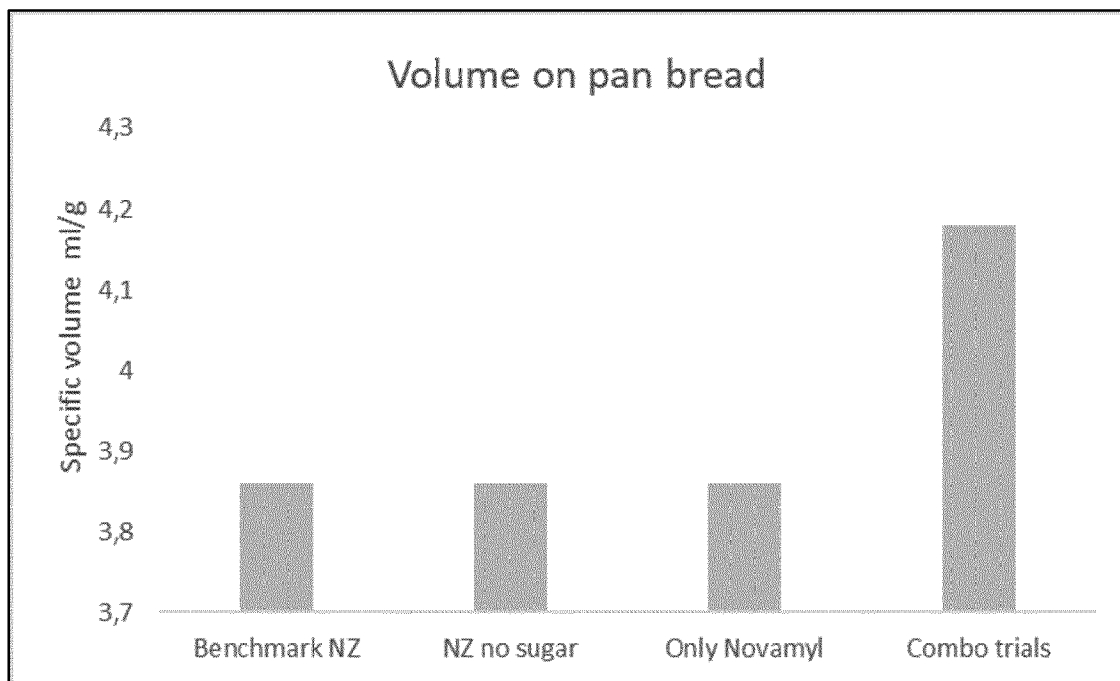
“Benchmark” includes sugar, “NZ no sugar” corresponds to Example 4 of D2, “only Novamyl” does not include glucoamylase, and “Combo” includes the enzyme cocktail according to the present invention.

The process used was:

Procedure	time / min
Mixing at low speed 17 rpm/ high speed 35 rpm (Diosna)	3+7 min
Tempratur after mix C	27-28 C
Floortime	15 min
Scaling dough 4x 600 g	10 min
Benchtime	20 min
Proofing 55 min/ 32C/86	120 min
Flour Dana+ from Cerelia mills	*Mixtime accoring to flour
Baking with steam 220 C	30 min



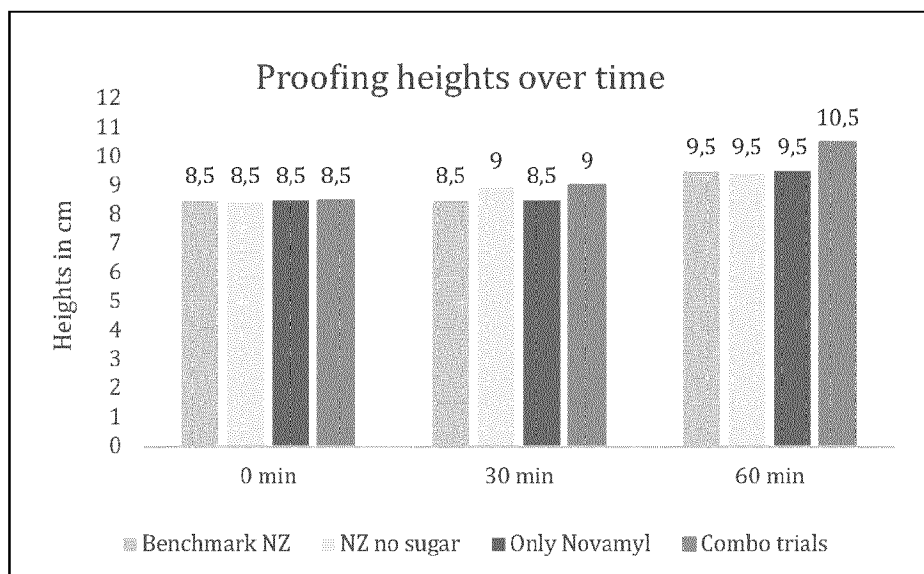
The results obtained regarding specific volume were:



