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(54) Virsraksts: **Paņēmiens starpprodukta, īpaši nesijātu miltu mīklas, iegūšanai no graudiem pārtikas produktu un līdzīgu produktu ražošanai**

(57) Kopsavilkums: Izgudrojums attiecas uz paņēmienu starpprodukta, īpaši nesijātu miltu mīklas, iegūšanai no graudiem pārtikas produktu, lopbarības vai līdzīgu produktu ražošanai, kas ietver graudu homogenizēšanu kontrolējamos temperatūras un mitruma apstākļos. Izgudrojums attiecas arī uz tādā veidā iegūtu nesijātu miltu mīklu vai, piemēram, no graudiem iegūtu nesēju maizes cepšanas piedevu maisījumiem. Bez tam izgudrojums attiecas arī uz nesijāto miltu mīklas izmantošanu nesijātu miltu maizes izstrādājumu pagatavošanai.

## PATENTA FORMULA

1. Paņēmiens starpprodukta iegūšanai no graudiem pārtikas produktu, lopbarības vai līdzīgu produktu ražošanai,
**atšķirīgs ar to,** ka graudus homogenizē ar ātru triecienmaisīšanas apstrādi kontrolējamos temperatūras un mitruma apstākļos.

2. Paņēmiens saskaņā ar 1. punktu,
**atšķirīgs ar to,** ka graudus homogenizē veselu graudu, nolobītu graudu, saspiestu graudu vai nolobītu, saspiestu graudu formā.

3. Paņēmiens saskaņā ar 1. vai 2. punktu,
**atšķirīgs ar to,** ka graudi tiek homogenizēti šķidruma klātbūtnē.

4. Paņēmiens saskaņā ar jebkuru no iepriekšējiem punktiem,
**atšķirīgs ar to,** ka temperatūra un mitrums tiek regulēti, regulējot homogenizatora jaudu un/vai šķidruma daudzumu homogenizatorā.

5. Paņēmiens saskaņā ar jebkuru no iepriekšējiem punktiem,
**atšķirīgs ar to,** ka tiek gatavota nesijātu miltu mīkla.

6. Paņēmiens saskaņā ar 5. punktu,
**atšķirīgs ar to,** ka nesijāto miltu mīkla tiek gatavota, apvienojot graudus veselu graudu formā ar citām sastāvdaļām un samaisot maisījumu homogēnā mīklā ar ātro triecienmaisīšanas apstrādi.

7. Paņēmiens saskaņā ar 6. punktu,
**atšķirīgs ar to,** ka nesijāto rudzu miltu mīkla tiek gatavota, apvienojot veselus rudzu graudus ar ūdeni, raugu, sāli un citām iespējamām piedevām un samaisot maisījumu homogēnā mīklā ar ātro triecienmaisīšanas apstrādi.

8. Paņēmiens saskaņā ar 6. punktu,
**atšķirīgs ar to,** ka neraudzēta vai skābena rudzu miltu mīkla tiek gatavota, apvienojot veselus rudzu graudus ar ieskābušu rudzu mīklu, ūdeni, raugu, sāli un citām iespējamām piedevām un samaisot maisījumu homogēnā mīklā ar ātro triecienmaisīšanas apstrādi.

9. Paņēmiens saskaņā ar 6. punktu,
**atšķirīgs ar to,** ka triecienmaisīšanas apstrādes stadijā mīklā papildus tiek ievadīta gāze.

10. Paņēmiens saskaņā ar jebkuru no iepriekšējiem punktiem,
**atšķirīgs ar to,** ka graudu sasmalcināšana tiek regulēta, savienojot triecienapstrādes stadiju ar sijāšanas un/vai šķirošanas ierīci.

11. Paņēmiens saskaņā ar 10. punktu,
**atšķirīgs ar to,** ka neapstrādātā frakcija, ko iegūst sijāšanas un/vai šķirošanas ierīcē, tiek atgriezta triecienmaisīšanas stadijā tālākai smalcināšanai.

