

# PATENT SPECIFICATION

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## COMPLETE SPECIFICATION

### Improved Grain Products and the Manufacture Thereof

We, F. HOFFMANN-LA ROCHE & Co.,  
AKTIENGESELLSCHAFT, a Swiss Company,  
of 124-184 Grenzacherstrasse, Basle,  
Switzerland, do hereby declare the inven-  
tion, 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 state-  
ment:—

10 The present invention is concerned with  
improvements in or relating to enriched  
grain products: more particularly, the  
invention is concerned with improved  
fortified foodstuffs comprising cereal grain  
15 products enriched with Vitamin B<sub>2</sub>  
(otherwise known as riboflavin) and with  
a process for the manufacture thereof.

It is well known that the commercial  
milling of cereal grains destroys much or  
20 all of the vitamins and minerals naturally  
occurring therein. After the milling  
process, the cereal grains (e.g., dehulled  
rice or maize grits) are therefore often  
enriched with vitamins and minerals to  
25 restore the lost nutrients. The white rice  
and maize grits of commerce are generally  
enriched with Vitamin B<sub>1</sub> (otherwise  
known as thiamine), niacin and iron. Ribo-  
flavin is also substantially destroyed in  
30 the milling process and it is desirable to  
restore this essential vitamin also. One  
process for enriching cereal grains with  
vitamins (including riboflavin) and  
minerals is already known (See British  
35 Patent Specification No. 646,747). This  
process consists in impregnating the cereal  
grains with a solution containing vitamins  
and mineral substances and coating the  
impregnated grains with an edible coating  
40 which comprises a film-forming agent, an  
adhesive agent and a plasticizer and which  
is insoluble in cold water but removable  
in hot water.

However, when cereal grains are en-  
45 riched with a vitamin material containing

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riboflavin there is imparted to the grain  
particles a yellow-orange colour which  
distinguishes the riboflavin enriched  
material from the conventional product of  
commerce and makes it less acceptable to 50  
consumers. In a grain product in which  
the enriched material is incorporated in  
the form of a premix, the coloured grains  
may be individually removed from the  
mixture (especially during culinary opera- 55  
tions) and thus the benefits of the vitamin  
and mineral enrichment are lost to the  
consumer. Coatings which have hitherto  
been applied to enriched rice and corn  
grits have failed to mask the colour. 60

It has now been found, according to the  
present invention, that a coating material  
will effectively mask the colouration  
imparted to cereal grain by enrichment  
with riboflavin and render the enriched 65  
grain indistinguishable from the un-  
enriched material.

Accordingly, the present invention pro-  
vides as a novel fortified foodstuff a  
riboflavin-enriched cereal grain coated 70  
with an edible water-repellant coating  
material containing sufficient titanium  
dioxide in suspension to mask the colour  
of the riboflavin.

According to the process provided by 75  
the invention, the novel fortified foodstuff  
aforesaid is manufactured by impregnat-  
ing a milled cereal grain with riboflavin  
or with a riboflavin-active material in  
aqueous acid solution and then coating the 80  
resulting enriched grain with an edible  
water-repellant protective coating material  
containing titanium dioxide in suspension.

Solutions of riboflavin or of a riboflavin- 85  
active material in an aqueous mineral  
acid (e.g., sulphuric acid) are suitable for  
the impregnation. Any riboflavin-active  
material which is soluble in acidic media  
may be used. Water-soluble vitamins, for  
example thiamine, niacin pantothenic 90

acid, pyridoxine, vitamin B<sub>12</sub>, ascorbic acid, biotin and folic acid may also be incorporated in the acid solution. After drying, the riboflavin-impregnated grain 5 is then coated with the protective coating material containing titanium dioxide in suspension. The latter material comprises basically corn protein or prolamine, such as zein, or other edible water-repellant 10 film. The titanium-dioxide is suspended in the coating material in a proportion of about 15% to 60% on a weight by volume basis; e.g., 15 to 60 grams of titanium dioxide to 100 ml. of coating material (in 15 the form of a solution). A lower aliphatic alcohol such as ethanol or isopropanol is used as the solvent in the solution of the coating material. In addition, an adhesive agent, such as abietic acid, a plasticizer 20 such as a higher fatty acid (e.g., stearic acid, palmitic acid or oleic acid), may be included in the coating material. It is preferred to dust talc on to the enriched and coated cereal grain while the coating 25 material is still tacky. Minerals normally found in cereal grain such as iron, calcium, magnesium, potassium, sodium, phosphorus, manganese and copper (in the form of compounds thereof, e.g., iron 30 phosphate), may also be added to the cereal grain. The latter may be done, for example, by including the iron in the dusting powder.