Benchmark:	3.86 ml/g (only alpha amylase)	index 100
NZ no sugar:	3.85 ml/g (alpha amylase and glucoamylase)	index 100
Only Novamyl:	3.65 ml/g (alpha amylase and maltogenic amylase)	index 95
Combo:	4.18 ml/g (alpha amylase, glucoamylase and maltogenic amylase)	index 108

As in the experiments with baguette, it is clearly seen that the dough containing the enzyme cocktail according to the invention results in a much higher volume than the other tested combinations of enzymes. It is also seen that “Only Novamyl” is not as effective and, therefore it should have been expected that maltogenic amylase in the “Combo” trial should lead to a lower index than the index for “NZ no sugar”. However, this is not the case as the index for “Combo” is higher.

The results obtained are also in compliance with the results seen from Example 4 (Figure 7) of the present invention.



The results relating to proofing heights over time show that “Combo” led to a faster proofing and the height of the dough “Combo” reached at 60 min is higher than the height reached for any of the other tested enzyme combinations.

The results of the experiments carried out by the Applicant clearly demonstrates unexpected advantages by using the enzyme cocktail according to the present invention. The time for proofing of the dough is markedly reduced and the volume is markedly increased. This leads to a more feasible and economic process compared with doughs with a longer proofing time.

A decrease in proofing time of a dough containing the enzyme cocktail of the invention and with no sugar added is also seen when compared with a dough containing added sugar. Thus, in Example 8 of the present application proofing heights have been measured (Toast with no sugar, 3% sugar, 6% sugar and the enzyme cocktail, see Figure 10 and the same for buns, with no sugar, but 6% or 14% sugar and the enzyme cocktail, see Figure 12). In these experiments the combination of alpha-amylase and amyloglucosidase have not been included, but the experiments clearly demonstrate the decrease in proofing time. The results are described on page 39-41 of the application as filed:

The results for toast are shown in Figs 10 and 11 and explained on page 39:

“As seen from Fig. 10 an increase in height after 30 min is about 66% for the dough with the three enzymes compared with about 33% for the doughs containing 3% or 6% sugar. After 45 min the increase is about 133% for the dough with the three enzymes compared with about 80% for the doughs containing 3% or 6% sugar. After 60 min the increase is about 200% for the dough with the three enzymes compared with about 80-150% for the doughs containing 3% or 6% sugar. In order to gain twice the height compared with the



start value, a toast dough containing the combination of the three enzymes according to the invention will reach this at least 15 min faster than that obtained for dough with 0%, 3%, 6% sugar without the combination of enzymes.”

And the results for buns are shown in Figs. 12 and 13 and explained on page 40-41:

“As seen from Fig. 12 an increase in height after 30 min is about 266% for the dough with the three enzymes compared with about 43%-66% for the doughs containing 6% or 14% sugar. After 60 min the increase is about 200% for the dough with the three enzymes compared with about 66%-133% for the doughs containing 6% or 14% sugar. After 90 min the increase is about 233% for the dough with the three enzymes compared with about 133%-200% for the doughs containing 6% or 14% sugar. In order to gain twice the height compared with the start value, a bun dough containing the combination of the three enzymes according to the invention will reach this at least 15 min faster than that obtained for dough with 6% or 14% sugar without the combination of enzymes.”

The Examiner also refers to D3 and D4. Example 5 of D3 uses a combination of maltogenic amylase and amyloglucosidase, and D4 mentions maltogenic amylase. However, in neither D3 nor D4 is any indication or mention that advantages regarding proofing time and high volume could be obtained if a combination of maltogenic amylase, amyloglucosidase and alpha amylase is used.

Therefore, we believe there would be no motivation for a person skilled in the art to add a maltogenic amylase to the two enzymes, alpha amylase and amyloglucosidase, used in D2.

In conclusion we believe the present invention as defined in the amended claims is novel and inventive.

Concluding Remarks

In case the Examiner does not agree that all the new claims are properly based on the application as originally filed, or that the invention defined in the new set of claims is novel or comprises an inventive step, and the Examiner thus considers issuing a negative International Preliminary Report on Patentability (IPRP), we respectfully request pursuant to Rules 66.4 and 66.6 PCT that a second Written Opinion is issued and, as an auxiliary measure, that a telephone interview is conducted prior to issuing the IPRP.