12. Paņēmiens saskaņā ar jebkuru no iepriekšējiem punktiem,
**atšķirīgs ar to,** ka tiek gatavots graudu produkts, kur graudu birstamības skaitlis tiek paaugstināts, paaugstinot homogenizēšanas jaudu un/vai samazinot šķidruma daudzumu homogenizatorā.

13. Paņēmiens saskaņā ar jebkuru no iepriekšējiem punktiem,
**atšķirīgs ar to,** ka sausa mīkla tiek gatavota, samazinot šķidruma daudzumu homogenizatorā un strādājot zemā temperatūrā.

14. Nesijātu miltu mīkla, kas gatavota ar paņēmienu saskaņā ar jebkuru no 5.-13. punktiem.

15. No graudiem ar paņēmienu saskaņā ar jebkuru no 1.-4. punktiem iegūts nesējs maizes cepšanas piedevu maisījumiem.

16. Rudzu nesijātu miltu mīklas, kas iegūta saskaņā ar jebkuru no 5.-13. punktiem, izmantošana nesijātu miltu maizes izstrādājumu pagatavošanai.

17. Nesijātu rudzu miltu mīklas, kas iegūta saskaņā ar 7. punktu, izmantošana rudzu trauslo sausiņu pagatavošanai.

18. Nesijātu rudzu miltu mīklas, kas iegūta saskaņā ar 8. punktu, izmantošana skābenas vai neraudzētas svaigas rudzu maizes pagatavošanai.

# Process for the manufacture of a semi-finished product, especially a wholemeal dough, from grain for foodstuffs and the like

The invention relates to a process for the manufacture of a semi-finished product from grain for foodstuffs, fodders, and the like, by homogenizing the grain under controlled temperature and moisture conditions. The semi-finished product so obtained may be e.g. a wholemeal dough used in the preparation of wholemeal bakery products.

An essential feature of the process according to the invention is that grain is processed without a preceding grinding or milling stage. In the preparation of a wholemeal dough, for instance, grain is combined with other dough ingredients in the form of whole grains instead of the traditional use of flour, whereafter a dough is prepared by stirring the dough mixture into a homogenous mass under wet milling conditions, the whole grains being ground simultaneously. In the processing of grain the traditional milling stage is thus omitted, as the grain can be delivered to bakeries or other processing plants as whole grains, i.e. in unground form.

The milling stage traditionally forms an essential part of the processing of grain prior to the baking stage. In a typical modern mill, grain is first cleaned, dried (if required), and then conditioned, i.e. the moisture content of storage-moist grain (below 14%) is increased to about 16% to facilitate the separation of bran. With bread grain, the next stage is the actual milling, which takes place step by step in roller mills which perform crushing, sieving, grading and grinding. Middlings formed at the crushing stage are separated by plan sifters and middlings

purifiers into different degrees of coarseness. Some of the middlings are passed to subsequent, finer rollers, some to purifiers. Purifiers separate the kernel and surface middlings by sieving and gravity separation (kernel fractions are heavier). Surface middlings are reground. Obtained flour separated by plan sifters is passed into bins. Flour of uniform quality is packed. Maturing agents, ascorbic acid, amylase and protease enzymes may be added to flour in connection with grinding. Wheat flour may also be bleached and supplemented with vitamins and minerals.

Wheat, for instance, yields the following products in connection with milling: wheat bran, whole-wheat crushings, wheat germs, grits and wheat flour (wheat wholemeal flour, white bread flour, all-purpose wheat flour, medium-coarse wheat flour, coarse wheat flour, and speciality or kernel wheat flour).

In the milling of rye a considerably smaller number of milling fractions are recovered. They include rye flour (rye wholemeal flour, sifted rye flour, bolted rye flour) and whole-rye crushings. Rye flour is not bleached, enriched, or supplemented. Milling of barley and oats and preparation of barley and oat flakes comprise their own specific process stages (such as polishing and dehusking).

