Devices for delivering elutable substances to a water-containing foodstuff, for example, a beverage, are provided. More particularly, devices for delivering an elutable substance to a foodstuff having an elongate body having at least one surface, wherein at least a portion of the surface of the body is porous and the elutable substance releasably present on at least a portion of the porous surface. Also provided are methods of producing such devices.
FIG. 11

Sweetness Profile for Different Concentrations

- 5% wt Sucralose
- 10% wt Sucralose
- 20% wt Sucralose
- Control
ELUTABLE SUBSTANCE DELIVERY DEVICES

FIELD OF THE INVENTION

[0001] The present invention relates to devices for delivering elutable substances to a water-containing foodstuff, for example, a beverage. More particularly, the present invention relates to a device for delivering an elutable substance to a foodstuff having an elongate body having at least one surface, wherein at least a portion of the surface of the body is porous and an elutable substance is affixed to at least a portion of the porous surface. The present invention also relates to methods of producing such devices.

BACKGROUND OF THE INVENTION

[0002] People often customize the taste, texture, aroma, and color of food and beverages by adding an elutable substance thereto. In particular, consumers often add sweeteners to their foods and beverages and consumers differ considerably in the amount of sweetness that they prefer. For example, sweeteners are added to beverages, such as, coffee and tea; on cereals; on fruit; as toppings on baked goods; and in many other ways. Sweetening a food or beverage alters its flavor and usually increases its appeal. This behavior is found in all cultures, but is especially prevalent in western cultures.

[0003] The amount of sweetness incorporated into a foodstuff during commercial production may not be adequate to satisfy some consumers while other consumers may find that the same amount of sweetness to be excessive. Therefore, there exists a long-felt need for mechanisms that consumers can use to increase the sweetness of a product at the time of consumption that is consistent with their personal preference, without introducing an additional caloric burden.

[0004] Methods for dispensing elutable substances into a liquid are known. For example, adding sweetener to an unsweetened iced tea beverage will typically involve several steps—adding the sweetener to the unsweetened iced tea beverage followed by stirring to incorporate the sweetener to create a sweetened iced tea beverage. Such sweetener is typically in a powdered, liquid, or tablet form. Similar effort is undertaken when adding powdered or liquid beverage mix to a liquid, e.g., water, milk, alcohol, and the like.

[0005] The availability of high intensity sweeteners (HIS) provides novel technical routes to the delivery of sweeteners to individual servings of beverages. These new technical approaches are made possible by the minute quantities of sweeteners that are needed to achieve adequate sweetening of individual servings. For example, sucralose is about 600 times as sweet as sucrose (table sugar or cane sugar). Therefore, one teaspoon of sugar (about 4 g) can be replaced by about 6.7 mg of sucralose.

[0006] Sweetening individual servings of a beverage presents a challenge in many food service situations. Frequently, an individual packet of a sweetener is provided along with a serving of a beverage. The packet may contain sucrose, or alternatively may contain high intensity sweeteners, such as, sucralose, aspartame, or saccharin. The user must open the packet and empty the contents into the beverage, and then stir the beverage to obtain dissolution of the sweetener and its complete dispersion in the liquid mass. The residual packaging of the packet creates waste that may present disposal problems under many situations. Also, a device is needed to stir the liquid to which the sweetener has been added. This stirring device may be a reusuable or disposable spoon. More frequently, especially in casual dining, convenience stores, or fast food situations a simpler stir stick is provided. This stick may be wooden, but more generally it is an extruded plastic object.

[0007] The multi-step process involved in satisfactorily adding an elutable substance to a liquid has been addressed by many methods. Most of these methods combine a stirring device with the elutable substance, e.g., sweetener, flavor, coffee, cocoa, tea, and the like.

[0008] One such approach is directed to placing a free flowing elutable substance inside a container having a receptacle for holding the substance.

[0009] U.S. Pat. No. 3,154,418, which is expressly incorporated herein by reference, discloses, among other things, a spoon having two cavities. One cavity is covered by a mesh and is used to contain a material, such as, tea, coffee, or cocoa for making a beverage. A second cavity was purported to be in a handle of the spoon. This second cavity is used to deliver beverage components, such as, sweetener. Delivery of material from the second chamber is achieved by squeezing the spoon handle or shaft of the stir stick, thereby breaking a seal and permitting the contents to flow into the beverage by gravity.

[0010] U.S. Pat. No. 3,824,322, which is expressly incorporated herein by reference, discloses a flavored tubular stirrer for alcoholic beverages. The disclosed stirrer was described as having stirring and handle portions, and flavoring means for aqueous alcoholic beverages that is held to a stirring portion of the stirrer with at least part of the flavoring communicable with an alcoholic beverage in which it is placed through or at an exterior surface of the stirring portion. The flavoring means were described as being a natural extract, a solid, or be capable of being converted to solid form by being deposited on or sorbed by a carrier. The carrier was described as being a sugar, sorbitol, mannitol, corn syrup solids, milk solids, monoglycerides or diglycerides, and the like. In addition, the perforations were disclosed as being pushed inwardly so as to provide projections to assist in holding the flavoring means in place therein.

[0011] U.S. Pat. Nos. 4,860,929 and 4,986,451, which are expressly incorporated herein by reference, allegedly disclose a dispensing device for soluble granular material. The device includes a tube containing a solid granular material. The tube being closed at both ends and having perforations along a portion of its length and having a paddle formed at one end. In this design and in the dry state, the granular material must be sized so as not to escape through the perforations while the granular material is in a dry state.

