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

(57) **Abstract:** The present invention relates to a process for producing a tea product. Colour imparts visual appearance of the black tea liquor. It is believed that black tea with rich red coloured liquor is always preferred by consumers. It is an object of the present invention to provide a black tea product which is significantly rich in red color when constituted into a beverage. The present inventors have found that adding iron oxide and ascorbic acid in the fermentation stage produces a tea product which is significantly richer in red color when constituted into a beverage. The present inventors have also found that adding amino acid along with ascorbic acid and iron oxide further enhances the red colour of the end product when reconstituted into a beverage.



A TEA PRODUCT

Technical Field

The present invention relates to a process for producing a tea product. More
5 particularly the present invention relates to a process for producing a black tea product.

Background

In the world of tea, black tea is one of the most commonly known tea products.
10 Black tea is generally prepared by a process which includes the steps of withering, macerating, fermenting and firing/drying. The characteristic colour, flavour and aroma of black tea are produced during fermentation. The term fermentation is traditionally used in the tea processing to refer to enzymatic oxidation. The tea is dried at high temperature after fermentation to arrest the
15 enzyme action and to bring down the moisture to a low level.

The sensory properties of black tea are of prime concern. The key sensory properties of a black tea beverage are its colour, appearance and aroma. The colour of the beverage is particularly important. A rich red coloured liquor is
20 preferred by consumers.

There are tea manufacturing processes for improving the sensory properties of black tea product disclosed in the art.

25 US2006/0228447 (Unilever, 2006) discloses a process for manufacturing a cold water soluble black leaf tea comprising the steps of (a) optionally withering freshly plucked tea leaf, (b) macerating the leaves, (c) allowing the leaves to ferment, (d) firing the leaves to arrest fermentation and (e) then drying them to yield black leaf tea, the process being characterised in that the tea leaves are treated before
30 fermentation or before mid-fermentation with a pH lowering agent, followed by treatment during fermentation with ascorbic acid, salts of ascorbic acid or mixtures

thereof at mid-fermentation or later in an amount that is sufficient for the black leaf tea to be infusible in water at 5 to 100°C.

5 US2008/0118602 (Unilever, 2008) discloses a process for the manufacture of a tea product which is readily infusible and has improved red colour. The process comprises contacting black tea with ascorbic acid and/or its salts, an oxidizing agent and water for a period of at least 5 minutes followed by drying to prepare a tea product that is infusible in water at 5 to 100°C.

10 Nonetheless there is still a need for a black tea product, and a process for producing the same, which is rich in red colour when constituted into a beverage and also a black tea beverage with improved red color.

Objects of the invention

15 It is therefore an object of the present invention to provide a black tea product.

It is another object of the present invention to provide a black tea product which is significantly rich in red color when constituted into a beverage.

20 It is yet another object of the present invention to provide a suitable alternative for producing a black tea product with improved red colour.

The present inventors have surprisingly found that adding iron oxide and ascorbic acid in the fermentation stage produces a tea product which is significantly richer
25 in red color when constituted into a beverage. The present inventors also found that adding an amino acid along with ascorbic acid and iron oxide further enhances the red colour of the end product when constituted into a beverage.

Summary of the invention

30 In a first aspect of the present invention there is provided a process for the preparation of a black leaf tea product, the process comprising the steps of:

- a. providing fresh tea leaf,

- b. macerating the tea leaf;
- c. fermenting the macerated tea leaf ; and
- d. drying the fermented tea leaf to a moisture content of less than 10% by dry mass of tea leaf to obtain the tea product,

5 characterized in that during the fermentation

- i. 0.005 to 5% of an iron oxide by dry mass of tea leaf, and
- ii. 0.1 to 8 % of ascorbic acid or a soluble salt or a derivative thereof by dry mass of tea leaf.

are added to the tea leaf.

10

In a second aspect of the present invention there is provided a black leaf tea product comprising;

- a) 0.05 – 50 g of iron per kilogram of dry tea product; and
 - b) 2 – 6 mg of NDA (2, 2'-nitrilodi-2(2')-deoxy-L-ascorbic acid monoammonium
- 15 salt) per gramme of dry tea product.

