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(54) Title: MODIFICATION OF THE TASTE AND PHYSICOCHEMICAL PROPERTIES OF NEOTAME USING HYDROPHOBIC ACID ADDITIVES

(57) Abstract

The taste and physicochemical properties of N–[N–(3,3–dimethylbutyl)–L–α–aspartyl]–L–phenylalanine 1–methyl ester are modified by using hydrophobic acid additives. Such hydrophobic acid additives include benzoic acid, valeric acid, acetic acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, citric acid, malic acid, lactic acid, gluconic acid, bitartric acid, fumaric acid, adipic acid and derivatives thereof. Methods for preparing these compositions, food products prepared with these compositions and methods of preparing food products with these compositions are also disclosed.

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TITLE

MODIFICATION OF THE TASTE AND PHYSICOCHEMICAL PROPERTIES OF NEOTAME USING HYDROPHOBIC ACID ADDITIVES

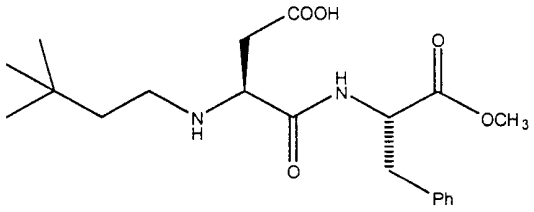
BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to the modification of the taste and physicochemical properties of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (neotame) using hydrophobic acid additives. This invention also relates to methods by which neotame compositions with these modified properties are prepared and to food products prepared with the neotame compositions of the present invention.

Related Background Art

It is known that N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (neotame) is an extremely potent sweetening agent (about 8000X sweeter than sugar) that has the formula



It is known that the chemical stability of sweetening agents can be modified by conversion to their salt forms, as well as providing benefits of increased dissolution and solubility. This has been demonstrated with respect to aspartame and several other known peptide sweeteners. See, for example, U.S. Patent Nos. 4,029,701, 4,031,258 and 4,153,737, European Patent Application No. EP 768401 and Spanish Patent 85-547855. Certain acid salts of neotame having increased dissolution rate and solubility are described in copending U.S. Patent Application No. 09/146,964, filed September 4, 1998.

Converting to salt forms is desirable for the purpose of increasing both the dissolution rate and the solubility of sweetening agents in aqueous food systems. However, it would be at times desirable to decrease the dissolution rate and solubility in low to intermediate moisture food systems such as chewing gum, dairy products, doughs and bakery batters in order to improve stability of the sweetener during the course of preparing the formulation or during processing. The

use of hydrophobic acid salts of neotame to provide a stability benefit is not disclosed.

It is also well known that flavor modifiers may be added to foods, beverages or personal care products, pharmaceutical preparations, or other compositions to increase acceptance of products by enhancing desirable tastes and/or aromas or by masking or eliminating undesirable taste and/or aroma attributes. Flavor modifiers may be used to modify the taste and/or aroma profile and/or the temporal taste and/or aroma profile of one or more specific flavoring ingredients. The temporal profile of a taste relates to the manner in which taste development occurs, e.g., the onset of the taste, the intensity of the taste, the time it takes for the taste to reach maximum taste intensity, the time it takes for the taste to dissipate (linger). Taste modifiers may be used in any concentration necessary to achieve the desired taste profile of a product for a desired application. Taste modifiers may be used above, below or at threshold concentrations to supplement, enhance, or modify the original taste of a composition. The threshold taste concentration of an ingredient is that concentration at which the taste of that ingredient can be detected in a food composition, and typically, is different for different food compositions. At below threshold concentrations, or sub-threshold concentrations, the taste modifier does not impart a characteristic taste of its own, but provides a taste-modifying effect to one or more tastes in a composition.

High intensity sweeteners, such as neotame, often produce a sweet taste that has a different temporal profile than that of sugar and/or produce a taste that

is incompatible with the other tastes present in food compositions. For example, the sweet taste produced by high intensity sweeteners may have a sweet taste that has a faster or a slower onset or a shorter or longer sweetness taste linger than the sweet taste produced by sugar or may change the taste balance of a food composition. Because of these differences, use of a high intensity sweetener to replace a bulk sweetener, such as sugar, in a food or beverage, may cause an unbalanced profile in the resulting food composition. It is well known to those skilled in the art of food/beverage formulations that changing the sweetener in a composition requires re-balancing of the flavor and taste profiles of the composition.

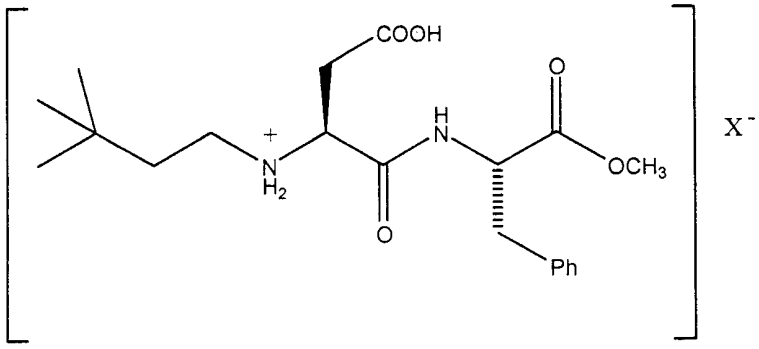
A high intensity sweetener that has a taste profile which can be selectively modified to impart specific desired taste characteristics could significantly expand the type and variety of compositions that may be prepared with that sweetener. Accordingly, it would be desirable to develop a method to selectively modify the taste characteristics of a high intensity sweetener. By adding hydrophobic acid additives to compositions containing neotame, the sweetness taste profile of neotame can be modified in this way.

SUMMARY OF THE INVENTION

This invention relates to compositions comprising N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester and at least one taste modifying hydrophobic acid additive that positively affects at least one taste characteristic imparted by neotame. Preferably hydrophobic acid additives include, for example, benzoic acid, valeric acid, acetic acid,

nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, citric acid, malic acid, lactic acid, gluconic acid, bitartric acid, fumaric acid, adipic acid and derivatives thereof.

Another embodiment of the present invention is directed to salts of neotame having increased hydrophobicity and increased stability compared to free neotame and also having the ability to positively impact at least one taste characteristic imparted by neotame. In particular, the salts of neotame of this invention can be represented by the formula



wherein X^- is selected from the group consisting of the conjugate bases derived by deprotonation of hydrophobic acid additives or derivatives thereof.

In another embodiment, neotame salts having increased hydrophobicity are prepared by the method comprising the steps of: dissolving neotame and a conjugate base of a hydrophobic acid additive or derivative thereof in a solvent; and agitating the solution to form a salt.

