(86) Date de dépôt PCT/PCT Filing Date: 2000/09/27
(87) Date publication PCT/PCT Publication Date: 2001/04/05
(85) Entrée phase nationale/National Entry: 2002/03/06
(86) N° demande PCT/PCT Application No.: US 2000/026514
(87) N° publication PCT/PCT Publication No.: 2001/022836
(30) Priorité/Priority: 1999/09/30 (60/156,805) US

(54) Titre : PROCÉDE PERMETTANT L'ACCROISSEMENT DE LA DUREE DE CONSERVATION DE SAVEURS DE COMPOSITIONS AQUEUSES AROMATISÉES AVEC UNE TENEUR EN EAU ET DES AROMES SENSIBLES AUX ACIDES ET COMPOSITIONS D'AROMES DOTEES DE DUREE DE CONSERVATION DE SAVEURS ACCRUES
(54) Title: METHOD FOR EXTENDING THE FLAVOR SHELF LIFE OF AQUEOUS COMPOSITIONS FLAVORED WITH MOISTURE AND ACID SENSITIVE FLAVORS AND FLAVOR COMPOSITIONS HAVING EXTENDED FLAVOR SHELF LIVES

(57) Abrégé/Abstract:
A method for extending the flavor shelf life of aqueous compositions flavored with moisture and acid sensitive flavors. The increased flavor shelf life is obtained by combining an edible organic acid and edible divalent salt with a moisture and acid sensitive flavor. Flavor compositions capable of providing an aqueous composition with an increased flavor shelf life are also disclosed.
Title: METHOD FOR EXTENDING THE FLAVOR SHELF LIFE OF AQUEOUS COMPOSITIONS FLAVORED WITH MOISTURE AND ACID SENSITIVE FLAVORS AND FLAVOR COMPOSITIONS HAVING EXTENDED FLAVOR SHELF LIVES

Abstract: A method for extending the flavor shelf life of aqueous compositions flavored with moisture and acid sensitive flavors. The increased flavor shelf life is obtained by combining an edible organic acid and edible divalent salt with a moisture and acid sensitive flavor. Flavor compositions capable of providing an aqueous composition with an increased flavor shelf life are also disclosed.
METHOD FOR EXTENDING THE FLAVOR SHELF LIFE OF AQUEOUS COMPOSITIONS
FLAVORED WITH MOISTURE AND ACID SENSITIVE FLAVORS AND FLAVOR
COMPOSITIONS HAVING EXTENDED FLAVOR SHELF LIVES

FIELD OF THE INVENTION

The present invention is directed to a method of extending the flavor shelf life of aqueous compositions flavored with moisture and acid sensitive flavors and flavor compositions having extended flavor shelf lives. When properly executed, the method embodiment of the present invention delays the transformation of flavor compounds into less desirable compounds, thereby prolonging the useful life of said flavor compounds. Furthermore, when the flavor compositions of the present invention are used to flavor aqueous compositions, they provide the aqueous composition with an extended flavor shelf life.

BACKGROUND OF THE INVENTION

It is common for aqueous compositions to contain moisture and acid sensitive flavor compounds that mask off-flavors or otherwise increase the consumer's enjoyment of aqueous compositions. Unfortunately, many of the flavors used in aqueous compositions have such a short flavor shelf life that by the time the aqueous composition is consumed, the composition's flavoring has been chemically transformed to such an extent that the consumer does not enjoy the full benefit of the flavoring compound. This is especially true with ready to drink beverages where the flavoring compounds may be almost completely transformed into less desirable compounds by the time the beverage reaches the consumer. For example, references such as "The Acid Catalysed Hydration of Sabinene and alpha-Thujene"; Cooper, M.A.; Holden, C.M.; Whittaker, D.; J.C.S. Perkin II, pp. 665-667 (1973) indicate that sabinene, a flavor compound found in citrus fruits, berries, juniper oils, and plant seeds, such as black peppercorn, is transformed into 1-terpinen-4-ol and other terpinenes in the presence of water or acids. The degradation of moisture and acid sensitive flavor compounds is noted indirectly by Japikse et. al., in the U.S. Pat. No. 4,647,466, wherein a process for the production of citrus flavor and aroma compositions is disclosed. Within the body of the patent, Japikse et. al. disclose compounds which are found in the juice, membrane, and peel of oranges after processing. Among the compounds cited by Japikse et. al. is terpeneol, a decomposition product of orange flavor. Although flavor components of fresh oranges, such as monoterpenes and sabinene were absent, Japikse et. al. does not appear to recognize the loss of flavor that is associated with the rate of loss of monoterpenes and sabinene nor does Japikse et. al. offer a solution to the problem.

The following brief summary of attempts to preserve flavor compounds, by delaying or preventing their exposure to aqueous compositions, indicates that the solution to extending the flavor shelf life of aqueous compositions flavored with moisture and acid sensitive flavors, had not been discovered.
Boskovic, et. al. in the U.S. Pat. No. 5,124,162 disclose the spray drying encapsulation of flavorants in a carbohydrate matrix. Although the flavorants are protected from loss and chemical transformation while in the carbohydrate matrix, upon exposing the encapsulated flavorant in a carbohydrate matrix to an aqueous composition, the carbohydrate matrix readily dissolves thus exposing the flavorants to moisture and subsequent chemical transformations.

In the U.S. Pat. No. 5,897,897, Porzio et. al. teaches an encapsulation composition comprising a glassy carbohydrate matrix, a plasticizer and flavor oils which is hot melt extruded to produce a glassy matrix. As with the spray dried encapsulation art, the extruded encapsulation composition readily dissolves when exposed to an aqueous compositions thus allowing for the subsequent chemical transformation of moisture and acid sensitive flavor compounds.