[0012] U.S. Pat. No. 5,125,534, which is incorporated herein by reference, discloses a multiple compartment dispenser that is capable of simultaneously dispensing multiple dry flavoring ingredients into a fluid. The dispenser described contains a chamber having a spine with a plurality of vanes or blades projecting therefrom that extend into a lower housing to form multiple compartments. The lower housing was described as being a dissolvable film, such as, gelatin or methylcellulose, that is formed to fit over the
bottom portion of the spine and the associated horizontally projecting vanes. Each of the multiple compartments was described as being individually filled with a flavoring ingredient prior to dispensing. Flavoring ingredients included sugar, coffee, hot chocolate, and bouillon.

[0013] U.S. Pat. No. 5,440,976, which is incorporated herein by reference, allegedly discloses a device for dispensing natural and artificial sweeteners into a beverage. The device includes a tube having perforations and at least one separator disk positioned therein, and a solid sleeve formed to receive the tube. The tube is in the sleeve such that the tube may be urged forward dispensing a measured amount of sweetener into the beverage. Control of sweetness intensity was allegedly described as being further enhanced by providing calibration markers on the surface of the tube.

[0014] U.S. Pat. No. 5,866,185, which is expressly incorporated herein by reference, discloses a device including a tube including a soluble or dispersible material and a soluble coating formed on the outer surface of the tubular portion. The soluble coating can be sugar or an artificial sweetener and is dissolved when the coating comes into contact with liquid. The tube is also disclosed as having perforations to control the rate that the soluble material is dispersed in the liquid. The soluble material was described as being a variety of substances that are soluble in liquid, including flavors, such as, cherry, orange, grape, and fruit punch.

[0015] Another approach is directed to attaching a solid mass to a handle and dissolving the solid mass in a liquid.

[0016] U.S. Pat. No. 3,869,555, which is incorporated herein by reference, discloses a soluble solid mass secured to a wooden stick. The solid mass was disclosed as having a base mass and an optional flavoring mass. The base mass was described as being instant coffee crystals or particles, tea, cocoa, egg nog, and chocolate with binder material. The flavoring mass was described as being powdered milk and/or sugar that is held together by a binder material, which could be sugar or may be taste-free.

[0017] U.S. Pat. No. 4,849,231, which is expressly incorporated herein by reference, discloses a stirring rod having a stirring body that has a holder for holding a solid mass, e.g., sugar lump. More than one holder can be included in the body of the stirring rod. In addition to sugar lumps, sweetener tablets containing high intensity sweeteners, such as, aspartame or saccharin, powdered milk, coloring, and flavoring are disclosed. In another embodiment, there is disclosed a wooden stirring body that was immersed in a warm, liquid sugar or other substance, where a quantity of substance has remained adhered thereto, the quantity corresponding to a quantity of substance, for example sugar or sweetener, e.g., aspartame, geared to an amount of beverage. After cooling, the solid piece of the substance is held by a holder. The quantity of substance to be added to the beverage was disclosed as being regulated by inserting the stirring rod more or less deeply into the beverage that is to be stirred.

[0018] U.S. Pat. No. 6,399,126, which is incorporated herein by reference, discloses a flavored beverage stirrer that includes a carrier and a cartridge. The cartridge was disclosed as being formed from a flavored material, which dissolves and adds flavor to a beverage.

[0019] U.S. Published Patent Application No. 2001/0038871, which is incorporated herein by reference, discloses an embodiment wherein a predetermined quantity of a water soluble extract is sprayed onto the inner surface of a straw. The coated interior of the straw will provide an agent of choice to be incorporated into a liquid.

[0020] The above approaches suffer from a number of drawbacks. In particular, due to the complexity of most of the above solutions, manufacturing costs and difficulties present obstacles to adoption. In addition, none of the solutions address the problem of increasing the dissolution rate of an elutable substance while maintaining the same compact size of the device.

SUMMARY OF THE INVENTION

[0021] The present invention is directed to a device that satisfies these needs. This disclosure provides new individual sweetening compositions that can avoid the incorporation of substantial amounts of carrier materials, while allowing custom sweetening levels, and eliminating package waste.

[0022] One embodiment of the invention is device for delivering an elutable substance to a foodstuff, an elongate body comprising, consisting of and/or consisting essentially of at least one surface, wherein at least a portion of the surface of the body is porous and an elutable substance affixed to at least a portion of the porous surface.

[0023] Another embodiment of the invention is a method of producing a device for delivering a sweetener. This method comprises, consists of, and/or consists essentially of providing a body having a first end and a second end, wherein at least a part of the body is porous, contacting at least a portion of the porous part of the body with a solution or slurry including an elutable substance dissolved or dispersed in a solvent, and allowing the solution or slurry to dry to a surface of the body of the device, wherein upon contacting a surface of the body of the device with a foodstuff, the sweetener composition is eluted into the foodstuff.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIG. 1 shows a front view of an embodiment of the present invention.

[0025] FIG. 2 shows a front view of an embodiment of the present invention.

[0026] FIG. 3 shows a front view (3A) and side view (3B) of an embodiment of the present invention.

[0027] FIG. 4A shows a front view of an embodiment of the present invention. FIG. 4B shows alternative cross-sectional views of FIG. 4A through 1-1 of the body.

[0028] FIGS. 5A-C shows a front view of various embodiments of the present invention.

[0029] FIGS. 6A-H shows a front view of various embodiments of the present invention.

[0030] FIGS. 7A-C shows a front view of various embodiments of the present invention. FIG. 7D is a cross-sectional view through plane 120. FIG. 7E shows a front view of an embodiment of the present invention. FIG. 7F is a cross-sectional view through plane 220.
FIGS. 8A-C shows a front view of various embodiments of the present invention.

FIG. 9 shows a front view of an embodiment of the present invention.

FIG. 10A shows a front view of an embodiment of the present invention.

FIG. 10B depicts a view through axis 350.