In yet another embodiment, salts of neotame having increased hydrophobicity are prepared by the method comprising: preparing a slurry of neotame in a solvent; adding a conjugate base of a hydrophobic acid additive or derivative thereof; and agitating to form a salt.

In a preferred embodiment of the present invention, at least one taste characteristic imparted by neotame is positively affected by adding a taste modifying hydrophobic acid additive to a composition containing neotame.

In another preferred embodiment, at least one taste characteristic imparted by neotame is positively affected and/or the stability of neotame is increased by adding a salt of the present invention to a composition.

DETAILED DESCRIPTION

This invention is directed to compositions comprising N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester and at least one taste modifying hydrophobic acid additive that positively affects at least one taste characteristic imparted by neotame, as well as to methods of positively affecting at least one taste characteristic imparted by neotame using hydrophobic acid additives.

Such compositions containing neotame, typically at sweetening effective concentrations, and at least one taste modifying hydrophobic acid additive, at below taste threshold concentrations, possess an improved taste compared to compositions containing neotame

without a taste modifying hydrophobic acid additive. Specifically, the improved taste results from the positive effect of the taste modifying hydrophobic acid additive on at least one taste characteristic imparted by neotame in the composition.

A taste characteristic imparted by neotame, as defined herein, is any attribute of the taste provided or enhanced by neotame at or above its sweetening threshold concentration. Such taste characteristics include, for example, the sweetness taste attribute inherent to neotame, its compatibility with other tastes or flavors in a composition, including, for example, neotame's effect on the balance of the tastes or flavors of a composition, as well as temporal taste attributes such as sweetness onset, sweetness intensity and sweetness linger.

The compositions comprising neotame and at least one taste modifying hydrophobic acid additive can be prepared simply by adding at least one hydrophobic acid additive to a composition containing neotame. Alternatively, the neotame and the hydrophobic acid additive can be added to a given composition at the same time. Typically, neotame is used at or above its sweetness threshold concentration, and the hydrophobic acid additive is used below taste threshold concentrations.

Any form of neotame may be used in the compositions of this invention. U.S. Patent No. 5,480,668, U.S. Patent No. 5,510,508 and U.S. Patent No. 5,728,862, which describe the preparation of neotame are incorporated by reference herein. Further, salts and metal complexes of neotame may be used, such as disclosed in U.S.

Patent Application No. 09/146,963, U.S. Patent Application No. 09/146,964, U.S. Patent Application No. 09/148,134, and U.S. Patent Application No. 09/146,965, all filed September 4, 1998, and all of which are incorporated by reference herein. The anhydrous form of neotame is suitable for use in this invention, as well as the various crystalline forms of neotame. Other exemplary forms of neotame that may be useful in this invention include cyclodextrin/neotame complexes such as disclosed in U.S. Provisional Patent Application No. 60/100,867 and co-crystallized neotame disclosed in U.S. Patent Application No. 09/154,568, both filed September 17, 1998, and the disclosure of both of which are incorporated by reference herein.

Any hydrophobic acid additive or derivative thereof can be employed in the preparation of the compositions of this invention. Preferably, the hydrophobic acid additive is selected from aliphatic and aromatic acids. The aliphatic acids may be saturated or unsaturated, such as C_2-C_{12} linear or branched alkyl mono-, di-, or tri-carboxylic acids, C_3-C_8 cycloalkyl or C_2-C_7 heterocycloalkyl mono- or di-carboxylic acids, wherein the hetero substituent may be independently one to four N, S or O; the substituted aliphatic acids may contain one or more substituents selected from hydroxyl, carboxyl, C_1-C_4 alkoxy, halo, aryl, heteroaryl or aryloxy substituent moieties. The aromatic acids may be aryl or heteroaryl mono- or di-carboxylic acids, wherein the aryl moiety may contain 6 to 20 carbons, and the hetero substituent may be independently one to four N, S or O; the substituted aromatic acids may contain one or more substituents selected from C_1-C_6 alkyl, hydroxyl, amino, C_1-C_4 alkoxy, halo, aryl, heteroaryl or aryloxy substituent moieties, wherein the

aryl moiety may contain 6 to 20 carbons, and the hetero substituent may be independently one to four N, S or O.

Such hydrophobic acid additives and derivatives thereof include, without limitation, benzoic acid, valeric acid, acetic acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, citric acid, malic acid, lactic acid, gluconic acid, bitartric acid, fumaric acid, adipic acid and derivatives thereof. Further exemplary hydrophobic acid additives include, without limitation, 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid (caffeic acid), 2-hydroxyvaleric acid, 2,4-dihydroxybenzoic acid, 3,4-dihydroxybenzoic, 2-hydroxyisocaproic acid, 4-hydroxybenzoic acid, 2,3-dihydroxybenzoic acid, 2-hydroxy-4-aminobenzoic acid, 3-hydroxy-4-aminobenzoic acid, 3-aminobenzoic acid, 3-hydroxybenzoic acid, 4-hydroxy-3-methoxycinnamic acid (ferulic acid), 4-methoxybenzoic acid (anisic acid), potassium cinnamate, sodium benzoate, potassium benzoate, trisodium citrate, tripotassium citrate, sodium acetate, calcium acetate, sodium malate, calcium lactate, sodium gluconate, calcium gluconate, potassium gluconate and potassium bitartrate (cream of tartar).

As used herein, the term "derivative" refers to any related form of hydrophobic acid additive, e.g., salts and the like, as well as to substituted forms of hydrophobic acid additives. As used herein, "X^-" is the anionic conjugate base derived by deprotonation of a hydrophobic acid.

According to this invention, modification of at least one of the taste characteristics imparted by neotame

may be accomplished by incorporating one or more of any of the above-described neotame taste modifying hydrophobic acid additives, in any combination, into a neotame-containing composition. In addition, this invention contemplates modification of at least one of the taste characteristics imparted by neotame by use of one or more of a variety of other neotame taste modifying ingredients in combination with one or more hydrophobic acid additives. The other neotame taste modifying ingredients useful herein are described in U.S. Provisional Patent Application No. 60/134,064, filed May 13, 1999, entitled "Use of Additives to Modify the Taste Characteristics of N-Neohexyl-α-Aspartyl-L-Phenylalanine Methyl Ester", which is incorporated by reference herein.

In a certain preferred embodiment of the present invention, it is desirable to form a salt of neotame and a hydrophobic acid additive and to then add the salt to a given composition. It is believed that such salts of neotame have increased hydrophobicity compared to free neotame in low to intermediate moisture applications. As a result, it is believed that the salts of this invention provide a number of improved properties over those of neotame, in addition to the aforementioned improved taste profile afforded by the presence of the hydrophobic acid additive. In particular, the dissolution rate is decreased, i.e., the salt dissolves slower than pure neotame in low to intermediate moisture applications, and stability is increased.

