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(54) **Title:** A LIQUID TEA PRODUCT

(57) **Abstract:** The present invention relates to a liquid tea product comprising 1 to 10 % by weight of soluble tea solids with a solubility of at least 50 g/L at 25°C in water, 1 to 6 % by weight of acidulant, 0.01 to 1 % by weight of preservatives, and water.



A LIQUID TEA PRODUCT

Technical Field

- 5 The present invention relates to a tea product and more particularly the present invention relates to a liquid tea product.

Background of the invention

- 10 Tea is one of the most widely consumed beverages in the world. Different formats of tea products are available in the market. Liquid tea products are being one of them. Teas with different natural additives are also quite popular. Honey is one such naturally available material that has various health benefits.

- 15 Different kinds of beverages with honey or its essence are disclosed in the art.

CN1954682 (JIN ZHONGYING NANO SCIENCE) discloses a health-care plum-honey-green tea-vinegar beverage with improved taste and rich nutrients for the patients of hepatocirrhosis and anorexia. It is prepared from plum, green tea, vinegar, honey, citric acid and essence.

20

CN1185285 (CHUNDU GROUP CO LTD LUOGANG) discloses the production method of jasmine honey tea comprising (wt%) jasmine tea juice (10 to 90), sophora flower honey (0.5 to 15) and cane sugar (5 to 15), and in the course of production the antioxidant Vc and VcNa are added. Citric acid is used to regulate its pH value to protect its natural pH value.

25

Liquid tea products are becoming popular day by day because of their ready availability and/or less effort at consumer end for preparing a beverage. These liquid tea products are preferably served at low temperature (about 2 to 15°C). Some of these liquid tea products are available in a ready-to-drink format or some of them may have to be diluted before making the final

- 30 beverage (in case of a concentrate product).

Ready-to-drink liquid tea product may be consumed directly without any further effort at the consumer end. In case of liquid tea product that needs dilution at the consumer end to produce consumable beverage, the typical practice is to store the diluted beverage at low temperature

- 35 (about 2 to 15°C) and consume the beverage within a period of 2 to 5 days.

Generally the amount of tea solids that is present in this kind of liquid tea products is relatively low. We have found that the addition of increased amount of tea solids in this type of product produces a hazy liquid, which is not preferred by the consumers. We have further found out that those liquid tea products with additives like honey which need dilution at the consumer end
5 produces flock formation and/or haziness when storing the diluted beverage for 2 to 5 days under low temperature. Consumers tend to waste/abandon the product when there is flock formation and/or haziness.

Objects of the invention

10 It is therefore an object of the present invention to produce a liquid tea product with relatively high amount of tea solids.

It is another object of the present invention to produce a liquid tea product with relatively high
15 amount of tea solids and with low haziness.

It is a further object of the present invention to produce a liquid tea product with honey which is substantially free from flock formation and/or haziness when diluted and stored under low temperature.

20 The present inventors have surprisingly found that tea solids that have high solubility produce a liquid tea product which is able to incorporate relatively high amount of tea solids with less haziness. They have further found that the same tea solids, when used for making a liquid tea product with honey, produces a product which is substantially free from flock formation and/or
25 haziness when diluted and stored. The tea solids are preferably sourced from a tea juice obtained by pressing fresh tea leaf.

Summary of the invention

30 In a first aspect the present invention provides a liquid tea product comprising:

- a) 1 to 10 % by weight of soluble tea solids with solubility at least 50 g/L at 25°C in water,
- b) 1 to 6 % by weight of acidulant,
- c) 0.01 to 1% by weight of preservatives; and
- 35 d) water.

In a second aspect the present invention provides a process for producing a process for producing a liquid tea product comprising the steps of:

- 5 a) obtaining soluble tea solids with solubility of at least 50 g/L at 25°C in water by processing fresh tea leaf ;
- b) adding the soluble tea solids and mixing with other ingredients to obtain a liquid tea product.

Any feature of one aspect of the present invention may be utilized in any other aspect of the invention. The word "comprising" is intended to mean "including" but not necessarily "consisting of" or "composed of." In other words, the listed steps or options need not be exhaustive. Except
10 of" or "composed of." In other words, the listed steps or options need not be exhaustive. Except in the operating and comparative examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts of material or conditions of reaction, physical properties of materials and/or use are to be understood as modified by the word "about". Numerical ranges expressed in the format "from x to y" are understood to include x and y. When for a
15 specific feature multiple preferred ranges are described in the format "from x to y", it is understood that all ranges combining the different endpoints are also contemplated.