It should be noted that the applicant reserves the right to re-introduce subject matter not covered by the amended set of claims later in the national phase prosecution of the present patent application.



Yours faithfully,
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CLAIMS – amended in response to Written Opinion – November 2021

1. A combination consisting of an alpha-amylase (EC 3.2.1.1), which is thermo-labile and has activity in a range of from 30 to 65 °C, an amyloglucosidase (EC 3.2.1.3), which is thermo-stable and has optimum activity at about 60-65 °C, and a maltogenic amylase (EC 3.2.1.133), which has optimal activity in a range of from 50 to 75 °C, and wherein the thermo-labile alpha-amylase, the thermo-stable amyloglucosidase and the maltogenic amylase are present in ratios corresponding to
 - from 20 to 48 Fau or from 28 to 40 Fau of the thermo-labile alpha-amylase,
 - from 578 to 1650 Agu or from 660 to 1650 Agu of the thermo-stable amyloglucosidase, and
 - from 500 to 2500 Manu or from 1000 to 2500 Manu of the maltogenic amylase.
2. A combination according to claim 1 for use in the preparation of a bakery product with no-added sugar.
3. A combination according to any one of the preceding claims further comprising a fiber.
4. A process for producing a bakery product with no-added sugar, the process comprising
 - i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
 - ii) proofing the dough,
 - iii) optionally shaping the dough into a desired form,
 - iv) optionally, infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by freezing at about -18 °C, and
 - v) optionally pre-baking or baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.
5. A process according to claim 4 comprising
 - i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and

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- optionally other ingredients common for preparing a dough, to obtain a dough,
- 5 ii) proofing the dough,
- iii) optionally shaping the dough into a desired form,
- iv) optionally, infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by freezing at about -18 °C, and
- v) baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.
- 10 6. A process according to claim 4, comprising
- i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
- 15 ii) proofing the dough,
- iii) optionally shaping the dough into a desired form,
- iv) optionally, infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by freezing at about -18 °C, and
- 20 v) pre-baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.
7. A process according to claim 4, comprising
- i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
- 25 ii) proofing the dough,
- iii) optionally shaping the dough into a desired form,
- iv) optionally, infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by freezing at about -18 °C, and
- 30 v) pre-baking the optionally shaped dough at a temperature in a range of from 180 to 250°C, followed by

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- vi) infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by frezzing at about -18 °C.

8. A process according to claim 4 comprising

- 5 i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
- 10 ii) proofing the dough,
- iii) shaping the dough into a desired form,
- iv) optionally, infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by frezzing at about -18 °C, and
- 15 v) baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.

9. A process according to claim 4 comprising

- 20 i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
- ii) proofing the dough,
- iii) optionally shaping the dough into a desired form,
- 25 iv) infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by frezzing at about -18 °C, and
- v) optionally pre-baking or baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.

30 10. A process according to claim 4 comprising

- i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,

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- 5
- ii) proofing the dough,
 - iii) shaping the dough into a desired form,
 - iv) infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by frezzing at about -18 °C, and
 - v) optionally pre-baking or baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.

11. A process according to claim 4 comprising

- 10
- i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
- 15
- ii) proofing the dough,
 - iii) optionally shaping the dough into a desired form,
 - iv) infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by frezzing at about -18 °C, and
- 20
- v) optionally pre-baking or baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.

12. A process according to claim 4 comprising

- 25
- i) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
 - ii) proofing the dough,
 - iii) shaping the dough into a desired form,
- 30
- iv) infreezing the un-baked product at a temperature in a range of from -35 °C - -45 °C for a time period of from about 15 min to about 30 min followed by frezzing at about -18 °C, and
 - v) optionally pre-baking or baking the optionally shaped dough at a temperature in a range of from 180 to 250°C.

