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(54) TREATMENT OF EDIBLE SEEDS AND A NOVEL FOODSTUFF PREPARED THEREFROM

(71) We, VICTOR MARCUS LEWIS and DAVID ADRIAN LEWIS, both citizens of the Commonwealth of Australia and both of 19 Boundary Street, Rushcutters Bay, New South Wales 2011, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the treatment of edible seeds and to a novel foodstuff prepared therefrom.

The term edible seeds means all those seeds which are suitable for human and/or animal consumption, examples of which are wheat, barley, rye, oats, triticale, maize, sorghum, millet, buckwheat, soyabeans, legumes, peas and lentils.

The seeds processed according to the present invention may be whole seeds with complete or partial removal of the bran layer, testa or seed coat, or seed products such as cracked seed particles, for example grits or split peas all of which are hereafter encompassed by the term seed.

Hitherto, it has been customary to flavour or supplement seeds by incorporating or combining with the seed various supplements such as vitamins, minerals, flavours and colours.

Numerous techniques have been employed to incorporate or combine such supplements with the seed, the most conventional of which are

- A) Steeping the seeds in solutions containing the supplements for a sufficient period of time to enable a sufficient quantity of the supplement to be absorbed by the seeds.
- B) Coating the seeds with solutions or suspensions of such supplements.
- C) Adding the supplements to the seeds during cooking.

These first two mentioned techniques are costly and time consuming and the last mentioned technique makes no departure from methods which have been in existence for hundreds of years.

It has also been known hitherto to manufacture so called meat extenders from proteins and other food components of seed origin. These extenders are usually a by-product. They have no natural meat-like texture and therefore they may require the use of relatively expensive manufacturing techniques to produce artificially in the extender a meat-like texture and an acceptable flavour.

The term meat extender as used in accordance with this invention means a foodstuff of seed origin which is used as a substitute for or as an addition to meat and which has a meat-like texture.

Meat means the flesh of edible mammals, fishes, birds and crustaceans.

The present invention from one aspect provides a process of producing a foodstuff from edible seeds which overcomes the problems associated with prior art methods and provides an economical, satisfactory and accurate method of incorporating additives into seeds.

A feature of the invention is that it permits the thorough incorporation of additives into seeds in a remarkably short space of time. The process is adaptable to continuous operation and allows the incorporation into the seed not only of water soluble additives but also emulsions and suspensions of insoluble materials which penetrate the seed through cracks or fissures provided therein.

A further feature of the invention is that it permits the amount of additives included in the seeds to be controlled within very fine limits and obviates the disadvantages of external coating methods which leave the coating visible and easily rubbed or washed off.

Seeds treated in accordance with the invention can be used in all those cases where untreated seeds are used as a foodstuff. They can be used for example as a vegetable, in desserts, and in meat dishes. They can also be used as meat extenders and a still further feature of the invention is that the treated seeds either before or after cooking may resemble to a marked degree untreated seeds and are difficult to distinguish therefrom.

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In the case where the seeds treated in accordance with the invention are to be used as a meat extender it is preferred to use those seeds which have a high gluten or other cohesive protein content. Examples of seeds possessing these characteristics are wheat, rye, barley and triticale. In certain applications for example where seeds treated in accordance with the invention are used as a meat extender it may be desirable to flatten the seed to the extent where it still remains a unitary structure but does not retain its natural shape and is flattened or compressed.

The invention therefore in its broadest aspect resides in a process of producing a foodstuff from edible seeds which comprises partially softening the seeds to prevent shattering under pressure, applying pressure to the partly softened seeds to produce cracks or fissures therein and applying an additive or additives to the seeds and impregnating the seeds with additive or additives through said cracks or fissures.

The invention also provides edible seed foodstuffs when produced according to the process of the invention.

The seeds are processed to partly soften them to the extent where most of the seeds will not break into particles during subsequent application of pressure thereto. This is achieved by partly hydrating and heating the seeds either simultaneously or sequentially.