The U.S. Pat. No. 5,759,599, assigned to Givaudan Roure Flavors Corporation, Cincinnati, Ohio teaches a method of encapsulating emulsified flavor oils using a polymer coating prepared by coacervation in water, which is cross-linked and then spray dried. The capsules thus formed must be fractured to release the flavor compounds. Again, when the capsules fracture, the flavors are no longer protected from chemical transformation. Furthermore, the residue from the polymer coating may present an objectionable texture to the consumer when the flavor capsules are combined with an aqueous composition.

In the U.S. Pat. No. 5,939,117, Chen et. al. disclose a method for preserving fresh fruit wherein a solution comprising calcium ions, ascorbate ions or erythorbate ions and water is applied to the surface of the freshly cut fruit to prevent browning and other spoilage. While this invention teaches how to preserve the key characteristics of fresh fruit, this invention does not teach a method of extending the flavor shelf life of an aqueous composition flavored with isolated moisture and acid sensitive flavor compounds. Further, this invention does not recognize the problem nor teach the solution to protecting moisture and acid sensitive flavors from chemical transformation due to hydrolysis, which occurs when the flavors are combined with an aqueous composition to form a product such as a beverage.

In summary, the art has failed to recognize the problem of protecting moisture and acid sensitive flavors from chemical transformation, due to hydrolysis, when the moisture and acid sensitive flavors are combined with aqueous compositions. At best, the art teaches that flavor compounds can be preserved by delaying or preventing their exposure to aqueous compositions. Since the art does not appear to recognize the problem nor teach the solution to protecting moisture and acid sensitive flavors from the chemical transformations that occur when the flavors are mixed with aqueous compositions, the consumer and possibly the manufacturers of aqueous compositions flavored with moisture and acid sensitive flavors may be unaware of the flavor benefits that are lost. In short, the consumer is deprived of the full benefits that flavor compounds are meant to provide. As a result, there remains a need for a method of extending the flavor shelf life of aqueous compositions flavored with moisture and acid sensitive flavors and flavor compositions having extended flavor shelf lives.
Applicants have studied the transformation processes of moisture and acid sensitive flavor compounds and their data indicates that the transformation processes are modeled by a base-10 logarithmic function of time and concentration, wherein time zero is the point at which the flavoring compound is exposed to moisture or acid. Surprisingly, applicants have found that the flavor shelf life of moisture and acid sensitive flavors can be extended by the addition of the combination of an edible organic acid and an edible divalent salt. Specific embodiments of the present invention include a novel method for extending the flavor shelf lives of moisture and acid sensitive flavor compounds and novel flavoring compositions that have extended flavor shelf lives. In many cases the flavor shelf life of an aqueous composition that is flavored with a moisture and acid flavor can be extended up to 127 hours at which time, at least about 10% of the flavoring compound is still present when measured per the protocol identified as Solid-Phase Microextraction Gas Chromatography-Mass Spectrometry "SPME-GC/MS Analysis of Volatiles of Beverages". As a result, the consumer is able to enjoy the flavoring benefits, as intended by the manufacturer, and due to the extended flavor shelf life, powdered flavored compositions that are hydrated by the consumer can be stored for an increased period of time.

Thus, an object of the present invention is to provide a method for extending the flavor shelf lives of aqueous compositions that are flavored by or with moisture and acid sensitive flavor compounds.

Another object of this invention is to provide flavor compositions that have extended flavor shelf lives.

These and other objects will become apparent from the following detailed description.

**SUMMARY OF THE INVENTION**

A method for extending the flavor shelf life of an aqueous composition that is flavored by or with a moisture and acid sensitive flavor comprising the steps of:

- a) providing a moisture and acid sensitive flavor,
- b) providing an edible organic acid component,
- c) providing an edible divalent salt component,
- d) combining said flavor and said edible organic acid component and said edible divalent salt component prior to exposing said moisture and acid sensitive flavor to moisture or acid.

A moisture and acid sensitive flavor composition comprising a moisture and acid sensitive flavor, an edible organic acid component and an edible divalent salt component wherein said flavor composition is a powder or tablet.
DETAILED DESCRIPTION OF THE INVENTION

DEFINITIONS

As used herein, the phrase "extending the flavor shelf life of a moisture and acid sensitive flavor" means retaining or extending the chemical identity of a moisture or acid sensitive flavor while the flavor is exposed to water or acid.

As used herein, the term "moisture and acid sensitive flavor" means a flavor that can be transformed to less desirable compounds when exposed to moist or acidic environments.

As used herein, it is understood that the "flavor shelf life" of a flavoring compound begins at the point at which the flavoring compound is combined with an aqueous composition.

As used herein, the term "combining" means placing said components in intimate physical contact and includes, but is not limited to processing methods such as blending, mixing, milling, stirring, and folding. When the components are "combined" it is understood that a salt may be formed.

As used herein, the term "aqueous composition" means a composition of matter that comprises at least 30% water as determined by the Association of Analytical Chemists (AOAC), "Official Methods of Analysis" (1990), 15th edition, Methods, 950.27, AOAC, Arlington, Virginia.

As used herein, "solid" means an essentially dry material in powder or granular form that can be reconstituted or diluted with water or other aqueous liquid to form a premix or added directly in dry form to an aqueous composition.

As used herein, the term "sabinene" means a monoterpenes as defined in Adv. Food Research, Academic Press, New York, (1970), Supplement 2, Kefford et. al. (review).

As used herein the articles a and an when used in a claim, for example, "an edible divalent salt" or "an edible organic acid " is understood to mean at least one of the components that are claimed or described.

As used herein the term "salt", unless further modified, means a compound that has one cation and at least one anion.

All percentages herein are by weight unless otherwise specified.