FIG. 11 is a graph depicting the sweetness profiles of a control and three devices of the present invention over a time period of ten seconds.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to subject disclosed in U.S. application Ser. No., entitled “ELUTABLE SUBSTANCE DELIVERY DEVICES”, which was filed on Sep. 13, 2005, and is hereby incorporated by reference as if recited in full herein.

One embodiment of the invention is a device for delivering an elutable substance to a foodstuff having an elongate body having at least one surface, wherein at least a portion of the surface of the body is porous and an elutable substance is affixed to at least a portion of the porous surface.

As used herein, unless otherwise indicated, the term “elutable substance” means any substance that dissolves or can be suspended in a liquid, which comprises water with or without other solutes. Examples of useful elutable substances include high intensity sweeteners, nutritive sweeteners, sugar alcohols, flavor, drug substances, vitamins, minerals, texture enhancers, coloring agents, aromas, and combinations thereof. A preferred elutable substance according to the present invention is a high intensity sweetener.

As used herein, unless otherwise indicated, the term “high intensity sweetener” means a substance that provides a high sweetness per unit mass as compared to sucrose and provides little or no nutritive value. Many high intensity sweeteners are known to those skilled in the art and any can be used in the present invention. Examples of high intensity sweeteners for use in the present invention include aspartame, acesulfame, alitame, brazzein, cyclamate acid, dihydrochalcones, extract of Dioscoreophyllum cumminsis, extract of the fruit of Pentadiplandra brazzeana, glycyrrhizin, hemedulcin, monellin, mogrosides, neotame, neohesperidin, saccharin, sucralose, stevia, thauatin, salts, derivatives, and combinations thereof. A preferred sweetener according to the present invention is sucralose.

The intensity of a sweetener may be assessed by determining the amount of the sweetener required to provide a sweetness comparable to a predetermined mass of a natural sugar, e.g., sucrose. In the present invention, this parameter is expressed in terms of “sucrose equivalent sweetness.” For example, if a sweetener is twice as intense as sucrose, 0.5 g of the sweetener equals a gram of sucrose equivalent sweetness.

In an embodiment of the present invention, the amount of high intensity sweetener present on the porous surface of the body is sufficient to provide about one-quarter to about 4 teaspoons of sucrose equivalent sweetness. Preferably, the amount of high intensity sweetener present on the porous surface of the body is sufficient to provide about 3 teaspoons of sucrose equivalent sweetness.

In another embodiment of the present invention, the amount of sucrose present on the porous surface of the body is sufficient to provide about one-quarter to about 4 teaspoons of sucrose equivalent sweetness. Preferably, the amount of sucrose present on the porous surface of the body is sufficient to provide about 3 teaspoons of sucrose equivalent sweetness.

As used herein, unless otherwise indicated, the term “nutritive sweetener” means a substance that provides sweetness and is also absorbable into the bloodstream and may be metabolized to provide energy for immediate use or for storage as fat. Nutritive sweeteners are typically extracted from plants that produce them in various quantities and for various purposes. For example, sucrose, a nutritive sweetener in widespread use, is produced from many sources, e.g., sugar cane and sugar beet roots. Examples of nutritive sweeteners include, e.g., corn syrup, glucose, fructose, tagatose, high fructose corn syrup, lactose, sucrose, trehalose, lactose, arabinose, trehalose, maltodextrin, soluble starch, inulin, and the like, alone or in combination.

As used herein, unless otherwise indicated, the term “sugar alcohol” means a food-grade alcohol derived from a sugar molecule. Sugar alcohols useful in the present invention include, for example, isomalt, erthyritol, hydrogenated isomaltulose, hydrogenated starch hydrolyzates, lactitol, maltitol, mannitol, sorbitol, xylitol, and combinations thereof.

As used herein, unless otherwise indicated, the term “drug substance” means materials with pharmacological or nutritional benefits. Drug substances useful in the present invention include, for example, acetaminophen, ibuprofen, famotidine, chlorpheniramine, pseudoephedrine, dextromethorphan, diphenhydramine, brompheniramine, clemastine, phenylpropanolamine, terfenadine, astemizole, loratadine, loperamide, loperamide-N-oxide, ranitidine, cimetidine, tramadol, cisapride, acetylsalicylic acid, doxylamine succinate, pharmaceutically acceptable salts thereof and combinations thereof.

As used herein, unless otherwise indicated, the term “flavor” means any substance that may be employed to produce a desired flavor. Any flavor known to those skilled in the art may be used in the present invention. The flavor used may be selected based on the type of foodstuff that will be contacted with the device for delivering a elutable substance. Flavors useful for flavoring coffee include, for example, cream, hazelnut, vanilla, chocolate, cinnamon, and pecan. In contrast, flavors useful for flavoring tea include, for example, lemon, lime, raspberry, peach, and mango. Blends of flavors are also suitable for these applications. Useful flavors include, for example, the above-mentioned flavors and vanillin, butter, butterscotch, tea, orange, tangerine, walnut, caramel, strawberry, banana, grape, plum, cherry, blueberry, pineapple, elderberry, watermelon, bubblegum, cantaloupe, guava, kiwi, papaya, coconut, mint, spearmint, and combinations thereof.

As used herein, unless otherwise indicated, the term “texture enhancer” means any substance that may be
employed to produce a desired texture. Texture enhancers useful in the present invention include, for example, guar gum, alginate and salts thereof, tara gum, gellan gum, xanthium gum, amalose, amaloepectin, konjac, and combinations thereof.