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13. A process according to claim 4 comprising
- a) mixing flour with a content of damaged starch of at least 5% by weight with a combination as defined in any one of claims 1-3; a yeast; water, and optionally other ingredients common for preparing a dough, to obtain a dough,
 - b) proofing the dough,
 - c) baking the dough at a temperature in a range of from 180 to 250 °C.
14. A process according to any one of claims 5, 6, 7, 8, 9, 10, 11, 12, 13, wherein the time of proofing to obtain a specified height of the dough is reduced with from 30% to 50% compared with the time of proofing of a dough to the same specified height, wherein the comparison dough has the same ingredients apart from omission of the combination as defined in any one of claims 1-3 and apart from inclusion of 6-7% sugar.
15. A process according to any one of claims 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, wherein the time of proofing to obtain twice the height compared with the start value is at least 15 min faster such as about 15 to 30 min faster for a dough containing the combination as defined in any one of claims 1-3 than that obtained for dough with 6% or 14% sugar without the combination as defined in any one of claims 1-3.
16. A process according to any one of claims 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, wherein the mixing step and the proofing step involve the action of the thermo-labile alpha-amylase as defined in claim 1 on starch polysaccharides in the flour to produce fermentable sugar.
17. A process according to any one of claims 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, wherein proofing step involves the action of the thermo-stable amyloglucosidase as defined in claim 1 and the maltogenic amylase as defined in claim 1 on poly-, oligo- and/or di-saccharides in the dough to increase the content of glucose and maltose in the baked product.
18. A combination according to any one of claims 1-3 or a process according to any one of claims 4-17, wherein the thermo-labile alpha-amylase is selected from fungal alpha-amylases or bacterial alpha-amylases.
19. A combination according to any one of claims 1-3, 18 or a process according to any one of claims, 4-18 wherein the alpha-amylase is a fungal alpha-amylase.

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20. A combination according to claim 19 or a process according to claim 19, wherein the fungal alpha-amylase is an endo-amylase that hydrolyzes (1,4)-alpha-D-glucosidic linkages in starch polysaccharides and is obtained from *Aspergillus oryzae*.
- 5 21. A combination according to any one of claims 1-3, 18-20 or a process according to any one of claims 4-20, wherein the maltogenic amylase has an optimum activity in a temperature range from 57 to 65°C.
- 10 22. A combination according to any one of claims 1-3, 18-21 or a process according to any one of claims 4-21, wherein the maltogenic amylase hydrolyzes (1,4)-alpha-D-glucosidic linkages in polysaccharides.
23. A combination according to any one of claims 1-3, 18-22 or a process according to any one of claims 4-22, wherein the maltogenic amylase is selected from amylases produced by bacteria.
- 15 24. A combination according to any one of claims 1-3, 18-23 or a process according to any one of claims 4-23, wherein the maltogenic amylase is produced by *Bacillus subtilis* (Novamyl 10000 BG) or *Bacillus stearothermophilus*.
- 20 25. A combination according to any one of claims 1-3, 18-24 or a process according to any one of claims 4-27, wherein the thermostable amyloglucosidase hydrolyzes terminal 1,4 linked alpha-D-glucosidic linkages from maltooligo- and polysaccharides to produce beta-D-glucose.
- 25 26. A combination according to any one of claims 1-3, 18-25 or a process according to any one of claims 4-28, wherein the thermostable amyloglucosidase is derived from *Aspergillus niger*.
27. A process according to any one of claims 5, 6, 7, 8, 13, wherein the dough is baked at a temperature in a range of from 180 to 250 °C, and a baked product is obtained having a fructose content of at the most 1% by weight.
- 30 28. A process according to any one of claims 4-27, wherein the yeast is *Saccharomyces cerevisiae*.
- 35 29. A process according to any one of claims 5, 6, 7, 8, 13, wherein the dough is baked and a baked product is obtained comprising

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- i) fructose in a concentration of at the most 2.6% by weight such as at the most 2.0% by weight or about 1% by weight,
 - ii) glucose in a concentration range from about 1.5 to about 4.5% by weight,
 - iii) lactose in a concentration of at the most 0.5% by weight,
 - iv) maltose in a concentration range of from 2.5 to 5.5% by weight,
 - v) saccharose in a concentration of at the most 0.5% by weight,

wherein the concentration is based on the total weight of the baked product.

30. A process according to claim 29, wherein the concentration of fructose in the baked product is 0.4, 0.7, 0.6, or 0.6% by weight.
- 10 31. A process according to claim 29 or 30, wherein the concentration of glucose in the baked product is in a range from about 3.0 to about 4.5% by weight or from about 3.5 to about 4.5% by weight.
32. A process according to any one of claims 29-31, wherein the concentration of glucose in the baked product is 3.8, 4.1, or 3.7% by weight.
- 15 33. A process according to any one of claims 29-32, wherein the concentration of lactose in the baked product is 0.1%.
34. A process according to any one of claims 29-33, wherein the concentration of maltose in the baked product is in a range from about 2.9 to about 3.6% by weight.
35. A process according to any one of claims 29-34, wherein the concentration of maltose in the baked product is 4.3, 5.2, or 3.2 by weight.
- 20 36. A process according to any one of claims 29-35, wherein the concentration of saccharose in the baked product is 0.1% by weight.
- 25 37. A combination according to claim 2, wherein the bakery product is a baked product as defined in any one of claims 29-36.

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