METHOD EMBODIMENTS

The methods described herein have been shown to extend the flavor shelf life of aqueous compositions flavored with moisture and acid sensitive flavors. Specifically, the methods comprise the steps of providing a moisture and acid sensitive flavor, providing an edible organic acid component, providing an edible divalent salt component, and combining said flavor and said edible organic acid component and said edible divalent salt component prior to exposing said moisture and acid sensitive flavor to moisture or acid. An optional step comprises combining said edible organic acid component with said edible divalent salt component to form a salt, prior to adding said edible organic acid component and said edible divalent salt component to said moisture and acid sensitive flavor. An additional optional, but less preferred, step is the step of
adding said edible organic acid component and said edible divalent salt component, whether pre-
combined to form a salt or as separate components, and a moisture and acid sensitive flavor to
an aqueous composition, prior to providing the aqueous composition to the consumer. Preferably, when the edible organic acid component, edible divalent salt component and moisture
and acid sensitive flavor are added separately to the aqueous composition, the edible divalent salt
component is added to the aqueous composition first, next the edible organic acid component is
added to the aqueous composition, and then the moisture and acid sensitive flavor is added to
aqueous composition. Even more preferably, when the edible organic acid component, edible
divalent salt component and moisture and acid sensitive flavor are added separately to the
aqueous composition, the edible organic acid component is added to the aqueous composition
first, next the edible divalent salt component is added to the aqueous composition, and then the
moisture and acid sensitive flavor is added to aqueous composition. Most preferably, the edible
organic acid component, edible divalent salt component and moisture and acid sensitive flavor
are simultaneously added to the aqueous composition.

The edible organic acid component, edible divalent salt component and moisture and acid
sensitive flavor can be functional in a variety of forms, including but not limited to powders, liquids,
liquid concentrates and premixes. However, as moisture and acid sensitive flavorings are
moisture and acid sensitive, it is preferred that the flavorings be essentially dry or encapsulated.
Most preferably the flavorings are in the form of a dry powder. The preferred state of the edible
organic acid component and edible divalent salt component, whether pre-combined to form a salt
or separate components, is an essentially dry powder or equilibrium hydrate salt. When the
edible organic acid component and edible divalent salt component, whether pre-combined to form
a salt or separate components, and moisture and acid sensitive flavor are essentially dry solids,
the method can include the additional optional step of forming tablets from each solid or from the
combined mixture of solids, prior to introducing the solids or mixture of solids to an aqueous
composition.

Flavors whose flavor shelf life can be extended by practicing the method of the present
invention can be obtained from a natural source or can be synthetically produced and include, but
are not limited, to moisture and acid sensitive flavors containing at least one compound selected
from the group consisting of monoterpenes, aldehydes, terpenes and esters. Preferred, flavors
whose flavor shelf life can be extended by practicing the method of the present invention include
moisture and acid sensitive flavors that contain at least one compound selected from the group
consisting of sabinene, citronellal, citral, cinnamic aldehyde, ethyl isobutyrate, ethyl acetate and
mixtures thereof. Non-limiting examples of flavors whose flavor shelf life can be extended by
practicing the method of the present invention include: orange, lemon, lime, grapefruit, apple,
grape, pear, cherry, watermelon, pineapple, cranberry, strawberry, juniper, raspberry, blackberry,
nectarine, rhubarb, plum, passion fruit, kiwi, raspberry; and mixtures thereof. The following
flavors are preferred: orange, lemon, lime, grapefruit, apple, grape, pear, cherry, watermelon,
pineapple, cranberry, strawberry, juniper; and mixtures thereof. The following flavors are even more preferred: orange, lemon, lime, grapefruit, apple, grape, pear, cherry and mixtures thereof. The most preferred flavors are orange, lemon, lime, grapefruit and mixtures thereof.

Edible organic acids that can be used to practice the method of present invention include: citric acid, malic acid, gluconic acid, adipic acid, lactic acid, acetic acid, succinic acid, fumaric acid, pyruvic acid, malonic acid, maleic acid, and mixtures thereof. Optical isomers of malic acid, gluconic acid, lactic acid and mixtures thereof may be used as well. Preferred edible organic acids are citric acid, malic acid, optical isomers of malic acid and mixtures thereof. Preferably, the molar ratio of edible divalent salt component and edible organic acid component is from about 1:1 to about 1:4.

Edible divalent salts that can be used to practice the method of the present invention include, but are not limited to, calcium salts or magnesium salts. Non-limiting examples of calcium salts or magnesium salts that can be used to practice the method of the present include: calcium carbonate, calcium hydroxide, calcium oxide, calcium gluconate, calcium fumarate, calcium lactate, calcium phosphate monobasic, calcium phosphate dibasic, calcium phosphate tribasic, calcium chloride, calcium sulfate, magnesium carbonate, magnesium hydroxide, magnesium oxide, magnesium sulfate, magnesium chloride, magnesium citrate, and mixtures thereof. Preferred divalent salts include: calcium carbonate, calcium hydroxide, calcium oxide, calcium phosphate monobasic, calcium phosphate dibasic, calcium phosphate tribasic, calcium chloride, calcium sulfate and mixtures thereof. Preferably, when the edible divalent salt component is a magnesium or calcium salt or mixture thereof, the salt provides a sufficient amount of cations, when combined with an aqueous composition, to provide the aqueous composition with at least 0.02% by weight cations which comprise magnesium, calcium or mixtures thereof. More preferably, when the edible divalent salt component is a magnesium or calcium salt or mixture thereof, the salt provides a sufficient amount of cations, when combined with an aqueous composition, to provide the aqueous composition with at least 0.03% to about 1.5% by weight cations which comprise magnesium, calcium or mixtures thereof. Most preferably, when the edible divalent salt component is a magnesium or calcium salt or mixture thereof, the salt provides a sufficient amount of cations, when combined with an aqueous composition, to provide the aqueous composition with about 0.05% to about 0.6% by weight cations which comprise magnesium, calcium or mixtures thereof.

