2075054

Process for the Production of a Yeast Extract.

This invention relates to a process for the production of a yeast extract in which a suspension of yeast cells is prepared, the cells are mechanically disintegrated and subjected to autolysis, autolysis being intensified by the addition of a proteolytic enzyme.

The industrial production of yeast extracts is based on various known processes, such as plasmolysis, autolysis, a combination of plasmolysis and autolysis or even their intensification by the addition of a proteolytic enzyme.

In plasmolysis, the cell content is released from the cell. It passes through the cellular membranes damaged either by thermal shock or under the effect of a hypertonic concentration of salts or sugars in a concentrated suspension of yeasts or even under the effect of certain solvents. The extract thus obtained has various deficiences which include a low degree of degradation of the proteins, a low vitamin content and an uninteresting taste.

In autolysis, the protoplasmic constituents are degraded by the actual enzymes in the yeast. During autolysis, the membranes and even the cell walls are also attacked, resulting in release of the autolysed protoplasm. Investigation of the mechanisms responsible for autolysis has reached a fairly advanced stage and it is possible to influence the yield of the process and the organoleptic qualities of the end product. However, the major fault of the process lies in the risks inherent in its long duration, particularly the risk of contamination of the suspension during autolysis

which represents a medium that is extremely favourable to the proliferation of microorganisms. To overcome this fault, it has been proposed to use various antimicrobial agents, particularly apolar organic solvents, for example chloroform, toluene or trichloroethylene in concentrations of up to 5%, ethanol or sodium chloride. However, the use of agents such as these is not without its disadvantages. Thus, taking the last example, the protection of autolysis by sodium chloride in a high concentration results in partial inhibition of the autolytic enzymes and lengthens the duration of the lysis or considerably reduces the yield quite apart from the corrosive effect on the installations used. In addition, the end product has a high salt content.

In the known processes based on a combination of plasmolysis and autolysis, plasmolysis is generally brought about by the addition of a large quantity of salt in a concentrated suspension of yeasts. This suspension generally has a dry matter content of more than 20% and the salt is added thereto in a quantity of at least 2 parts to 10 parts of dry weight of yeast. However, this quantity of salt still does not ensure asepsis of the process and an addition of ethanol of up to 9% of the total volume has been proposed. Under these conditions, the autolysis time exceeds 60 h and, even if the final suspension is passed through an autoclave to increase the yield, it still does not exceed 60%. There is even one known process of this type in which the cell membranes are damaged by thermal

shock brought about by spray-drying of the suspension. In this case, autolysis of the yeasts resuspended in water is carried out over a period of 24 to 48 h at 45°C without any provision for microbial protection.

Finally, so far as the combination of plasmolysis and autolysis intensified by the addition of proteolytic enzymes is concerned, various processes of this type have been proposed, having in common with one another the advantage of being easier to control and of shortening the necessary incubation time. However, the yields obtained scarcely exceed 55%.

The present invention is the outcome of a search for a simple and effective process which does not have any of the above-mentioned disadvantages attending known processes and which enables an extract of high nutritive value and excellent organoleptic qualities to be obtained in a high yield under totally aseptic conditions.

The present invention provides a process for producing a yeast extract which comprises preparing a suspension of yeast cells, mechanically disintegrating the cells, subjecting the cells to autolysis, the autolysis being intensified by the addition of a proteolytic enzyme, a sulphite (as herein defined) being added to the yeast suspension before or after mechanical disintegration, separating insoluble fractions from the hydrolysed suspension, adding a compound of calcium to the supernatant liquid which forms a precipitate with the sulphite, and clarifying the supernatant liquid.

By virtue of the process according to the invention,

it is possible to produce a highly pure extract in a very short time under conditions which can be controlled particularly easily and which may be varied as required and in a hitherto unequalled yield. In particular, it has been found that, by adding sulphite before or during autolysis, not only are the proteolytic enzymes activated and safe antimicrobial protection obtained, but a hitherto unknown, valuable precipitation effect is also subsequently obtained in the supernatant phase of the centrifuged autolysed suspension when a compound of calcium is added thereto, enabling this supernatant phase to be clarified. This supernatant phase is always cloudy because of particles which cannot be separated. It is presumed that these particles are fixed and entrained in the precipitation of the insoluble compound which is formed between the sulphite and the compound of calcium.