Further, the neotame salts of this invention can effectively be dissolved in various fats and waxes in concentrations of 5% or more. Such fats and waxes

include, for example, stearine 27, stearic acid, shellac, polyethylene wax and polypropylene wax. Typically, a fat such as stearine 27, which is a solid at room temperature, is heated to a temperature of about 65°C in order to effectively dissolve the neotame salt.

For these reasons, the salts of the present invention can be used particularly effectively in low and intermediate moisture applications to increase the stability of neotame, though their use is not limited to such applications. Neotame stability improvement in baked goods, chewing gum and other confections (low to intermediate moisture applications) can be realized by using these neotame salts. It is generally known that stability can be further increased by selection of an appropriate particle size for a given application. The degree of increase in dissolution rate can be further manipulated by either increasing the particle size of the resulting salt or by changing the hydrophobicity of the counter ion.

The salts of this invention may be prepared by adding neotame and a hydrophobic acid additive or derivative thereof to an amount of solvent effective to dissolve both the neotame and the hydrophobic acid additive, and then stirring for a period of time to achieve formation of a salt. Suitable solvents include, without limitation, ethanol, methanol, water, isopropanol, acetone, ethyl acetate, methyl acetate and mixtures thereof. Preferably, the solvent is an alcohol or an alcohol/water mixture. Typically, the concentration of neotame is up to about 35% by weight in solution, the concentration of hydrophobic acid additive is up to about 35% by weight in solution. Optionally, the

mixture is heated generally to a temperature in the range of about 20°C to about 55°C. The molar ratio of neotame mixed with acid is about 1:1. Addition of excess hydrophobic acid additive may cause hydrolysis of the methyl ester.

Alternatively, these salts can be prepared by adding a hydrophobic acid additive or derivative thereof to a slurry of neotame in a solvent. The solvents, concentrations of solutes, optional heating and molar ratios are the same as set forth above. In a preferred embodiment of this method, a strong inorganic acid such as HCl may be added to facilitate salt formation.

The salt products of this invention may be recovered by evaporating the solvent in vacuo. The salt products may also be recovered by distilling, filtering, freeze drying or spray drying the resulting solution. The salt products of the present invention may be dried in a desiccator, oven, tray or tumble dryer. Typically, a salt having about a 1:1 molar ratio of neotame to hydrophobic acid additive is isolated, but one of ordinary skill in this art would recognize that slight variations can exist due to isolation and/or analytical conditions. For example, the molar ratio may range from about 0.5:1 to about 1:0.5, as shown by analysis.

At least one hydrophobic acid additive can be added to any neotame-containing food composition. Similarly, the salts of neotame and a hydrophobic acid additive of the present invention are suitable for use in any food composition. The term food as used herein includes, for example, beverages, fluid dairy products, condiments, baked goods, frostings, bakery fillings, cereals, nutraceuticals, gelatins, candy and chewing

gum. In that regard, the disclosures of copending U.S. Patent Application Nos. 09/213,263, 09/213,860 and 09/215,460, all filed December 17, 1998, directed to the use of neotame in dairy products, baked goods and beverages, respectively, are incorporated by reference herein. Further, the disclosures of copending U.S. Provisional Patent Application Nos. 60/112,915, filed December 18, 1998, 60/125,617, filed March 22, 1999, 60/126,191, filed March 25, 1999, and 60/126,654, filed March 29, 1999, directed to the use of neotame in chewing gum, cereals, gelatins and nutraceuticals, respectively, are incorporated by reference herein. In preferred embodiments of the present invention, neotame salts are used in low to intermediate moisture food applications, such as chewing gum, baked goods, dairy products and confections.

This invention is also directed to food compositions, such as described above, containing an effective amount of at least one taste modifying hydrophobic acid additive or salt thereof to positively affect at least one taste characteristic imparted by neotame. Further, this invention is directed to food compositions, preferably low to intermediate moisture food compositions as described above, containing an effective amount of a neotame hydrophobic acid additive salt to increase the stability of neotame.

At least one taste modifying hydrophobic acid additive can be added to any neotame-containing table-top or powdered soft drink composition. In that regard, the disclosure of copending U.S. Patent Application No. 09/215,461, filed December 17, 1998, directed to the use of neotame in table-top compositions is incorporated by reference herein. Further, the salts

of the present invention are suitable for use in any table-top or powdered soft drink composition. Table-top sweeteners comprising the present neotame compositions may also include any other ingredients commonly present in table-top sweeteners in order to tailor the taste of a given product to a specific end use. Table-top sweeteners comprising the present neotame compositions may take any known form. Suitable forms include, but are not limited to, sachets including the sweetener in powder or granular form, tablets, liquid sweeteners, and jar, pouches, pocket or other forms in which the sweetener may be measured in, for example, spoon for spoon form.

Determination of the amount of hydrophobic acid additive or neotame hydrophobic acid additive salt to be added to a given composition can be readily determined by one of ordinary skill in the art. The amount of hydrophobic acid additive or neotame salt thereof that may be added to a particular composition may vary depending on the degree of taste modification desired, the effectiveness of the hydrophobic acid additive(s) to modify the taste characteristics imparted by neotame, the taste threshold concentration of the hydrophobic acid additive(s), other flavors or ingredients in the composition, as well as the characteristics of the composition.

Generally however, neotame is present in the compositions of the present invention at, above or below its sweetness threshold concentration; a hydrophobic acid additive is present below its own taste threshold concentration, but in an amount effective to positively impact at least one taste

characteristic imparted by neotame and/or to increase the stability of neotame.

Accordingly, a hydrophobic acid additive may be added to a neotame-containing composition in an amount from about 0.25 ppm to about 50 ppm and preferably from about 5 ppm to about 30 ppm.

A hydrophobic acid additive salt of neotame may be present in a given composition in an amount effective to deliver the desired neotame concentration, as can be appreciated by one of ordinary skill in the art. Generally, the salt is present at a concentration below the taste threshold of the conjugate base of the hydrophobic acid additive. For example, for a beverage composition, typically the desired concentration of neotame ranges from about 2 ppm to about 150 ppm. Accordingly, the benzoic salt of neotame would be added in an amount of from about 2.5 ppm to about 200 ppm to deliver the equivalent amount of neotame since neotame accounts for 75.6% of the salt's weight. Similarly, the cinnamic acid salt of neotame would have to be added in an amount of from about 3 ppm to about 225 ppm to deliver the equivalent amount of neotame, since neotame accounts for 67.2% of the salt's weight.