The method of this invention can be used by manufacturers of beverages and other aqueous compositions, and single strength and concentrated solids, such as powders or tablets, that are designed to be mixed with an aqueous composition to form a product. The invention is particularly useful when applied to essentially dry single strength or concentrated solids, that contain at least one moisture and acid sensitive flavor, as the invention can extend the flavor of the product that results when the essentially dry solid is mixed with the aqueous composition. In many cases the flavor shelf life of an aqueous composition that is flavored with a moisture and
acid sensitive flavor can be extended up to 127 hours at which time, at least about 10% of the
flavoring compound is still present when measured per the protocol identified as Solid-Phase
Microextraction Gas Chromatography-Mass Spectrometry "SPME-GC/MS Analysis of Volatiles of
Beverages". Most preferably, the flavor shelf life of an aqueous composition that is flavored with
a moisture and acid sensitive flavor can be extended up to 36 hours at which time, at least about
50% of the flavoring compound is still present as measured per the protocol identified as Solid-
Phase Microextraction Gas Chromatography-Mass Spectrometry "SPME-GC/MS Analysis of
Volatiles of Beverages". The SPME-GC/MS protocol is disclosed below.

SPME-GC/MS ANALYSIS OF VOLATILES OF BEVERAGES

Solid-Phase Microextraction Gas Chromatography-Mass Spectrometry (SPME-GC/MS) is
a sampling and analysis technique well suited for flavor analysis.

1. Instrument and conditions
   a) SPME manual sampling assembly comprising a 2 cm Stableflex® fiber with a dual
      coating of carboxen and divinylbenzene (30 μm/50 μm) suspended in
      polydimethylsiloxane, obtained from Supelco, Inc. of Bellefonte, Pennsylvania, USA;
   b) Gas Chromatograph (GC): Hewlett Packard (HP) model 6890 having an injector
temperature of about 250 °C and the following temperature program:
      i) an initial temperature of about 50 °C which is held for about 2 minutes,
      ii) increase the initial temperature at a rate of about 5 °C/min until a
temperature of about 200 °C is reached,
      iii) next, the temperature is increased at about 10 °C/min until a temperature
      of about 250 °C is reached,
      iv) hold at about 250 °C for about 3 minutes. The total run time is about 40 minutes;
   c) GC column: Durabond® (30 meters in length, 252 μm column ID and 1.0 μm film
      thickness) obtained from J&W Scientific of Folsom, California, USA;
   d) Carrier gas: Helium having a flow rate of 2ml/min.;
   e) The Detector was a model HP 5973 Mass Selective Detector (MSD) obtained from
      Hewlett Packard, Santa Clarita, California, USA having a
      i) source temperature of about 230 °C, and
      ii) a Mass Spectrometer Quad temperature of about 150 °C.

2. Sample preparation
   a) Separately equilibrate the moisture and acid sensitive flavor compound and the
desired aqueous composition to about 22 °C.
   b) Add the moisture and acid sensitive flavor compound to the desired aqueous
      composition.
c) Equilibrate the aqueous composition containing a moisture and acid sensitive flavor compound at about 22 °C for about 5 minutes.

3. Flavor analysis by SPME-GC/MS
   a) Transfer 60 mls of the combined moisture and acid sensitive flavor compound and aqueous composition to a 100 ml headspace sampling glass vial containing a Teflon® coated magnetic stirring bar.
   b) Seal the vial with a standard Teflon® gas tight crimp seal.
   c) Equilibrate the contents of the vial at about 22 °C for about 15 minutes.
   d) Initiate sampling
      i) Sampling time should be about 15 minutes.
      ii) The desorption time for the SPME fiber should be about 3 minutes.
   e) Identify flavor compounds using the MS spectral libraries of John Wiley & Sons and the National Institute of Standards and Technology (NIST), purchased and licensed through Hewlett Packard.
   f) Integrate the peaks using the Chemstation® software obtained from Hewlett Packard, Santa Clarita, California, USA.

Protocols used to determine the levels and types of edible organic acid components are disclosed by the following references:

20


25


Pyruvic acid is analyzed by the protocol disclosed in GIF-Labor-Fachz., C. W. Klampfl and W. Buchberger, April 1999, 19, 4-8.

30

Malonic acid is analyzed by the protocol disclosed in Bunseki, T. Tsuda, April 1999, (4), 335-339.

35

Gluconic and succinic acids are analyzed by the protocol disclosed in Ind-Aliment (Pinerolo, Italy), C. M. Lanza et al., Nov. 1995, 34(342), 1173-1175.
Fumaric and maleic acids are analyzed by the protocol disclosed in the Journal of Liquid Chromatography, E. A. Dietz et al., Apr 1994, 17 (7), 1637-1751.

Adipic acid is analyzed by the protocol disclosed in Bunseki-Kagaku, Oct 1988, K. Fujimura et al., 37 (10), 549-553.

The level and type of the cations of the edible divalent salts were determined according to the protocol listed in the following reference:


The protocol for determining the level and type of flavor contained in an aqueous composition is titled "SPME-GC/MS Analysis of Volatiles of Beverages" and is the same protocol that is used to determine flavor shelf life extension.

**FLAVOR COMPOSITIONS**

The flavor compositions described herein have been shown to provide aqueous compositions with extended flavor shelf lives. Specifically, the flavor compositions of the present invention comprise a moisture and acid sensitive flavor, an edible organic acid component and an edible divalent salt component.

The edible organic acid component, edible divalent salt component and moisture and acid sensitive flavor can comprise a variety of functional forms, including but not limited to powders, liquids, liquid concentrates and premixes. However, as moisture and acid sensitive flavorings are moisture and acid sensitive, it is preferred that the flavorings be essentially dry. Most preferably the flavorings are in the form of a dry powder. The preferred state of the edible organic acid component and edible divalent salt component, whether pre-combined to form a salt or separate components, is an essentially dry powder or an equilibrium hydrate salt. When the edible organic acid component and edible divalent salt component, whether pre-combined to form a salt or separate components, and moisture and acid sensitive flavor are essentially dry solids, tablets may be formed from the solids or mixture of solids prior to combining the solids with an aqueous composition.