Detailed description of the invention

20 Tea product of the invention:

The present invention provides a liquid tea product comprising:

- a) 1 to 10 % by weight of soluble tea solids with solubility at least 50 g/L at 25°C in water,
- b) 1 to 6 % by weight of acidulant,
- 25 c) 0.01 to 1% by weight of preservatives; and
- d) water.

Liquid tea product preferably means a tea product in liquid form which may be consumed directly or may have to be diluted suitably before consumption.

30 In case the liquid tea product as defined above needs dilution, the dilution is preferably carried out with cold water having temperature in the range of 0 to 10°C.

In case of a liquid tea product which needs dilution, the product viscosity before dilution is preferably in the range of 35 to 70 Centipoise and more preferably in the range of 40 to 60 Centipoise at room temperature (about 25°C).

- 5 The liquid tea product of the invention comprises 1 to 10%, preferably 2 to 10% and more preferably 3 to 10% by weight of soluble tea solids.

Soluble tea solids refer to tea solids that are readily soluble in water. According to the present invention the solubility of the soluble tea solids for the product of the present invention is at
10 least 50 g/L, preferably 70 g/L, more preferably 80g/L and further more preferably 90 g/L and most preferably from 60 to 120 g/L at 25°C in water.

The liquid tea product of the invention also comprises 1 to 6%, preferably 2 to 5% and more preferably 3 to 5% by weight of acidulant. This is preferably added for maintaining the desired
15 pH of the product. The pH of the liquid concentrate tea product is in the range of 2.5 to 4, preferably 3 to 3.5. Any suitable food grade acidulant may be added for this purpose. The most preferable acidulant is citric acid.

The liquid tea product of the invention further comprises 0.01 to 1%, preferably 0.03 to 1% and
20 more preferably 0.05 to 0.5% by weight of a preservative. The preservative may preferably be selected from sorbic acid and its derivatives, sodium benzoate, benzoic acid or mixtures thereof.

The liquid tea product of the present invention preferably comprises 10 to 25 % by weight of
25 honey. Honey is a well known natural sweet food (highly viscous) made by bees using nectar from flowers. The nectar collected by bees is naturally broken down into simple sugars (fructose and glucose) and stored in honeycomb. Evaporation takes place inside the honeycombs and thus produces a thick liquid known as honey. After this, the beekeepers collect the honey from the honeycomb by separating the wax and the honey. Honey also
30 contains small amounts of polysaccharides, flavonols and proteins.

Honey has a unique taste which is preferred by a lot of people. It is also believed to be of high nutrition value with a number of health benefits. A number of people refer it as a natural energy booster. Consumption of honey regularly is believed to make improved immunity system within
35 human body.

The composition of the present invention preferably comprises 12 to 25%, more preferably 15 to 25% and most preferably 17 to 25% by weight of honey.

When honey is used in the liquid tea product of the invention, it also preferably comprises 35 to 55 %, preferably 40 to 55 % and more preferably 45 to 55 % by weight of a solubilizer. The present inventors have found that honey, when combined with water and the other ingredients of the composition tends to phase separate. The advantage of addition of solubilizer is that it tends to prevent this phase separation. Any solubilizer that may be used for food application may preferably be used. The more preferable solubilizer may be selected from ethanol, propan-1, 2-diol, glycerin (glycerol), propylene glycol, polyphthylene glycol (PEG). The most preferred solubilizer is glycerin.

The liquid tea product also preferably comprises other additives e.g. fortificants, colours, flavours and any other additives suitable to be used for beverage composition.

To produce the liquid tea product of the present invention the soluble tea solids are preferably obtained from a tea juice that is produced by expressing fresh tea leaf. The fresh tea leaf is preferably comminuted before pressing. The comminuted leaf preferably undergoes fermentation before pressing. A suitable process of pressing tea leaves to produce the juice is explained in the following paragraphs.

Process to produce tea product of the invention:

The present invention provides a process for producing a liquid tea product comprising the steps of:

- a) obtaining soluble tea solids with solubility of at least 50 g/L at 25°C in water by processing fresh tea leaf ;
- b) adding the soluble tea solids with other ingredients to obtain a liquid tea product.

In the first step the soluble tea solids with solubility at least 50 g/L, preferably 70 g/L, more preferably 80g/L and further more preferably 90 g/L and most preferably from 60 to 120 g/L at 25°C in water in water is obtained by processing fresh tea leaves.

Any kind of tea processing which produces soluble tea solids with solubility at least 50g/L at 25°C in water is suitable for process of the present invention.

