PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

EP. 0040237

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 3:
C12N 1/18, 1/04

A1

(11) International Publication Number: WO 81/01415

(43) International Publication Date: 28 May 1981 (28.05.81)

(21) International Application Number: PCT/NL80/00038

(22) International Filing Date: 17 November 1980 (17.11.80)

(31) Priority Application Number: 7908427

(32) Priority Date: 19 November 1979 (19.11.79)

(33) Priority Country: NL

(71) Applicants *(for all designated States except US):* GIST-BROCADES N.V. [NL/NL]; Wateringseweg 1, P.O. Box 1, NL-2600 MA Delft (NL).

(72) Inventors; and
(75) Inventors/Applicants *(for US only):* VAN 'T RIET, Johannes [NL/NL]; Roerdompdreef 6, NL-2665 TD Bleiswijk (NL). DE BRUIJN, Jacobus, Theodorus [NL/BE]; Pikkelblokstraat 10, B-1900 Overijse (BE).

(74) Agent: VAN DER STRAATEN, Jan Anthony,; Gist-Brocades N.V., Patents & Trademarks Department, Wateringseweg 1, P.O. Box 1, NL-2600 MA Delft (NL).

(81) Designated States: AT (European patent), AU, BR, CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), JP, LU (European patent), MC, NL (European patent), SE (European patent), SU, US.

Published
*With international search report*

(54) Title: PROCESS FOR THE PREPARATION OF ACTIVE DRIED MICROORGANISMS

(57) Abstract

Process for the preparation of active dried microorganism mass and in particular active dried baker's yeast, comprising a disintegration of a compressed mass of microorganisms into particles and drying these particles in a fluidized bed drying equipment without previously dried air up to a dry matter content of from 75 to 90%, whereafter the particles of the microorganism mass are additionally treated in a vacuum drum, at a temperature of from 25 to 45°C and a pressure of from 1-10 mm Hg (133-1330 Pa), until the particles have reached a final dry matter content of from 90-98%. Preferably yeast particles are initially dried in a fluidized bed dryer using air of an initial temperature of from 90-130°C and having a space velocity in the bed of 0.8-2.0 m/s, while the particles are kept on a wet-bulb temperature of at most 45°C, and whereby the load of the fluidized bed dryer is 100-1000 kg/$m^2$ floor area. More preferably a surface active agent is added to the microorganism mass before drying.

*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | | | |
|---|---|---|---|
| **AT** | Austria | **KP** | Democratic People's Republic of Korea |
| **AU** | Australia | **LI** | Liechtenstein |
| **BR** | Brazil | **LU** | Luxembourg |
| **CF** | Central African Republic | **MC** | Monaco |
| **CG** | Congo | **MG** | Madagascar |
| **CH** | Switzerland | **MW** | Malawi |
| **CM** | Cameroon | **NL** | Netherlands |
| **DE** | Germany, Federal Republic of | **NO** | Norway |
| **DK** | Denmark | **RO** | Romania |
| **FI** | Finland | **SE** | Sweden |
| **FR** | France | **SN** | Senegal |
| **GA** | Gabon | **SU** | Soviet Union |
| **GB** | United Kingdom | **TD** | Chad |
| **HU** | Hungary | **TG** | Togo |
| **JP** | Japan | **US** | United States of America |

Process for the preparation of active dried microorganisms.

The invention relates to a process for the preparation of active dried microorganisms, and more particularly of active dried yeast, such as baker's yeast, brewer's yeast, wine yeast and the like.

Several processes for the drying of yeast are known in general. For instance the British Patent Specification no. 1.132.793 discloses the drying of compressed yeast, i.e. a yeast having a dry matter content of about 30%, in a fluidized bed.

Also the British Patent Specification no. 1.230.205 discloses a similar process, relating to the preparation of dry baker's yeast of a high protein content.

In addition the British Patent Specification no. 1.064.212 discloses a process, whereby yeast is spray dried, while according to the British Patent Specification no. 1.140.016 an expanded mass of finely divided yeast is dried in rectangular plastic trays.

However, these beforementioned British patent specifications only represent some examples of the numberless known drying methods for yeast and more particularly baker's yeast.

Difficulties are encountered with those processes, in countries with a moist, warm climate, e.g. moist tropical countries, because it appeared impossible to dry the yeast up to a sufficiently high dry matter content with the available moist air, in other words to dry the yeast over a certain dry matter content in connection with the desired keeping quality, while its activity is maintained. Therefore, the moisture content of the air to be used has to be diminished anyhow during the final drying.