Flavors that can be used to produce the flavor composition of the present invention can be obtained from a natural source or can be synthetically produced and include, but are not limited, to moisture and acid sensitive flavors containing at least one compound selected from the group consisting of monoterpenes, aldehydes, terpenes and esters. Preferred, flavors that can be
preserved by practicing the method of the present invention include moisture and acid sensitive
flavors that contain a compound selected from the group consisting of sabinene, citronellal, citral,
cinnamic aldehyde, ethyl isobutyrate, ethyl acetate and mixtures thereof. Non-limiting examples
of flavors that can be preserved by practicing the method of the present invention include: orange,
lemon, lime, grapefruit, apple, grape, pear, cherry, watermelon, pineapple, cranberry, strawberry,
juniper, raspberry, blackberry, nectarine, rhubarb, plum, passion fruit, kiwi, raspberry; and
mixtures thereof. The following flavors are preferred: orange, lemon, lime, grapefruit, apple,
grape, pear, cherry, watermelon, pineapple, cranberry, strawberry, juniper; and mixtures thereof.
The following flavors are even more preferred: orange, lemon, lime, grapefruit, apple, grape, pear,
cherry and mixtures thereof. The most preferred flavors are orange, lemon, lime, grapefruit and
mixtures thereof.

Edible organic acids that can be used to produce the flavoring composition of present
invention include: citric acid, malic acid, gluconic acid, adipic acid, lactic acid, acetic acid, succinic
acid, fumaric acid, pyruvic acid, malonic acid, maleic acid, and mixtures thereof. Optical isomers
of malic acid, gluconic acid, lactic acid and mixtures thereof may be used as well. Preferred
edible organic acids are citric acid, malic acid, optical isomers of malic acid and mixtures thereof.
Preferably, the molar ratio of edible divalent salt component and edible organic acid component is
from about 1:1 to about 1:4.

Edible divalent salts that can be used to produce the flavoring composition of the present
invention include, but are not limited to, calcium salts or magnesium salts. Non-limiting examples
of calcium salts or magnesium salts that can be used to practice the method of the present
include: calcium carbonate, calcium hydroxide, calcium oxide, calcium gluconate, calcium
fumarate, calcium lactate, calcium phosphate monobasic, calcium phosphate dibasic, calcium
phosphate tribasic, calcium chloride, calcium sulfate, magnesium carbonate, magnesium
hydroxide, magnesium oxide, magnesium sulfate, magnesium chloride, magnesium citrate, and
mixtures thereof. Preferred divalent salts include: calcium carbonate, calcium hydroxide, calcium
oxide, calcium phosphate monobasic, calcium phosphate dibasic, calcium phosphate tribasic,
calcium chloride, calcium sulfate and mixtures thereof. Preferably, when the edible divalent salt
component is a magnesium or calcium salt or mixture thereof, the salt provides a sufficient
amount of cations, when combined with an aqueous composition, to provide the aqueous
composition with at least 0.02% by weight cations which comprise magnesium, calcium or
mixtures thereof. More preferably, when the edible divalent salt component is a magnesium or
calcium salt or mixture thereof, the salt provides a sufficient amount of cations, when combined
with an aqueous composition, to provide the aqueous composition with at least 0.03% to about
1.5% by weight cations which comprise magnesium, calcium or mixtures thereof. Most
preferably, when the edible divalent salt component is a magnesium or calcium salt or mixture
thereof, the salt provides a sufficient amount of cations, when combined with an aqueous
composition, to provide the aqueous composition with about 0.05% to about 0.6% by weight cations which comprise magnesium, calcium or mixtures thereof.

The flavoring composition of this invention can be used by manufactures of beverages and single strength and concentrated solids, such as powders or tablets, that are designed to be mixed with an aqueous composition to form a product. The invention is particularly useful when incorporated into essentially dry single strength or concentrated solids, such as a powder drink mix, as the invention can extend the flavor of the product that results when the essentially dry solid is mixed with the aqueous composition. In many cases the flavor shelf life of an aqueous composition containing a flavoring composition of the present invention, can be extended up to 127 hours at which time, at least about 10% of the flavoring compound is still present as measured per the protocol identified as Solid-Phase Microextraction Gas Chromatography-Mass Spectrometry "SPME-GC/MS Analysis of Volatiles of Beverages". Most preferably, the flavor shelf life of an aqueous composition that is flavored with a flavor composition of the present invention can be extended up to 36 hours at which time, at least about 50% of the flavoring compound is still present as measured per the protocol identified as Solid-Phase Microextraction Gas Chromatography-Mass Spectrometry "SPME-GC/MS Analysis of Volatiles of Beverages". The SPME-GC/MS protocol is disclosed in the "Methods Embodiment" Section of the present application.

The protocols for determining the levels and types of edible organic acid components used in the flavor compositions of the present invention are the same as and are disclosed in the "Methods Embodiment" Section of the present application.

The protocol for determining the levels and types of cations of the edible divalent salt components used in the flavor compositions of the present invention is the same as and is disclosed in the "Methods Embodiment" Section of the present application.

The protocol for determining the levels and types of moisture and acid sensitive flavors used in the flavor compositions of the present invention is the same as and is disclosed in the "Methods Embodiment" Section of the present application.

**OPTIONAL INGREDIENTS**

Optional ingredients which can be combined with the flavor composition described herein, without detracting from the present invention, include, but are not limited to, clouding agents (e.g. titanium dioxide, creamers), colors, dyes, thickeners, carbohydrates, artificial and natural sweeteners, starches, fibers, water, fruit solids, vitamins, minerals (other than the Ca, Mg listed), carbonating agents, preservatives, and flow agents (e.g. SiO2).