Grain ground in this way is delivered to bakeries, where a dough is prepared by combining the flour typically with water, yeast, salt and other possible additives. The dough can be prepared by different type of processes, the most usual being the one-stage process and the multi-stage process. In the one-stage process, all raw materials are mixed at the same time into a dough, which is kneaded typically for 8 to 20 minutes. This process is most widely used in the preparation of wheat bread and mixed bread. In the

multi-stage process, part of the flour to be used for a dough is handled in one or more preliminary stages (sour, sourdough, etc.). Nearly all rye bread products, for instance, are prepared by this process. When the baking raw material consists of flour from which one of the grain components (usually husks or germ) has been removed, a separate milling stage is necessary. On the contrary, whole grains can be used in addition to flour in the preparation of wholemeal products.

At present, however, a common practice is to separate the milling stage and the baking stage even in the preparation of wholemeal products. Wholemeal is traditionally prepared in a normal mill by combining fractions of different degrees of coarseness so that the final wholemeal contains all cereal grain components.

However, it is to be noted that as wholemeal contains all grain components (such as the fat-containing germ that easily turns rancid), it decays quickly or at least deteriorates in quality in a relatively short time. The storage life of whole cereal grains (several years) is of quite a different order than that of flour. When cereal grains are used as raw material in the baking of wholemeal products, the decay problem associated with flour is avoided and the span of time between grains and a final bakery product is minimized, which will certainly affect the flavour and freshness of the product.

The process according to the invention is also very useful when there is no mill available though there are grains, and when the final bakery product should be obtained from grains as soon as possible.

The invention relates to a process for the manufacture of a semi-finished product from grain for

foodstuffs, fodders or the like by homogenizing the grain under controlled temperature and moisture conditions.

The semi-finished product is especially a wholemeal dough, such as a wheat wholemeal or rye wholemeal dough. It may also be a grain-based carrier material for mixtures of baking additives. In addition, the semi-finished product may be a product prepared from wheat, rye, barley, or oats, and intended for use in starch or fodder industries.

As used herein, the homogenization of grain refers to the refining of cereal grains while simultaneously mixing them into a homogenous product. Grain to be homogenized may consist of whole grains, dehusked grains, pre-crushed grains (grain fragments) or dehusked pre-crushed grains. The falling number of the grain is not a limiting factor, but even grain with a lower falling number can be used in the process. The moisture content of the grain is not either limiting, although it is usual to use storage-moist grain (moisture content about 12 to 14%).

Cereal grains to be processed are cleaned prior to use by conventional methods so as to remove impurities (straws, stones, etc.) mixed with the grains in harvesting and threshing.

Grain may be homogenized dry (at storage moisture) or in the presence of liquid, usually water. When storage-moist grain is processed without liquid or in the presence of a liquid amount as small as possible at a high homogenizing power, the temperature of the grains increases under the influence of the mechanical energy exerted on them, and so the grains are not only refined but also heat-treated, which increases the falling number of the grains, i.e. improves the baking characteristics of the grain. In

this way, grain with a low falling number can be used as raw material. The heat treatment results in a homogenized, heat-treated, almost dry grain powder which can be used as a dough component immediately or after storage.

In the preparation of a wholemeal dough, for instance, grain is homogenized in the presence of dough liquid.

Homogenization of grain may be performed in any device capable of breaking the grains and of operating both under dry and moist conditions and within a relatively wide temperature range. Preferably, an impact-mixer type device is used, which operates even under moist conditions.

Temperature and moisture are controlled by adjusting the power of the homogenizing device and/or the amount of liquid in the homogenizing device. As mentioned above, when a high mixing/refining power and the smallest possible amount of liquid are used, the temperature of the grains increases due to the mechanical energy exerted on them, so that the grains are heat-treated. A relatively large amount of liquid is used when the dough prepared from the grains is to be baked immediately. On the contrary, a very small amount of liquid and a low temperature are used when a so-called dry dough is prepared.

