METHODS FOR PROCESSING COFFEE CHERRY SKIN AND PULP INTO DRIED CASCARA, LIQUID EXTRACT, AND POWDER

Field of the Invention

The present invention pertains to nutraceutical science and technology.

Background of the Invention

As health consciousness increases among individuals, there has been a notable rise in preventive measures to mitigate illnesses and diseases. One such measure is the intentional consumption of foods that confer health benefits and promote overall well-being. This shift is driven by higher education levels and increased health awareness, leading individuals to recognize that food and beverage choices encompass more than mere sustenance but extend to nutritional value and health benefits. With the growing awareness of the benefits provided by functional drinks, consumers are increasingly seeking products that offer more than basic hydration. This demand has catalyzed the production of various dietary supplements in convenient formats, such as tablets, gummies, powdered drinks, and fortified coffees.

Beverages derived from coffee cherries enjoy widespread global popularity and have been continually developed to enhance their health benefits. These beverages offer the stimulating effects of caffeine and health benefits from antioxidants, phenolic complexes, and other bioactive compounds inherent in coffee cherries, each with distinct properties. The efficacy of coffee cherries has attracted significant interest from researchers and consumers due to their extracts' various therapeutic properties, including antioxidant effects, weight loss benefits, and digestive system improvements. These properties render coffee cherry extracts particularly suitable for incorporation into supplemented food products.

Following comprehensive patent database searches, prior inventions related to the extraction of substances from coffee beans, coffee cherries, and their skins for use in beverage compositions were identified as follows:

A Canadian patent, publication number CA3067465C, titled "Coffee Cherry Processing Methods and Extraction Products Obtained by the Same," discloses a method for processing coffee cherries. This method comprises the following steps: (1) adding water to coffee cherries, coffee pulps, or unroasted coffee beans derived from the coffee cherries to form a suspension; (2) wet

grinding this suspension in multiple steps to achieve an average particle size of 100 micrometers or less; and (3) separating the suspension, including at least the separation of the heavy phase and light phase, to obtain at least one coffee cherry extract selected from the coffee cherry aroma, coffee cherry oil, coffee cherry powder, coffee cherry juice, coffee pulp aroma, coffee pulp powder, coffee pulp juice, coffee aroma, and green or roasted coffee powder.

An international patent application, publication number WO2015158895A1, titled "Coffee Extracts and Formulations Containing Them," discloses novel extracts of Coffea sp. beans characterized by a high caffeoylquinic acid content and the absence of glycosylated kaurane derivatives such as atractyloside, carboxyatractyloside, and atractyligenin glycosides. These compounds are useful for treating type 2 diabetes and metabolic syndrome and reducing body weight. The extracts can be incorporated into foods or formulated in dietary compositions such as tablets, capsules, or drinks. Additionally, the invention includes a process for preparing these extracts.

A U.S. patent, publication number US20160030350A1, titled "Preparation of Coffee-Based Extracts and Powders," discloses processes for preparing antioxidant-rich compositions, particularly from coffee cherries. These processes involve promptly applying a preservative coating to de-beaned coffee cherries and optionally storing them under refrigerated conditions before preparing an extract or powder.

Based on the above, prior inventions with claims related to substances extracted from coffee beans and coffee cherries for use in beverage compositions were identified, showcasing various selection and extraction processes. However, no inventions were found detailing extraction methods from coffee cherry skin or pulp, disinfection methods, or the ingredients of coffee extract products in either liquid or powder form at the specified ratio for use as health-benefit functional foods to lower blood lipid levels.

The invention of liquid and powder products derived from coffee cherry skin and pulp extract has led to the development of specific processing methods for dried coffee cherry skin and pulp (dried cascara). These methods encompass processes for producing liquid extract, beverages, and powder products, which possess a long shelf life and contain active ingredients, including polyphenols with high levels of chlorogenic acids and epicatechin. These substances exhibit properties including antioxidation, anti-inflammation, regulation of glucose and lipid metabolism,

increased insulin sensitivity, reduction of blood lipid levels, and prevention of coronary heart disease.