These and other aspects, features and advantages will become apparent to those of ordinary skill in the art from a reading of the following detailed description. For the avoidance of doubt, any feature of one aspect of the present invention may be

20 utilised 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. It is noted that the examples given in the description below are intended to clarify the invention and are not intended to limit the invention to those examples per se. Similarly, all

25 percentages are weight/weight percentages unless otherwise indicated. 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

30 y" are understood to include x and y. When for a 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

"Tea" for the purposes of the present invention means material from *Camellia sinensis* var. *sinensis* and/or *Camellia sinensis* var. *assamica*.

5 "Leaf tea" for the purposes of this invention means a tea product that contains tea leaves and/or stem in an uninfused form, and that has been dried to a moisture content of less than 30% by weight, and usually has a water content in the range 1 to 10% by weight (i.e. "made tea").

10 "Black tea" refers to substantially fermented tea.

"Fermentation" refers 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
15 colourless catechins in the leaves are converted to a complex mixture of yellow and orange to dark-brown polyphenolic substances.

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

Process for preparation of the tea product

The present invention provides a process for preparation of black leaf tea product comprising the steps of:

- 25 a. providing fresh tea leaf,
b. macerating the tea leaf;
c. fermenting the macerated tea leaf ; and
d. drying the fermented tea leaf to a moisture content of less than 10% by dry mass of tea leaf to obtain the tea product,
30 characterized in that during the fermentation
i. 0.005 to 5% of an iron oxide by dry mass of tea leaf, and

- ii. 0. 1 to 8 % of ascorbic acid or a soluble salt or a derivative thereof by dry mass of tea leaf.

are added to the tea leaf.

- 5 Optionally after plucking the fresh tea leaf it is subjected to a step known as withering. The tea leaf may include leaf, buds, stem and other parts of the tea plant. Withering is a process where plucked tea leaves are allowed to lose moisture over a period of time, preferably in a shallow trough where biochemical reactions occur causing formation of many beneficial compounds including aroma
- 10 compounds. Preferably to speed-up the moisture-losing process, fresh dry air is passed in a regulated manner through the leaf. Generally withering is carried out for a period of 10 to 18 hours, preferably for 12 to 16 hours.

- 15 Maceration is a process where the tea cellular structure is broken which causes further biochemical reactions to occur. This can be done in different ways. Preferably it is done either by the CTC process or by the orthodox method. The main aim of this process is to damage the leaf to break the cellular structure. In the CTC process it is done by a CTC machine where three actions viz. cutting, tearing and curling are performed on the tea leaf. In the orthodox process it is
- 20 done by subjecting the tea leaf to a rolling movement under pressure and then twisting the leaf thereby rupturing the cells and releasing the juice.

- 25 Maceration is carried out after plucking of the fresh tea leaf; preferably maceration is carried out after an optional step of withering to obtain the black tea product of the invention.

- The macerated leaf is then fermented which is a process in which enzymes in the tea leaf use atmospheric oxygen to oxidize various substrates to produce coloured products. According to the present invention
- 30 i. 0.005 to 5% of an iron oxide by dry mass of tea leaf,
- ii. 0. 1 to 8 % of ascorbic acid or a soluble salt or a derivative thereof by dry mass of tea leaf;

are added during the fermentation process.

Iron oxide is added in the fermentation stage in an amount from 0.005 to 5%, preferably from 0.5 to 5 %, more preferably 1 to 5% and most preferably 1 to 3 %
5 by dry mass of tea leaf. The iron oxide may be ferrous oxide or ferric oxide or mixtures thereof.

Ascorbic acid is added in an amount of from 0.1 to 8%, preferably from 1 to 8% and more preferably from 2 to 5% by dry mass of tea leaf. Ascorbic acid may be
10 added as it is or as a soluble salts or a derivative thereof. Mixtures of these may be added. Some examples of soluble salts or derivatives of ascorbic acid include sodium and/or potassium salts of ascorbic acid, de-hydro ascorbic acid, 1-scorbamic acid etc.

15 Iron oxide and ascorbic acid may be added together or separately one after another. There is no particular preference of the order of addition. Preferably iron oxide and ascorbic acid are added in the form of a solution in water, since this gives better distribution on the tea leaf.