Further, a salt may be added to a given composition in such a way so as to deliver both a sub-threshold amount of neotame and a sub-threshold amount of hydrophobic acid additive. In those cases, it is preferable that the salt be used in combination with some other natural or high intensity sweetener, including another form of neotame. In short, given the desired neotame concentration for a particular application, one of ordinary skill in the art would readily be able to

determine how much salt should be added. The desired neotame concentrations for various applications are disclosed in the copending applications incorporated by reference above.

In preferred embodiments of the present invention, cinnamic acid and derivatives thereof, such as 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid and potassium cinnamate, are added to a neotame-sweetened cola beverage at concentrations of about 5 to about 50 ppm. For example, 4-hydroxycinnamic acid has been found to be effective at a concentration of about 10 ppm and potassium cinnamate has been found to be effective at a concentration of about 5 to about 10 ppm.

In other exemplary embodiments of the present invention, 2,4-dihydroxybenzoic acid and 4-hydroxybenzoic acid may be added to a neotame-sweetened strawberry flavored powdered soft drink composition in concentrations to deliver from about 5 to about 50 ppm in the finished beverage. In further exemplary embodiments of the present invention, 2,4-dihydroxybenzoic acid and 4-hydroxybenzoic acid may be added to a neotame-sweetened table-top composition in an amount to deliver 5 to about 50 ppm in a finished coffee beverage.

Further, it is known that the acetic and citric salts of neotame shorten the linger of neotame in a given composition. Additionally, the benzoic salt of neotame shortens the linger and quickens the onset of neotame in a given composition.

It is understood that not all of the hydrophobic acid additives or salts thereof described herein will affect at least one characteristic of the taste of neotame in all product uses or at all concentrations. For example, hydrophobic acid additives that are useful for affecting at least one characteristic of the taste of neotame in a coffee beverage or in a cola beverage having a selected flavor formula may or may not be useful for affecting at least one characteristic of the taste of neotame in a fruit-flavored soft drink beverage or in a cola beverage having a different flavor formula. Hydrophobic acid additives that are useful for affecting at least one characteristic of the taste of neotame in a formulation using one co-ingredient (e.g., a tabletop preparation using a selected bulking agent) may or may not be useful for affecting at least one characteristic of the taste of neotame in a similar formulation using a different co-ingredient (e.g., a different bulking agent). However, the hydrophobic acid additives and salts thereof according to this invention will positively affect one or more of the taste characteristics imparted by neotame in at least one product use. Based upon the teachings provided herein, it is considered to be within the ordinary skill of one in the art to select and evaluate hydrophobic acid additives to determine which taste modifying ingredients may be suitable for use in a product and to determine suitable use concentrations of the taste modifying ingredients for such product.

The neotame compositions of the present invention can be used for the above-described purposes alone or in combination with known bulking agents. Suitable bulking agents include, but are not limited to,

dextrose, maltodextrin, lactose, inulin, polyols, polydextrose, cellulose and cellulose derivatives and organic acids including, but not limited to, citric acid and malic acid.

The neotame compositions of this invention may be used in combination with known natural sweeteners as well as other high intensity sweeteners. Sweeteners that may be employed include, without limitation, aspartame, acesulfame salts (e.g., acesulfame-K), sucralose, saccharin, alitame, cyclamates, stevia derivatives, thaumatin, sucrose (liquid and granulated), high fructose corn syrup, high conversion corn syrup, crystalline fructose, glucose (dextrose), polyol sugar alcohols, invert sugar and mixtures thereof.

The Examples which follow are intended as an illustration of certain preferred embodiments of the invention, and no limitation of the invention is implied.

EXAMPLE 1

Benzoic Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a 1 L flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles), 50 ml methanol and 4.91 g benzoic acid (0.04 moles) were charged. The contents of the flask were mixed well until completely dissolved. The methanol was evaporated under vacuum, and the residue was left to dry for two days in an oven at 40°C-45°C under 25" Hg vacuum. A glue-like product was formed, which was then

diluted with ethanol to form an approximately 10% solution.

EXAMPLE 2

Valeric Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a 0.5 L 3-neck flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles), 45 ml ethanol, 5 ml water and 4.08 g valeric acid (0.04 moles) were charged. The contents of the flask were mixed well and heated to 30°C. Vacuum (25" Hg) was applied, and the mixture was distilled under vacuum at a maximum pot temperature of 45°C. The product was left in a desiccator under 29 mbar vacuum. The final salt product consisted of 67.1% neotame, and the solubility of the valeric salt was 1.50% w/w in water.

EXAMPLE 3

Acetic Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a 0.5 L 3-neck flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles), 50 ml ethanol, 20 ml water and 2.4 g acetic acid (0.04 moles) were charged. The contents of the flask were mixed well and heated to 30°C. The mixture was distilled under vacuum. The residue was left in a desiccator under 28 mbar vacuum. The final salt product was 80.4% neotame, and the solubility of the acetic salt was 1.8% w/w in water.

EXAMPLE 4

Nonoic Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a Brucher flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles) and 50 ml ethanol were charged. The contents of the flask were mixed until the neotame dissolved. Then 6.33 g nonoic acid (0.04 moles) were added. The contents of the flask were mixed for 15 minutes. The mixture was evaporated on a rotary evaporator under vacuum (25" Hg). The product was left in a desiccator under 28 mbar vacuum. The final salt product was 59.3% neotame, and the solubility of the nonoic salt was 0.43% w/w in water.

EXAMPLE 5

Isobutyric Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a 100 ml Brucher flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles) and 50 ml 90% ethanol were charged. The contents of the flask were mixed until the neotame dissolved. Then 3.52 g isobutyric acid (0.04 moles) were added. The contents of the flask were mixed for 15 minutes. The mixture was evaporated on a rotary evaporator under vacuum (25" Hg) and in a 55°C bath. The residue was left in a desiccator under 28-29 mbar vacuum. The final salt product was 69.4% neotame, and the solubility of the isobutyric salt was 1.9% w/w in water.

EXAMPLE 6

Cyclohexocarboxylic Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a 100 ml Brucher flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles) and 50 ml 90% ethanol were charged. The contents of the flask were mixed until the neotame dissolved. Then 5.12 g cyclohexocarboxylic acid (0.04 moles) were added. The contents of the flask were mixed well and evaporated on a rotary evaporator under vacuum (25" Hg) and in a 55°C bath. The product was left in a desiccator under 28 mbar vacuum. The final salt product was 63.8% neotame, and the solubility of the cyclohexocarboxylic salt was 1.15% w/w in water.

EXAMPLE 7

Cinnamic Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a 100 ml Brucher flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles) and 50 ml 90% ethanol were charged. The contents of the flask were mixed until the neotame dissolved. Then 5.93 g cinnamic acid (0.04 moles) were added. The contents of the flask were mixed for 15 minutes. The mixture was evaporated on a rotary evaporator under vacuum (25" Hg) and in a 55°C bath. The residue was left in a desiccator under 25 mbar vacuum. The final salt product was 67.52% neotame, and the solubility of the cinnamic salt was 0.15% w/w in water.