In addition, the coffee pulp extract has been proven to reduce cholesterol absorption in cultured human intestinal cells, decrease fatty liver in cultured hepatocytes, lower blood LDL cholesterol and triglyceride levels, reduce insulin resistance, mitigate fatty liver, and prevent renal complications from diabetes mellitus in laboratory animals. These effects exhibit comparable efficiency to clinical drugs such as lipid-lowering statins, the lipid absorption-reducing ezetimibe, and the antidiabetic metformin. Furthermore, when the coffee pulp extract drink products are consumed in combination with statins or ezetimibe, the blood lipid-lowering efficacy is enhanced.

Summary of the Invention

This invention pertains to the manufacturing processes of dried coffee cherry skin and pulp (dried cascara), extract drink products, and powder products derived from coffee cherry skin and pulp, encompassing the following key methods: (i) a processing method for producing dried coffee cherry skin and pulp, (ii) a processing method for producing extract drink products from dried coffee cherry skin and pulp, and (iii) a processing method for producing powder products from dried coffee cherry skin and pulp. The resulting products are clinically proven to aid in lowering LDL, triglycerides, and total cholesterol levels while increasing HDL cholesterol levels.

The objective of this invention is to develop extract products from coffee cherry skin and pulp by extracting active ingredients, including phenolics, chlorogenic acids, caffeine, catechin, epicatechin, and other compounds. These ingredients are combined into an extract that aids in lowering LDL, triglycerides, and total cholesterol levels while increasing HDL. Additionally, the extract helps reduce type 2 diabetes mellitus and insulin resistance as well as mitigates inflammatory conditions in the body by maintaining the function of organic cation-transporting proteins through oxidative stress control. Therefore, this coffee skin and pulp extract product can be considered a novel alternative supplemented food suitable for health-conscious individuals or those with hyperlipidemia.

Brief Description of the Drawings

Figure 1 illustrates the processing method for producing dried products from coffee cherry skin and pulp.

Figure 2 illustrates the processing method for producing extract drinks from dried coffee cherry skin and pulp.

Figure 3 illustrates the processing method for producing powders from dried coffee cherry skin and pulp.

Figure 4 illustrates the temperature distribution within the material at various control temperatures and positions.

Detailed Description of the Invention

This invention pertains to the manufacturing process of an extract product derived from coffee cherry skin and pulp, resulting in the coffee pulp extract (CPE) with active ingredient contents, specifically polyphenols containing high levels of chlorogenic acids and epicatechin. The resulting extract exhibits a significantly extended shelf life. These substances possess properties including antioxidation, anti-inflammation, regulation of glucose and lipid metabolism, increased insulin sensitivity, reduction of blood lipid levels, and prevention of coronary heart disease. Prior to extraction, the coffee cherry skin and pulp are prepared by a specific method to yield an efficient extract through the following steps:

1. Processing Method for Producing Dried Products from Coffee Cherry Skin and Pulp (Figure 1), with the steps detailed as follows:

A. Select pre-treated coffee cherries with a fruit grade of no less than 90%, a sweetness level of 5 to 20 Brix, and a red color coverage of more than 90% to ensure appropriate ripeness for the safe manufacture of an efficient dried coffee cherry product.

B. Perform a heavy metal test on the coffee cherries obtained from Step A using a test kit. Discard any cherries containing excessive levels of heavy metals. The test kit is small, lightweight, and easily portable, making it suitable for use in remote areas and expediting the preliminary screening for metals.

C. Immerse the coffee cherries with acceptable heavy metal levels, as determined in Step B, in 0.5 to 2 ppm ozonized water for 10 to 20 minutes.

D. Immerse the coffee cherries in 100 to 200 ppm chlorinated water to eliminate various germs, including bacteria, viruses, fungi, and spores. These disinfection methods are highly efficient and do not leave residual chemicals in the dried coffee cherries.

E. Mill the coffee cherries obtained from Step D using a dry milling method to minimize the loss of active ingredients from the coffee cherry skin and pulp.