Conventional methods of hydration and heating are employed as is well understood in the food processing industry. The seeds may be hydrated by soaking or spraying with water and heating may be conveniently effected by steaming either under pressure or at atmospheric pressure. If desired the hydration and heating may be effected simultaneously by steaming. It is preferred however to separate the hydration and heating steps as referred to above.

The period of hydration and heating varies widely depending on the type of equipment used and the seed being treated.

For example some wheats require 5 minutes soaking followed by 30 minutes steaming at atmospheric pressure, rye or rye-corn require dipping in water for 15 seconds followed by steaming for two minutes at 15 p.s.i. gauge and tritical may be sprayed with water until the water uptake of the seed is 15% followed by heating in steam for 5 minutes at 15 p.s.i. gauge.

The degree of softening will in each case be determined by simple experiment. The governing factor is that the seed need only be softened to the extent that it will not shatter under pressure e.g. by rolling but will have cracks or fissures formed therein to permit the penetration of additives into the seeds by subsequent treatment in accordance with the invention.

Pressure is then applied to the seeds to produce the mentioned cracks or fissures. Such pressure can be applied in various ways. It may for example be applied internally by heating the seeds either at atmospheric pressure or heating the seeds under pressure with or without a subsequent sudden release of such pressure to cause a degree of expansion in the seeds sufficient to produce the cracks or fissures. It is preferred to apply the pressure to the seeds externally by impact or by passing the seeds between rollers.

In the preferred form of the invention the cracks or fissures are produced with rollers. The degree of compression may vary within wide limits. In those cases where it is desired to process seeds which are to be consumed as whole seeds the degree of compression is only just sufficient such that the seeds return in a marked degree to their original shape. In certain cases e.g. where the seeds are to be used as a meat extender it may be desirable to compress the seeds to the extent that they do not return to their natural shape. This is achieved by increasing the pressure on the seeds over and above that used for seeds which are to return substantially to their natural shape.

The compression of the seeds is conveniently effected by passing the seeds between rollers.

The gap between the rollers will vary widely depending on the nature of the seeds being rolled and the characteristics which the final product is to possess. Where the seeds are to return substantially to their natural shape they are passed between rollers with the gap between the rollers of 0.8 mm for wheat, 0.6 mm for rye-corn and 1.0 mm for lentils. When the seeds are to exhibit a flattened appearance the gap between rollers is reduced by approximately half. The degree of compression will need to be determined for each seed type rolled. As with the hydration and heating step the governing factor is that the seeds are not pulverised or shattered.

The compression of the seeds produces numerous cracks or fissures which renders them highly absorbent and this conditions the seeds to receive additives such as flavourings, seasonings, sauces, sugars, salts edible oils and fats, vegetable juices, meat juices, preservatives, nutritional supplements such as vitamins and minerals, enzymes, therapeutic agents, coloring, anti-oxidants or sequestrants or any other desired ingredient.

The additives may be added singly or in any combination as desired and made be contained in solutions, suspensions or emulsions. They may also be added by mixing dry powdered additives with the seeds.

In the case where the additives are contained in solutions, suspensions or emulsions the seeds are simply soaked in or mixed with or sprayed with the solution, suspension or

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emulsion and after a remarkably short period or time it will be found that the solution, suspension or emulsion has been absorbed to the required degree.

5 In the case where the additives are in powder form it is preferable to dampen the seeds and then mix the powder with them.

The absorption period varies widely, in accordance with the nature of the seed treated, the degree of treatment and the nature of the equipment used. From a commercial standpoint the absorption period can be almost instantaneous and should not take longer than five minutes.

15 It may be necessary in certain cases to allow a tempering period after mixing to permit the additives to be uniformly absorbed throughout the seed. The tempering period can vary within wide limits depending on the nature of the seed, the way in which and the conditions under which the additives are incorporated into the seed. The tempering period required will be determined in each case by simple experiment as is well understood in the art.

