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A Process for the Production of an Acid
Beverage Enriched in Protein.

The present invention relates to a process for the production of an acid beverage enriched in protein, particularly a fruit juice beverage or a fruit flavoured beverage.

5 Acid fruit juice or fruit flavoured beverages meet with a certain approval, even among individuals or populations whose diet is poor or unbalanced. Thus, such beverages represent an advantageous medium for nutritious complements, notably proteins which are capable
10 of enriching or balancing this diet. This is why fruit juice or fruit flavoured beverages have already been proposed which are enriched in lactic proteins, notably caseinates which are soluble at acid pH values.

15 In fact, the pH values of fruit juice beverages or fruit flavoured beverages are similar to those of fruit juices i.e., pH values of from 3 to 3.5. However, in some non-milk-producing countries for example, or even simply for dietetic reasons, due to the fact, for example, that a vegetable extract, such as a soya extract
20 has a buffer effect lesser than that of cow's milk and that at the same pH, it thus has a less aggressive acid taste, it may prove desirable to be able to produce an acid beverage enriched in vegetable protein, notably in soya protein. However, it is known that vegetable
25 proteins precipitate at isoelectric pH values and that these values generally cover the range of from 3 to 3.5 which is advantageous for acid beverages. Thus, there are virtually no acid beverages enriched in vegetable

proteins, because such proteins do not remain in solution at the pH values concerned.

An object of the present invention is to provide a process for the production of an acid beverage enriched
5 in vegetable proteins, in which these proteins are and remain completely dissolved.

The present invention provides a process for the production of an acid beverage enriched in protein which comprises preparing an aqueous suspension of a vegetable
10 material rich in protein, particularly soya protein, using water and/or fruit juice, adding calcium to provide concentration of from 5 to 50 mmol/l, and reducing the pH of the suspension to from 3 to 3.5 thereby extracting solids from the vegetable material, separating insoluble material,
15 and if desired adding to the protein solution a fruit juice or a fruit flavouring and sugar and pasteurising the solution.

In fact, it has been found that if an extraction of vegetable material rich in protein, such as soya, for
20 example, at pH 3.5 only allows about 10% of the solids to be extracted from this material because the operation is being carried out in the vicinity of the isoelectric point of the proteins, it is possible to extract up to 40 to 70 % of these solids at pH values of from about 3 to
25 3.5 in the presence of a calcium concentration of from about 5 to 50 mmol/l.

The double advantage of the present process should

be seen in the fact that it allows the production of acid beverages enriched in vegetable proteins, in which these proteins are and remain soluble and that the acid beverage which is obtained is also enriched in calcium, and this
5 in a proportion which may attain that which is naturally found in cow's milk, for example.

The vegetable material rich in protein which is preferred in the present invention is soya in all forms thereof, such as whole or defatted meal, whole
10 or defatted flour, concentrate or isolate.

As used herein, the term "fruit juice" should be understood as the liquid obtained by squeezing ripe fruits, such as oranges, grapefruit, pineapples, plums, apricots, mandarines or blackcurrants, for example.
15 Such juices have pH values of from about 2.5 to 3.5. The term "fruit flavouring" should be understood herein as including any concentrated preparation imparting to the solution the taste of a fruit, such as those listed above. Such concentrated preparations may also impart
20 the colour of said fruits to the solution.

In order to carry out the present process, an aqueous suspension of from 4 to 10 % by weight of the vegetable material may be prepared and calcium is added so that the concentration thereof is from 5 to 50 mmol/l.
25 The calcium may be added in the form of chloride, acetate, tartrate, malate or lactate. The pH may be adjusted to from 3 to 3.5 using any strong, edible acid, such as

hydrochloric acid, or organic acids, such as acetic, tartaric, malic or lactic acid. The solids may be extracted from the vegetable material at a temperature of from 20 to 100°C over a period of from 10 to 30 minutes.

5 The fruit juice may be used as any desired proportion of the liquid used. Likewise, the flavouring may be used in very variable proportions, depending on its concentration or on the desired effect, but a quantity of flavouring of from 0.1 to 2 g per litre of liquid used

10 may be indicated as being preferred. Finally, the beverage may be pasteurized over a period of from 1 to 2 minutes at from 75 to 85°C and it may then be poured into, for example, lacquered cans, glass bottles or cardboard packs having a suitable internal lining.

15 The following Examples are provided by way of illustration. The percentages in the Examples are expressed by weight.

Example 1

20 5 kg of defatted soya flour are dispersed in 65 kg of cold tap water. The pH is adjusted to 3.0 using hydrochloric acid. The suspension is stirred for half an hour at ambient temperature. It is then brought to boiling point and is allowed to boil for 10 minutes.