F. Immerse the coffee cherry skin and pulp obtained from Step E in 100 to 200 ppm potassium metabisulfite for 10 to 15 minutes to eliminate various germs, including bacteria, viruses, fungi, and spores.

G. Dry the coffee cherry skin and pulp at 70 to 90 degrees Celsius for 1 to 4 hours to remove moisture.

H. Dry the coffee cherry skin and pulp again at 50 to 70 degrees Celsius until the water activity is in the range of 0.3 to 0.5, ensuring that the coffee cherry pulp has an initial relative moisture content of 39% and the skin has a final relative moisture content of no more than 0.2%. This process ensures that the coffee cherry skin and pulp retain their unique flavor while preserving more active ingredients.

I. Record the weight of the coffee cherry skin and pulp obtained from Step H, and package them in a double-layer bag, with the innermost layer capable of protecting against air and moisture. Then, reduce the oxygen content to less than or equal to 0.02% to prolong the shelf life.

The processing method for producing dried products from coffee cherry skin and pulp involves key steps, including drying to remove moisture at temperatures between 70 to 90 degrees Celsius. Additionally, the initial relative moisture content of the coffee cherry pulp is maintained at 39%, and the relative moisture content of the skin is reduced to no more than 0.2%. This process not only protects against mold formation and spoilage but also ensures that the coffee cherry skin and pulp retain more active ingredients. Experimental studies have confirmed that moisture control is crucial for maintaining quality and enhancing the efficacy of extracts derived from coffee cherry skin and pulp.

In addition, the described manufacturing method fully utilizes coffee cherries—including the skin, pulp, and beans—resulting in a process that efficiently reduces costs and screening time. By using all parts of the coffee cherries, this method not only adds economic value but also

promotes sustainable resource use, making the manufacturing process more environmentally friendly by upcycling what was once agricultural waste. This approach helps reduce manufacturing waste generation, positively impacting the environment and significantly lowering costs.

1.1. Antioxidation Results of Coffee Cherry Skin and Pulp Samples and Total Phenolic Contents

An antioxidation test of coffee cherry skin and pulp samples, along with the measurement of total phenolic contents, yielded the results shown in Table 1. The findings indicated that the total phenolic contents in the samples were correlated with their antioxidant activity. Specifically, the first coffee cherry skin and pulp sample exhibited the highest antioxidant activity compared to the second and third samples.

Table 1. Antioxidation results of coffee cherry skin and pulp samples and total phenolic contents.

	Sample 1	Sample 2	Sample 3
Antioxidant: ABTS (IC_{50}, µg/mL)	18	27	27
Antioxidant: DPPH (IC_{50}, µg/mL)	82	153	140
Total polyphenol (as Gallic Acid) (mg/L of Gallic Acid)	17.40	10.47	7.61

1.2.Tannin Content Results

Based on the results of tannin content measurements in the first, second, and third coffee cherry skin and pulp samples, it was found that the first sample contained the highest amount of tannins, measured in mg/L of Gallic acid, followed by the second and third samples, respectively, as shown in Table 2.

Table 2. Tannin contents in coffee cherry skin and pulp samples.

	Tannin Contents	
	mg/L of Gallic Acid	mg. of Gallic Acid equivalent per gram of dry weight (mg GAE/g of DW**)
Sample 1	54.31	27.15
Sample 2	35.76	17.88
Sample 3	30.58	15.29

1.3. Temperature Distribution Inside Material at Different Control Temperatures and Positions

Based on Figure 4, which illustrates the temperature distribution inside the material at different control temperatures and positions, it was found that the temperatures within the material at various locations were similar. This uniformity is attributed to the material's energy absorption from the same wavelength range and the use of infrared radiation for drying, which does not require a medium to conduct heat from the source to the product. As a result, there was no medium-induced energy loss, leading to a relatively homogeneous heat distribution within the drying chamber.

