

STORAGE STABLE, CITRUS-FLAVORED COMPOSITIONS AND BEVERAGES

TECHNICAL FIELD

The present disclosure relates generally to storage-stable citrus-flavored compositions
5 and beverages and to methods for their preparation. More particularly, the present disclosure
relates to foods and beverages including a citrus flavor and a plant extract as a stabilizing agent.

BACKGROUND

Citrus-flavored beverages (particularly orange, lemon and lime) are among the most
10 popular beverage flavors. Unfortunately, some components of citrus flavors, for example citral,
are very unstable and rapidly decompose through a series of reactions. In addition to reducing
the fresh citrus flavor, these reactions produce potent flavor and odorant compounds, which
significantly decrease the shelf life of citrus-flavored products.

15 A need therefore exists for a stabilizing agent which effectively inhibits the formation of
undesirable off-flavor and odor associated with aged citrus-flavored food and beverage products,
thus increasing the stability and shelf-life of these products.

SUMMARY

20 Surprisingly, the applicant has found that the addition of at least one citrus flavor
ingredient and a plant extract as a stabilizer to flavored beverage compositions can improve the
stability and shelf-life of citrus-flavored food and beverages.

In one embodiment, a composition includes a) at least one citrus flavor ingredient; and b)
a stabilizing agent including from about 1,000 ppm to about 50,000 ppm of a plant extract. The
25 plant extract is an extract of saffron.

In another embodiment, a citrus-flavored beverage includes a) a beverage base; b) at least
one citrus flavor ingredient; and c) a stabilizing agent selected from an extract of saffron.

In another embodiment, a composition includes a) at least one citrus flavor ingredient;
and b) a first stabilizing agent selected from an extract of saffron; and c) a second stabilizing
30 agent selected from an extract of rosemary.

In another embodiment, a citrus-flavored beverage includes a) a beverage base; b) at least
one citrus flavor ingredient; and c) a first stabilizing agent selected from an extract of saffron;
and d) a second stabilizing agent selected from an extract of rosemary.

In another embodiment, a method of preparing a storage-stable, citrus-flavored composition, includes the steps of the sequential, simultaneous or separate incorporation into a citrus-flavored composition of at least one citrus flavor ingredient and a stabilizing agent including from about 1,000 ppm to about 50,000 ppm of a plant extract, wherein the plant extract
5 is an extract of saffron.

In another aspect, the invention provides the use of at least one citrus flavor ingredient and a stabilizing agent including a plant extract to improve the stability and shelf-life of citrus-flavored products.

These and other aspects and embodiments of the invention will be further described in the
10 following description.

DETAILED DESCRIPTION

The following text sets forth a broad description of numerous different embodiments of the present disclosure. The description is to be construed as exemplary only and does not
15 describe every possible embodiment since describing every possible embodiment would be impractical, if not impossible. It will be understood that any feature, characteristic, component, composition, ingredient, product, step or methodology described herein can be deleted, combined with or substituted for, in whole or part, any other feature, characteristic, component, composition, ingredient, product, step or methodology described herein. Numerous alternative
20 embodiments could be implemented, using either current technology or technology developed after the filing date of this patent, which would still fall within the scope of the claims. All publications and patents cited herein are incorporated herein by reference.

The present disclosure is based on the surprising discovery that a combination of at least one citrus flavor ingredient and a plant extract as a stabilizing agent, incorporated into a
25 composition could improve the stability and shelf-life of citrus-flavored compositions, particularly citrus-flavored food and beverages. The stabilizing effect of plant extracts comprising saffron or a combination of saffron and rosemary is surprisingly and unexpectedly superior to that of other stabilizing agents.

As used herein, "citrus flavor ingredient" means an ingredient derived from the fruit from
30 plants of the genus Citrus of the family Rutaceae. Non-limiting examples of these include grapefruit, lemon, orange, lime, mandarin, bergamot and pomelo. The flavor ingredients may be a completely natural flavor extracted from the plant itself, a completely synthetic flavor produced by combining individual citrus flavor-conferring substances, or a mixture of the two. There are

many commercially available citrus flavor ingredients and they are used in a wide variety of comestible compositions.