It will be appreciated that such a process will be a relatively expensive one and therefore will not be permitted in general, and more particularly not for a bulk product such as dried baker's yeast.

In order to avoid the beforementioned disadvantages, it is an object of the present invention to provide an improved process for the production of active dried microorganisms and particularly active dried yeast, which comprises disintegrating a compressed mass of microorganisms into small particles and drying these particles with non-previously dried air up to a dry matter content of 75-90% and preferably 85-90%, whereafter the particles of the

microorganism mass are transmitted into a room, which can be evacuated and wherein the particles are kept at a temperature of 25-45°C and preferably of 30-35°C, while the pressure is lowered up to a value of 1-10 mm Hg (133-1330 Pa), and preferably of 5-7 mm Hg (665-930 Pa), until the particles have reached a dry matter content of 90-98% and preferably 92-94%.

With the term "compressed mass of microorganisms" is meant a mass of microorganisms, obtained by means of fermentation, from which the accompanying liquid has been removed as far as possible by mechanical means, such as filtration, centrifugation etc.

In the case of yeast a so called compressed yeast having a dry matter content varying between 25 and 50% and more specifically between 30 and 40%, is obtained in this way. Thereby the so called "Salzverfahren", disclosed in the British Patent Specification no. 763.926, may be suitably applied.

According to the process of the present invention, characterized by a drying period in the evacuated space of from 2.5 to 40 hours and more usually from 5-20 hours, which is dependent on the desired dry matter content, the expensive preparation of dry air, which should normally be necessary for the final stage of the drying process, is avoided. Moreover the present process is much more advantageous than in the case, wherein the complete drying process should be carried out in an evacuated space, because for the initial stage of the drying process the use of moist air is still possible and because the vacuo pumps can be much smaller and less energy consuming than would be necessary for the complete drying process under vacuo.

The presently proposed process is particularly suitable for the preparation of active dried yeast (derived from a Saccharomyces cerevisiae strain), but may also be applied with good results on other types of yeast, such as brewer's yeast, wine yeast and the like or even on other kinds of microorganisms such as dried moulds and the like.

After removal, as far as possible, of the liquid from the mass of microorganisms by mechanical means, e.g. a filter, the obtained mass is disintegrated, preferably by extruding the yeast through a perforated plate to form strands and breaking up the strands to form particles. The holes in the plate may have a cross section of 0.5-3 mm and preferably 1.2-1.6 mm, while after drying

particles, having sizes of about 0.4-1.5 mm, are obtained.

The load of the bed may vary from 100-1000 kg/m$^2$ of floor area.

Before drying a surface active agent may be added to the material to be dried, in an amount of e.g. 0.5-5% and more particularly 1-2% by weight, calculated on dry matter.

Suitable surface active agents are e.g. esters of saturated or unsaturated fatty acids and an alcohol, such as sorbitan monolaurate, sorbitan monostearate, sorbitan monooleate, glyceryl monostearate, glyceryl distearate, glyceryl monopalmitate, propylene glycol monostearate or glyceryl mono- or dipalmitate or -stearate, wherein free hydroxy groups optionally have been esterified with a suitable acid for consumption, such as citric acid, tartaric acid, fumaric acid, malic acid, lactic acid and the like.

The initial drying until a dry matter content of 75-90%, is preferably carried out by the application of a fluidized bed method e.g., as disclosed in the British Patent Specification no. 1.230.205, using drying air or an initial temperature of from 60 to 200°C, and preferably 90-130°C. The yeast particles are kept during such a process, on a wet-bulb temperature of at most 45°C, and in general at most 35°C.

The load of the fluidized bed drying equipment is varying in amounts from 100-1000 kg/m$^2$ floor area and preferably 400-800 kg/m$^2$ and more preferably 600 kg/m$^2$ in general.

According to a preferred embodiment of the presently proposed process, the load of the fluidized bed drying equipment is about 600 kg/m$^2$ floor area, while open air is sucked, having a dew point of 10-30°C and more preferably of 15-25°C, while the air is filtered to obtain dust free air and is heated in a previous step to 90-120°C and more preferably about 110°C.

The air space velocity in the fluidized bed will normally amount from 0.5-2.5 m/s and more generally 1.2 m/s, while the leaving air is almost saturated with water vapour and the relative humidity decreased in the final stage of drying.