The processing the fresh tea leaf as described above in step (a) preferably comprises the steps of:

- i. pressing fresh tea leaf thereby producing tea juice and leaf residue; and
- 5 ii. subjecting the tea juice to a step of drying to obtain soluble tea solids.

"Fresh tea leaf" refers to tea leaf, buds and/or stem that have never been dried to a water content of less than 30% by weight, and usually have water content in the range 60 to 90%.

The fresh tea leaves are preferably from the plant *Camellia sinensis*. The preferable variety is
10 *Camellia sinensis* var. *sinensis* and/or *Camellia sinensis* var. *assamica*. Especially preferred is material from var. *assamica*.

Expression of the fresh tea leaf:

15 The tea leaf is preferably pressed / squeezed to take out the juice. The amount of expressed juice is preferably at least 50 mL per kg of the fresh tea leaves. The expression step is preferably achieved in any convenient way so long as it allows for separation of the tea juice from the leaf residue and results in the required quantity of juice. The machinery used to express the juice may, for example, include a hydraulic press, a pneumatic press, a screw
20 press, a belt press, an extruder or a combination thereof. Then, the juice and the leaf residue may separated by filtration or centrifugal separation.

The fresh tea leaf is preferably comminuted before pressing. This may preferably be carried out by crushing, tearing and curling which is known as CTC. One or more CTC steps may be
25 carried out. Alternately the fresh tea leaf is rolled in an orthodox roller or comminuted in a rotorvane or combination thereof. During these steps precursors present in the tea leaf become amenable to the enzymes.

The comminuted leaf preferably undergoes fermentation before pressing. Fermentation refers
30 to the oxidative and hydrolytic process that tea undergoes when certain endogenous enzymes and substrates are brought together, e.g. by mechanical disruption of the cells by maceration of the leaves. During this process colourless catechins in the leaves are converted to a complex mixture of yellow and orange to dark-brown polyphenolic substances. Fermentation is preferably carried out by keeping the leaf at a temperature of 15 to 35°C for 15 minutes to 3

hours. Preferably the temperature of the fermentation is between 25 to 35°C and more preferably around 30 to 35°C. The time for fermentation preferably is from 30 minutes to 3 hours and more preferably 1 to 3 hours.

- 5 The juice may be obtained from the fermented tea leaves in a single pressing or in multiple pressings of the tea leaves. Preferably the juice is obtained from a single pressing as this allows for a simple and rapid process.

10 In order to minimize generation of off-flavours in the leaf tea and/or juice, it is preferred that the expression step is performed at ambient temperature. For example, the leaf temperature may be from 5 to 40 °C, more preferably 10 to 30 °C.

The time and pressure used in the expression step can be varied to yield the specified amount of juice. Typically, however, the pressures applied to express the juice will range from 0.5 MPa (73 psi) to 10 MPa (1450 psi). The time over which the pressure is applied will typically range from 1 second to 1 hour, more preferably from 10 second to 20 minutes and most preferably from 30 second to 5 minutes.

20 The leaf residue may be processed further to obtain a regular black leaf tea product.

Drying the tea juice:

After obtaining the tea juice it is preferably subjected to a further step of drying to obtain soluble tea solids in powdered form. Any suitable drying technique may be used for this purpose. The preferable drying process may include freeze drying, drying by using rotary evaporator and spray drying.

After obtaining the soluble tea solids it is added with the other ingredients and mixed to obtain the liquid tea product of the present invention.

30 "Other ingredients" means the rest of the ingredients excluding the soluble tea solids as disclosed in the previous sections. In case of the liquid tea product that does not need dilution, the term "other ingredients" includes acidulant, preservatives and water. In case of a tea product that needs dilution before consumption, the term other "other ingredients" includes acidulants, preservative, water and honey, optionally also includes a solubilizer.

The mixing step may be carried out by any suitable mixing mechanism.

Now the invention will be demonstrated in terms of examples. The following examples are just
5 for illustration and in no way limit the scope of the present invention.

Examples:

Preparing the liquid tea products:

10

Two sets of liquid tea products were prepared as described below:

Set 1: The first set of tea products which do not contain honey and do not require dilution were prepared according to Table 1.

15

Table 1:

Ingredients	Ex A	Ex 1	Ex B	Ex 2	Ex C	Ex 3
	Weight %					
Soluble tea solids (Solubility 70 g/L)	-	0.14	-	2	-	4
Soluble tea solids (solubility 37 g/L)	0.14	-	2	-	4	-
Citric acid	0.18	0.18	0.18	0.18	0.18	0.18
Sorbic acid	0.02	0.02	0.02	0.02	0.02	0.02
Sugar	7.9	7.9	7.9	7.9	7.9	7.9
Water	To 100	To 100	To 100	To 100	To 100	To 100

The tea products of Table 1 were prepared by simply mixing the different ingredients at room temperature (~25°C) and stirring for about 30 minutes followed by transferring in a bottle as a
20 product.