The vitamins and minerals may be 35 added to the grain or a highly fortified premix may be prepared. Preferably a premix is formed by enriching a portion of the cereal grain with a highly concentrated amount of vitamins and minerals in 40 the manner aforesaid. The premix is then mixed with unenriched milled cereal grain in a proportion of about 1 part of enriched grain to about 199 parts of unenriched grain to produce a mixture 45 containing the desired proportion of vitamins and minerals. Cereal grain such as rice and maize grits which have been enriched and coated in accordance with the invention closely resemble commerci- 50 ally available forms of cereal grains acceptable to the consumer and are not readily distinguishable therefrom.

We are aware of the Public Health (Preservatives etc., in Food) Regulations 55 1925-27, and insofar as the present invention relates to the manufacture for sale in the United Kingdom of foodstuffs preserved by the process herein described, we make no claim to use the invention in 60 contravention of the law.

In order that the process of this invention may be more clearly understood and readily put into effect, the following examples are now given by way of 65 illustration:

#### EXAMPLE 1

A solution containing 10 g. of concentrated sulphuric acid, 22 g. of water, 1.4 g. of riboflavin, 18 g. of niacin and 3.06 g. of thiamine was poured over 1,952 g. of 70 medium grain rice in an open vessel with rapid mixing. The mixing was continued for 10 minutes. The vitamin-impregnated rice was then dried in a current of warm air for 2 hours at 43°C.

A coating solution containing 30 g. of zein, 19.6 g. of abietic acid, 24.3 g. of a fatty acid mixture comprising 90% stearic acid, 6% palmitic acid and 4% 75 oleic acid, 206.25 ml. of isopropanol and 7.5 ml. of water was prepared. 25 g. of titanium dioxide were slurried in 135 ml. of this coating solution.

The titanium dioxide-containing coating solution was then applied to the vitamin- 85 impregnated rice by stirring the enriched rice into the solution. While the rice was still wet, a mixture of 62 g. of iron pyrophosphate and 90 g. of talc was dusted on to the rice. The coated rice was 90 mixed for a few minutes and then dried in a current of warm air for one hour at 43°C. The balance of the coating solution was then applied to the dry enriched rice kernels and an additional 67.5 g. of talc 95 were dusted on to the wet mixture. The rice was mixed for 15 minutes and then dried at 43°C., for 2 hours.

#### EXAMPLE 2

A vitamin solution containing 98 g. of 100 water, 32 g. of sulphuric acid, 5.84 g. of riboflavin, 64 g. of niacin and 9.1 g. of thiamine was poured while warm over 1,580 g. of maize grits in an open vessel with rapid mixing. Mixing was continued 105 for 10 minutes and then the vitamin-impregnated grits were dried in a current of warm air for 2 hours at 43°C.

A coating solution containing 71.5 g. of zein, 78.3 g. abietic acid, 28.93 g. of the 110 fatty acid mixture employed according to Example 1, 639 ml. of isopropanol and 17 ml. of water was prepared. 100 g. of titanium dioxide were slurried in 400 ml. of this coating solution.

The slurry was then applied to the vitamin-impregnated maize grits by stirring the maize grits into the slurry. While still wet, a mixture of 247 g. of iron pyrophosphate and 146 g. of talc was 120 applied to the maize grits as a dusting powder. The impregnated and coated maize grits were mixed for a few minutes and then dried for one hour at 43°C. The balance of the coating solution was then 125 applied to the dry maize grits. An additional 80 g. of talc were dusted on to the grain. The enriched and coated maize grits were mixed for 5 minutes and then dried in a current of warm air at 43°C. 130

What we claim is:—

1. A fortified foodstuff comprising a riboflavin-enriched milled cereal grain coated with an edible water-repellant coating material containing titanium dioxide in suspension.

2. A fortified foodstuff in accordance with Claim 1, wherein the enrichment contains water soluble vitamins in addition to the riboflavin.

3. A fortified foodstuff as claimed in Claim 1 or Claim 2, wherein the cereal grain comprises rice or maize grits.

4. Fortified foodstuffs as claimed in any one of the preceding claims, wherein the coating material comprises a maize protein such as zein.

5. Fortified foodstuffs as claimed in any one of the preceding claims, wherein the said coating material comprises zein, abietic acid and an edible higher fatty acid.

6. A process for the manufacture of fortified foodstuffs as claimed in any one of the preceding claims, which process comprises impregnating a milled cereal

grain with riboflavin or a riboflavin-active substance in aqueous acid solution and coating the resulting enriched grain with an edible, water-repellant coating containing titanium dioxide in suspension.

7. A process as claimed in Claim 6, wherein the impregnation is brought about by treating the grain with an aqueous acid solution containing riboflavin or a riboflavin-active substance.

8. A process as claimed in Claim 6 or Claim 7, wherein the said coating comprises zein and, in suspension, 15% to 60% titanium dioxide on a weight by volume basis.

9. A process in accordance with any one of the preceding process claims, wherein the cereal grain is rice or maize grits.

10. A process for the manufacture of fortified foodstuffs, substantially as described with reference to the examples given.

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