Abstract: The fortification of tea using any of the commonly known iron salts results in complexion of iron with tea polyphenols when tea is brewed, leading to discoloration of the brew and making it unpalatable. This invention overcomes this problem by identifying iron salts and provides process for manufacture of iron fortified tea using the identified iron salts, wherein the identified iron salt does not interact with the tea polyphenols, when beverage is made. The fortified tea manufactured has appearance similar to regular tea and the tea beverage prepared from such iron fortified tea by the same process as used for regular tea has appearance and taste similar to beverage prepared from regular tea with the additional benefit of iron enrichment to the consumers. This invention is applicable to fortification of both black tea and green tea.
IRON FORTIFIED TEA AND A PROCESS FOR MANUFACTURE THEREOF

TECHNICAL FIELD

This invention relates to an iron fortified tea and a process for manufacture thereof wherein tea may be black tea or green tea of leaf grade, fannings grade, dust grade or any mixture thereof. Tea being most widely consumed beverage world over, the iron fortified tea of the present invention has vast economic significance as well as is of great importance to public health as it would help in reducing iron deficiency of population through the consumption of tea beverage prepared from iron fortified tea of the present invention.

BACKGROUND OF THE INVENTION

Iron deficiency anemia is a serious nutrition related health problem, affecting more than 3 billion people in the world. In India, the situation is even worse where iron deficiency anemia is more than 70% among the persons in lower age group and more than 50% among the persons in other age groups and is spread across demography and all age groups. While iron deficiency is one of the direct causes of anemia, it is also the cause of various other physiological disorders like energy deficiency, poor growth and development. Therefore iron fortification in food, particularly through tea, which is widely consumed across in India, is considered as a key measure to provide the necessary dietary iron as source to minimize the effect of iron deficiency and the risk of iron deficiency induced anemia.

Tea beverage is known to have an inhibitory effect on the absorption of iron in the food consumed, particularly when tea beverage is taken immediately after or
along with the food. This inhibitory effect of tea beverage is due to the presence of tea polyphenols, which complex with the iron in the food thereby inhibiting its bioavailability. This inhibitory effect of tea beverage on the absorption of iron of food particularly when consumed with or immediately before tea beverage could be mitigated by fortification of tea with an iron salt. However, the problem associated with such approach of fortification of tea with an iron salt is that addition of any of the commonly available iron salts to tea for the purposes of such iron fortification causes complexation of tea polyphenols with such iron salts which results in discoloration of tea. The beverage prepared from the tea fortified with such iron salts therefore lacks the normal appearance and taste of regular tea and therefore would not be accepted for consumption by the tea consumers just like a regular tea beverage. The present invention overcomes this problem and has identified an iron salt and developed a process for iron fortification of tea with the identified iron salt, after considerable research and development with various iron salts, which does not result in any discoloration of tea as the identified iron salt does not interact with tea polyphenols. There is, therefore no change in the tea profile and taste character and hence no difference between tea beverages prepared from the iron fortified tea of the present invention as compared to the tea beverage prepared from the regular tea. As such, the tea beverage prepared from the iron fortified tea of the present invention can be taken by consumers like a regular tea beverage with additional beneficial effects of iron enrichment through the consumption of the tea beverage.

SUMMARY OF INVENTION

According to the present invention, there is provided an iron fortified tea and a process for manufacture thereof. The present invention is one of the
breakthrough inventions. Tea beverage, which is one of the most widely consumed beverage at all levels in the society, has a negative association with respect to Iron, due to its interaction with Iron resulting in discoloration of the liquor making it undesirable to consumers. Whereas, the present invention provides iron fortified tea, in which the Iron added do not interact with tea in solution and hence the liquor is not affected and at the same time has a texture like a regular tea and beverage prepared therefrom has similar taste characteristics as that of regular tea and also has enhanced bio-availability of iron. The Iron deficiency being one of the leading causes of anemia and several other diseases, this invention will give a long term benefit in combating iron deficiency, by providing dietary iron through Tea and that would impact the general health status of the population.