20 Adding ascorbic acid or a soluble salt or a derivative thereof along with iron oxide in the fermentation stage gives a black tea product which is rich in red colour when constituted into a beverage which meets the consumer preference. Ascorbic acid or a soluble salt or a derivative thereof along with iron oxide may be added any time during the fermentation process provided that the ascorbic acid or a
25 soluble salt or a derivative thereof and iron oxide is in contact with the tea leaf for a sufficient time. ~~Sufficient time preferably means 20 – 70 minutes, more preferably 30 – 60 minutes.~~

Optionally in the fermentation stage an amino acid is also added along with the
30 ascorbic acid or a soluble salt or a derivative thereof and the iron oxide. The amino acid is added in an amount ranging from 0.05 to 4%, preferably from 0.5 to 4%, more preferably from 1 to 4% and most preferably 2 to 4% by dry mass of tea

leaf. The amino acids are preferably selected from Lysine, Glycine, Alanine, Aspartic acid, Tryptophan and mixtures thereof. Glycine is the most preferred one because it is observed that addition of glycine produces a tea product which is superior in red colour than any other amino acid.

5

When an amino acid is added, it may be added together with ascorbic acid and iron oxide or separately one by one. There is no particular preference of the order of addition. Preferably the amino acid is added in the form of a solution in water since this results in a better distribution on the tea leaf.

10

Adding an amino acid in the fermentation stage enhances the red colour of the end beverage.

Fermentation after addition of ascorbic acid and iron oxide and also preferably amino acid is carried out for about 20 to 90 minutes, preferably for 30 to 90 minutes and more preferably ~~for~~ from 30 to 45 to 90 minutes.

The fermented leaf is then subjected to drying. The tea leaf is dried to a moisture content of less than 10%, preferably a moisture content of less than 5% by dry mass of the tea leaf. Drying is the process where the tea leaf is contacted with air at a temperature of preferably 50-100°C, during which the leaf loses moisture and the enzyme activities are stopped. By drying, the moisture content of the tea leaf is brought down to less than 10% preferably 2-3%. A tray drier or fluidized bed drier is preferably used for drying the tea leaf.

25

The tea product obtainable by the process of the present invention comprises;

- a) 0.05– 50 g of iron per kilogram of dry tea product; and
- b) 2 – 6 mg of NDA (2, 2'-nitritol-2(2')-deoxy-L-ascorbic acid monoammonium salt) per gm of dry tea product.

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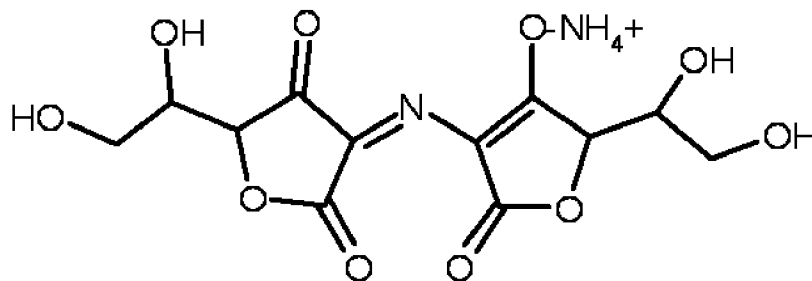
The black leaf tea product obtainable by the process of the present invention is infusible in an amount of 2 parts of tea leaf in 100 parts of water for 2 minutes at

100°C to provide an infusion having a redness value (a^*) as measured on CIE $L^*a^*b^*$ scale using D65 illuminant at 25°C of greater than 34.

Tea product of the invention

- 5 The present invention also provides a black leaf tea product comprising;
- a) 0.05 – 50 g of iron per kilogram of dry tea product; and
 - b) 2 – 6 mg of NDA (2, 2'-nitrilodi-2(2')-deoxy-L-ascorbic acid monoammonium salt) per gm of dry tea product.
- 10 Preferably the iron content of the dry tea product of the invention is in the range of 1 -50 g, more preferably 5-50 g and most preferably 10-40 g per kilogram of dry tea product.

- The black tea product of the present invention also comprises NDA. NDA is a
- 15 pigment having chemical name 2, 2'-nitrilodi-2(2')-deoxy-L-ascorbic acid monoammonium salt. NDA which is responsible for the redness of the end beverage has the following structure:



- 20 Preferably the NDA content of the dry tea product of the invention is in the range of 2-5 mg, more preferably 2-4 mg per gram of dry tea product.

- Not wishing to be bound by theory it is believed that iron oxide catalyzes ascorbate free radical generation which speeds up ascorbic acid oxidation. Then
- 25 the oxidized ascorbic acid, i.e. dehydro ascorbic acid, reacts with an amino acid (in case of no addition of amino acids externally in the fermentation process it

reacts with the amino acids that are present in tea itself) to form the red colored pigment NDA.