In those cases where a long shelf life is required it is desirable to subsequently subject the seeds to drying but this step is optional and not essential to the performance of the invention. Conventional drying methods may be employed such as heated conveyors or hot air jets.

After treatment the treated seeds are packaged and are ready for sale or use.

35 In the case where it is desired to give the seeds a flattened appearance as for example when the seeds are to be used as a meat extender it may be necessary to again pass the seeds through the rollers. Thereafter the seeds may be dried to a moisture content of the required degree and packaged.

The resulting product if desired blends both physically and visually with chopped or minced meat, poultry, fish, crustaceans or other meat protein foods to produce an economical extension thereof.

The meat extender when used in this way provides a high acceptable product which complements and blends ideally with the meat to which it is added.

The seeds in any case are highly absorptive during cooking and readily absorb water, sauces, meat juices, vegetable juices and fats. They meet with consumer acceptance because of their pleasing flavour, texture and appearance.

The invention will now be further illustrated with reference to the following examples.

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EXAMPLE 1

Wheat: Wheat, having a normal moisture content of about 12%, by weight, has part of the bran layer removed by passing the seeds

through a pearling or polishing machine of a type which may act either by abrasion of the seeds against one another or by the action of an abrasive wheel or roller. The moisture content of the wheat is increased to 30—40% by soaking for five minutes in water, followed by heating in steam for 30 minutes at atmospheric pressure. While still warm the seeds are slightly compressed or flattened by passing them through a roller mill with a gap between the rollers of 0.8 mm, the moisture content, degree of gelation of the starch in the seeds and the setting of the rollers having been adjusted so that the seeds are not shattered. The seeds are then mixed in a rotary mixer with 15% of their weight of water containing an edible vitamin supplement (thiamin 40 p.p.m., riboflavin 30 p.p.m. and niacin 100 p.p.m.). The solution is absorbed by the seeds within one minute. The seeds are then left to temper for a period of one hour, and then dried to a moisture content of 10% which makes them self-preserving. The dried seeds have returned substantially to their original shape.

EXAMPLE 2

Maize Grits: The grits are prepared in the normal manner from maize by removing the outer seed coat and germ, and breaking the seeds into particles of a size, which will not pass through a 5 mesh sieve. The moisture content of the grits is then increased to 25—35%, by weight, by soaking for 5 minutes in water followed by steaming for 30 minutes at atmospheric pressure. While still warm, the grits are passed through a roller mill with the gap adjusted so that the grits are slightly flattened, but not shattered. They are then mixed with 15% by weight of a solution containing 5% by weight of can sugar 3% by weight of sodium chloride and a trace of artificial sweetcorn flavour, the balance being water. The solution is completely absorbed in 3 minutes. The grits are allowed to stand for 3 hours, by which time they substantially return to their original shape. The grits are then dried to a moisture content of 10%.

EXAMPLE 3

Rye or Ryecorn: Cleaned seeds of rye are passed through a pearling machine with settings adjusted to remove about 5% of the bran layer. The seeds are dipped in water for 15 seconds, allowed to drain and then steamed for 2 minutes at 15 p.s.i. On removal from the steamer, the moisture content has risen to approx. 40%. The seeds are then passed through a roller mill set at 0.6 mm gap and are then sprayed with 15% of solution containing 3% of salt and a small percentage of caraway flavour in a continuous rotary mixer. The solution is immediately absorbed. The seeds are allowed to condition for an hour and are then dried to a moisture

content of 10%. The seeds substantially return to their original shape.

EXAMPLE 4

- 5 *Lentils*: Lentils are soaked in water for three minutes and are then steamed at atmospheric pressure for 20 minutes. The steamed lentils are passed through a roller mill set at a gap of 1 mm, so that the cotyledons are cracked but not shattered. The warm seeds are then mixed in a tumble mixer with 10% by weight of a flavouring solution containing curry flavours, 5% salt and 0.5% monosodium glutamate. The solution is completely absorbed in 5 minutes.