As used herein, "beverage base" means a combination of the normal ingredients used to prepare a citrus beverage, apart from the citrus flavor and stabilizing agent. These are standard ingredients used in art-recognized quantities, and include water, sugars and other sweetening agents, surfactants and suspending agents, thickeners, rheology modifiers, dyestuffs and coloring matters.

As used herein, "storage stable" means that the stability of the flavor system is improved in the presence of the stabilizing agent relative to the stability of the flavor system without the stabilizing agent. The term "stabilizing agent," as used herein, refers to compounds which increase the stability of the citrus flavor system. The stabilizing agents of the present invention increase the stability of the citrus flavor system by inhibiting the synthesis of undesirable oxidative degradation products. Citrus flavor stabilization in accordance with the present disclosure is effective with citrus-flavored compositions in general and particularly applicable to compositions containing citral and/or a citral derivative as the flavor ingredient.

As used herein, "plant extract" refers to a substance derived from a plant source, including modifications thereof, and which can be obtained using the general methods recited herein and other equivalent methods generally known in the art.

While the mechanism of citrus flavor stabilization is not fully understood, and not wishing to be bound by any specific theory, it is believed that certain compounds present in plant extracts protect the citrus flavor ingredient or derivatives of the flavor ingredient from oxidative chemical reactions. In accordance with embodiment, these compounds inhibit the formation of p-methylacetophenone, which is an oxidative degradation product of p- α -dimethylstyrene. p-Methylacetophenone, a potent odorant, is a major contributor to the off-flavor and odor characteristic of aged citrus-flavored compositions, particularly citral-flavored food products. Accordingly, any plant-derived compound or combination of compounds which are effective in inhibiting the formation of p-methylacetophenone are encompassed by the present disclosure.

The storage-stable compositions according to the present disclosure are prepared by providing at least one citrus-flavor ingredient and adding a stabilizing agent to the composition. As mentioned previously, the at least one citrus-flavor ingredient means an ingredient derived from the fruit from plants of the genus *Citrus* of the family Rutaceae. Any flavor ingredients suitable for use in flavored beverage compositions may be employed according to the present disclosure. In one example, the flavor ingredient may include citral or a citral derivative. In another example, the flavor ingredient may include at least one suitable flavor ingredient,