The temperatures in the material increased rapidly due to the infrared radiation process, which facilitated steam diffusion from the material. Initially, the coffee cherry skin and pulp exhibited an internal temperature of 20 degrees Celsius, which gradually rose as the ceramic sheet transferred the heat fully. Subsequently, the temperatures inside the coffee cherry skin and pulp rapidly decreased due to the high surface water content; the evaporated surface water extracted heat from the coffee cherry skin and pulp, resulting in a decreased surface temperature.

2. Processing Method for Producing Extract Drinks from Dried Coffee Cherry Skin and Pulp (Figure 2), with the steps detailed as follows:

A. Grind the dried and moisture-removed coffee cherry skin and pulp, then sieve through a mesh no larger than 160 to ensure proper phenolic compound content and significantly reduce manufacturing costs.

B. Prepare extracts using a ratio of 200 to 300 grams of dried coffee cherry skin and pulp per 1 to 1.5 liters of hot water, immersing for 10 to 20 minutes. The hot water should be at a temperature of 90 to 100 degrees Celsius, with a pH of 6 to 7, and a hard water content of no more than 100 milligrams per liter to increase active ingredient contents.

C. Centrifuge the coffee cherry skin and pulp obtained from Step B at 1,800 to 3,600 revolutions per minute to separate the pulpy residue.

D. Mix the obtained supernatant with drink compositions, including the coffee cherry skin and pulp extract, honey, and an edible acid.

E. Disinfect the mixture obtained from Step D using a retort process, subjecting it to temperatures of 90 to 130 degrees Celsius and pressures of 5 to 20 bars for 15 to 20 minutes. This yields the coffee cherry skin and pulp extract drink product in liquid form with a pH value of less than 4.6, a sweetness level of 10 to 20 Brix, and a density range of 1.5 to 2 grams per cubic centimeter. The composition of the final product is as follows:

- Total phenolic content (TPC): 40 - 60% by weight
- Chlorogenic acids: 20 - 40% by weight
- Caffeine: 5 -10% by weight
- Tannin: 0.1 - 5% by weight
- Catechin: 1 – 5% by weight

Based on Tables 3 and 4, it was found that the coffee cherry skin and pulp powder with the highest phenolic compound content was 160-mesh powder, containing 3.476 milligrams of Gallic acid per gram of powder. The powder with the least phenolic content was less than 80-mesh, with a phenolic compound content of 1.952 milligrams of Gallic acid per gram of powder. It was observed that smaller powder sizes resulted in higher concentrations, likely due to increased surface areas allowing more reactions.

Table 3. Percent loss from sieving and size sorting.

Powder size	Powder Distribution (weight in grams)		% loss
	Pre-sieved	Post-sieved	
Less than 80 mesh	492.03	28.57	3.14
80 mesh		47.89	
100 mesh		56.00	
120 mesh		5.62	
140 mesh		32.12	
160 mesh		306.36	
Total		476.56	

Table 4. Total phenolic contents of coffee cherry skin and pulp samples.

Powder size	Absorption				Concentration (milligrams/liter)	Phenolic compound content (milligrams of Gallic acid/gram powder)
	1st time	2nd time	3rd time	Mean		
Less than 80 mesh	0.848	0.835	0.850	0.84	390.4	1.952
80 mesh	0.861	0.845	0.846	0.851	393.4	1.967
100 mesh	1.035	1.019	1.014	1.023	141.1	2.371
120 mesh	1.131	1.280	1.269	1.227	569.9	2.849
140 mesh	1.247	1.264	1.261	1.257	584.3	2.921
160 mesh	1.509	1.495	1.477	1.497	695.2	3.476

3. Processing Method for Producing Powders from Dried Coffee Cherry Skin and Pulp (Figure 3), with the steps detailed as follows:

A. Grind the dried and moisture-removed coffee cherry skin and pulp, then sieve through a mesh no larger than 160 to ensure proper phenolic compound content and significantly reduce manufacturing costs.

B. Prepare extracts using a ratio of 200 to 300 grams of dried coffee cherry skin and pulp per 1 to 1.5 liters of hot water, immersing for 10 to 20 minutes. The hot water should be at a temperature of 90 to 100 degrees Celsius, with a pH of 6 to 7, and a hard water content of no more than 100 milligrams per liter to increase active ingredient contents.