The final dried iron enriched tea provided by the present invention has 99.5 to 99.88% of regular tea, 0.1 to 0.3% of iron salt and 0.02 to 0.2% of starch base, wherein regular tea is black tea or green tea in leaf grade, fannings grade, dust grade or any mixture thereof. As per the present invention, the iron enriched tea is manufactured by uniform mixing of a dried concentrate with regular tea in the ratio of 1:4. The dried concentrate is prepared by spraying the iron solution over regular tea and drying in a fluid bed drier in the temperature range of 70 to 90 degree C till the moisture content is less than 5%. The iron solution for this purpose is prepared by adding an iron salt to a homogenized starch base prepared as per the present invention and maintained at a temperature in the range of 60 to 70 degree C, wherein the iron salt is selected from ferrous bis glycine sulphate and ferric trisglycinate.

An object of the present invention is therefore to provide an iron fortified tea and process for manufacture thereof wherein the tea manufactured has the same
texture as that of regular tea and the tea beverage prepared therefrom has taste and characteristics of a regular tea beverage.

Another object of the present invention is to provide an iron fortified tea which provides minimum of 20mg dietary iron in 100g tea. Each cup of the tea beverage prepared from the iron fortified tea of the present invention provides minimum 0.4mg iron. If three cups of such tea beverage are consumed per day, these would provide minimum 1.2mg of iron that would meet minimum of 4.5% of the recommended daily allowance of 28mg of Iron per day.

Still another object of the present invention is to provide an iron fortified tea which has higher bioavailability of iron as compared to other iron fortified foods and beverages, using different iron salts which are typically used for the food and beverages iron fortification such as Ferric pyrophosphate, Ferrous sulfate etc.

Further object of the present invention is to provide an iron fortified tea wherein iron salt used for fortification is ferrous bis glycine sulfate or ferric trisglycinate. The amino acid (in this case Glycine) in the case of these iron salts is bonded to Iron, leaving no vacant orbital in the iron atom, which prevents iron present in these salts from complexing with polyphenols and other similar molecules, thereby iron remains more bioavailable for absorption in the digestive tract.

Still further object of the present invention is to provide an iron fortified tea wherein the dietary iron fortification in tea does not lead to any change in color or other organoleptic properties of the tea and the tea beverage is prepared from the iron fortified tea of the present invention using the same process as used for the preparation of regular tea beverage.
Yet further object of the present invention is to provide an iron fortified tea and process for manufacture thereof wherein the process enables uniform distribution of dietary iron in the tea as well as in the beverage prepared therefrom.

Even further object of the present invention is to provide an iron fortified tea which has a shelf life of six months in the pack.

Further objects and advantages of the present invention would be evident from the detailed description and the illustrative examples that follow.

**DESCRIPTION OF THE INVENTION**

According to this invention, the 100g of the final product of dried iron fortified tea of the present invention comprises following ingredients expressed as weight percentage of the product:

- **Regular Tea** - 99.5 to 99.88%, preferably 99.6 to 99.7%
- **Iron salt** - 0.1 - 0.3%, preferably 0.15 -0.25%
- **Starch base** - 0.02 to 0.2% preferably 0.05 to 0.1%

According to this invention, the process for manufacture of the iron fortified tea comprises the steps of:

(a) **Preparation of Homogenized Starch Mix**

Deionised water is heated in the range of 50-85 Deg C preferably in the range of 65-75 Deg C. The minimum temperature of 50 Deg C is necessary as
below 50 Deg C, the ingredients are not completely soluble in the said deionised water and therefore when iron salt is added to the said water, it does not result in uniform dispersion of the ingredients in the water. Starch base is added to such pre-heated water and is homogenized for at least 15 minutes using a Silverson homogenizer maintaining temperature in the range of 65 to 75 degree C, so as to ensure proper mixing and distributing of ingredients evenly in the solvent. Starch base and deionised water are taken in the ratio in the range of 1:50 to 1:75 in weight by volume of deionised water

(b) Preparation of Iron Solution

An iron solution is prepared by addition of an iron salt to the homogenized starch mix obtained by step (a) and mixing for at least 15 min, ensuring maintaining of temperature not below 50 Deg C but preferably in the range of 60-70 Deg C. Iron salt and the homogenized mix are taken in the weight by volume ratio of around 1:20. The iron salt is selected from ferrous bis glycine sulphate and ferric trisglycinate that has 10 to 20% iron.