including, but not limited to, 1,1-diethoxyethane; 3-hydroxybutan-2-one; 1-phenylethanone; benzaldehyde; Bergamot oil; 2-methylpropyl acetate; butanal; butyric acid; 2-methylpropanoic acid; 2-methyl-5-prop-1-en-2-ylcyclohex-2-en-1-ol; (2E)-3-phenylprop-2-enal; (E)-3,7-dimethylocta-2,6-dienal; 3,7-dimethyloct-6-enal; 3,7-dimethyloct-6-en-1-ol; (E)-1-(2,6,6-trimethylcyclohexa-1,3-dien-1-yl)but-2-en-1-one; 6-pentyltetrahydro-2H-pyran-2-one; 5-hexyloxolan-2-one; decanal; chroman-2-one; methyl 2-(methylamino)benzoate; dimethyl sulfide; 1-methyl-4-prop-1-en-2-ylcyclohexene; 5-octyloxolan-2-one; ethyl acetate; ethyl butanoate; ethyl 2-methylpropionate; ethyl 3-phenylprop-2-enoate; ethyl decanoate; ethyl formate; ethyl heptanoate; ethyl hexanoate; ethyl 3-hydroxybutanoate; ethyl 3-hydroxyhexanoate; ethyl 2-methylbutanoate; ethyl octanoate; ethyl 3-methylbutanoate; ethyl propionate; pent-1-en-3-one; 2-methyl-5-propan-2-ylcyclohexa-1,3-diene; 7,11-dimethyl-3-methylidenedodeca-1,6,10-triene; 2-ethyl-4-hydroxy-5-methylfuran-3-one; (E)-3,7-dimethylocta-2,6-dien-1-ol; (E)-3,7-dimethylocta-2,6-dien-1-yl acetate; grapefruit oil; hexanal; hexanoic acid; E-hex-2-enal; (Z)-hex-3-en-1-ol; (Z)-hex-3-en-1-yl acetate; (E)-4-(2,6,6-trimethylcyclohex-1-en-1-yl)but-3-en-2-one; lemon oil; 15 lemon oil terpeneless; lime oil; lime oil terpeneless; 3,7-dimethylocta-1,6-dien-3-ol; 3,7-dimethylocta-1,6-dien-3-yl acetate; 3-hydroxy-2-methyl-4H-pyran-4-one; mandarin oil; 4-methyl-4-sulfanylpentan-2-one; 2-(4-methylcyclohex-3-en-1-yl)propane-2-thiol; mercapto-para-menthan-3-one; methyl acetate; methyl 2-aminobenzoate; 2-methyl-butanoic acid; methyl 3-phenylprop-2-enoate; methyl 3-oxo-2-pentylcyclopentaneacetate; 5-methylfuran-2-carbaldehyde; 20 7-methyl-3-methyleneocta-1,6-diene; (Z)-3,7-dimethylocta-2,6-dien-1-yl acetate; 5-pentyloxolan-2-one; nonanal; 4,4a-dimethyl-6-(prop-1-en-2-yl)-4,4a,5,6,7,8-hexahydronaphthalen-2(3H)-one; 5-butyloxolan-2-one; octanal; octanoic acid; orange cold pressed oil; orange essence oil; orange oil terpenes; orris concrete; osmanthus absolute; 2,3-pentanedione; 3-methylbutyl acetate; 3-methylbutyl 3-methylbutanoate; propyl acetate; rose oil; 25 (2E,6E,9E)-2,6,10-trimethyldodeca-2,6,9,11-tetraenal; (2E,6E)-2,6-dimethyl-10-methylidenedodeca-2,6,11-trienal; tangerine cold pressed oil; tarragon oil; 4-methyl-1-propan-2-ylcyclohex-3-en-1-ol; 1-methyl-4-propan-2-ylcyclohexa-1,3-diene; 2-(4-methyl-1-cyclohex-3-enyl)propan-2-ol; 1-methyl-4-(propan-2-ylidene)cyclohex-1-ene; 2-(4-methylcyclohex-3-en-1-yl)propan-2-yl acetate; 4a,5-dimethyl-3-prop-1-en-2-yl-2,3,4,5,6,7-hexahydro-1H-naphthalene; 30 4-hydroxy-3-methoxybenzaldehyde; and mixture thereof.

The at least one citrus-flavor ingredient should be present in the storage-stable composition and the citrus-flavored beverage in an organoleptically effective amount. This amount will depend upon the nature of the flavor ingredient, as well as the nature of the flavored

beverage and the effect that is desired to be achieved, and it is within the purview of the skilled person to experiment with the desired amounts.

According to certain embodiments, the amount of the at least one citrus-flavor ingredient present in the composition may be in the concentration of from at least about 10,000 ppm to about 800,000 ppm. According to another embodiment, the amount of the at least one citrus-flavor ingredient present in the composition may be in the concentration of from at least about 20,000 ppm to about 300,000 ppm. The level in ppm refers to the single flavor ingredient, or where there is more than one flavor ingredient, the total amount of flavor ingredients.

According to certain embodiments, the amount of the at least one citrus-flavor ingredient may be present in a citrus-type beverage in a concentration of from about 10 ppm to about 20,000 ppm; in another embodiment of from about 100 ppm to about 5,000 ppm. The level in ppm refers to the single flavor ingredient, or where there is more than one flavor ingredient, the total amount of flavor ingredients.

According to the present disclosure, the stabilizing agent is a plant extract. In one embodiment, the plant extract may be selected from an extract of saffron and/or an extract of rosemary. In another embodiment, the plant extract may be selected from the group consisting of an extract of saffron, an extract of rosemary and combinations thereof. Saffron is found in the flower of *Crocus sativus*, commonly known as the “saffron crocus”, whereas rosemary is derived from plants in the *Labiatae* family. The process for preparing extracts of saffron and rosemary are well known to one skilled in the art.