C. Mix the extract obtained from Step B with clean water at a ratio of 1 to 2 and boil at 90 to 100 degrees Celsius.

D. Add a coating agent into the mixture, stir well, and then filter. The coating agent comprises:

- Maltodextrin: 50 - 60% by weight
- Semi-synthesized polymer: 30 - 40% by weight
- Gelling agent : 5 - 10% by weight

The semi-synthesized polymer can be selected from hydroxypropyl methylcellulose, methylcellulose, ethylcellulose, hydroxyethyl cellulose, or any combination thereof. The gelling agent can be selected from gum Arabic, tragacanth, algin, pectin, guar gum, xanthan gum, or any combination thereof.

E. Subject the extract to a spray drying process with an inbound hot air temperature of 180 to 200 degrees Celsius and an outbound temperature of 90 to 100 degrees Celsius for 50 to 60 minutes per 80 to 100 liters of extract. This temperature setting enhances manufacturing efficiency and yields by reducing raw material loss due to nozzle clogging, thereby minimizing the time and resources needed for maintenance and increasing overall manufacturing capacity.

F. Mix the extract obtained from Step E with drink compositions to produce the coffee pulp extract in powder form. As a result, the final product should have a pH value of less than 4.6, a sweetness level of 10 to 20 Brix, and a moisture content of less than or equal to 6%. The composition comprises:

- Total phenolic content (TPC): 0.1 - 1% by weight
- Chlorogenic acids: 50 - 60 % by weight
- Caffeine: 10 - 20 % by weight
- Tannin: 25 - 30 % by weight
- Catechin: 0.1 - 1% by weight

The drink compositions comprise:

- Coffee pulp extract powder: 70 - 75% by weight
- Coffee powder: 15 - 20% by weight
- Inositol hexaphosphate: 8 - 10% by weight
- Stevia powder: 0.1 - 0.5% by weight

Inositol hexaphosphate can be selected from any one of rice germ, molasses, peanut, dry lima bean, raisin, or a combination thereof. This compound possesses antioxidant properties that help protect against oxidative damage, has insulin resistance-preventing activity, and decreases insulin resistance.

Based on Tables 5 and 6, it was found that processing the powder from dried coffee cherry skin and pulp resulted in a moisture content of 3% to 5% before grinding, a total phenolic compound content of 30 to 40 milligrams Gallic acid equivalents per gram of extract, and a post-dissolution sweetness level of 7 Brix. The integration of the extract with drink compositions enhances the efficacy of the coffee cherry skin and pulp extract drink product. For example, the addition of stevia increases the chlorogenic acid content, and the use of rice germ reduces lipid accumulation.

Table 5. Total phenolic contents in the drink product.

Sample name	Total phenolic content (mg GAE/g extract)
COL/CD19	37.60

Table 6. Total phenolic contents in the powder product.

Liquid volume prior to spray dry (kilogram)	Product powder (gram)	Generation rate (%)	Total phenolic content (gram)	Reference method
17.83	475	2.66	43.16±0.06	Total Phenolic Content in Extracts Model, AOAC 2017.13

3.1. Results Following Consumption of Coffee Cherry Skin and Pulp Extract Drink Products

Based on a test conducted on subjects consuming the coffee cherry skin and pulp extract drink product, the mean LDL was 172.4 ± 28.5 milligrams per deciliter. After 24 weeks, LDL, triglyceride, and total cholesterol levels decreased by approximately 16.9%, 18.0%, and 8.0%, respectively, while HDL increased by approximately 5.9% ($p<0.01$ compared to the baseline). These lipid changes were evident by week 4. The control group showed no statistically significant differences in triglyceride and total cholesterol levels at 24 weeks from the baseline. However, HDL and LDL levels in the control group statistically significantly decreased by approximately 4.2% and 8.2%, respectively.