The seeds are allowed to condition for three hours, and are then dried back to a moisture content of 10%. The seeds substantially return to their original shape.

EXAMPLE 5

- 25 *Sorghum*: Seeds of sorghum (milo) are passed through an abrasive peeler adjusted to remove the major part of the seed coat. The decorticated seeds are then sprayed with water while being conveyed to a holding hopper, where they are allowed to stand for 30 minutes. The seeds are next steamed at atmospheric pressure for thirty minutes and passed through a roller mill, adjusted so that the seeds are cracked, but not shattered or broken. Thereafter the seeds are mixed with 10% of a solution containing B-carotene 100 p.p.m., thiamine 40 p.p.m., riboflavin 30 p.p.m. and lysine 0.2%. The solution is completely absorbed within 5 minutes. A tempering period of 1 hour is allowed, after which the seeds are dried in a dehydrator to 10% moisture. The sorghum seeds so produced have a uniform penetration of fortifying nutritional additives which will not rub or wash off the surface of the seeds and the seeds substantially return to their natural shape.

EXAMPLE 6

- 50 *Triticale*: Triticale is a cross between wheat and rye and is notable for its high protein content. Triticale seeds are scratched in a pearling machine and sprayed with water as they move along a conveyor to such an extent that water uptake by the seeds is 15%. The seeds are heated in steam for 5 minutes at 15 p.s.i. gauge of steam pressure and are next passed through a roller mill set to a gap of 0.4 mm. The seeds are then placed in a tumble mixer and treated with 20% of their weight of a solution containing 15% by weight of hydrolysed vegetable protein, 2% by weight caramel colour and 2% by weight spices and seasonings and beef flavour. The solution is absorbed totally in 2 minutes. The seeds are allowed to stand for 10 minutes and then dried in a dehydrator to a moisture content of 8%. The resultant

flavoured seeds present a flattened appearance and are ideal for adding to minced or chopped meat together with the appropriate amount of water, as a low-cost extender for meat.

EXAMPLE 7

Flavoured Rice: Long grain rice is steeped in water for five minutes, drained and allowed to stand for an hour. It is then steamed for five minutes at 5 p.s.i. steam pressure and passed through a roller mill with a gap between the rollers of 0.6 mm. The rice is next mixed with 10% of its weight of a sauce containing tomato juice, paprika oleoresin, pepper oleoresin, and other seasonings in a tumble mixer for two minutes by which time the sauce has been completely absorbed. The rice is allowed to stand for an hour and then dried back to a moisture content of 8%. The rice substantially returns to its original shape.

EXAMPLE 8

Flavoured Wheat: Wheat which has been abrasively peeled as in Example 1, is similarly soaked in water, steamed and rolled.

The rolled wheat is mixed with 10% of its weight of a solution containing chicken flavour, 5% by weight of salt, seasonings, 0.1% by weight of β -Carotene in water dispersible form and potassium sorbate in quantity sufficient to give 0.1% by weight of sorbic acid in the finished product.

Mixing is carried out in a rotary mixer for 5 minutes by which time the solution is completely absorbed and the wheat returns substantially to its natural shape.

The wheat is packaged and distributed under refrigeration as a semi-perishable product with a moisture content of approx. 45%.

EXAMPLE 9

Wheat Meat Extender: High protein (14% protein) wheat is scratched in a pearling machine and steeped in water for five minutes. It is allowed to drain and then steamed for 3 minutes at 15 p.s.i. gauge. While still hot, the wheat is passed through a roller mill with a gap of 0.8 mm.

After rolling, the wheat is mixed in a tumble mixer with 20% of its weight of a solution containing natural and artificial meat flavours, 5% by weight of salt, spices and seasonings. The solution is completely absorbed within 2 minutes. The wheat so treated is allowed to stand for 4 hours, and again rolled, this time through a gap of 0.3 mm.