Preferably the air temperature is lowered at the end of the drying process as function of the actual bed temperature, being at most 35°C.

The active dried microorganism mass obtained according to the first drying step has a dry matter content of from 75-90%.

The evacuated room, which may be applied for the last

stage of drying, may consist of a vacuum drum, which may be rotated and whereby water may be circulated with a temperature of 25-45°C through an external jacket.

According to a preferred embodiment of the presently proposed process, the initial vacuum in the rotating vacuum drum is 10-20 mm Hg (1300-2600 Pa) while the pressure further decreases during this drying step to 10-2 mm Hg (1300-250 Pa). Biologically active dried microorganisms, preferably dried active baker's yeast, prepared by the process of the invention, constitute further features of the invention. The following example illustrates a way in which the present invention can be carried into effect.

Example

Baker's yeast was prepared in the usual way, using molasses as nutrient. As phosphorus source ammoniumphosphate is used and as nitrogen source urea and ammonium sulphate were added.

The obtained yeast showed a nitrogen content of 6.0-9.0% with several experiments, and 7.2% in general, calculated on dry matter.

The phosphate content was 1.4-3.0% calculated on dry matter and in general 1.8%.

The yeast was centrifugated and washed and was subsequently processed to a compressed yeast, showing a dry matter content of 30-36% and more preferably 34-35%, according to the method of the "Salzverfahren" by means of socalled vacuumfilters.

The so obtained compressed yeast was, optionally after addition of a surface active agent, extruded through a plate, having holes of a diameter of 1.4 mm, and the so obtained strands (like spaghetti) were broken up and were passed into a fluidized bed drying equipment.

The load of the fluidized bed drying was 100-1000 $kg/m^2$ floor area and in general 600 $kg/m^2$. Open air showing a dew point of 13-24°C, was sucked. This air was filtered to dust free and heated in a heat exchanger up to 110°C. The space velocity of the air in the fluidized bed amounted from 0.8-2.0 m/s and in general 1.2 m/s.

The leaving air was almost saturated with water vapour, while at the end of the drying, the relative humidity decreased.

During the final part of this drying step, the air temperature was lowered as function of the actual bed temperature, whereby the bed temperature amounted to at most 35°C.

After a drying period of 3 hours, a yeast was obtained, showing a dry matter content of 85-90%. The so obtained yeast particles were transmitted into a rotating vacuum drum for additional drying.

The inner wall of the vacuo drum was corrugated in order to increase the heated area.

Water having a temperature of from 30-35°C was passed through a jacket around the inner wall. After filling the drum was brought under vacuo, whereby a pressure of 15 mm Hg (2000 Pa) was initially reached, while this pressure decreased in the course of drying to 6 mm Hg (800 Pa). After a drying time in the drum of about 10 hours, the yeast showed a dry matter content of from 92% to 94%. The so obtained dried yeast was subsequently tested as to dough-raising activity and in baking experiments. At a dosage of 6g of dried yeast per kg of flour, a satisfactory dough raising activity and bread volume were obtained.

Claims

1. Process for the preparation of active dried microorganisms and in particular active dried baker's yeast, characterized in that a compressed mass of microorganisms is divided into particles and the particles are dried in a fluidized bed drying equipment with not previously dried air up to a dry matter content of from 75-90%, whereafter the particles of the microorganism mass are transmitted in a room, which may be evacuated, wherein the particles are kept on a temperature of from 25-45°C and the pressure is lowered to a value of from 1-10 mm Hg (133-1330 Pa), until the particles have reached a final dry matter content of from 90-98%.

2. Process according to claim 1, characterized in that yeast particles are dried in a fluidized bed drying equipment using drying air of an initial temperature of from 90-130°C and having a space velocity in the fluidized bed of 0.8-2.0 m/s, while the particles are kept on a wet bulb temperature of at most 45°C, and whereby the load of the fluidized bed dryer is 100-1000 $kg/m^2$ floor area.

3. Process according to claims 1 and 2, characterized in that compressed yeast particles of a dry matter content of 30-36% and of a size of from 1.2-1.6 mm, are dried in a fluidized bed dryer, while the load is 400-800 $kg/m^2$ floor area, and using open air of a dew point of 13-24°C, which is previously heated up to 110°C, and which has a space velocity of 1.2 m/s.

4. Process according to claims 1-3, characterized in that in the final stage of the drying in the fluidized bed equipment the air temperature is lowered as function of the bedtemperature, while the bed temperature is at most 35°C.