25 The suspension is then cooled to 20°C, homogenised, 191 g of $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ (20 mM) are added and the pH is adjusted to 3.2 with KOH. The insoluble material is removed by

centrifugation. 60 kg of a protein solution are obtained containing 5 % of dry material and 2.63 % of protein. The protein content of the solution is adjusted to 2 % with water and 6 kg of sucrose are added.

5 The protein solution is divided into several portions which are each flavoured with a different flavouring, i.e., pineapple, lemon, orange, mandarine and cola, respectively in a proportion of 0.4 g, 0.2 g, 0.1 g, 0.2 g and 2 g of commercial flavouring per kg of protein
10 solution. Clear, coloured acid beverages are obtained, judged by experienced tasters as good to delicious. The beverages are pasteurized and are introduced into flame-sterilised, 450 g capacity cans. They are stored under refrigeration.

15 Thus, with a good extraction yield of the protein of about 70 %, an organoleptically, economically and nutritionally advantageous product^t is obtained, in which the proteins have not coagulated during pasteurization and the trypsin inhibitor has been 80 % destroyed,
20 and which contains 2 % of soya protein, 10 % of sugar, 17 mmol/l of calcium, 7 mmol/l of magnesium, 34 mmol/l of potassium and 0.4 mmol/l of sodium, while having a pH of 3.2.

Examples 2 to 8 and Comparative Examples

25 Various beverages are produced, by varying the starting material, the pH, the extraction medium and the quantity of calcium added. The production method is

similar for each beverage, i.e.:

10 g of soya flour are dispersed in 90 g of water. The pH is adjusted using 6 N HCl, and at the same time calcium is added in the form of $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$. The suspension is then stirred vigorously,

- 5 brought to boiling point by injecting steam for 1 minute, cooled to ambient temperature, left to draw while being gently stirred for 30 minutes, and centrifuged at 3 000 r.p.m. (acceleration of $20\,000\text{ ms}^{-2}$).

- The solid residue is removed, the protein content of
10 the supernatant is adjusted to 2 % by adding water when this content exceeds 2 %, 10 % by weight of sucrose are added, and the material is pasteurized at 70°C , flavoured and canned.

- 15 The following Table describes the various tests.

Example No.	Starting material	pH	Extraction medium	Dry matter content of dispersion %	Calcium added mmol/l	Protein yield %
2	Unheated defatted flour	3.5	Orange juice	9	30	58
3	Unheated defatted flour	3.5	Water	9	30	42
4	Whole flour	3.2	Water	4	20	22
5	Whole flour	3.2	Water	4	30	38
6	Defatted flour	3.2	Water	4	20	34
7	Defatted flour	3.2	Water	4	30	54
8	Unheated defatted flour	3.0	Water	9	9	66
Comparison	Whole flour	3.2	Water	4	0	11
Comparison	Defatted flour	3.2	Water	4	0	17

In this Table, under the heading of "starting material", the unheated defatted flour is a specific soya flour which has not undergone any thermal treatment during defatting, in contrast to conventional defatted soya flour. Moreover, the protein yield is expressed in % of the initial protein content of the starting material.

In Examples 2 to 8, clear, flavoured beverages are obtained which are enriched in protein and are advantageous as much as from the organoleptic point of view as from the nutritional and economic view point. As far as the latter point is concerned, there is quite obviously a decisive effect, obtained by adding calcium, on the quantity of protein which may be solubilized within the pH range of from 3 to 3.5.



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CLAIMS

1. A process for the production of an acid beverage enriched in protein, which comprises preparing an aqueous suspension of a vegetable material rich in protein using water and/or fruit juice, adding calcium to provide a concentration of from 5 to 50 mmol/l, and reducing the pH of the suspension to from 3 to 3.5 thereby extracting solids from the vegetable material, and separating insoluble material.
2. A process as claimed in Claim 1, wherein the vegetable material rich in protein is a material rich in soya protein.
3. A process as claimed in Claim 1 or 2, wherein the vegetable material is soya in the form of whole or defatted meal, whole or defatted flour, concentrate or isolate.
4. A process as claimed in any of Claims 1 to 3, wherein the aqueous suspension contains from 4 to 10 % by weight of the vegetable material.
5. A process as claimed in any of Claims 1 to 4, wherein calcium is added in the form of calcium chloride, calcium acetate, calcium tartrate, calcium malate or calcium lactate.



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6. A process as claimed in any of Claims 1 to 5 in which at least one of a fruit juice, a fruit flavouring and sugar is added to the solution obtained after separation of insoluble material.

7. A process as claimed in any of Claims 1 to 6 wherein the solution obtained after separation of insoluble material is pasteurised.

8. A process for the production of an acid beverage substantially as described with particular reference to the Examples (excluding the Comparative Examples).

9. An acid beverage when prepared by a process as claimed in any of Claims 1 to 8.