According to certain embodiments, the amount of the saffron extract present in the composition may be in the concentration of from at least about 1,000 ppm to about 50,000 ppm. According to another embodiment, the amount of the saffron extract present in the composition may be in the concentration of from at least about 5,000 ppm to about 30,000 ppm.

According to certain embodiments, the amount of the saffron extract may be present in a citrus-type beverage in a concentration of from about 0.1 ppm to about 250 ppm; in another embodiment of from about 1 ppm to about 60 ppm.

According to certain embodiments, the amount of the rosemary extract present in the composition may be in the concentration of from at least about 1,000 ppm to about 50,000 ppm. According to another embodiment, the amount of the rosemary extract present in the composition may be in the concentration of from at least about 10,000 ppm to about 30,000 ppm.

According to certain embodiments, the amount of the rosemary extract may be present in a citrus-type beverage in a concentration of from about 0.1 ppm to about 250 ppm; in another embodiment of from about 2.5 ppm to about 125 ppm.

In another embodiment, the stabilizing agent may include a mixture of the saffron extract and the rosemary extract. In one example, the stabilizing agent may include the saffron extract and the rosemary extract in a weight ratio from 0.02 to 50. In another example, the weight ratio of saffron extract to rosemary extract may be 0.15 to 3.0.

5 When expressed as “ppm”, the concentration is parts per million by weight based on the total weight of the consumable or additive, as the situation dictates. It should be understood that when a range of values is described in the present disclosure, it is intended that any and every value within the range, including the end points, is to be considered as having been disclosed. For example, “a range of from 1 ppm to 1000 ppm” of plant extract is to be read as indicating
10 each and every possible number along the continuum between 1 and 1000. It is to be understood that the inventors appreciate and understand that any and all values within the range are to be considered to have been specified, and that the inventors have possession of the entire range and all the values within the range.

Citrus-flavored compositions according to the present disclosure may contain other
15 optional ingredients. For example, citrus-flavored compositions may contain a salt of citric acid. Suitable citric acid salts include potassium citrate or sodium citrate, or mixtures thereof. Citrus-flavored compositions according to the present disclosure may also contain a weighting agent. Suitable weighting agents include any of those weighting agents known in the art for use in flavored beverage compositions. Examples of suitable weighting agents include, but are not
20 limited to sucrose esters, such as saccharose acetate isobutyrate (SAIB), polyol fatty acid esters, polyol benzoates, rosin gums, ester gums, and the like.

When a weighting agent is employed in a flavored beverage composition, it may be used in amounts up to 150 wt % based on the total amount of flavor ingredients contained in the flavored beverage composition.

25 Other ingredients that might be employed in citrus-flavored compositions include, but are not limited to fruit pulp; sweeteners; organic acids, such as malic acid, lactic acid, and the like; nutritional supplements, such as vitamins and mineral salts; antioxidants; preservatives; rheology modifiers; solvents; buffering agents; clouding agents; and dyes.

The invention will be further described with reference to methods of forming citrus-
30 flavored compositions, which methods form additional aspects of the invention.

A citrus-flavored composition according to the present disclosure may be prepared when the at least one citrus-flavor ingredient; the stabilizing agent; and any other optional ingredients referred to hereinabove are mixed together to form the citrus-flavored composition.

The manner or sequence in which the ingredients are mixed is not particularly important, although when selecting the method in which the essential or optional ingredients are combined, the skilled person will have regard to routine considerations related to supply chain, such as ease and cost of manufacture, storage, transportation and the like. In particular, the skilled person will
5 have regard for any incompatibility that might exist between any of the ingredients, e.g., immiscibility of ingredients.

In principle, it is possible that all ingredients may be mixed together extemporaneously to provide the citrus-flavored composition of the present disclosure. However, for the reasons set forth immediately above, extemporaneous preparation may not be advantageous or even
10 desirable.

More typically, however, the preparation of citrus-flavored compositions according to the present disclosure proceeds by first forming a flavor concentrate comprising the at least one citrus-flavor ingredient; the stabilizing agent and any of the optional ingredients as desired or appropriate. Thereafter, the flavor concentrate may be diluted with an aqueous phase, which may
15 contain any of the other optional ingredients that are desired or appropriate, in order to provide the citrus-flavored beverage composition.