5. Process according to claims 1-4, characterized in that the walls of the evacuated room is kept on a temperature of from 30-35°C.

6. Process according to claims 1-5, characterized in that the particles of the microorganism mass are dried up to a final dry matter content of from 92-94%.

7. Process according to claims 1-6, characterized in that the initial vacuo in the rotating drum is 10-20 mm Hg (1300-2600Pa), while the pressure further decreases during this drying step to 10-2 mm (1300-250 Pa).

8. Process according to claims 1-7, characterized in that

a surface active agent is added to the microorganism mass before drying.

9. Process according to claim 8, characterized in that the surface active agent is selected from the group consisting of esters of saturated or unsaturated fatty acids and an alcohol, such as sorbitan monolaurate, sorbitan monostearate, sorbitan monooleate, glyceryl monostearate, glyceryl distearate, glyceryl monopalmitate, propylene glycol monostearate or glyceryl mono- or dipalmitate or -stearate, wherein free hydroxy groups optionally have been esterified with a suitable acid for consumption, such as citric acid, tartaric acid, fumaric acid, malic acid, lactic acid and the like.

10. Process according to claims 8 and 9, characterized in that an amount of the surface active agent of 0.5-5%, and preferably 1-2%, calculated on the dry matter content of microorganism is added.

11. Biological active, dried microorganism and in particular active dried yeast, obtained according to the process of the claims 1-10.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/NL 80/00038

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.[3] C 12 N 1/18; C 12 N 1/04

## II. FIELDS SEARCHED

Minimum Documentation Searched [4]

| Classification System | Classification Symbols |
|---|---|
| Int.Cl.[3] | C 12 N 1/00; C 12 N 1/04; C 12 N 1/18 |

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

## III. DOCUMENTS CONSIDERED TO SE RELEVANT [14]

| Category * | Citation of Document, [16] with indication, where appropriate, of the relevant passages [17] | Relevant to Claim No. [18] |
|---|---|---|
| X | US, A, 2894842, published July 14, 1959 see column 1, line 35 to column 3, line 10; examples 1 to 5; claims 1 to 16, J.H. Mitchell et al. | 1,6,8,9,10, 11 |
| X | Chemical Abstracts, vol. 78, no. 21, issued May 28, 1973 (Columbus, Ohio, US), G.A. Bocharova et al.: "Quality of bakers' yeasts dried out by a combined method", see page 243, abstract no. 134485f, Khlebopek. Konditer. Prom. 1973, (1), 26-8 (Russ.) | 1,5,6,11 |
| X | US, A, 3843800, published October 22, 1974 see column 3, lines 52-63; examples 1,3-8; claims 1,4,8,17, A. Langejan (cited in the application) corresponding to GB, 1230205 | 1-4 |
| | DE, A, 2515029, published October 14, 1976 see page 2, line 31 to page 5, line 10; examples 1-6; claims 1-4,16, C.H. Boehringer Sohn | 1,5,6,8-11 |

./.

* Special categories of cited documents: [15]

"A" document defining the general state of the art

"E" earlier document but published on or after the international filing date

"L" document cited for special reason other than those referred to in the other categories

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but on or after the priority date claimed

"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

## IV. CERTIFICATION

| Date of the Actual Completion of the International Search [1] | Date of Mailing of this International Search Report [2] |
|---|---|
| 19th February 1981 | 2nd March 1981 |

| International Searching Authority [1] | Signature of Authorized Officer [20] |
|---|---|
| EUROPEAN PATENT OFFICE Branch at The Hague<br>P.O.Box 5818 Patentlaan ,2<br>2280 HV RIJSWIJK (ZH) The Netherlands | G.L.M. Kruydenberg |

Form PCT/ISA/210 (second sheet) (October 1977)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

| | |
|---|---|
| BE, A, 512562, published January 2, 1953 see page 3, lines 1 to 33, page 3, line 47 to page 4, line 7, abstract, L.A. Hastir | 1,5,6,11 |
| G. Greed et al.: "Yeast Technology" 1973, The Avi publishing Co, Inc. (Westport, Connecticut, US), see page 92, lines 21-38; page 93, figure 5.12 | 1,11 |

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [10]

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

1. ☐ Claim numbers....., because they relate to subject matter [12] not required to be searched by this Authority, namely:

2. ☐ Claim numbers....., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [13], specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

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

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the International application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.