Homogenization of grain in the preparation of a wholemeal dough, for instance, is preferably performed as wet milling in an impact-mixer type device.

In order that the homogenization of grain could be adjusted, the homogenizing device is combined with a sieving and/or grading device. A coarse fraction obtained from the sieving and/or grading stage can thus be recycled into the homogenizing device for further refining.

In the following the invention will be described more fully with respect to the preparation of a wholemeal dough.

The invention relates especially to a process for preparing a wholemeal dough by combining whole grains with other dough ingredients and stirring the obtained mixture into a homogenous dough by wet milling. The wholemeal dough so obtained is usually baked immediately into a final wholemeal bakery product by conventional baking methods.

Grain raw material may be of any kind, but the invention relates especially to the preparation of a rye wholemeal dough to be used in the preparation of rye wholemeal bakery products, such as rye crispbread and sour or unleavened fresh rye bread. Wheat may also be used. Also, it is possible to combine wheat and rye. Grain with a lower falling number may also be used as the falling number can be altered during dough preparation by adjusting the mixing power and the amount of dough liquid so that the obtained dough will have suitable baking characteristics. Storage-moist grains are usually used in the process. It is also possible to use undried grains (moisture content below 30%), especially in cases where they can be used very soon after harvesting. Grains are processed whole or possibly after pre-crushing (as grain fragments).

To prepare a dough for rye wholemeal crispbread, rye grains are combined with water, yeast, salt and other possible additives, and the mixture is stirred into a homogenous dough by wet milling. In the preparation of fresh sour rye bread, rye sour is also mixed in. The obtained mixture of dough ingredients is subjected to intense mixing and grinding in a wet milling device. Wet milling may be performed in any mixer/grinder device having a sufficient power to

break the grains and capable of operating under wet milling conditions. For instance, an Atrex mixer (supplier Flowcon Ltd., Valkeakoski, Finland) may be used. In wet milling all dough ingredients are brought into intimate contact with each other.

A finished dough so obtained is baked by conventional methods into final bakery products, such as fresh bread, crispbread, biscuits, etc. Preferably, the obtained dough is used in the preparation of fresh rye bread, such as hollow rye loaves (a round flat rye bread with a hole in the middle), and rye crispbread.

In the preparation of so-called ice bread, gas (air or carbon dioxide) is incorporated in the dough in addition to the conventional dough ingredients. The process takes place at a low temperature of about +4 to +8°C. A sufficiently low temperature is obtained e.g. by a heat exchanger. At such a low temperature, an optimal amount of gas is retained in the dough so that the bread will subsequently raise under the influence of the gas when temperature is risen.

The amount of water used in wet milling may vary. In the preparation of rye dough, about 1 kg of grains is typically used per 700 to 900 g of water. In the preparation of sourdough, 1 kg of grains per 1.5 kg of water is used, calculated on the final dough. In the preparation of so-called dry dough, only about 0.3 kg of water per 1 kg of grains is used, and the process takes place at a very low temperature. Such a dry dough keeps relatively well when kept cool; on one hand it does not decay and on the other hand its microorganisms remain viable for subsequent souring of the dough. As dry dough endures well storage and delivery, it is possible to prepare a larger batch of dough at a catering centre, and then deliver it to smaller bakeries for preparation of final bakery

products.

At the wet milling stage it is also possible to increase the falling number of grain of inferior quality. The operating temperature of the device rises when a high grinding/mixing power is used or the amount of dough liquid is reduced, and so the grains will be heat-treated while the α-amylase enzyme of the grains is inactivated. The higher the α-amylase activity, the lower the falling number and the worse the baking characteristics of the grain. With rye, for instance, such inferior baking characteristics include reduced dough yield, extremely forceful proof, increased loaf volume at the expense of bread texture, very dark crust colour, poor bread texture and dark crumb, lack of crumb elasticity, chewing-gum-like breadcrumb structure, and sweet bread flavour. The process according to the invention allows the falling number to be increased e.g. from 62 to 150, which improves the usability of grain of inferior quality.