Another advantage of the process according to the invention lies in the fact that the insoluble residue obtained during centrifuging is completely free from contamination and in the fact that it may perfectly well be directly used in the manufacture of food products.

Finally, it is possible by the process according to the present invention to produce yeast extracts of low salt content in which the concentration of sodium chloride does not exceed 6%, i.e. three times less than in conventional extracts. A product such as this is of considerable interest from the dietetic point of view.

The yeasts normally used in the production of yeast extracts, particularly Saccharomyces cerevisiae, bakers yeast and brewers yeast and Candida utilis, may be used as starting material for carrying out the process according to the invention. A suspension having a dry matter content of from 10 to 25% is preferably prepared therefrom.

The mechanical disintegration step may be carried out in any mill, homogeniser or apparatus which functions on the principle of sudden expansion capable of releasing the protoplasm with the endoenzymes under conditions in which the endoenzymes retain their full activity. To this end, it is possible in particular to use for example ball mills, fluid pressure homogenisers or ultrasonic disintegrators.

In one preferred embodiment, the pH-value of the suspension is adjusted to a value of from 4.4 to 6.8 before disintegration and to a "neutral" value of from 6.5 to 7 after disintegration, at least one proteolytic enzyme which is active at a neutral pH is added, the whole is incubated with gentle stirring for 15 to 22 h at a neutral pH and a total of from 300 to 2000 ppm of a sulphite and a total of from 300 to 2000 ppm of formaldehyde are added in several batches during the incubation process.

In the context of the invention, a sulphite is understood to be any food-grade chemical compound which is capable of releasing sulphur dioxide, particularly sodium and potassium sulphite, disulphite and metabisulphite, with sulphur dioxide itself also being suitable.

In another preferred embodiment, the pH of the suspension is adjusted to a value of from 3.0 to 5.5 and from 200 to 2000 ppm of a sulphite are added before disintegration. The whole may even be gently stirred for 30 to 60 minutes at ambient temperature before disintegration. During disintegration, the pH may rise spontaneously to 5.1-6.0. At least one proteolytic enzyme which is active at an acid pH value is added and the whole is incubated with gentle stirring for 15 to 22 h at an acid pH.

Any food-grade acid or base may be used for making the pH adjustments. It is preferred to use hydrochloric acid and sodium hydroxide. The choice of the proteolytic enzyme depends upon its activity, the necessary temperatures and pH-value and its price in relation to the organoleptic qualities of the products of intensified autolysis. Very good results may be obtained in the two embodiments mentioned above with papain used in a quantity of at least 0.3 g per litre of suspension and with incubation temperatures in the range from 45 to 65°C. However, the process according to the invention is by no means limited to use of this particular enzyme and others, particularly trypsin and other proteases of various origins and mixtures thereof, may be used with equally good results at adequate pH-values and incubation temperatures.

After the enzyme-intensified autolysis process, the enzymes may be inactivated by heating. The suspension is preferably heated for 35 to 70 minutes at 90 to 95°C. This

not only inactivates the enzymes, it also coagulates the insoluble fractions to a certain extent. The insoluble fractions thus coagulated may then be separated by filtration or centrifuging for example. Separation is preferably carried out by centrifuging under heat at 60 to 80°C.

After separation of the insoluble fractions, very fine particles are left in the supernatant phase, making it cloudy. All the sulphite also remains therein. There is then added to the suspension a compound of calcium which is preferably selected from the soluble compounds, such as calcium chloride, calcium gluconate or calcium hydroxide. The compound of calcium is preferably added in the same molar quantity as the sulphite at a pH value of from 6.5 to 7.5. A precipitate is obtained and is separated. This clarification step may be carried out for example by filtration or centrifuging.