Nonlimiting examples of natural carbohydrates include monosaccharides such as: erythrose, threose, ribose, arabinose, xylose, ribulose, glucose, galactose, mannose, fructose and sorbose, disaccharides such as sucrose, maltose, maltulose and lactose, and complex
carbohydrates such as: raffinose, maltotriose, maltotetraose, glycogen, amylose, amylopectin and maltodextrins.

Effective levels of non-caloric sweeteners can be used in all embodiments of the present invention to sweeten said embodiments. Nonlimiting examples of non-caloric sweeteners include aspartame, saccharin, cyclamates, sucralose, acesulfame-potassium, L-aspartyl-L-phenylalanine lower alkyl ester sweeteners, L-aspartyl-D-alanine amides as disclosed in US patent 4,411,925 to Brennan, et al (1983), L-aspartyl-D-serine amides disclosed in US 4,399,163 to Brennan et al (1983), L-aspartyl-hydroxymethyl alkane amide sweeteners disclosed in U.S. 4,338,346 issued to Brand (1982), L-aspartyl-1-hydroxyethylalkane amide sweeteners disclosed in US 4,423,029 to Rizzi (1983), glycyrrhizins, synthetic alkoxy aromatics, neotame, xylitol, mannitol, sorbitol, allitame, Luo Han Guo extract, stevioside, honey, sucrose, dextrose, glucose, fructose, extract, fructooligosaccharides, and other natural sources of sweeteners can also be used.

FLAVOR COMPOSITION PREPARATION

The flavor composition of the present invention can be prepared by blending the proper amounts and ratios of all the required dry ingredients together. Specifically, the process of making comprises the steps of providing a moisture and acid sensitive flavor, providing an edible organic acid component, providing an edible divalent salt component, and combining said flavor and said edible organic acid component and said edible divalent salt component prior to exposing said moisture and acid sensitive flavor to moisture or acid. An optional step comprises combining said edible organic acid component with said edible divalent salt component to form a salt, prior to adding said edible organic acid component and said edible divalent salt component to said moisture and acid sensitive flavor. The resulting flavor compositions are solids and include granules and bulk powders.

A final optional step is to form tablets or capsules from the flavor compositions. Tablets may contain suitable binders, lubricants, diluents, disintegrating agents, coloring agents, flavoring agents, flow-inducing agents and melting agents. Suitable carriers and excipients that may be used to formulate dry forms of the present invention are described in U.S. Patent 3,903,297, Rober, issued September 2, 1975. Techniques and compositions for making dry forms useful in the methods of this invention are described in the following references: H.W. Houghton (ed.), Developments in Soft Drinks Technology, vol. 3 (Elsevier, 1984), chapter 6; 7 Modern Pharmaceutics, Chapters 9 and 10 (Banker & Rodes (ed.), 1979); Liberman et al.; Pharmaceutical Dosage Forms: Tablets (1981); and Ansel, Introduction to Pharmaceutical Dosage Forms, 2nd Edition (1976).

The essentially dry mixture, either as a powder, granules, tablets, or capsules can later be dissolved in a proper amount of water, carbonated or non-carbonated, or other aqueous liquid to make a final drinkable beverage or other aqueous composition. Preferably, when the edible
organic acid component, edible divalent salt component and moisture and acid sensitive flavor are added separately to an aqueous composition, the edible divalent salt component is added to the aqueous composition first, next the edible organic acid component is added to the aqueous composition, and then the moisture and acid sensitive flavor is added to aqueous composition. Alternatively, dry forms of the present invention may be incorporated in other products, including but not limited to nutrient bars, cereal bars and energy bars, candy, to impart to such products an extended flavor shelf life.

EXAMPLES

The following are specific embodiments of flavor compositions of the present invention and methods for making them. These examples are illustrative of the invention and are not to be construed to limit the invention in any way. The orange flavors used in the following examples comprise mixtures of Natural Orange Durarome obtained from Firmenich, Anaheim, California, U.S.A., and Safety Harbor, Florida, U.S.A., and Natural Orange Juice flavor obtained from Firmenich, Anaheim, California, U.S.A., and U.S.A., and Natural & Artificial Orange Flavor, and Artificial Orange Booster Flavor, and Flavorburst® Artificial Fruit Topnote obtained from Givaudan-Roure, East Hanover, New Jersey, U.S.A. and Cincinnati, Ohio, U.S.A., Calcium Carbonate, food grade, obtained from J.T. Baker, Philipsburg, New Jersey, U.S.A., Citric Acid, food grade, obtained from Cargill, Naperville, Illinois, U.S.A., Malic (D/L) Acid, food grade, obtained from Bartek Ingredients Inc., Stoney Creek, Ontario, Canada.

Example 1

A powdered flavor composition was prepared according to the present invention by:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange Flavors</td>
<td>11.5</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>22.8</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>43.3</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>22.4</td>
</tr>
</tbody>
</table>

1. All of the ingredients were weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients were then mixed to a uniform appearance.
3. 2.6 grams of the flavor composition was combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.
4. The aqueous composition was analyzed via the SPME-GC/MS protocol and found to contain about 30% more sabinene and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 2

A powdered flavor composition of Example 1 containing sufficient optional ingredients, to allow said powder flavor composition to serve as a powder drink mix, was prepared by:

10 Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>86.61</td>
</tr>
<tr>
<td>Xanthan Gum</td>
<td>0.14</td>
</tr>
<tr>
<td>Titanium Dioxide</td>
<td>0.05</td>
</tr>
<tr>
<td>Orange Flavors</td>
<td>1.51</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>3.00</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>5.69</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>2.94</td>
</tr>
<tr>
<td>FD&amp;C Yellow #6</td>
<td>0.04</td>
</tr>
<tr>
<td>FD&amp;C Yellow #5</td>
<td>0.02</td>
</tr>
</tbody>
</table>

1. All of the ingredients were weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients were then mixed to a uniform appearance.
3. 25 grams of the powder drink mix was combined with 200 grams of water leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.
4. The aqueous composition was analyzed via the SPME-GC/MS protocol and found to contain about 37% more sabinene and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 3

A powdered flavor composition containing sufficient optional ingredients, to allow said powder flavor composition to serve as a powder drink mix, was prepared by:

Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt%</th>
</tr>
</thead>
</table>


1. All of the ingredients were weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients were then mixed to a uniform appearance.