EXAMPLE 8

Anisic Salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

In a 100 ml Brucher flask, 15.12 g N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester (0.04 moles) and 50 ml 90% ethanol were charged. The contents of the flask were mixed until the neotame dissolved. Then 6.08 g anisic acid (0.04 moles) were added. Some acid did not dissolve. Another 50 ml ethanol were added, and the mixture was heated to 50°C. The contents of the flask were mixed until everything dissolved. The solvent was evaporated and a semi-glue-like material was obtained. Then 100 ml ethanol were added. The mixture was heated to 50°C and then cooled in an ice bath. Solids precipitated out (about 2 g). Ethanol (50 ml) was evaporated and 2 g more solid were precipitated out in an ice bath. All solvent was evaporated and a glue-like material was obtained again. This residue was dissolved in 50 ml of ethanol and cooled in an ice bath, whereupon more crystals precipitated out. The final salt product was 68.64% neotame, and the solubility of the anisic salt was 0.32% w/w in water.

EXAMPLE 9

1:10 Benzoic N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester/Cyclodextrin

Into a Brucher flask, 100 g ß-cyclodextrin, 25 ml 20% solution of benzoic neotame (obtained in Example 1) and 25 ml ethanol were charged. The mixture was mixed well to form a paste. The product was then left for 1 hour and then dried in an oven at 40°C under 25" Hg vacuum.

The product was 1.43% N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester.

EXAMPLE 10

Benzoic N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester/Sorbitol

Into a Brucher flask, 100 g sorbitol, 9,2 ml of 12.17% solution of benzoic neotame (obtained in Example 1), and 40 ml ethanol were charged. The mixture was mixed well. Then the product was placed in a drying pan and dried in an oven at 40°C under 25" Hg vacuum for 12 hours. The product was 0.71% neotame.

EXAMPLE 11

Chewing Gum with Benzoic N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester

A chewing gum was made using the ingredients listed in Table 1 and the procedure outlined below.

Table 1.

ingredient	formula %	batch target weight (g)	tolerance + (g)	actual weight (g)
sorbitol powder	44.68	1563.94	5	1563.94
gum base	27	945	5	945
lycasin	15	525	5	525.5
glycerin	6	210	5	210.43
mannitol	3	105	2	105.05
peppermint flavor	1.5	52.5	1	52.57
benzoic neotame	2.826	98.94		98.94

The sorbitol (grade P60W, Roquette American, Keokuk, Iowa) was divided into two equal portions, A and B. The lycasin (grade 85%, Roquette American) was weighed directly into the sorbitol B portion. The gum base (Gala226-01, Cafosa Gum Co., Barcelona, Spain) was placed in an Aaron mixer. Hot water was circulated (no higher than 57°C) through the mixer jacket. The gum base was heated using a heat gun until softened. The benzoic neotame was hand mixed with the sorbitol A portion. The mixer was set at speed #80 on the speed dial. While mixing, the mixture of benzoic neotame and sorbitol was added gradually and then mixed for 6 minutes. The lycasin from the sorbitol B portion was transferred into the mixer without touching the sides of the mixer and then mixed for about 2 minutes. The glycerin (food grade, Witco Corp., Memphis, Tennessee) was transferred into the mixer while the gum was being mixed. While mixing, the remaining sorbitol B portion and mannitol (grade 60, Roquette American) were gradually added to the mixer. The mixture was mixed

for 5 minutes, and the sides of the mixer were scraped. Then the mixture was mixed for an additional 1 minute. While mixing the peppermint flavor was gradually added, and the mixture was mixed for about 4 minutes. The circulating water was stopped. The mixture was mixed for 1 minute. The mixer was stopped and the product was allowed to sit for about 5-10 minutes while in the mixer.

Approximately 100 g of mannitol for use as a dusting powder was weighed. The chewing gum was divided into 4 portions, each weighing approximately 630-635 g. As each portion was removed, the gum was formed into balls and dusted with mannitol.

Each ball was rolled with a rolling pin on a sanitized, marble table to a thickness of approximately 0.2". Each sheet was divided into two portions. The sheets were rolled out on wax paper in baking pans and allowed to sit at room temperature for at least 5 minutes. Each sheet was then returned to the table, rolled again to flatten and scored with the aid of a cutting roller in one direction. Each scored sheet was transferred to the baking pan and let sit. Then each scored sheet was cut in the other direction with a pizza cutter. The pieces (2.6-2.8 g, 0.2" (0.5 cm) thick, 1.5" (3.8 cm) long, 0.5" (1.3 cm) wide) were separated, wrapped and packaged in groups of six.

The stability of benzoic neotame was evaluated by measuring the concentration of neotame at 0, 2 and 4 weeks time in both a control and a benzoic neotame chewing gum sample. The control was a sample of chewing gum prepared in a manner similar to the above

procedure, except pure neotame was employed as the sweetener. The results are in Table 2 below.

Table 2.

sample	neotame (ppm) at 0 week	neotame (ppm) at 2 weeks	% neotame remaining at 2 weeks	neotame (ppm) at 4 weeks	% neotame remaining at 4 weeks
control	226.9	151.0	66.55	97.6	43.01
benzoic neotame	176.3	166.2	94.27	158	89.62

EXAMPLE 12

Benzoic N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester in Chocolate Cake

Chocolate cake was made using the ingredients listed in Table 3 and the procedure outlined below.

Table 3.

ingredient	formula %
cake flour	21.26
non-fat dry milk (high heat)	1.07
xanthan gum	0.10
instant cleargel (starch) (National Starch, Bridgewater, New Jersey)	0.98
monocalcium phosphate monohydrate	0.09
baking soda	0.65
SAPP 28 (sodium acid pyrophosphate)	0.21
flour salt	0.53
vanillin	0.10
cocoa	5.53
EC-25 (emulsifier) (Quest Inc., Hoffmann Estates, Illinois)	2.04
bunge D0-100 (shortening) (Bunge Co., Bradley, Illinois)	6.63
litesse II (polydextrose) (Cultor, Ardsley, New York)	5.80
M180 (maltodextrin) (Grain Processing Corp., Muscatine, Iowa)	11.60
sorbitol	5.80
benzoic neotame	0.0125
water	25.444
whole eggs	12.16

A 100 g batch of cake batter was prepared as follows. The EC-25 and shortening were blended in a Hobart mixer on medium speed for 2.5 minutes. The mixing was stopped, and the bowl was scraped. The benzoic neotame was added and the mixture was mixed manually at speed 1 for 30 seconds and then at speed 2 for 2 minutes. All dry ingredients were added and blended at speed 1 for 5 minutes, with the bowl being scraped at 2.5 minutes. The mixing was stopped. All of the eggs and part of the water (6.64%) were added, and the mixture was mixed for 1 minute at speed 1 then at speed 2 for 2 minutes,

with scraping after 1 minute. The remaining water was added, and the mixture was mixed at speed 1 for 1 minute, with scraping after 30 seconds. In an 8" (20.3 cm) round pan, 425 g of the cake mix was poured. The cake was baked at 195°C for 30 minutes.