Grain starch can be pregelatinized by performing wet milling in the presence of hot water or by introducing hot steam into the material to be ground. Obtained pregelatinized dough mass can be used as a dough component to improve the anti-staling properties of the final product (bread) (the so-called skållning method).

Wet milling brings all dough components into intimate contact with each other, which improves the baking characteristics of the dough. In this way, the use of additives, such as emulsifiers and enzymes, can be minimized.

It is also possible to perform sieving and/or grading after the mixing (wet milling) of the dough by connecting e.g. a wet sieve after the mixing unit. The coarse fraction can thus be recycled to the mixer for

further refining. Similarly, sieving/grading may be performed after pre-crushing. In this way one will get closer to the particle size distribution of normal coarse rye flour, and a larger amount of fine flour is obtained, which affects favourably the properties of the end product. Refined fraction contains larger quantities of broken starch usable as nutrient of yeast or bacteria. Further cleaving of broken starch e.g. enzymatically produces sugars that give the bread colour and flavour.

Sieving/grading devices also more generally allow adjustment of the ratio between coarse and fine flour fractions in the final bakery product.

The invention will be illustrated by the following detailed working examples.

In the examples, two commercial devices were used for dough preparation: Atrex grinder and Atrex mixer (device supplier Flowcon Ltd., Valkeakoski, Finland). These devices can be used for grinding and mixing materials of widely varying types. In the devices, grinding and mixing are based on the utilization of impact energy and attrition. They may be classified mainly as impact-mixer type devices. In such devices, the grinding takes place in a substantially horizontal chamber where the grinding/mixing means (plates) are arranged/may be arranged at a varying angle with respect to each other. The mutual position of the grinding/mixing means may be varied, which allows the grinding power to be adjusted (the grains may pass through in an almost unground state or after having been subjected to a sufficient desired impact-grinding treatment).

Example 1. Preparation of dough from whole cereal grains

Unprocessed rye grains (falling number of rye 130) were introduced by a screw feeder into the above-described Atrex mixer (mass flow rate 5 kg/min). A premixed suspension of sourdough (= soured rye dough), yeast, salt and water was introduced through a dosage device at a mass flow rate of 7.1 kg/min. The amounts were as follows:

| | (kg) |
|---|---|
| Unground rye | 24.0 |
| Sourdough of rye | 24.0 |
| Water | 8.0 |
| Yeast | 1.5 |
| Salt | 0.58 |

The sourdough contained 8.6 kg of rye flour (fine, Melia) and 15.4 kg of water. The pH of the sourdough (18 h) was 3.5 and its acid number 20.5.

Processing conditions in the mixer were as follows:

| | |
|---|---|
| Upper rotor (rpm) | 1,900 |
| Lower rotor (rpm) | 1,500 |
| Mass flow of grains (kg/min) | 5.0 |
| Mass flow of liquid (kg/min) | 7.1 |
| Rye temperature (°C) | 13 |
| Liquid temperature (°C) | 22 |
| Dough temperature (°C) | 30 |

The grains were broken into flour when they passed through the mixer. The following table shows the particle size distribution obtained when grains were

processed dry in the mixer without the addition of dough liquid.

Table 1. Particle size distribution of rye ground dry in the mixer

| Sieve (m) | Normal coarse rye flour (%) | Flour from Atrex mixer (%) |
|---|---|---|
| 1,600 | - | 4.0 |
| 1,320 | - | 7.3 |
| 1,000 | 2.0 | 15.0 |
| 670 | 20.0 | 27.5 |
| 390 | 28.0 | 13.9 |
| 275 | 12.0 | 8.2 |
| 132 | 9.0 | 11.3 |
| <132 | 33.0 | 12.8 |

As the grains were ground in the mixer, they also mixed with the dough liquid, and the device yielded a dough which was used in the following test baking. As compared with the preparation of a normal rye dough, the handling time of dough (normally about 7 to 10 min) is considerably shorter in the mixer. The rising of the temperature of the dough is due to the work performed during mixing.