The flattened wheat seeds are then dried at 100°C in a through-bed dryer to a moisture content of 8% and are packaged for use.

EXAMPLE 10

Seasoned Fortified Wheat: Wheat which has

5 been abrasively peeled as in Example 1 is
similarly soaked in water, steamed and rolled.
The rolled wheat is mixed with 2% of its
weight of powdered salt (sodium chloride)
5 containing 200 p.p.m. of thiamin. The wheat
together with the dry additive is mixed in a
tumble mixer for 5 minutes. The wheat is
then allowed to condition for 2 hours during
10 which time the powdered soluble additives
are found to have dissolved in water already
present in the wheat seeds and to have sub-
stantially penetrated through the cracks or
fissures in the seeds. The seeds are then
15 dried to a moisture content of 10%.

WHAT WE CLAIM IS:—

1. A process of producing a foodstuff
from edible seeds which comprises partly
softening the seeds to prevent shattering
20 thereof under pressure, applying pressure to
the partly softened seeds to produce cracks
or fissures therein, thereafter applying an
additive to the seeds and impregnating the
seeds with said additive through said cracks
25 or fissures.

2. A process of producing a foodstuff as
claimed in claim 1 wherein the seeds are
partly softened by partly hydrating the seeds
and heating the seeds either simultaneously
30 or sequentially.

3. A process of producing a foodstuff as
claimed in claim 2 wherein the hydration of
the seeds is effected by soaking the seeds in
water.

4. A process of producing a foodstuff as
claimed in claim 2 wherein hydration of the
seeds is effected by spraying the seeds with
water.

5. A process of producing a foodstuff
40 as claimed in claims 2 to 4 wherein the seeds
are heated by steaming.

6. A process of producing a foodstuff as
claimed in any one of claims 1 to 5 wherein
said pressure is applied to said seeds by
compressing the seeds between rollers.

7. A process of producing a foodstuff as
claimed in claim 6 wherein the compression
applied to said seeds is such that the seeds
return to a marked extent to their original
50 shape after the incorporation of said addi-
tives therein.

8. A process of producing a foodstuff as
claimed in claim 6 wherein the compression
applied to said seeds is such that the seeds do
not return to their natural shape after the
55 incorporation of said additives therein.

9. A process of producing a foodstuff
as claimed in claim 8 wherein said compres-

sion is applied to said seeds before and after
the incorporation of said additives in said
seeds. 60

10. A process of producing a foodstuff as
claimed in any one of claims 1 to 9 wherein
said additives comprise any one or more of
65 the following, flavourings, seasonings, sauces,
sugars, salts, edible oils and fats, vegetable
juices, meat juices, preservatives, nutritional
supplements, vitamins, minerals, enzymes,
therapeutic agents, colourings, anti oxidants
and sequestrants. 70

11. A process of producing a foodstuff
as claimed in any one of claims 1 to 10
wherein said additives are applied to said
seeds by soaking said seeds in a solution,
75 suspension or emulsion containing said addi-
tives.

12. A process of producing a foodstuff
as claimed in any one of claims 1 to 10
wherein said additives are applied to said
seeds by spraying said seeds with a solution,
80 suspension or emulsion containing said addi-
tives.

13. A process of producing a foodstuff
as claimed in any one of claims 1 to 10
wherein said additives are applied to said
seeds by dusting dry additives to previously
85 dampened seeds.

14. A process of producing a foodstuff
as claimed in any one of claims 1 to 13
wherein a tempering period is allowed after
the incorporation of said additives in said
seeds to permit the uniform penetration of
90 said additives throughout said seeds.

15. A process of producing a foodstuff
as claimed in any one of claims 1 to 14
95 wherein said seeds are subsequently dried to
reduce the moisture content thereof.

16. A process of producing edible seeds
substantially as hereinbefore described with
reference to examples 1 to 10. 100

17. Edible seeds whenever prepared by
the process as claimed in any one of claims
1 to 16.

18. Edible seeds having additives incor-
porated therein through cracks or fissures
105 produced in softened seeds by compression.