The stability of benzoic neotame was evaluated by measuring the concentration of neotame and a primary degradant, demethylated neotame, in batter and cake. The control batter and cake were prepared in a manner similar to the above procedure, except pure neotame was used as the sweetener. The benzoic neotame/cyclodextrin was prepared according to Example 9. The benzoic neotame/maltodextrin was prepared in the same manner. The results are shown in Tables 5 and 6. The information in Table 6 is based on the average of each of the three trials for each sample presented in Table 5.

Table 5.

sample	trial	demethylated neotame (ppm)	neotame (ppm)
control batter	1	6.86	117.71
	2	6.58	117.05
	3	49.01	70.73
control cake	1	64.36	34.05
	2	63.43	32.68
	3	64.22	33.32
benzoic neotame/maltodextrin batter	1	37.45	141.61
	2	39.74	146.01
	3	38.61	144.41
benzoic neotame/maltodextrin cake	1	105.48	48.74
	2	104.51	47.10
	3	105.43	46.06
benzoic neotame/cyclodextrin batter	1	28.54	138.11
	2	29.54	142.26
	3	27.17	125.96
benzoic neotame/cyclodextrin cake	1	93.61	40.75
	2	96.34	46.83
	3	93.41	45.31

Table 6.

sample	demethylated neotame (ppm)	neotame (ppm)
control batter	*	*
control cake	64.00	33.35
benzoic neotame/ maltodextrin batter	38.60	144.01
benzoic neotame/ maltodextrin cake	105.14	47.30
benzoic neotame/ cyclodextrin batter	28.42	135.44
benzoic neotame/ cyclodextrin cake	94.45	44.30

* was not calculated due to an outlying number

In all of the examples that follow, at least one taste characteristic in the beverage or food product prepared using neotame and one or more taste modifying ingredients, has been positively affected compared to the taste of the beverage or food product prepared using neotame, without added taste modifying ingredient(s).

The following examples 13-32 are directed to evaluations of taste modifying ingredients in either a cola-flavored beverage or a reconstituted powdered soft drink beverage containing about 15 ppm to about 25 ppm neotame (sweetening concentration). When a neotame salt was used as a taste modifying/sweetening ingredient, the neotame salt was added in an amount sufficient to provide about 15 ppm to about 25 ppm neotame (e.g., about 0.0028 g of a potassium neotame salt would be used to provide 100 ml of a 25 ppm neotame solution). The taste modifying ingredient was dissolved in the sweetened beverage and the beverage

was allowed to stand overnight at room temperature prior to evaluation. Evaluations of the cola-flavored beverages were conducted using a beverage containing water, sodium benzoate (0.16%), phosphoric acid (0.22%), citric acid (0.05%), trisodium citrate (0.08%), caffeine (0.03%), Flavor 28 (1.72%), sweetened with neotame in an amount of about 0.0015% to about 0.0025% (15 ppm to 25 ppm), adjusted to pH 3.2 using sodium citrate.

EXAMPLE 13

Addition of 2-hydroxyisocaproic acid at a concentration of 5 to 50 ppm to a neotame-sweetened cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 14

Addition of tannic acid at a concentration of 10, 20 or 50 ppm to a neotame-sweetened cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 15

Addition of 2,4-dihydroxybenzoic acid at a concentration of 8 to 10 ppm in a neotame-sweetened punch flavored drink positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 16

Addition of cream of tartar (potassium bitartrate) at a concentration of 7 ppm in a neotame-sweetened reconstituted strawberry-flavored powdered soft drink positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 17

Addition of para-hydroxybenzoic acid at a concentration of 10 ppm to a neotame-sweetened reconstituted punch-flavored powdered soft drink positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 18

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing calcium gluconate (0.0074% by weight, beverage concentration 0.31 ppm), neotame (0.09% by weight, beverage concentration 3.75 ppm) and Unidex® bulking agent.

EXAMPLE 19

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing calcium lactate (0.0074% by weight, beverage concentration 0.31 ppm), neotame (0.09% by weight, beverage concentration 3.75 ppm) and Unidex® bulking agent.

EXAMPLE 20

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing cream of tartar (potassium bitartrate, 0.2% to 0.4% by weight, beverage concentration about 8.3 to 16.7 ppm), neotame (0.09% by weight, beverage concentration 3.75 ppm) and Unidex® bulking agent.

EXAMPLE 21

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing benzoic acid (0.0269% by weight, beverage concentration 1.12 ppm), maltodextrin (80.50% by weight, beverage concentration 3354 ppm), neotame (0.079% by weight, beverage concentration 3.3 ppm) and Unidex® bulking agent.

EXAMPLE 22

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing sodium gluconate (0.0744% by weight, beverage concentration 3.1 ppm), neotame (0.09% by weight, beverage concentration 3.75 ppm) and Unidex® bulking agent.

EXAMPLE 23

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing 2,4-dihydroxybenzoic acid (0.24% by weight, beverage concentration 10 ppm), neotame (0.079% by weight, beverage concentration 3.3 ppm) and Unidex® bulking agent.

EXAMPLE 24

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing 2,4-dihydroxybenzoic acid (0.24% by weight, beverage concentration 10 ppm), glycerol (0.034% by weight, beverage concentration 1.4 ppm), neotame (0.079% by weight, beverage concentration 3.3 ppm) and Unidex® bulking agent.

EXAMPLE 25

At least one taste characteristic imparted by neotame was positively affected in a whitened, brewed coffee beverage that was sweetened with a solid tabletop sweetener containing para-hydroxybenzoic acid (0.24% by weight, beverage concentration 10 ppm), neotame (0.079% by weight, beverage concentration 3.3 ppm) and Unidex® bulking agent.

EXAMPLE 26

Addition of cinnamic neotame salt at a concentration of 34.8 ppm to a cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 27

Addition of 2-hydroxyvaleric neotame salt at a concentration of 34.2 ppm to a cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 28

Addition of 4-hydroxycinnamic neotame salt at a concentration of 35.9 ppm to a cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 29

Addition of benzoic neotame salt at a concentration of 47.6 ppm to a cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 30

Addition of 2,4-dihydroxybenzoic acid at a concentration of 5 ppm to a neotame-sweetened strawberry-flavored reconstituted powdered soft drink positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 31

Addition of 4-hydroxycinnamic acid at a concentration of 10 ppm to a neotame-sweetened cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

EXAMPLE 32

Addition of potassium cinnamate at concentrations of 5 and 10 ppm to a neotame-sweetened cola-flavored beverage positively affected at least one taste characteristic imparted by neotame.