[0048] As used herein, unless otherwise indicated, the term "coloring agent" means any substance that may be employed to produce a desired color. Coloring agents useful in the present invention include, for example, FD&C Blue No. 1 (Brilliant Blue), FD&C Blue No. 2 (Indigotine), FD&C Green No. 3 (Fast Green), FD&C Red No. 3 (Erythrosine), FD&C Red No. 40 (Allura Red), FD&C Yellow No. 1 (Tartazine), FD&C Yellow No. 6 (Sunset Yellow), annatto extract, anthocyanins, aronia/red fruit, beet juice & powder, beta-carotene, beta-apo-8-carotenal, black currant, butan-2-one, cannabixanthin, caramel, carbo medicinialis, carmine, carmine/beta-carotene, carmine blue, carminic acid, carrot & carrot oils, chlorophyll, chlorophyllin, cochenille extract, copper-chlorophyll, copper-chlorophyllin, curcumin, curcumin/curcuminoid, elderberry, grape & grape skin extracts, lhibiscus, lutein, mixed carotenoids, paprika, paprika extract, paprika oleoresin, riboflavin, saffron, spinach, stinging nettle, titanium dioxide, turmeric, and combinations thereof.

[0049] As used herein, unless otherwise indicated, the term "aroma component" means any volatile substance that may be employed to produce a desired scent. Aroma components useful in the present invention include, for example, essential oils (citrus oil), expressed oils (orange oil), distilled oils (rose oil), extracts (fruits), anethole (liquorice, anise seed, ozo, fennel), anisole (anise seed), benzaldehyde (marzipan, almond), benzyl alcohol (marzipan, almond), camphor (cinnamomum camphora), cinnamaldehyde (cinnamon), citral (citronella oil, lemon oil), d-limonene (orange) ethyl butanoate (pineapple), eugenol (clove oil), furfural (strawberry), furfural, caramel, linalool (coriander, rose wood), menthol (peppermint), methyl butanoate (apple, pineapple), methyl salicylate (oil of wintergreen), nerol (orange flowers), nerolidol (orange flowers), pentalyl butanoate (pear, apricot), pentyl pentanoate (apple, pineapple), sorbolon (maple syrup, curry, fennugreek), strawberry ketone (strawberry), substituted pyrazines, \textit{e.g.}, 2-ethoxy-3-isopropylpyrazine; 2-methoxy-3-sec-butylpyrazine; and 2-methoxy-3-methylpyrazine (tasted seeds of fennegreek, cumin, and coriander), thujone juniper, common sage, Nootka cypress, and wormwood), thymol (camphor-like), trimethylamine (fish), vanillin (vanilla), salts, derivatives, and combinations thereof. Preferred aromas according to the present invention are essential oils (citrus oil), expressed oils (orange oil), distilled oils (rose oil), extracts (fruits), benzaldehyde, d-limonene, furfural, menthol, methyl butanoate, pentalyl butanoate, and combinations thereof.

[0050] As used herein, unless otherwise indicated, the term "body" means any structure having a first end and a second end and a plurality of surfaces, such that the body has a length \( (z) \) equal to the distance between the first and second ends, a width \( (x) \), and a depth \( (y) \). In the present invention, at least a portion of the plurality of surfaces of the body is porous. The porous portion of the body may be made of any porous material that is inert in relation to water, \textit{i.e.}, neither dissolves in nor reacts with water. Examples of materials useful in the construction of the porous portion of the body include, for example, wood, a porous plastic, and a porous mineral material.

[0051] A preferred material for the construction of the porous portion of the body is wood. Bodies composed of wood are well-known and have a low cost. Wood also has the advantage of being biodegradable, and therefore, is environmentally friendly as used in the present invention. In contrast, porous plastics and mineral materials are long-lasting and may therefore be reused many times. Accordingly, a porous plastic or mineral material may also be employed in the present invention as the porous portion of the body in an environmentally-friendly manner.

[0052] The bodies of the present invention have a three-dimensional shape with an elongated length as compared to width and depth. The bodies of the present invention may provide increased surface area per unit length compared to a conventional stirrer in the shape of a cylindrical-shaped rod (see, \textit{e.g.}, FIG. 2) having similar dimensions. Moreover, bodies of the present invention may provide increased mixing action compared to a cylindrical shaped rod having similar dimensions. Examples of useful shapes for a body of the present invention include, for example, a triangular prism (FIG. 6A), a rectangular prism (FIGS. 3A and B and 6B), a pentagonal prism (FIG. 6C), a hexagonal prism (FIG. 6D), heptagonal prism (FIG. 6E), an octagonal prism (FIG. 6F), a nonagonal prism (FIG. 6G), a decagonal prism (FIG. 6H), an elliptical cylinder (FIG. 9), a spoon (FIG. 5), and a paddle (FIG. 8). A preferred shape for the body according to the present invention is a rectangular prism (FIG. 3A and B).

[0053] Turning now to FIG. 1, one embodiment of the present invention is a body \( (1) \) having the shape of a square prism. The body has a first end \( (10) \), a second end \( (20) \), a plurality of sides \( (30_{x-d}) \), and a central axis \( (40) \) running through the center of the body. Elutable substance is affixed to body \( (1) \). The body has a length \( (z) \), width \( (x) \), and depth \( (y) \), which dimensions are defined by the following equations:

\[
x_{1} = a_{1} + y_{1}
\]

\[
x_{2} = a_{2} + y_{2}
\]

\[
y_{1} + y_{2} = y_{1}
\]

\[
z = b (y_{1} + y_{2})
\]

wherein \( x_{1} \) and \( y_{1} \) are the width and depth, respectively, of the first end of the body \( (10) \), \( x_{2} \) and \( y_{2} \) are the width and depth, respectively, of the second end of the body \( (20) \), \( a_{1} \) and \( a_{2} \) each equal from about 0.05 to about 20, \( b \) is greater than about 10, and \( c \) can be up to about 100. In a preferred embodiment, \( a_{1} \) is from about 0.25 to about 4, \( a_{2} \) is from about 0.25 to about 4, \( b \) is about 20, and \( c \) is about 1.