3. 25 grams of the powder drink mix was combined with 200 grams of water leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition was analyzed via the SPME-GC/MS protocol and found to contain about 65% more sabinene and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

5. The aqueous composition was analyzed after 24 hours and was found to contain about 53% of its original level of sabinene while a similar beverage containing the same level and type of materials, except for the edible divalent salt component, was found to have less than 1% of its original level of sabinene.

6. The aqueous composition was analyzed after 120 hours and was found to contain about 15% of its original level of sabinene while a similar beverage containing the same level and type of materials, except for the edible divalent salt component, was found to have less than 1% of its original level of sabinene.

**Example 4**

A powdered flavor composition containing sufficient optional ingredients, to allow said powder flavor composition to serve as a powder drink mix, was prepared by:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>88.76</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>2.94</td>
</tr>
</tbody>
</table>
Xanthan Gum 0.14  
Titanium Dioxide 0.06  
Orange Flavors 1.54  
CCM powder* 6.50  
FD&C Yellow #6 0.04  
FD&C Yellow #5 0.02

* CCM powder is calcium-citrate-malate salt (20-26% elemental calcium by weight) obtained from Jost Chemicals, St. Louis, Missouri, U.S.A.

1. All of the ingredients were weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients were then mixed to a uniform appearance.
3. 25 grams of the powder drink mix was combined with 200 grams of water leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.
4. The aqueous composition was analyzed via the SPME-GC/MS protocol and found to contain about 55% more sabinene and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.
5. The aqueous composition was analyzed after 24 hours and was found to contain about 49% of its original level of sabinene, while a similar beverage containing the same level and type of materials, except for the edible divalent salt component, was found to have less than 1% of its original level of sabinene.
6. The aqueous composition was analyzed after 24 hours and was found to contain about 11% of its original level of sabinene, while a similar beverage containing the same level and type of materials, except for the edible divalent salt component, was found to have less than 1% of its original level of sabinene.

Example 5

A powdered flavor composition was prepared according to the present invention by:

Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange Flavors</td>
<td>12.2</td>
</tr>
<tr>
<td>Ca(OH)₂</td>
<td>18.0</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>46.0</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>23.8</td>
</tr>
</tbody>
</table>
1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients are then mixed to a uniform appearance.

3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabine and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 6

A powdered flavor composition was prepared according to the present invention by:

Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange Flavors</td>
<td>13.2</td>
</tr>
<tr>
<td>Mg(OH)₂</td>
<td>11.7</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>49.5</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>25.6</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients are then mixed to a uniform appearance.

3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabine and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 7

A powdered flavor composition is prepared according to the present invention by:

Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange Flavors</td>
<td>12.5</td>
</tr>
<tr>
<td>MgCO₃</td>
<td>16.1</td>
</tr>
</tbody>
</table>
Citric Acid  47.1
Malic Acid  24.3

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients are then mixed to a uniform appearance.
3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.
4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabinene and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 8
A powdered flavor composition containing sufficient optional ingredients, to allow said powder flavor composition to serve as a powder drink mix, is prepared by:

Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>89.09</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>2.92</td>
</tr>
<tr>
<td>Xanthan Gum</td>
<td>0.14</td>
</tr>
<tr>
<td>Titanium Dioxide</td>
<td>0.06</td>
</tr>
<tr>
<td>Orange Flavors</td>
<td>1.54</td>
</tr>
<tr>
<td>Ca(OH)$_2$</td>
<td>2.26</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>1.92</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>2.01</td>
</tr>
<tr>
<td>FD&amp;C Yellow #6</td>
<td>0.04</td>
</tr>
<tr>
<td>FD&amp;C Yellow #5</td>
<td>0.02</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients are then mixed to a uniform appearance.
3. 25 grams of the powder drink mix are combined with 200 grams of water leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.
4. The aqueous composition are analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabinene and at least 10% more citronellal after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 9

A powdered flavor composition is prepared according to the present invention by:

Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grape Flavor</td>
<td>11.5</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>22.8</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>43.3</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>22.4</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients are then mixed to a uniform appearance.
3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.
4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more ethyl acetate after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 10

A powdered flavor composition is prepared according to the present invention by:

Formulation:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juniper Flavors</td>
<td>11.5</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>22.8</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>43.3</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>22.4</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients are then mixed to a uniform appearance.
3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabinene after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 11
A powdered flavor composition is prepared according to the present invention by:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juniper Flavors</td>
<td>12.5</td>
</tr>
<tr>
<td>MgCO₃</td>
<td>16.1</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>47.1</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>24.3</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients are then mixed to a uniform appearance.

3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabinene after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

Example 12
A powdered flavor composition is prepared according to the present invention by:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherry Flavors</td>
<td>12.5</td>
</tr>
<tr>
<td>MgCO₃</td>
<td>16.1</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>47.1</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>24.3</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients are then mixed to a uniform appearance.
3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabinene after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

**Example 13**

A powdered flavor composition is prepared according to the present invention by:

**Formulation:**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raspberry Flavor</td>
<td>12.5</td>
</tr>
<tr>
<td>MgCO₃</td>
<td>16.1</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>47.1</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>24.3</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients are then mixed to a uniform appearance.