Other variations and modifications of this invention will be obvious to those skilled in this art. This invention is not to be limited except as set forth in the following claims.

What is claimed is:

1. A composition comprising a sweetening effective amount of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester and at least one hydrophobic acid additive or derivative thereof, wherein said hydrophobic acid additive is present in an amount effective to positively affect at least one taste characteristic imparted by said N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester.

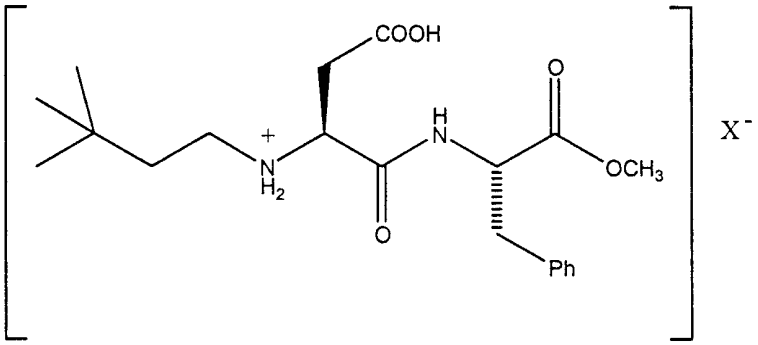
2. The composition according to claim 1, wherein the hydrophobic acid additive is selected from the group consisting of benzoic acid, valeric acid, acetic acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, citric acid, malic acid, lactic acid, gluconic acid, bitartric acid, fumaric acid, adipic acid and derivatives thereof.

3. The composition according to claim 2, wherein the hydrophobic acid additive is selected from the group consisting of 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid, 2-hydroxyvaleric acid, 2-hydroxyisocaproic acid, 4-hydroxybenzoic acid, 2,4-dihydroxybenzoic acid, 3,4-dihydroxybenzoic acid, 2,3-dihydroxybenzoic acid, 2-hydroxy-4-aminobenzoic acid, 3-hydroxy-4-aminobenzoic acid, 3-aminobenzoic acid, 3-hydroxybenzoic acid, 4-hydroxy-3-methoxycinnamic acid, 4-methoxybenzoic acid, potassium cinnamate, sodium benzoate, potassium benzoate, trisodium citrate, tripotassium citrate, sodium acetate, calcium acetate, sodium malate, calcium

lactate, sodium gluconate, calcium gluconate, potassium gluconate and potassium bitartrate.

4. A composition according to claim 1, wherein said composition is selected from the group consisting of beverages, fluid dairy products, condiments, baked goods, frostings, bakery fillings, cereals, nutraceuticals, gelatins, powdered soft drinks, table-top sweeteners, candy and chewing gum.

5. A salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester represented by the formula

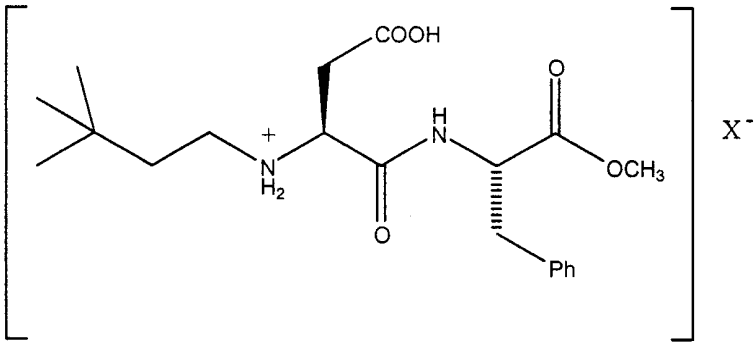


wherein X^- is a conjugate base derived by deprotonation of the hydrophobic acid additive or derivative thereof.

6. The salt according to claim 5, wherein the hydrophobic acid additive is selected from the group consisting of valeric acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, lactic acid, bitartric acid, adipic acid and derivatives thereof.

7. The salt according to claim 6, wherein the hydrophobic acid additive is selected from the group consisting of 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid, 2-hydroxyvaleric acid, 2-hydroxyisocaproic acid, 4-hydroxy-3-methoxycinnamic acid, potassium cinnamate, calcium lactate and potassium bitartrate.

8. A composition comprising a salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester represented by the formula



wherein X^- is a conjugate base derived by deprotonation of the hydrophobic acid additive or derivative thereof, wherein said composition is selected from the group consisting of beverages, fluid dairy products, condiments, baked goods, frostings, bakery fillings, cereals, nutraceuticals, gelatins, powdered soft drinks, table-top sweeteners, candy and chewing gum.

9. The composition according to claim 8, wherein the hydrophobic acid additive is selected from the group consisting of valeric acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid,

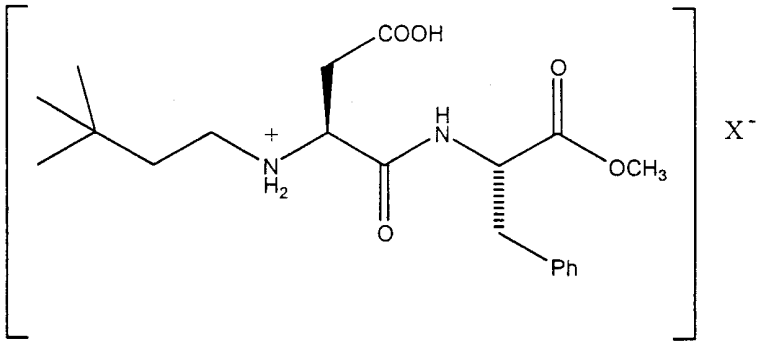
lactic acid, bitartric acid, adipic acid and derivatives thereof.

10. The composition according to claim 9, wherein the hydrophobic acid additive is selected from the group consisting of 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid, 2-hydroxyvaleric acid, 2-hydroxyisocaproic acid, 4-hydroxy-3-methoxycinnamic acid, potassium cinnamate, calcium lactate and potassium bitartrate.

11. A composition according to claim 8, wherein said salt is present in an amount effective to provide a sweetening effective amount of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester and an effective amount of said conjugate base of said hydrophobic acid additive to positively impact at least one taste characteristic imparted by said N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester.