[0054] As used herein, unless otherwise indicated, the term "all numerical ranges provided" is intended to expressly include at least all numbers that fall between the endpoints of ranges.

[0055] FIG. 2 shows a conventional stirrer having a cylindrical, rod-shaped body \( (370) \). The body has a first end \( (380) \), a second end \( (390) \), an outer surface \( (400) \), and a central axis \( (410) \) running through the center thereof. Elutable substance \( (22) \) is affixed to body \( (370) \). In this figure, \( y_{1} \) and \( y_{2} \) represent the diameter at the first and second ends \( (380 \text{ and } 390) \), respectively.
Turning now to FIG. 3A, a rectangular prism is depicted having a body (420) with a first end (430) and a second end (440). The rectangular prism has a front (450), a back (460), sides (470 and 480), and top and bottom sides (490 and 500, respectively). Elutable substance (33) is affixed to body (420). A central axis (510) runs through the center of the rectangular prism. FIG. 3B shows a side view of the rectangular prism of FIG. 3A. In FIGS. 3A and B, z represents the length of the rectangular prism, x1 and y1 represent the width and depth, respectively, of the rectangular prism at first end (430) and x2 and y2 represent the width and depth, respectively, of the rectangular prism at second end (440).

Now turning to FIG. 4A, another embodiment of the present invention has a modified tongue depressor shape as shown with body (520) a wider first end (530) a narrower second end (540), and a central axis (550) running down the center of the body. The body (520) has a front (560), a back (570), and a central portion (580) between the front and back. Elutable substance (44) is affixed to body (520). In this embodiment, z is the length from the first end (530) to the second end (540), x1 and y1 are the width and depth, respectively, at the first end (530) and x2 and y2 are the width and depth, respectively, at the second end (540). FIG. 4B is a cross section through plane perpendicular to the central axis (550) at the first end of the body (1, -1). As depicted, the cross-sectional form may take a plurality of shapes (e.g., 590, 600, and 610).

Turning now to FIG. 5, the body shape may take the form of various "spoons" (FIGS. 5A, 5B, and 5C). Elutable substance (55, 55a-55c) is affixed to spoon (620, 660, 700). With reference to FIG. 5A, for example, the spoon (620) may have a relatively narrow handle portion (630), which is integrally connected to an end portion (640) that is wider than the handle portion and terminates with a curved end (650). With reference to FIG. 5B, the spoon (660) may have a relatively narrow handle portion (670), which is integrally connected to an end portion (680) that is wider than the handle portion and terminates with a straight end (690). With reference to FIG. 5C, the spoon (700) may have a relatively narrow handle portion (710), which is integrally connected to an end portion (720) that is wider than the handle portion and terminates in a point (725). Each spoon has a front (625, 665, and 705), a back (626, 666, and 706), and a side portion (627, 667, and 707).

Turning now to FIG. 6, depicted are various exemplary prism shapes that may be used as the body of the device. In particular, FIG. 6A depicts a triangular prism (FIG. 6A), a rectangular prism (FIG. 6B), a pentagonal prism (FIG. 6C), a hexagonal prism (FIG. 6D), heptagonal prism (FIG. 6E), an octagonal prism (FIG. 6F), a nonagonal prism (FIG. 6G), and a decagonal prism (FIG. 6H). In each instance, the first and second ends, central axis, and respective sides are shown as summarized in the Table below:

<table>
<thead>
<tr>
<th>Figure</th>
<th>BODY</th>
<th>First End</th>
<th>Second End</th>
<th>Central Axis</th>
<th>Sides</th>
<th>Elutable Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6A</td>
<td>730</td>
<td>740</td>
<td>750</td>
<td>760</td>
<td>770</td>
<td>66A</td>
</tr>
<tr>
<td>6B</td>
<td>800</td>
<td>810</td>
<td>820</td>
<td>830</td>
<td>840</td>
<td>60B</td>
</tr>
</tbody>
</table>

Turning now to FIGS. 7A-C, the shape of the body of the present invention is not limited to a rectangular shape as shown in FIG. 1. For example, the body may be a polyhedron, such as for example an eight-sided shape (FIG. 7A) or a ten-sided shape (FIG. 7B or 7C). In these embodiments, the body (50a, b, c) has a front end (60a-c) and a second end (70a-c) and a plurality of sides (80a-v) that separate the first and second ends by a length (l or z, l' or z'); l" or z" and radiate out from a central axis (90a-c) running longitudinally through the center of the body. Elutable substance (77a, 77b, and 77c) is affixed to body (50a, 50b, and 50c). With reference to FIG. 7A, adjacent sides (e.g., 80a/e, 80b/c; 80a/e) meet in points (100a, b, c) and form a star (110) when viewed as a cross-section (FIG. 7D) through a plane (120) perpendicular to the central axis (90a). The length of the body is greater than a diameter of a circle (130a) whose center is bisected by the central axis (90a) and whose perimeter lies along the points of the star (100a, b, c). Although formation of the star by taking a cross-section through rectangular prism 3A is described, the same holds true for any like rectangular prism, such as those shown in FIGS. 3B and C (e.g., when the cross-section is taken through plane 121 that is perpendicular to central axes 90b and c).

Turning now to FIG. 7E, the body (140) has a first end (150) and a second end (160) and a plurality of sides (170a-p) that separate the first and second ends by a length (l or z), wherein a plurality of teeth (180a-d) extend out from a central axis (190) running longitudinally through the center of the body. Each tooth (180a-d) includes at least three adjacent sides (e.g., 170a-c) of the body that are configured to form at least first and second lateral faces (e.g., 170a and c) rising from a trough (200a-d) and a forward face (e.g., 170b) interconnecting the lateral faces (170a and c). The teeth form a gear-like form (210) when viewed as a cross-section (FIG. 7F) through a plane (220) perpendicular to the central axis (190). The length of the body is greater...
than a diameter of a circle (230) whose center is bisected by the central axis (190) and whose perimeter (240) lies along the forward face (170b, f, j, n) of each tooth. Elutable substance (77%) is affixed to body (140).