(c) Preparation of Concentrate and Spraying of Iron Solution over Regular Tea

The iron solution obtained by step (b), with a solid content of 4 - 7%, is sprayed over regular tea and mixed for minimum 5-10 min in a Forberg mixer, which has an axial spray arrangement and paddle type blenders, to ensure uniform distribution of iron salt in the tea. The regular tea may be leaf grade, fannings grade, dust grade or any mixture thereof. The mixture of iron solution and regular tea after thorough mixing is dried in a fluid bed drier at a
temperature between 70 to 90 Deg C to a moisture less than 5%, thereby obtaining the dried concentrate iron fortified tea. The ratio of volume of iron solution to the regular tea over which it is sprayed is in the range of 1:5 to 1:6 in volume by weight of regular tea.

(d) Preparation of Iron Fortified Tea

The dried concentrate obtained by step (c) is then mixed with regular tea in the ratio of 1:4 by weight in a rotary blender or vertical static blender to ensure uniform distribution of Iron in the desired level.

WORKING EXAMPLES

The invention will now be illustrated with working examples which are intended to be illustrative examples so as to illustrate the working of the invention and are not intended to be taken restrictively to imply any limitation on the scope of the present invention.

Example 1

30 litre of Deionised water is heated between 70 and 75 Deg C. 0.6 kg of Starch base is added to such pre-heated treated water and is homogenized for 15 minutes using a Silverson or high speed homogenizer. 1.5 kg of ferrous bis glycine sulphate is added to the homogenized mix and homogenized again for 15 min at 55-60 deg C. The iron solution thus obtained is sprayed over 150 kg of black tea (dust grade) with moisture < 5% taken in the Forberg blender. The blending is continued for 5-10 min where the fortificant iron solution is blended in the tea uniformly and then dried in the fluid bed drier between 70-80 deg C to get 152.1 Kg dried concentrate with final moisture of
5%. 100 Kg of the final dried concentrate is then blended with black tea (dust grade) at 1:4 ratio to get 500 Kg final product.

**Example 2**

30 litre of Deionised water is heated between 70 to 75 Deg C. 0.6 kg of Starch base is added to such pre-heated treated water and is homogenized for 15 minutes using a Silverson homogeniser. 1.5 kg of ferrous bis glycine sulphate is added to the homogenized mix and homogenized again for 15 min at 55-60 deg C. The iron solution thus obtained is sprayed over 150 kg of green tea (leaf grade) with moisture <5% taken in the Forberg blender. The blending is continued for 5-10 min where the fortificant iron solution is blended in the tea uniformly and then dried in the fluid bed drier between 70-80 deg C to get 152.1 Kg dried concentrate with final moisture of 5%. The final dried concentrate is then blended with green tea (leaf grade) at 1:4 ratio to get 760.5 Kg final desired product.

**Example 3**

100 litre of Deionised water is heated between 70 to 75 Deg C. 2 kg of Starch base is added to such pre-heated treated water and is homogenized for 20 minutes using a Silverson homogeniser. 4 kg of Ferric trisglycinate is added to the homogenized starch mix thus obtained and homogenized again for 25 min at 55-60 deg C. The iron solution thus obtained is then sprayed over 600 kg black tea (fannings grade) with moisture <5% taken in the Forberg blender in 4 batches. The blending is continued for 5-10 min where the fortificant iron solution is blended in the tea uniformly and then dried in the
fluid bed drier between 70-80 deg C to get 606.4 Kg concentrate with final moisture of 5%. The dried concentrate is then blended with black tea (fannings grade) at 1:4 ratio to get 3032 Kg of final desired product.

It is to be understood that the iron fortified tea of the present invention and process for manufacture thereof is susceptible to modifications, equivalent changes and adaptations by those skilled in the art. Such modifications, equivalent or minor process parameter changes and adaptations embodying the principles and features of the present invention are intended to be within the scope of the present invention which is further set forth under the following claims:
CLAIMS:

1. An Iron fortified tea comprising:
   (a) regular tea in quantity in the range of 99.5 % to 99.88 % by weight of the product, wherein regular tea is black tea or green tea in leaf grade, fannings grade, dust grade or any mixture thereof;
   
   (b) iron salt in quantity in the range of 0.1 - 0.3% by weight, wherein iron salt is selected from ferrous bis glycine sulphate and ferric trisglycinate;
   
   (c) Starch base in quantity in the range of 0.02 to 0.2% by weight, wherein the starch used is specialty tapioca dextrin with high solubility, good clarity and bland taste.