5 The black tea product of the invention preferably also contains 0.1 -4 g of ascorbic acid, preferably 0.5 to 2 g of ascorbic acid per kilogram of dry tea product.

Colour characteristics of the tea product

The color of the black tea liquor is generally determined by L^* , a^* and b^* values. These values indicate the color characteristics of a particular tea product.

10

The International Commission on Illumination (CIE) introduced CIE $L^*a^*b^*$ scale of colour measurement in 1976. CIE $L^*a^*b^*$ is based on the opponent-colours theory, which assumes that the receptors in the human eye perceive colour as the following pairs of opposites:

15

Light-Dark
Red-Green, and
Yellow-Blue.

20

The CIE $L^*a^*b^*$ colour scale is an approximately uniform colour scale. In a uniform colour scale, the differences between points plotted in the colour space correspond to visual differences between the colours plotted. The CIE $L^*a^*b^*$ colour space is organized in a cube form. The L^* axis runs from top to bottom. The maximum value for L^* is 100, which represents a perfect reflecting diffuser. The minimum is $L^*=0$, which represents black. The a^* and b^* axes have no specific numerical limits. Positive a^* is red and negative a^* is green. Similarly, positive b^* is yellow and negative b^* is blue.

25

30

CIE $L^*a^*b^*$ values are preferably measured using a color measuring instrument e.g. a spectrophotometer. A Hunterlab colour measuring instrument may be preferably used for this purpose. The colour measurements are preferably carried out under D65 illuminant. D65 is a standard illuminant defined by the CIE. The

D65 illuminant is intended to represent average daylight throughout the visible spectrum.

To measure the redness value of the infusion of the black tea product of the invention, it is brewed in hot water.

A tea infusion prepared by brewing 2 parts (by weight) of tea product according to the invention in 100 parts of water for 2 minutes at 100°C is characterized in that the redness value (a^*) as measured on CIE $L^*a^*b^*$ scale using D65 illuminant at 25°C is greater than 34.

The redness value (a^*) of the infusion of the tea product of the present invention as measured on CIE $L^*a^*b^*$ scale using D65 illuminant at 25°C is preferably greater than 35, more preferably greater than 36, and further more preferably greater than 37. Although there is no particular upper limit for the value of a^* , it may well be up to 70 or more preferably up to 60.

Now the invention will be demonstrated with the help of examples. The examples are for the purpose of illustration of the invention and in no way limits the scope of the invention.

Examples

Process of preparation of the black tea product of the invention

800 g of withered tea leaf was macerated using multiple cut on a CTC machine. This ~~dhool~~dhool (moisture level 75%) was then fermented for 45 minutes. After that the compositions according to Table 1 were added and mixed thoroughly to ~~make~~ensure of homogeneous mixing. The treated dhool was then fermented for another 45 min on a continuous fermenting unit at 25°C followed by drying in a tray drier at 100-120°C for 20 minutes to bring the moisture to ~ 3% on black tea basis.

Colour measurement:

Colour (CIE L*a*b* values) ~~were~~ measured using a Hunterlab Ultrascan XE (Model-USXE/UNI version 3.4, Hunterlab Associates Laboratories Inc. Virginia). A halogen cycle lamp was used as the light source. The illuminant used was D65 and the measurements were made at 10°-Observer angle. Measurements were made using a quartz cuvette of 2cm path length. The infusion was filled up to the brim in the cuvette and placed in the instrument for color measurement. The instrument was calibrated using a standard white tile (Hunterlab Duffuse/8°, mode-RSEX, Port-1" and area- large) in accordance with the instructions provided in the instructions manual. The a* values were measured at room temperature (~25°C).

Comparison of red colour of the black tea infusion

For the colour measurement tea infusions were prepared with the different samples as tabulated in the following Table 1. Example numbers A, B, C, D, E, F are the examples that are outside the scope of the present invention whereas Example numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 are the examples that are inside the scope of the present invention. The infusion was prepared by brewing 2 g of tea leaf in 100 g of water for 2 minutes at 100°C. Then the a* value of the infusion was measured using the method as described ~~herein~~ above. The results are summarized in ~~the following~~ Table 1.