[0062] In a preferred embodiment and with reference to FIGS. 7A-C, the body has a length (L, L', or L") and a diameter (d1, d2, d3, d4) is a diameter of a cross-section at the first end (60a, b, or c) of the body, and d2 (or d3 or d4) is a diameter of a cross-section at the second end of the body (70a, b, c). More preferably, d1/d2 is about 1 and L/(d1 + d2)/2) is about 20.

[0063] In an additional embodiment, the dimensions of the body are defined by the following equations:

\[ x_1 = a \gamma_1 \]
\[ y_1 = a^2 \gamma_1 \]
\[ y_2 = c \gamma_1 \]
\[ z = b \gamma_1 \]

wherein z (or z' or z'') is the distance between the first and second ends of the body, x1 (or x1, or x1') and x2 (or x2, or x2') (X2, X3, and X4, not shown) are the distances in a body having cross-sectional stars between two adjacent points of the cross-sectional stars formed by cross-sections taken at the first and second ends, respectively. With reference to FIG. 7E, x1 and x2 (not shown) are the distances in a body (220) having cross-sectional gears between the apexes of two adjacent teeth (e.g., 180a and 180b) at a cross-section taken at the first and second ends (150 and 160), respectively. With reference to FIGS. 7A-C, y1 (or y1, or y1') and y2 (or y2, or y2') (not shown), respectively, represent the distance between two points on adjacent sides that form an apex of the star in cross-sectional form with respect to the first and second ends, wherein the two points are equidistant between the apex of the star and the central axis of the body. With reference to FIG. 7E, y1 and y2 (not shown), respectively, represent the distance from the bottom of a trough to the apex of the teeth of a gear in a cross-section taken at the first and second ends of the body, respectively. y1 and y2 each equal from about 0.05 to about 20, b is greater than about 10, and c is up to about 100. The blades of the cross-sectional stars or the teeth of the cross-sectional gear may be of equal length or may be of different lengths.

[0064] In an additional embodiment, the body has a cross-sectional star with from 3 to 25 points. Preferably, the body has a cross-sectional star with from 3 to 6 points, more preferably 3 points. In another embodiment, the body has a cross-section gear with 2 to 25 teeth. Preferably, the body has a cross-section gear with 3 to 15 teeth, more preferably 3 teeth.

[0065] Turning now to FIG. 8, a further embodiment of the present invention has a body (250a-c) with first (260a-c) and second (270a-c) ends, a central axis (280a-c) running longitudinally through the center of the body, and two or more blades (290a-i) that are integrally connected to one of the ends of the body. Each blade has a first and second surface (e.g., 300a and 300b in FIG. 8A) and an apex (e.g., 310a and 310b in FIG. 8A). Elutable substance (88', 88'', and 88''') is affixed to body (250a-c). In a preferred embodiment, the dimensions of the body are defined by the following equations:

\[ x = a y \]
\[ z = b y \]

wherein x is the distance between apexes (e.g., 310a and 310b) of two adjacent blades (e.g., 290a and 290b), y is the distance between the first and second surfaces (e.g., 300a and 300b) of the blades at a point equidistant from the central axis (280a) and the apex (e.g., 310a) of the blade (e.g., 290a), z is the distance from the first end of the body (e.g., 260a) to the second end (e.g., 270a), a is from about 1 to about 100, and b is greater than about 10. More preferably, a is about 10 and b is about 20. With respect to FIGS. 8B and C, x', x'', y', y'', z', and z'', are defined in the same manner.

[0066] In an embodiment of the present invention, the body has from 2 to 8 blades, preferably 3 blades, integrally connected.

[0067] Turning now to FIG. 9, the body (1570) is depicted in the shape of an elliptical cylinder. The body has a first end (1580), a second end (1590), an outer surface (1600), and a central axis (1610) running through the center of the cylinder. Elutable substance (99) is affixed to body (1570). The dotted line circumscribes a circle (1620) whose perimeter lies along points p1 and p2, which are at opposite ends of the major axis (1625) of an ellipse formed by taking a cross-section through a plane (1626) that is perpendicular to the central axis (1610) at the first end (1580).

[0068] Now turning to FIG. 10, the body (320) has first (330) and second (340) ends and a central axis (350) running longitudinally through the center of the body. A first portion (360) of the body is rod-shaped and a second portion (370) is a three-dimensional spiral. The body (320) has a length (z) measured from the first end (330) to the second end (340), which is from about 4 to about 8 inches, and a width (x) of from about one-eighth of an inch to about one-half of an inch. Elutable substance (1010) is affixed to body (320). With reference to FIG. 10B, which shows a bottom view of the body of FIG. 10A, the outer diameter of the spiral (d5) may be from about one-quarter of an inch to about 1 inch. The inner diameter of the spiral (d5) may be from 0 to about seven-eighths of an inch. The vertical distance over which the spiral portion of the body completes one full turn (360°) (t) may be from about one-quarter to about one inch. In a preferred embodiment of the spiral shaped body, the length (z) is about 6 inches, the width (x) is about one-quarter of an inch, the outer diameter (d5) of the spiral is about one-half of an inch, the inner diameter (d5) of the spiral is about one-quarter of an inch, and t equals about one-half inch.

[0069] It should be noted that the body of the present invention may be hollow or partially hollow thereby increasing the surface on which the elutable substance may be present. The embodiments described above, for example, may be solid, hollow throughout their entire length, or hollow for some portion of the length, e.g., one-half of the length.