In one embodiment the citrus-flavored beverage may be carbonated.

The use of a composition including a citrus-flavor ingredient and a stabilizing agent in beverage formulations results in a citrus beverage with a surprising degree of “robustness”, i.e.
20 more stable with respect to heat and light degradation.

EXAMPLES

The following examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations of the invention are possible
25 without departing from the spirit and scope of the present disclosure.

Example 1—Carbonated Beverage Base

An illustrative beverage base formula was prepared as follows:
30

TABLE 1

Ingredients	g
Syrup*	1000
Carbonated purified water	2000

*The syrup from Table 1 comprises the following components:

- 5
- High fructose corn syrup (Brix 75°) 45.8 g
 - Granulated sugar 6.0 g
 - Anhydrous citric acid 0.5 g
 - Trisodium citrate 0.3 g
 - Purified water 947.4 g

10

To the beverage base in Table 1 were added the following at a weight concentration of 0.08%:

- Control (Lemon flavor produced and commercially available by Givaudan);
 - Example 1 (Lemon flavor including 12,000 ppm of saffron extract);
 - Example 2 (Lemon flavor including 25,000 ppm of rosemary extract);
- 15
- Example 3 (Lemon flavor including 12,000 ppm of saffron extract and 25,000 ppm of rosemary extract)

20

The beverages were stored in thermostatic chamber at 50 °C for seven days. After, the beverages were submitted and assessed by a panel of 4 trained flavorists tasting blind by comparing Examples 1-3 to the Control. Key attributes related to off-note masking power and strength of impression of lemon-like yellowness were evaluated based on the scale in Tables 2 and 3, respectively.

Table 2

Off-note Masking Power		
Score	Description Corresponding to Score	
5	0	No effect
	1	Slight masking effect
	2	Masking effect is decent
	3	Masking effect is good
10		

Table 3

Strength of the Impression of Lemon-like Yellowness		
Score	Description Corresponding to Score	
15	0	No effect
	1	Yellowness is slightly pushed up
	2	Yellowness is stronger
	3	Yellowness is very strong
20		

The results are documented below (Table 4) for the Control and Examples 1-3. The results are recorded as an average of the panelist's scores.

Table 4

Attribute	Evaluation Score			
	Control	Ex. 1	Ex. 2	Ex. 3
Off-note Masking Power	-	1.5	1.75	2.75
Strength of the Impression of Lemon-like Yellowness	-	2.0	2.0	2.5

As shown above, Examples 1, 2 and 3 each showed improvement in masking power and lemon-like yellowness as compared to the Control. Further, Example 3 (combination of saffron extract and rosemary extract) showed an increased masking power and strength of lemon-like yellowness compared to the Control and Examples 1 and 2.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed is:

1. A composition comprising:
 - a) at least one citrus flavor ingredient; and
 - 5 b) a stabilizing agent comprising from 1,000 ppm to 50,000 ppm of a plant extract, wherein the plant extract is an extract of saffron.
2. The composition according to claim 1, wherein the stabilizing agent further comprises a second plant extract, wherein the second plant extract comprises an extract of rosemary.
- 10 3. The composition according to claim 2, wherein the composition comprises from 1,000 ppm to 50,000 ppm of the extract of rosemary
4. The composition according to claim 1, wherein the at least one citrus flavor ingredient is
15 citral.
5. A citrus-flavored beverage comprising:
 - a) a beverage base;
 - b) at least one citrus flavor ingredient;
 - 20 c) a first stabilizing agent selected from an extract of saffron; and
 - d) a second stabilizing agent selected from an extract of rosemary.
6. The citrus-flavored beverage according to claim 5, wherein beverage is carbonated.
- 25 7. The citrus-flavored beverage according to claim 5, wherein the extract of saffron is present in an amount of from 0.1 ppm to 250 ppm.
8. The citrus-flavored beverage according to claim 5, wherein the extract of rosemary is present in an amount of from 0.1 ppm to 250 ppm.
- 30