The resulting rye dough was baked into hollow rye loaves. The following baking conditions corresponding to the average processing values of hollow rye loaves were used in the baking process:

| | |
|---|---|
| Floor time (min) | 60 |
| Dough temperature (°C) | 26.5 |
| Moulding | + |

| | |
|---|---|
| Raw weight (g) | 370.0 |
| Proofing (min/°C/RH) | 70/36/75 |
| Baking (min/°C) | 35/230 |
| Steam | normal |
| Weight after baking (g) | 265.0 |
| Baking loss (%) | 28.5 |

The test loaves were similar to conventional loaves prepared from rye flour, and they had a fresh, good flavour. The baking characteristics of the dough corresponded to those of a dough prepared from normal coarse rye flour.

Reference example. Preparation of dough from preground cereal grains

In this example, the procedure was the same as above except that rye grains were first preground in the above-described Atrex grinder. Grinding conditions in the grinder were as follows:

| | |
|---|---|
| Upper rotor (rpm) | 2,300 |
| Lower rotor (rpm) | 2,300 |
| Feeder (%) | 20.6 |
| Mass flow (kg/min) | 758 |
| Grain temperature (°C) | 12.0 |
| Flour temperature (°C) | 16.4 |

After grinding the flour was sieved in a sieve of about 2 mm to separate unground grains and the coarsest fraction (under normal grinding conditions, sieving takes place automatically in connection with grinding). The following table shows the particle size distribution of the flour obtained from the grinder (which corresponded to the particle size distribution

of the flour obtained from the mixer), the particle size distribution of normal coarse rye flour, and other properties. It is to be noted that the falling number remained unchanged.

Table 2. Particle size distributions of rye ground in an Atrex grinder and normal coarse rye flour, and other properties.

| Sieve (m) | Coarse rye flour (%) | Flour ground in Atrex mixer (%) |
|---|---|---|
| 1,600 | - | 4.0 |
| 1,320 | - | 7.3 |
| 1,000 | 2.0 | 15.0 |
| 670 | 20.0 | 27.5 |
| 390 | 28.0 | 13.9 |
| 275 | 12.0 | 8.2 |
| 132 | 9.0 | 11.3 |
| <132 | 33.0 | 12.8 |
| Moisture % | 15 ± 0.5 | 13.2 → 12.7 |
| Falling number | 130 - 170 | 130 → 132 |
| Water retention % | - | 66.5 |
| Amylogram: | | |
| Gel. temperature (°C) | - | 57.0 |
| Peak temperature (°C) | - | 64.5 |
| Max. viscosity (Bu) | - | 95 |

Preground rye was introduced into the above-described mixer by a screw feeder (mass flow rate 5 kg/min), and a premixed suspension of sourdough, yeast, salt and water was introduced by a dosage

device (mass flow rate 7.1 kg/min). The amounts of the different components were the same as in Example 1. Process conditions during mixing were as follows:

| | |
|---|---|
| Upper rotor (rpm) | 1,300 |
| Lower rotor (rpm) | 1,300 |
| Mass flow of flour (kg/min) | 5.0 |
| Mass flow of liquid (kg/min) | 7.1 |
| Rye temperature (°C) | 12.5 |
| Liquid temperature (°C) | 22 |
| Dough temperature (°C) | 30 |

In the mixer all raw materials were mixed into a dough which was baked into rye loaves similarly as in Example 1. Baking conditions were as follows:

| | |
|---|---|
| Floor time (min) | 60 |
| Dough temperature (°C) | 26.0 |
| Moulding | + |
| Raw weight (g) | 370.0 |
| Proofing (min/°C/RH) | 70/36/75 |
| Baking (min/°C) | 35/230 |
| Steam | normal |
| Weight after baking (g) | 276.0 |
| Baking loss (%) | 25.6 |

The obtained loaves were very similar to those obtained in Example 1.