Set 2: Another set of tea products which contain honey and require dilution before consumption were prepared according to Table 2.

Table 2:

Ingredients	Ex D	Ex 4	Ex E	Ex 5	Ex F	Ex 6
	Weight %					
Soluble tea solids (Solubility 70 g/L)	-	3.5	-	7.5	-	9
Soluble tea solids (solubility 37 g/L)	3.5	-	7.5	-	9	-
Honey	17	17	17	17	17	17
Glycerin	45	45	45	45	45	45
Citric acid	4	4	4	4	4	4
Sorbic acid	0.05	0.05	0.05	0.05	0.05	0.05
Water	To 100	To 100	To 100	To 100	To 100	To 100

The tea products of Table 2 were prepared using the following protocol:

- 5 Soluble tea solids (either one with solubility 37 g/L or one with 70 g/L), citric acid, and sorbic acid were added in water (~95°C) in their respective amount as per Table 2. This mixture was then taken in a beaker and placed on a hot plate maintained at a temperature of 70 ± 2 °C with constant stirring for 10 minutes. After that honey and glycerin were added into the beaker and then again stirred for another 10 minutes on the same hot plate and transferred in a bottle as a
- 10 product.

For the ease of understanding, all the examples which are inside the scope of the present invention are given numerical numbers (e.g. 1, 2, etc.) and all the examples that are outside the scope of the present invention (control) are given alphabetical designation (e.g. A, B, etc.).

15

- In the examples of Table1 and Table 2; the soluble tea solids (solubility ~37g/L) were obtained from Martin Bauer Group (Article No: 285260), citric acid was obtained from Sigma (Catalogue No: C0759), glycerin was obtained from Mediplus Pharma Lab Bangalore (IP grade), sorbic acid was obtained from Sigma (Catalogue No: S1626) and honey was obtained from Dabur
- 20 India Pvt. Ltd. The water used was Milli Q water (Millipore® India). The conductivity of the Milli Q water was 18.2 MΩ.cm at 25°C. The Ca++ content of the Milli Q water was 0.1 ppt (which is negligible)

Preparation of soluble solids with solubility ~ 70 g/L:

Fresh tea leaves were plucked from the southern India tea plantation and withered for 18 hours to obtain a moisture content of ~70%. After that the withered leaves were passed through a CTC machine for 4 times to obtain macerated tea leaves known as dhool. The dhool was then fermented by keep it in open atmosphere for about 1 hour. After that the fermented dhool was passed through a screw press (Vincent CP4 press at a back pressure of 0.2 MPa) to obtain tea juice. The tea juice was collected followed by centrifugation to obtain a tea juice without any residual leaves. After that, the tea juice was subjected to drying under vacuum using a Rotary Evaporator. The temperature of the water in the evaporator was set at 45°C and the vacuum was 10 milli bar. The material obtained after drying was kept in a vacuumed dessicator for 18 hours and a dry powder was obtained (moisture content <3%).

Determination of solubility of the soluble solids

In a volumetric flask 100 mL milli Q water was added. After that tea soluble solids were added in excess and stirred unless saturated solution was obtained and insoluble solids phase separated. After that the solution was sonicated using an ultrasonicator for 10 minutes. After that the solution was centrifuged at 4093 g at room temperature (~25°C) for 10 minutes. The supernatant was decanted and precipitates were separated. After that the precipitates were dried. The amount of precipitates thus obtained was subtracted from the initial amount of added soluble solids to obtain the solubility.

The solubility of the powder obtained from Martin Bauer Group (Article No: 285260) was measured as 37g/L.

The solubility of the powder obtained by the process as described above (from the tea juice) was found to be 70g/L.

Turbidity measurement:

The liquid products of Table 1 (Set 1) were stored under refrigerated condition (about 4°C) for 2 days (about 48 hours). The liquid concentrate tea products as prepared according to Table 5 2 (Set 2) were taken and diluted with Milli Q water (Millipore® India) at a level of 1:30. After that all the solutions were stored under refrigerated condition (about 4°C) for 2 days.

After 2 days all the samples (Set 1 and 2) were taken out and brought to ambient temperature (about 25°C) (to avoid condensation outside the cell). Then the turbidity was measured. The 10 turbidity was measured using a turbidity meter (HACH, 2100N).