Consumption of the coffee skin and pulp extract drink products will, therefore, enable consumers to lower LDL, triglycerides, and total cholesterol levels, and significantly increase HDL levels more than the control group ($p<0.001$ when compared between groups). Additionally, it was found that the insulin resistance indicator (HOMA index) decreased in the subject group receiving the coffee skin and pulp extract drink product, along with a reduction in inflammation compared to the control group. However, hepatic lipid content, overall fat areas, abdominal fat areas, subcutaneous fat areas, body circumferences, body compositions, blood pressure levels, hemoglobin A1c, insulin, and hematological panel results exhibited no significant differences between the groups.

Best Mode of the Invention

The best mode for carrying out the invention is described in detail under the Detailed Description of the Invention section.

Claims

1. A processing method for producing dried products from coffee cherry skin and pulp comprises the following steps:

A. preparing coffee cherries by selecting pre-treated coffee cherries exhibiting a fruit grade of no less than 90%, a sweetness index ranging from 5 to 20 Brix, and a red color coverage exceeding 90%;

B. conducting a heavy metal assay on the coffee cherries obtained from Step A, and discarding any cherries that exhibit excessive levels of heavy metals;

C. immersing the coffee cherries that met the standard of the heavy metal assay from Step B in 0.5 to 2 ppm ozonized water for a duration of 10 to 20 minutes;

D. subsequently immersing the coffee cherries treated in Step C in 100 to 200 ppm chlorine water;

E. milling the coffee cherries treated in Step D using a dry milling method;

F. immersing the coffee cherry skin and pulp obtained from the milling process in Step E in 100 to 200 ppm potassium metabisulfite for a duration of 10 to 15 minutes;

G. drying the coffee cherry skin and pulp obtained from Step F at a temperature range of 70 to 90 degrees Celsius for a period of 1 to 4 hours to remove moisture;

H. further drying the coffee cherry skin and pulp obtained from Step G at a temperature range of 50 to 70 degrees Celsius until the water activity reaches a range of 0.3 to 0.5, ensuring the coffee cherry pulp achieves an initial relative moisture content of 39%, and the coffee cherry skin achieves a final relative moisture content of no more than 0.2%; and

I. recording the weight of the dried coffee cherry skin and pulp obtained from Step H, placing them in a double-layer bag with the innermost layer providing protection against air and moisture, and reducing the oxygen content to less than or equal to 0.02%, thereby yielding the dried products.

2. A processing method for producing extract drinks from dried coffee cherry skin and pulp comprises the following steps:

A. grinding the dried coffee cherry skin and pulp obtained from the previous steps, followed by sieving through a mesh no larger than 160;

B. preparing extracts using a ratio of 200 to 300 grams of ground and dried coffee cherry skin and pulp per 1 to 1.5 liters of hot water, and immersing for 10 to 20 minutes, where the hot water has a temperature range of 90 to 100 degrees Celsius, a pH level of

6 to 7, and a hard water content not exceeding 100 milligrams per liter, to increase the active ingredient content;

C. centrifuging the immersed coffee cherry skin and pulp mixture obtained from Step B using a centrifuge operating at 1,800 to 3,600 revolutions per minute to separate the pulpy residue;

D. mixing the obtained supernatant or liquid from Step C with beverage compositions; and

E. disinfecting the mixture obtained from Step D using a retort process, applying temperature and pressure conditions suitable for disinfecting food in sealed containers with a temperature range of 90 to 130 degrees Celsius and a pressure range of 5 to 20 bars, for a duration of 15 to 20 minutes, thereby yielding extract drinks.