[0070] In another embodiment of the present invention, the device for delivering an elutable substance includes a body made of wood in the shape of a rectangular prism with a length of about 6 inches, a width of about one-quarter inch
and a depth of about one-thirty-second of an inch, impregnated with sucralose in an amount sufficient to deliver about 3 teaspoons of sucrose-equivalent sweetness when contacted with a water-containing substance.

[0071] The devices for delivering an utable substance of the present invention may be packaged in a many ways. For example, the devices for delivering an utable substance may be placed into boxes, envelopes, pouches, or other suitable packages. A small number of devices for delivering an utable substance, for example, about 2 to about 50, may be placed in a suitable package for the convenience of a single user. The incorporation of these into a pouch or an envelope may be particularly convenient for the user. A larger number of devices for delivering an utable substance, for example, from about 50 to about 5000, may be packaged into a single container. This approach may be especially suitable for food service applications.

[0072] The devices for delivering an utable substance of the present invention may also be individually packaged into a suitable protective container. This container may be a sealed pouch or a sleeve made from plastic film or paper. The container may also be a tube formed of plastic or cardboard. The container may also be formed from a metal foil, or a combination of the materials disclosed above. Individually packaged containers may be especially useful in situations where hygiene may be compromised, such as camping trips, outdoor activities, or crowded conditions.

[0073] The devices of the present invention may be used in connection with a dispenser that simplifies their use, e.g., the dispenser facilitates the release of a single device for delivering an utable substance. One example is a dispenser containing a sliding or hinged opening, wherein the diameter of the opening permits only one device for delivering an utable substance to be released at a time. Another example is a dispenser with a depressible or sliding button or tab, wherein each actuation of the sliding button or tab results in the ejection of a single device for delivering an utable substance. These dispensers have a benefit of requiring only one hand for their use; permitting the user to simultaneously hold a food container in the other hand.

[0074] A further embodiment of the present invention is a method of producing a device for delivering an utable substance. With reference to FIG. 3, this method includes providing a body (420) having a first end (430) and a second end (440), wherein at least a part of the body is porous, contacting at least a portion of the porous part of the body with a solution or slurry including an utable substance dissolved, dispersed or suspended in a solvent, and allowing the solution or slurry to dry to a surface of one or more sides (470 and/or 480) of the body of the device, wherein upon contacting a surface of the body of the device with a foodstuff, the sweetener composition is dispersed into the foodstuff.

[0075] As used herein, unless otherwise indicated, the term “solution” means any liquid deemed safe for human consumption and useful to dissolve, disperse, or suspend one or more utable substances. Examples of food-grade solvents useful in the present invention include water, ethanol, and ethyl acetate. Preferably, the solvent is water.

[0076] In this embodiment, the contacting step may be carried out at a pressure greater than atmospheric pressure. For example, the contacting step may be carried out at a pressure from about 1 atmosphere to about 3 atmospheres of pressure, preferably at about 2 atmospheres of pressure.

[0077] A solution or slurry may include about 1 g of utable substance per 3 milliliters of water, which is heated to at least 70° F and maintained at this temperature. A portion of the porous portion of the body is contacted with the slurry or solution for from about 1 minute to about 30 minutes, preferably for about 5 minutes. The body is dried for about 1 minute to about 30 minutes, preferably for about 10 minutes, at a temperature from about 100° F to about 300° F, preferably about 160° F.

[0078] In the present invention, the utable substance may be a high intensity sweetener; and the solution or slurry comprises from about 0.1% by weight of a high intensity sweetener to about saturation with a high intensity sweetener. Preferably, the solution or slurry comprises from about 5% by weight of a high intensity sweetener to about saturation with a high intensity sweetener. More preferably, the solution or slurry comprises from about 15% by weight of a high intensity sweetener to about saturation with a high intensity sweetener. For example, approximately 30 grams of sucralose dissolved in 100 milliliters of water at room temperature will produce a near saturated solution.

[0079] Preferably, the amount of high intensity sweetener present on the porous part of the body is sufficient to provide to a foodstuff about one-quarter to about 4 teaspoons of sucrose equivalent sweetness, more preferably 3 teaspoons of sucrose equivalent sweetness.

[0080] The shape and material of the bodies used in this method are as described above. The amount and identity of the utable substance used in this method are also as described above.

[0081] The method may further include submerging about one inch of the length of a body made of wood in the shape of a rectangular-prism with a length of about 6 inches, a width of about one-quarter inch and a depth of about one-eighth of an inch, in a solution of 20% sucralose by weight to impregnate the body with an amount of sucralose sufficient to deliver about 3 teaspoons of sucrose-equivalent sweetness.

[0082] The devices of the present invention provide a method of delivering an utable substance to a water-containing foodstuff by contacting a device for delivering an utable substance with the foodstuff. The devices may be contacted with the foodstuff in any manner. Useful contacting methods include, for example, stirring, dunking, dipping, submerging, spinning, and twirling. Preferably, the foodstuff is stirred with a device according to the present invention.

[0083] As used herein, unless otherwise indicated, the term “water-containing foodstuff” may be any edible substance containing sufficient water to release the utable substance from the body upon contact. Useful water-containing foodstuffs include, for example, beverages, puddings, sauces, gravies, syrups, and glazes. A preferred foodstuff for the present invention is a beverage.

[0084] The amount of sweetness delivered to the foodstuff is generally dependent on three factors: the amount of
elutable substance present on the porous part of the body, the mixing action of the body, and the amount of time the body is in contact with the foodstuff.

The longer the device for delivering an elutable substance is in contact with the foodstuff, the greater the amount of elutable substance delivered to the foodstuff. With a high intensity sweetener, for example, the longer the device for delivering an elutable substance is in contact with the foodstuff, the sweeter the foodstuff will taste. Of course, with continued contact with the foodstuff, the device for delivering an elutable substance will eventually be exhausted of the elutable substance.