The solution obtained may then be concentrated, for example by evaporation in vacuo, to obtain a paste or may be dried, for example by spray drying, to obtain a powder. The product which the process according to the invention thus makes it possible to obtain represents up to 70% by weight or more of the dry matter of the starting yeast. A yield as high as this is quite remarkable.

The product obtained by the process according to the invention, which has excellent and controllable organoleptic qualities and a totally reproducible chemical composition, even with different starting yeasts, may be

used as a supplement or condiment in soups, stocks, sauces, meats, relishes, fish, vegetables, cocktail snacks, bread and biscuits, as an additive rich in vitamins for confectionery, chocolate, sweets, dairy products, particularly cheese, and dietetic products, and as an essential constituent of culture media in industrial fermentation for example.

The invention is illustrated by the following Examples in which the percentages quoted represent percentages by weight.

EXAMPLE 1

10 litres of a suspension of Candida utilis yeasts having a dry matter content of 16% are prepared. The pH value of the suspension is adjusted to 3.5 by the addition of 15% hydrochloric acid. 100 ml of a 10% solution of sodium sulphite are added and the suspension is gently stirred for 40 minutes at ambient temperature. The suspension is then subjected to continuous disintegration in a horizontal ball mill. A suspension containing 86-90% of crushed cells and having a pH value of 5.5 is collected in a jacketed tank.

Papain is then added in a quantity of 3 g per litre of suspension. After incubation for 20 hours at 55°C, the enzymes are inactivated by heating for 1 hour at 90°C. The suspension is then centrifuged with heating at 60 to 65°C in an automatic decanting centrifuge.

The supernatant phase is neutralised to a pH of 6.8 to 7 by the addition of sodium hydroxide. Calcium chloride is added in the same molar quantity as the sodium sulphite

added at the beginning. The precipitate is separated by centrifuging with heating for a second time.

The pH of the solution is lowered to 5.4 by the addition of 15% HCl and sodium chloride is added in such a quantity as to obtain a concentration of 13% in a final paste having a dry matter content of 80%. The solution is concentrated by evaporation in vacuo at a temperature of 75 to 80°C to a dry matter content of 70%. The product is then heated at 90°C for 30 minutes at atmospheric pressure to produce a Maillard reaction after which evaporation is continued to a dry matter content of 80%.

A yeast extract having the following composition is obtained:

dry matter content	81.6	%
total nitrogen	7.2	%
free α-amino nitrogen	2.0	%
reducing substances	4.1	%
sodium chloride	12.9	%
ash	17.9	%
colour (extinction at 480 nm of a 5% solution)	1.16	

The total micro-organism count does not exceed 10 to 20 per gram of product.

The yield calculated on the basis of the dry weight of the starting yeasts amounts to 71%. The product has a very pure, full taste and is particularly suitable for use as a condiment in soups, sauces and other main course dishes.

EXAMPLE 2

The procedure is as described in Example 1 up to the second centrifuging step, except that papain is used in a quantity of 1.5 g per litre of suspension and incubation is carried out over a period of 18 hours.

The insoluble fractions obtained after the first centrifuging step are washed. Their pH is adjusted to 7 and they are sterilised for 15 minutes at 115°C. A cream-coloured gelatinous paste of very fine texture is obtained and may be used as a low-calorie additive in food products, its composition being as follows:

dry matter content	16	%
total nitrogen	0.6	%
total carbohydrates (glucose-mannose in a ratio of 1:1)	5.8	%
fat	2.5	%
ash	1.2	%

The pH value of the solution obtained after the second centrifuging step is lowered to 5.2. The solution is concentrated to a dry matter content of 30% and is filtered on active carbon. Evaporation in vacuo is continued at a moderate temperature to avoid as far as possible any Maillard reaction. A yeast extract paste having the following composition is obtained:

dry matter content	80	%
total nitrogen	7.8	%
free α-aminonitrogen	1.7	%

sodium chloride	5.8	%
ash	11.0	%
fat	0.1	%
colour (extinction at 480 nm of a 5% solution)	0.12	

The paste has a neutral taste and is particularly suitable for use as a vitamin-containing additive or supplement in confectionery or in dairy products for example.