12. A composition according to claim 8, wherein said salt is present in an amount effective to provide a sub-threshold amount of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester and an effective amount of said conjugate base of said hydrophobic acid additive to positively impact at least one taste characteristic imparted by said N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester.

13. A method of preparing a salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester represented by the formula



wherein X^- is a conjugate base derived by deprotonation of a hydrophobic acid additive or derivative thereof, comprising the steps of:

combining N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester and said conjugate base in a solvent; and

agitating to form said salt.

14. The method according to claim 13, wherein X^- is a conjugate base derived by deprotonation of a hydrophobic acid additive selected from the group consisting of valeric acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, lactic acid, bitartric acid, adipic acid and derivatives thereof.

15. The method according to claim 14, wherein X^- is a conjugate base derived by deprotonation of a hydrophobic acid additive selected from the group consisting of 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid, 2-hydroxyvaleric acid, 2-hydroxyisocaproic acid, 4-hydroxy-3-methoxycinnamic acid, potassium cinnamate, calcium lactate and potassium bitartrate.

16. The method according to claim 13, wherein the solvent is selected from the group consisting of ethanol, methanol, water, isopropanol, acetone, ethyl acetate, methyl acetate and mixtures thereof.

17. The method according to claim 13, wherein the molar ratio of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester to said conjugate base is about 1:1.

18. The method according to claim 13, further comprising the step of:

isolating the salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester.

19. The method according to claim 18, wherein said step of isolating is accomplished by a method selected from the group consisting of evaporation, distillation, freeze drying, spray drying and combinations thereof.

20. The method according to claim 13, wherein said step of combining comprises preparing a slurry of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester in said solvent; and adding said conjugate base to said slurry.

21. The method according to claim 20, further comprising adding a strong inorganic acid to said slurry.

22. A method of positively affecting at least one taste characteristic imparted by N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester comprising:

adding a hydrophobic acid additive to a composition containing N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester.

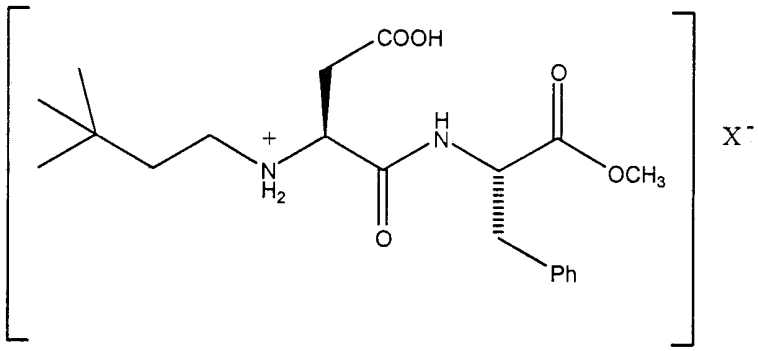
23. The method according to claim 22, wherein the hydrophobic acid additive is selected from the group consisting of benzoic acid, valeric acid, acetic acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, citric acid, malic acid, lactic acid, gluconic acid, bitartric acid, fumaric acid, adipic acid and derivatives thereof.

24. The method according to claim 23, wherein the hydrophobic acid additive is selected from the group consisting of 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid, 2-hydroxyvaleric acid, 2-hydroxyisocaproic acid, 4-hydroxybenzoic acid, 2,4-dihydroxybenzoic acid, 3,4-dihydroxybenzoic acid, 2,3-dihydroxybenzoic acid, 2-hydroxy-4-aminobenzoic acid, 3-hydroxy-4-aminobenzoic acid, 3-aminobenzoic acid, 3-hydroxybenzoic acid, 4-hydroxy-3-methoxycinnamic acid, 4-methoxybenzoic acid, potassium cinnamate, sodium benzoate, potassium benzoate, trisodium citrate, tripotassium citrate, sodium acetate, calcium acetate, sodium malate, calcium lactate, sodium gluconate, calcium gluconate, potassium gluconate and potassium bitartrate.

25. The method according to claim 22, wherein said composition is selected from the group consisting of beverages, fluid dairy products, condiments, baked goods, frostings, bakery fillings, cereals, nutraceuticals, gelatins, powdered soft drinks, table-top sweeteners, candy and chewing gum.

26. A method of positively affecting at least one taste characteristic imparted by N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester comprising:

adding a salt of N-[N-(3,3-dimethylbutyl)-L-α-aspartyl]-L-phenylalanine 1-methyl ester represented by the formula



wherein X^- is a conjugate base derived by deprotonation of the hydrophobic acid additive or derivative thereof, to a composition.

27. The method according to claim 26, wherein the hydrophobic acid additive is selected from the group consisting of valeric acid, nonoic acid, isobutyric acid, cyclohexocarboxylic acid, cinnamic acid, anisic acid, caproic acid, isocaproic acid, tannic acid, lactic acid, bitartric acid, adipic acid and derivatives thereof.

28. The method according to claim 27, wherein the hydrophobic acid additive is selected from the group consisting of 4-hydroxycinnamic acid, 2,4-dihydroxycinnamic acid, 3,4-dihydroxycinnamic acid, 2-hydroxyvaleric acid, 2-hydroxyisocaproic acid, 4-

hydroxy-3-methoxycinnamic acid, potassium cinnamate, calcium lactate and potassium bitartrate.

29. The method according to claim 26, wherein said composition is selected from the group consisting of beverages, fluid dairy products, condiments, baked goods, frostings, bakery fillings, cereals, nutraceuticals, gelatins, powdered soft drinks, table-top sweeteners, candy and chewing gum.

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/US 00/12581

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23L1/236 A23L2/60 A21D2/24 A23G3/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A23L A21D A23G

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
CHEM ABS Data, WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 12956 A (THE NUTRASWEET COMPANY) 18 March 1999 (1999-03-18) claims 1,5,7-14 page 6, line 19 - line 35 example 4	1-29
A	WO 99 12954 A (THE NUTRASWEET COMPANY) 18 March 1999 (1999-03-18) abstract page 1 -page 4	1-29
A	WO 99 12957 A (THE NUTRASWEET COMPANY) 18 March 1999 (1999-03-18) abstract	
A	WO 99 12955 A (THE NUTRASWEET COMPANY) 18 March 1999 (1999-03-18) abstract	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 August 2000	30/08/2000

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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X,P	WO 99 30577 A (THE NUTRASWEET COMPANY) 24 June 1999 (1999-06-24) abstract page 6, line 24 - line 29	1,4,8, 22,25, 26,29
X,P	WO 99 30576 A (THE NUTRASWEET COMPANY) 24 June 1999 (1999-06-24) abstract page 4, line 15 - line 20	1,4,8, 22,25, 26,29

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INTERNATIONAL SEARCH REPORT

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PCT/US 00/12581

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