Table 1

Example Number	Wt % of Compositions added at the fermentation stage	Measured a* value
A	No addition	26
B	4% Ascorbic acid	35
C	0.5% Fe ₂ O ₃	29
D	2% Fe ₂ O ₃	29
E	4% Ascorbic acid + 2% Lysine	36

F	4% Ascorbic acid + 2% Glycine	36
1	4% Ascorbic acid + 0.5% Fe ₂ O ₃	37
2	4% Ascorbic acid + 1% Fe ₂ O ₃	37
3	4% Ascorbic acid + 0.5% Fe ₂ O ₃ + 2% Lysine	40
4	4% Ascorbic acid + 0.5% Fe ₂ O ₃ + 2% Glycine	51
5	4% Ascorbic acid + 1% Fe ₂ O ₃ + 2% Glycine	51
6	2% Ascorbic acid + 1% Fe ₂ O ₃ + 2% Glycine	38
7	2% Ascorbic acid + 1% Fe ₂ O ₃ + 4% Glycine	42
8	4% Ascorbic acid + 0.5% Fe ₂ O ₃ + 2% Aspartic Acid	41
9	4% Ascorbic acid + 0.5% Fe ₂ O ₃ + 2% Alanine	40
10	4% Ascorbic acid + 0.5% Fe ₂ O ₃ + 2% Tryptophan	40

From the above table it is evident that examples number 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 provide a tea product which have higher a* values than those produced by the example numbers A, B, C, D, E and F. It is also observed that among the examples number 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 those with the amino acid (example numbers 3, 4, 5, 6, 7, 8, 9 and 10) provide much higher a* values compared to than examples number 1 and 2.

It was also observed that adding ascorbic and iron oxide together and optionally together with amino acid in the made black leaf tea product (i.e. not in the processing steps) has no effect on the redness (a*) value of the tea infusion.

It is therefore possible by way of the present invention ~~to invention~~ to provide a black tea product which is significantly richer in red color when constituted into a beverage. Also the present invention provides a suitable alternative for producing a black tea product with improved red colour.

Claims:

1. A process for preparation of black leaf tea product comprising the steps of:
 - a. providing fresh tea leaf,
 - 5 b. macerating the tea leaf;
 - c. fermenting the macerated tea leaf ; and
 - d. drying the fermented tea leaf to a moisture content of less than 10% by dry mass of tea leaf to obtain the tea product, characterized in that during the fermentation
 - 10 i. 0.005 to 5% of an iron oxide by dry mass of tea leaf, and
 - ii. 0. 1 to 8 % of ascorbic acid or a soluble salt or a derivative thereof by dry mass of tea leaf.are added to the tea leaf.
- 15 2. A process as claim in claim 1 wherein there is an additional step of withering the fresh tea leaf in between step (a) and step (b).
3. A process as claimed in claim 1 or claim 2 wherein 0.05 to 4% of amino acid by dry mass of tea leaf is added during the fermentation process.
- 20 4. A process as claimed in claim 3 wherein the amount of amino acid is in the range of 2 to 4% by dry mass of tea leaf.
5. A process as claimed in claim 3 or claim 4 wherein the amino acid is
- 25 selected from Lysine, Glycine, Alanine, Aspartic acid, Tryptophan and mixtures thereof.
6. A process as claimed in claim 5 wherein the amino acid is Glycine.
- 30 7. A process as claimed in any one of the preceding claims wherein the amount of ascorbic acid added in the fermentation process is in the range of 2 to 5% by dry mass of tea leaf.

8. A black leaf tea product comprising;
- a) 0.05– 50 g of iron per kilogram of dry tea product; and
 - b) 2 – 6 mg of NDA (2, 2'-nitrilodi-2(2')-deoxy-L-ascorbic acid monoammonium salt) per gm of dry tea product.

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9. The black leaf tea product as claimed in claim 8 which is infusible in an amount of 2 parts of tea leaf in 100 parts of water for 2 minutes at 100°C to provide an infusion having a redness value (a^*) as measured on CIE $L^*a^*b^*$ scale using D65 illuminant at 25°C of greater than 34.

10

10. The black leaf tea product as claimed in claim 9 wherein the redness value (a^*) as measured on CIE $L^*a^*b^*$ scale using D65 illuminant at 25°C is greater than 35.

15

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/060955

A. CLASSIFICATION OF SUBJECT MATTER
 INV. A23F3/14 A23F3/08
 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)

EP0-Internal, WPI Data, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008/118602 A1 (NARAYANAN VENKATRAJ VENKATRAO [IN] ET AL) 22 May 2008 (2008-05-22) cited in the application abstract; example 1 -----	1-10
A	EP 2 119 374 A1 (KAO CORP [JP]) 18 November 2009 (2009-11-18) example 1 -----	1-10



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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

"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

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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