2. An Iron fortified tea as claimed in claim 1 wherein regular tea content is in the range of 99.6 to 99.7%.

3. An Iron fortified tea as claimed in claim 1 wherein iron salt is in quantity in the range of 0.15 to 0.25%

4. An Iron fortified tea as claimed in claim 1 wherein starch base is in quantity in the range of 0.05 to 0.1%

5. An Iron fortified tea as claimed in claim 1 wherein the beverage prepared from the tea provides a minimum 0.4mg of iron per cup of tea.
6. An Iron fortified tea as claimed in claim 1 wherein 100g of the tea provides minimum 20mg of dietary iron.

7. A process for manufacture of an Iron fortified tea comprising steps of:
   (a) preparation homogenized starch mix by mixing pre-heated deionised water with starch base followed by homogenizing the mix for at least 15 minutes using a Silverson or high speed homogenizer; wherein starch base with respect to deionised water is taken in the weight by volume ratio of 1:50 to 1:75 and where said deionised water is pre-heated to a temperature in the range of 50-85°C and while mixing temperature is maintained in the range of 65-75°C and wherein the starch used is specialty tapioca dextrin with high solubility, good clarity and bland taste;

   (b) preparing an iron solution by adding an Iron salt to the homogenized mix obtained by step (a) and homogenizing the resultant mix further for at least 15 minutes, wherein temperature is maintained in the range of 60-70°C and wherein iron salt is selected from ferrous bis glycin sulphate and ferric trisglycinate and wherein said iron salt is taken in the weight by volume ratio around 1:20 with respect to homogenized mix obtained by step (a) and wherein the iron solution obtained has solid content in the range of 4-7% ;

   (c) preparation of dried concentrate by spraying of iron solution obtained by step (b) in a Forberg mixer on regular tea and mixing for 5-10 minutes in the blender followed by drying the mixture to
moisture less than 5% in a fluid bed drier, at 70 - 80 Deg C wherein the iron solution obtained by step (b) and regular tea are taken in the volume by weight ratio of 1:5 to 1:6 thereby obtaining dried concentrate where regular tea is black tea or green tea in leaf grade, fannings grade, dust grade or any mixture thereof; and

(d) preparation of desired iron fortified tea by mixing dried concentrate obtained by step (c) with a regular tea in the ratio of 1:4 by weight.

8. A process as claimed in claim 7 wherein the deionised water is heated to a temperature in the range of 65-75 °C.

9. A process as claimed in Claim 7, where in the mix after spraying is dried between 73 and 78 Deg C.
INTERNATIONAL SEARCH REPORT

International application No
PCT/IN 09/00467

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A23F 3/00 (201.00.01)
USPC - 426/597

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)
USPC: 426/597,435,595

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

Electronic databases consulted during the international search (name of database and, where practicable, search terms used)
Electronic Databases Search: PubWEST DB=PGPB, USPT, USOC, EPAB, JPAB; PLUR-NO: OP=ADJ, Google Scholar, Google Patent Search
Terms Used: ferrous bis glycine sulphate, ferrous bis-glycinate, ferrous bisglycinate, feric trisglycinate, feric tris-glycinate, ferrochel, dextrins, tapioca dextrins, iron, ferrous, ferric, fannings, leaf grade, dust grad

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<tbody>
<tr>
<td>A</td>
<td>US 20030064130 A1 (Blair et al.) 3 April 2003 (03.04.2003) entitre document, esp: abstract, paras [0041]-[0054]. Table 1, Table 3.</td>
<td>1-9</td>
</tr>
<tr>
<td>A</td>
<td>US 6436453 B1 (Van Lengerich et al.) 20 August 2002 (20.08.2002) entire document, esp: col 8 In 3-17; col 20 In 37-53; col 21 In 7-47; Example 1.</td>
<td>1-9</td>
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Further documents are listed in the continuation of Box C.

D

"A" Special categories of cited documents
"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)
"G" document referred to on oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

Date of the actual completion of the international search
27 December 2009 (27.12.2009)

Date of mailing of the international search report
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Form PCT/ISA/210 (second sheet) (July 2009)
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