19. Meat extenders consisting of edible
seeds having additives incorporated therein
through cracks or fissures produced in
softened seeds by compression. 110

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been abrasively peeled as in Example 1 is similarly soaked in water, steamed and rolled. The rolled wheat is mixed with 2% of its weight of powdered salt (sodium chloride) containing 200 p.p.m. of thiamin. The wheat together with the dry additive is mixed in a tumble mixer for 5 minutes. The wheat is then allowed to condition for 2 hours during which time the powdered soluble additives are found to have dissolved in water already present in the wheat seeds and to have substantially penetrated through the cracks or fissures in the seeds. The seeds are then dried to a moisture content of 10%.

WHAT WE CLAIM IS:—

1. A process of producing a foodstuff from edible seeds which comprises partly softening the seeds to prevent shattering thereof under pressure, applying pressure to the partly softened seeds to produce cracks or fissures therein, thereafter applying an additive to the seeds and impregnating the seeds with said additive through said cracks or fissures.
2. A process of producing a foodstuff as claimed in claim 1 wherein the seeds are partly softened by partly hydrating the seeds and heating the seeds either simultaneously or sequentially.
3. A process of producing a foodstuff as claimed in claim 2 wherein the hydration of the seeds is effected by soaking the seeds in water.
4. A process of producing a foodstuff as claimed in claim 2 wherein hydration of the seeds is effected by spraying the seeds with water.
5. A process of producing a foodstuff as claimed in claims 2 to 4 wherein the seeds are heated by steaming.
6. A process of producing a foodstuff as claimed in any one of claims 1 to 5 wherein said pressure is applied to said seeds by compressing the seeds between rollers.
7. A process of producing a foodstuff as claimed in claim 6 wherein the compression applied to said seeds is such that the seeds return to a marked extent to their original shape after the incorporation of said additives therein.
8. A process of producing a foodstuff as claimed in claim 6 wherein the compression applied to said seeds is such that the seeds do not return to their natural shape after the incorporation of said additives therein.
9. A process of producing a foodstuff as claimed in claim 8 wherein said compres-

sion is applied to said seeds before and after the incorporation of said additives in said seeds.

10. A process of producing a foodstuff as claimed in any one of claims 1 to 9 wherein said additives comprise any one or more of the following, flavourings, seasonings, sauces, sugars, salts, edible oils and fats, vegetable juices, meat juices, preservatives, nutritional supplements, vitamins, minerals, enzymes, therapeutic agents, colourings, anti oxidants and sequestrants.

11. A process of producing a foodstuff as claimed in any one of claims 1 to 10 wherein said additives are applied to said seeds by soaking said seeds in a solution, suspension or emulsion containing said additives.

12. A process of producing a foodstuff as claimed in any one of claims 1 to 10 wherein said additives are applied to said seeds by spraying said seeds with a solution, suspension or emulsion containing said additives.

13. A process of producing a foodstuff as claimed in any one of claims 1 to 10 wherein said additives are applied to said seeds by dusting dry additives to previously dampened seeds.

14. A process of producing a foodstuff as claimed in any one of claims 1 to 13 wherein a tempering period is allowed after the incorporation of said additives in said seeds to permit the uniform penetration of said additives throughout said seeds.

15. A process of producing a foodstuff as claimed in any one of claims 1 to 14 wherein said seeds are subsequently dried to reduce the moisture content thereof.

16. A process of producing edible seeds substantially as hereinbefore described with reference to examples 1 to 10.

17. Edible seeds whenever prepared by the process as claimed in any one of claims 1 to 16.

18. Edible seeds having additives incorporated therein through cracks or fissures produced in softened seeds by compression.

19. Meat extenders consisting of edible seeds having additives incorporated therein through cracks or fissures produced in softened seeds by compression.

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