3. The processing method for producing extract drinks from dried coffee cherry skin and pulp as recited in claim 2, wherein the coffee cherry skin and pulp are subjected to moisture removal to ensure dryness.
4. The processing method for producing extract drinks from dried coffee cherry skin and pulp as recited in claim 2, wherein the drink compositions comprise extracts of coffee cherry skin and pulp, honey, and edible acids.
5. The processing method for producing extract drinks from dried coffee cherry skin and pulp as recited in claim 2, wherein the coffee cherry skin and pulp extracts in liquid form have a pH value of less than 4.6.
6. The processing method for producing extract drinks from dried coffee cherry skin and pulp as recited in claim 2, wherein the coffee cherry skin and pulp extracts in liquid form have a sweetness level ranging from 10 to 20 Brix.
7. The processing method for producing extract drinks from dried coffee cherry skin and pulp as recited in claim 2, wherein the coffee cherry skin and pulp extracts in liquid form have a density ranging from 1.5 to 2 grams per cubic centimeter.
8. The processing method for producing extract drinks from dried coffee cherry skin and pulp as recited in claim 2, wherein the active ingredients in the coffee cherry skin and pulp extracts in liquid form comprise:

- Total phenolic content (TPC): 40 - 60% by weight,
- Chlorogenic acids: 20 - 40% by weight,
- Caffeine: 5 - 10% by weight,
- Tannin: 0.1 - 5% by weight, and
- Catechin: 1 - 5% by weight.

9. A processing method for producing powders from dried coffee cherry skin and pulp comprises the following steps:

A. grinding the dried coffee cherry skin and pulp obtained from the previous steps, followed by sieving through a mesh no larger than 160;

B. preparing extracts using a ratio of 200 to 300 grams of ground and dried coffee cherry skin and pulp per 1 to 1.5 liters of hot water, and immersing for 10 to 20 minutes, where the hot water has a temperature range of 90 to 100 degrees Celsius, a pH level of 6 to 7, and a hard water content not exceeding 100 milligrams per liter, to increase the active ingredient content;

C. mixing the extracts obtained from Step B with clean water at a ratio of 1:2, and then boiling the mixture at a temperature range of 90 to 100 degrees Celsius;

D. adding a coating agent to the mixture, stirring well, and then filtering the mixture;

E. spray drying the filtered mixture with an inbound hot air temperature of 180 to 200 degrees Celsius and an outbound temperature of 90 to 100 degrees Celsius for a duration of 50 to 60 minutes per 80 to 100 liters of extracts; and

F. mixing the spray-dried extracts obtained from Step E with drink compositions to yield powders.

10. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 9, wherein the coffee cherry skin and pulp are subjected to moisture removal to ensure dryness.

11. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 9, wherein the coating agent comprises:

- Maltodextrin: 50 - 60% by weight,
- Semi-synthesized polymer: 30 - 40% by weight, and
- Gelling agent: 5 - 10% by weight.

12. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 11, wherein the semi-synthesized polymer is selected from the group consisting of hydroxypropyl methylcellulose, methylcellulose, ethylcellulose, hydroxyethyl cellulose, or a combination thereof.

13. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 11, wherein the gelling agent is selected from the group consisting of gum arabic, tragacanth, algin, pectin, guar gum, xanthan gum, or a combination thereof.

14. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 9, wherein the drink compositions comprise:

- Coffee pulp extract powder: 70 - 75 % by weight,
- Coffee powder: 15 - 20 % by weight,
- Inositol hexaphosphate: 8 - 10 % by weight, and
- Stevia powder: 0.1 - 0.5 % by weight.

15. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 14, wherein inositol hexaphosphate is selected from the group consisting of rice germ, molasses, peanuts, dry lima beans, raisins, cantaloupe, grapefruit, cabbage, brewer's yeast, or a combination thereof.

16. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 9, wherein the coffee cherry pulp extracts in powder form have a pH value of less than 4.6.

17. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 9, wherein the coffee cherry pulp extracts in powder form have a sweetness level of 10 to 20 Brix.

18. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 9, wherein the coffee cherry pulp extracts in powder form have a moisture content of less than or equal to 6%.

19. The processing method for producing powders from dried coffee cherry skin and pulp as recited in claim 9, wherein the coffee cherry pulp extracts in powder form comprise:

- Total phenolic content (TPC): 0.1 - 1 % by weight,
- Chlorogenic acids: 50 - 60 % by weight,
- Caffeine: 10 - 20 % by weight,
- Tannin: 25 - 30 % by weight, and
- Catechin: 0.1 - 1 % by weight.