3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more cinnamic aldehyde after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

**Example 14**

A powdered flavor composition is prepared according to the present invention by:

**Formulation:**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple Flavor</td>
<td>11.5</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>22.8</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>43.3</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>22.4</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.
2. The ingredients are then mixed to a uniform appearance.

3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more ethyl isobutyrate after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

**Example 15**

A powdered flavor composition is prepared according to the present invention by:

**Formulation:**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranberry Flavor</td>
<td>11.5</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>22.8</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>43.3</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>22.4</td>
</tr>
</tbody>
</table>

1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients are then mixed to a uniform appearance.

3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more ethyl acetate after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.

**Example 16**

A powdered flavor composition is prepared according to the present invention by:

**Formulation:**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange Flavor</td>
<td>11.5</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>16.8</td>
</tr>
<tr>
<td>MgCO₃</td>
<td>6.0</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>43.3</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>22.4</td>
</tr>
</tbody>
</table>
1. All of the ingredients are weighed and placed into a stainless steel mixing bowl having a dry powder mixer equipped with a blunt stainless steel blade.

2. The ingredients are then mixed to a uniform appearance.

3. 2.6 grams of the flavor composition is combined with 200 grams of water containing 22 grams of sugar leading to an aqueous composition flavored with a moisture and acid sensitive flavor compound, edible organic acid component and edible divalent salt.

4. The aqueous composition is analyzed via the SPME-GC/MS protocol and found to contain at least 10% more sabinene after 40 minutes than a similar beverage containing the same level and type of materials except for the edible divalent salt component.
WHAT IS CLAIMED IS:

1.) A method for extending the flavor shelf life of an aqueous composition that is flavored by or with a moisture and acid sensitive flavor, said method characterized by the steps of:
   a) providing a moisture and acid sensitive flavor, preferably a powdered moisture and acid sensitive flavor;
   b) providing an edible organic acid component, preferably a powdered edible organic acid component;
   c) providing an edible divalent salt component, preferably a powdered edible divalent salt component;
   d) combining said flavor and said edible organic acid component and said edible divalent salt component prior to exposing said moisture and acid sensitive flavor to moisture or acid.

2.) The method of Claim 1 characterized by the further step of combining said edible organic acid component with said edible divalent salt component to form a salt, prior to adding said edible organic acid component and said edible divalent salt component to said moisture and acid sensitive flavor.

3.) The method of Claim 1 characterized by the further step of forming a mixture of powdered moisture and acid sensitive flavor, powdered edible organic acid component and powdered edible divalent salt component, and preferably forming said mixture into a pill or tablet prior to exposing said mixture to moisture or acid.

4.) The method of Claim 1 characterized by the further step of adding said flavor and said edible organic acid component and said edible divalent salt component to an aqueous composition, preferably said edible organic acid component is added to said aqueous composition first, next said edible divalent salt component is added to said aqueous composition, then said moisture and acid sensitive flavor is added to said aqueous composition.

5.) The method of any preceding claim, further characterized in that said moisture and acid sensitive flavor is a flavor that is acid sensitive from a pH of 2.0 to 4.8.

6.) The method of any preceding claim, further characterized in that said moisture and acid sensitive flavor is a flavor containing at least one compound selected from the group consisting of monoterpenes, aldehydes, terpenes and esters, preferably said moisture and acid sensitive flavor is a flavor containing at least one compound selected from the group consisting of sabinene, citronellal, citral, cinnamaldehyde, and ethyl isobutyrate, ethyl...
acetate; most preferably said moisture and acid sensitive flavor is a flavor selected from the

group consisting of:

a) orange, lemon, lime, grapefruit,
b) apple, grape, pear, cherry,
c) watermelon, pineapple,
d) cranberry, strawberry, juniper,
e) raspberry, blackberry,
f) nectarine, rhubarb, plum,
g) passion fruit, kiwi, raspberry; and
h) mixtures thereof.

7.) The method of any preceding claim, further characterized in that said edible organic acid
component is selected from the group consisting of citric acid, malic acid, gluconic acid,
adipic acid, lactic acid, acetic acid, succinic acid, fumaric acid, pyruvic acid, malonic acid,
maleic acid and mixtures thereof or an optical isomer of an organic acid selected from the

group consisting of malic acid, gluconic acid, lactic acid and mixtures thereof; preferably
said edible organic acid component is selected from the group consisting of citric acid, malic
acid and mixtures thereof.

8.) The method of any preceding claim, further characterized in that said edible divalent salt
component is selected from the group consisting of calcium salts or magnesium salts;
preferably said edible divalent salt component is selected from the group consisting of
calcium carbonate, calcium hydroxide, calcium oxide, calcium gluconate, calcium fumarate,
calcium lactate, calcium phosphate monobasic, calcium phosphate dibasic, calcium
phosphate tribasic, calcium chloride, calcium sulfate, magnesium carbonate, magnesium
hydroxide, magnesium oxide, magnesium sulfate, magnesium chloride, magnesium citrate,
and mixtures thereof; and most preferably said edible divalent salt component is selected
from the group consisting of calcium carbonate, calcium hydroxide, calcium oxide, calcium
phosphate monobasic, calcium phosphate dibasic, calcium phosphate tribasic, calcium
chloride, calcium sulfate and mixtures thereof.

9.) The method of any preceding claim, further characterized in that the molar ratio of said
d edible divalent salt component and said edible organic acid component is from 1:1 to 1:4;
preferably said edible divalent salt component's cation is selected from the group consisting
of calcium or magnesium and said cation is present in a sufficient quantity, when added to
an aqueous composition to provide said aqueous composition with at least 0.02% by
weight elemental calcium, magnesium or mixtures thereof; preferably 0.03% to 1.5% by
weight elemental calcium, magnesium or mixtures thereof and most preferably 0.05% to
0.6% by weight elemental calcium, magnesium or mixtures thereof.