The results of the experiment are summarized below in Table 3:

Table 3:

Example No.	Turbidity (NTU)	Amount of soluble tea solids (wt %)
A	8	0.14
1	<u>6</u>	
B	40	2
2	<u>22</u>	
C	99	4
3	<u>50</u>	
D	64	3.5
4	<u>28</u>	
E	86	7.5
5	<u>30</u>	
F	108	9
6	<u>43</u>	

15

From the above table, it is evident that the compositions which are inside the scope of the present invention provide beverages with improved (i.e. much lower) turbidity values than example which are outside the scope of the present invention e.g. Examples 1, 2, 3, 4, 5 and 20 6 have much lower turbidity value when compared to their control counterpart Examples A, B, C, D, E and F. It is also clear from the above table that by way of present invention it is now possible to incorporate relatively high amounts of soluble tea solids in a liquid concentrate tea product without incurring high turbidity value.

Therefore from the above discussion it is evident that it is now possible by way of present invention to produce a liquid tea product with relatively high amount of tea solids and with low haziness and also to produce a liquid tea product with honey which is substantially free from flock formation and/or haziness when diluted and stored.

Claims:

- 1) A liquid tea product comprising:
 - a) 1 to 10 % by weight of soluble tea solids with a solubility at least 50 g/L at 25°C in water,
 - b) 1 to 6 % by weight of acidulant,
 - c) 0.01 to 1% by weight of preservatives; and
 - d) water.
- 2) A liquid tea product as claimed in claim 1 wherein the solubility of said tea solids is at least 70g/L.
- 3) A liquid tea product as claimed in claim 1 or claim 2 comprising 10 to 25 % by weight of honey.
- 4) A liquid tea product as claimed in claim 3 comprising 35 to 55 % by weight of solubilizer.
- 5) A liquid tea product as claimed in claim 4 wherein the solubilizer is selected from glycerin, propylene glycol or mixtures thereof.
- 6) A liquid tea product as claimed any one of claims 1 to 5 wherein the preservatives are selected from sorbic acid and its derivatives, sodium benzoate, benzoic acid or mixtures thereof.
- 7) A liquid tea product as claimed any one of claims 1 to 6 wherein the acidulant is citric acid.
- 8) A liquid tea product as claimed in any one of claims 1 to 7 further comprising flavors.
- 9) A liquid tea product as claimed in any one of claims 1 to 8 wherein the tea solids are obtained from a tea juice that is expressed from fresh tea leaf.
- 10) A liquid tea product as claimed in claim 9 wherein the fresh tea leaf is comminuted before expressing the juice.

- 11) A liquid tea product as claimed in claim 10 wherein the comminuted leaf undergoes fermentation before expressing the juice.
- 12) A process for producing a liquid tea product comprising the steps of:
- 5 a) obtaining soluble tea solids with solubility of at least 50 g/L at 25°C in water by processing fresh tea leaf ; and
- b) adding the soluble tea solids and mixing with other ingredients to obtain a liquid tea product.
- 10 13) A process as claimed in claim 12 wherein step (a) comprises the steps of:
- i. pressing fresh tea leaf thereby producing tea juice and leaf residue; and
- ii. subjecting the tea juice to a step of drying to obtain soluble tea solids.
- 14) A process as claimed in any one of the preceding claims 13 wherein the fresh tea leaf
- 15 is comminuted before pressing.
- 15) A process as claimed in claim 14 wherein the comminuted leaf undergoes fermentation before pressing.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/066260

A. CLASSIFICATION OF SUBJECT MATTER
INV. A23F3/16 A23F3/30
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A23F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/260005 A1 (GOVINDASWAMY VADIVEL [IN] ET AL) 3 October 2013 (2013-10-03)	1,2,4-12
Y	paragraph [0023] - paragraph [0053]; claims 1-8; example 1	3
X	----- WO 2009/059924 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; UNILEVER HINDUSTAN [IN]; COLLIVER) 14 May 2009 (2009-05-14) claims 1-4 page 17, line 14 - page 18, line 10 page 19, line 5 - page 21, line 10 page 24, line 11 - line 15	1,2,7-15
X	----- WO 2009/059925 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; UNILEVER HINDUSTAN [IN]; COLLIVER) 14 May 2009 (2009-05-14) claims 1-3,10-16; example 1; table 1 page 9, line 15 - page 12, line 27 ----- -/-	1,2



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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

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"T" later document published 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; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/066260

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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