Other applications

Foregoing general discussion and experimental examples are intended to be illustrative of the present invention. Other variations within the spirit and scope of this invention are possible and will

present themselves to those skilled in the art. For instance, the dough prepared by the process described in Example 1 may also be used for the preparation of other types of fresh rye wholemeal breads, such as pan breads and round hearth breads.

The same process may also be used for the preparation of a dough for rye crispbread and rye biscuits. Rye grains used as cereal raw material may be replaced with wheat grains or a mixture of wheat and rye grains.

Claims:

1. Process for the preparation of a semi-finished product from grain for foodstuffs, fodders, or the like, c h a r a c t e r i z e d in that the grain is homogenized by quick impact-mixing treatment under controlled temperature and moisture conditions.

2. Process according to claim 1, c h a r a c t e r i z e d in that the grain is homogenized in the form of whole grains, dehusked grains, pre-crushed grains, or dehusked pre-crushed grains.

3. Process according to claim 1 or 2, c h a r a c t e r i z e d in that the grain is homogenized in the presence of liquid.

4. Process according to any of the preceding claims, c h a r a c t e r i z e d in that the temperature and moisture are controlled by adjusting the power of the homogenizing device and/or the amount of liquid in the homogenizing device.

5. Process according to any of the preceding claims, c h a r a c t e r i z e d in that a wholemeal dough is prepared.

6. Process according to claim 5, c h a r a c t e r i z e d in that the wholemeal dough is prepared by combining the grain in the form of whole grains with other dough ingredients and stirring the mixture into a homogenous dough by quick impact-mixing treatment.

7. Process according to claim 6, c h a r a c t e r i z e d in that a rye wholemeal dough is prepared by combining whole rye grains with water, yeast, salt and other possible additives, and stirring the mixture into a homogenous dough by quick impact-mixing treatment.

8. Process according to claim 6, c h a r a c t e r i z e d in that an unleavened or sour rye wholemeal

dough is prepared by combining whole rye grains with sourdough of rye, water, yeast, salt and other possible additives, and stirring the mixture into a homogenous dough by quick impact-mixing treatment.

9. Process according to claim 6, c h a r a c t e r i z e d in that gas is additionally incorporated in the dough at the impact-mixing treatment stage.

10. Process according to any of the preceding claims, c h a r a c t e r i z e d in that the grinding of grains is adjusted by combining the impact-treatment stage with a sieving and/or grading device.

11. Process according to claim 10, c h a r a c t e r i z e d in that a coarse fraction obtained from the sieving and/or grading device is recycled to the impact-mixing stage for further refining.

12. Process according to any of the preceding claims, c h a r a c t e r i z e d in that a grain product is prepared where the falling number of grains has been increased by increasing the homogenizing power and/or reducing the amount of liquid in the homogenizing device.

13. Process according to any of the preceding claims, c h a r a c t e r i z e d in that a dry dough is prepared by reducing the amount of liquid in the homogenizing device and operating at a low temperature.

14. Wholemeal dough prepared by a process according to any of claims 5 to 13.

15. Grain-based carrier prepared by a process according to any of claims 1 to 4 for mixtures of baking additives.

16. Use of a wholemeal dough prepared by a process according to any of claims 5 to 13 for the preparation of wholemeal bakery products.

17. Use of a rye wholemeal dough prepared according to claim 7 for the preparation of rye crispbread.

18. Use of a rye wholemeal dough prepared according

to claim 8 for the preparation of sour or unleavened fresh rye bread.

ABSTRACT

The invention relates to a process for the preparation of a semi-finished product, especially a wholemeal dough, from grain for foodstuffs, fodders or the like by homogenizing the grain under controlled temperature and moisture conditions. The invention also relates to a wholemeal dough so obtained or e.g. a grain-based carrier for mixtures of baking additives. The invention further relates to the use of the wholemeal dough for the preparation of wholemeal bakery products.