EXAMPLE 3

An extract is prepared in the same way as described in Example 1, except that no sodium chloride is added to the solution after the second centrifuging step and the solution is concentrated by evaporation in vacuo at a moderate temperature (to avoid as far as possible any Maillard reaction) up to a dry matter content of 80%. The yeast extract obtained has a neutral taste and is light in colour, its sodium chloride content being less than 4.5%.

This extract is used in the preparation of a dietetic product based on malt extract. To this end, a malt extract having a dry matter content of 66% is prepared having virtually all the diastasic and proteolytic activity of the starting malt. The malt extract and the yeast extract are mixed in ratios of from 9:1 to 7:3. The pH of the mixture is adjusted to 5.0 with lactic acid.

The product corresponding to the mixture of 7 parts of malt extract to 3 parts of yeast extract has a dry matter content of 71%, of which 60% is sugar (expressed

as glucose), 9.5% proteins and 0.9% NaCl. Its water activity does not exceed 0.62 at 30°C, at which level any growth of microorangisms is completely inhibited. Its organoleptic qualities are hardly different from those of the initial malt extract.

* C L M S *

CLAIMS

1. A process for the production of a yeast extract which comprises preparing a suspension of yeast cells, mechanically disintegrating the cells, subjecting the cells to autolysis, the autolysis being intensified by the addition of a proteolytic enzyme, a sulphite (as herein defined) being added to the yeast suspension before or after mechanical disintegration, separating insoluble fractions from the hydrolysed suspension, adding a compound of calcium to the supernatant liquid which forms a precipitate with the sulphite, and clarifying the supernatant liquid.

2. A process as claimed in claim 1, wherein the yeast is Saccharomyces cerevisiae, bakers yeast, brewers yeast or Candida utilis, a suspension of cells having a dry matter content of from 10 to 25% and a pH value of from 4.4 to 6.8 is prepared before disintegration and, to carry out intensified autolysis after mechanical disintegration of the cells, the pH is adjusted to a neutral pH of 6.5 to 7, at least one proteolytic enzyme active at a neutral pH is added, the whole is incubated with gentle stirring for 15 to 22 h at a neutral pH and a total of from 300 to 2000 ppm of sulphite and a total of from 300 to 2000 ppm of formaldehyde are added in several batches during the incubation process.

3. A process as claimed in claim 1, wherein the yeast is Saccharomyces cerevisiae, bakers yeast, brewers yeast or Candida utilis, a suspension of cells having a dry matter content of from 10 to 25% and a pH value of from 3.0 to 5.5 is prepared, from 200 to 2000 ppm of a sulphite are added and, to carry out intensified

autolysis after mechanical disintegration of the cells, at least one enzyme active at an acid pH is added and the whole is incubated with gentle stirring for 15 to 22 h at an acid pH.

4. A process as claimed in any of Claims 1 to 3, wherein after the intensified autolysis step, the suspension is heated for 35 to 70 minutes at 90 to 95°C and the insoluble fractions are separated by centrifuging at 60 to 80°C.

5. A process as claimed in any of Claims 1 to 4, wherein the compound of calcium is added in the same molar quantity as the sulphite at a pH of 6.5 to 7.5 and clarification is effected by separating the precipitate thus obtained.

6. A process as claimed in any of Claims 1 to 5, wherein the enzyme added is papain, the papain is added in a quantity of at least 0.3 g per litre of suspension and the whole is incubated at a temperature of from 45 to 65°C.

7. A process for the production of a yeast extract substantially as described with particular reference to any of the Examples.

8. A yeast extract when prepared by a process as claimed in any of Claims 1 to 7.

The text of the specification has been reproduced by photocopying the applicants original typescript. It may contain a few amendments which are difficult to read. The original typescript containing these amendments may be inspected on the premises of the Patent Office