The following examples are provided to further illustrate the compositions and methods of the present invention. These examples are illustrative only and are not intended to limit the scope of the invention in any way.

EXAMPLES

Example 1

A solution of 20 grams of neat sucralose (Tate & Lyle Plc., McIntosh, Ala.) is dissolved in 60 grams of tap water (New Brunswick, N.J. public supply). The solution is at a temperature of 73°F. A small amount of sucralose is left undissolved. Two porous wood sticks about 5 inches long, about one-half inch wide, and about one-thirty second inch deep are placed in the solution. After 5 minutes, the sticks are removed and placed on a metal rack suspended over a heat source and dried for about 10 minutes. The temperature at the rack is about 160°F.

Two cups of Columbian coffee are brewed with a FLAVIA coffee machine. Nothing is added to the coffee. Two panelists taste the coffee and use the sticks to stir the coffee in increments of approximately 10 seconds. After each 10-second period the panelists again taste the coffee. After each of the three ten second periods both panelists report an increase in sweetness level in the coffee, the last has a sweetness level equivalent to about 2 teaspoons of sucrose.

Example 2

Devices of the present invention are prepared and their delivery of sweetness to coffee is compared to a control in which the sucralose is added directly to the coffee.

Saturated solutions of sucralose in water are prepared by dissolving the sucralose in water as shown in Table 1.

TABLE 1

<table>
<thead>
<tr>
<th>Sucralose solution</th>
<th>% Sucralose by Weight</th>
<th>Sucralose (g)</th>
<th>Water (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.51</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7.02</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>14.04</td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

Each solution is heated to and maintained at 60°C. A predefined area of a wooden stick as described in Example 1 is then soaked in a solution for 5 minutes by suspension from above. Each body is then dried overnight. This produces three different devices of the present invention. Ten of each of the three devices are prepared in this manner.

As a control, 1 teaspoon of coffee and 2 teaspoons of SPLENDA® Brand No Calorie Sweetener (McNeil Nutritional LLC, Fort Washington, Pa.) are dissolved in hot water at a typical temperature used to brew coffee. For each device of the present invention a cup of coffee is prepared by dissolving one teaspoon of coffee in 300 milliliters of hot water at a temperature typically used to brew coffee.

Each device and a control are individually assessed by ten testers every two seconds for their sweetness over a total of ten seconds. In the case of the control, the time after addition of the SPLENDA® Brand No Calorie Sweetener is indicated. For each of the devices of the invention, the time of stirring with the body is indicated. The results are shown in Table 2.

TABLE 2

| Assessed sweetness over time for control and three devices of the present invention |
|---------------------------------|----------------------------------|------------------|
| Time (sec)                     | Device                          | Sweetness Score  |
| 2                              | 4                                | 6                | 8                | 10                |
| 5% wt Sucralose                | 0.12                             | 0.56             | 0.79             | 1.06              | 1.30              |
| 10% wt Sucralose               | 0.28                             | 3.07             | 3.55             | 4.22              | 4.58              |
| 20% wt Sucralose               | 3.12                             | 2.50             | 3.26             | 3.53              | 3.79              |
| Control                        | 1.92                             | 3.95             | 3.95             | 3.95              | 3.95              |

The sweetness profile for the three devices and the control are also shown in FIG. 11.

Example 3—Comparative Example

The ratio of surface area to length for a square prism-shaped body of the present invention (FIG. 1) is compared to that of a conventional cylindrical stirrer (FIG. 2). The surface area of the top and bottom of the two devices is not included because it is not dependent on length, and generally, has a negligible value compared to the overall surface area of these devices.

Square Prism-Shaped Body

A rectangular prism has a surface area (excluding top and bottom) of:

\[ S = 2(\text{length} \times \text{width}) + 2(\text{length} \times \text{depth}) \]

The square prism-shaped body of this example has a length (z) of 10 inches, a width (x_1 and x_2) of 1 inch, and a depth (y_1 and y_2) of 1 inch. Thus, the surface area of the square prism is:

\[ 2(10 \times 1 \text{ in}) + 2(10 \times 1 \text{ in}) = 40 \text{ in}^2 \]

Accordingly, the ratio of surface area to length is 40:10 or 4:1 for a square prism-shaped body.

Cylindrical Stirrer

A cylindrical stirrer has a surface area of the (excluding the top and bottom) of:

\[ S = \pi \times \text{length} \]

[0091] Each solution is heated to and maintained at 60°C. A predefined area of a wooden stick as described in Example 1 is then soaked in a solution for 5 minutes by suspension from above. Each body is then dried overnight. This produces three different devices of the present invention. Ten of each of the three devices are prepared in this manner.
The cylindrical stirrer of this example has a length of 10 inches and a diameter of 1 inch. Thus, the surface area of the cylindrical stirrer is:

\[ 2\pi (0.5 \text{ in}) (10 \text{ in}) = 31.416 \text{ in}^2 \]

Accordingly, the ratio of surface area to length is 31.416:10 or 3.1416:1 for a cylindrical stirrer.

Example 4

A device for delivering an elutable substance has a body made of wood. The body has a length of approximately 6 inches, a width of approximately one-quarter of an inch, and a depth of one-thirty-second of an inch. 20.1 milligrams of sucralose (3 sucrose equivalent teaspoons of sweetness) is present on one end of the body.

When this device is used to stir a hot beverage, such as coffee, approximately two sucrose equivalent teaspoons of sweetness (13.4 milligrams of sucralose) are delivered with 10 seconds of stirring.

The scope of the present invention is not limited by the description, examples and suggested uses herein and modifications can be made without departing from the spirit of the invention. Thus, it is intended that the present invention cover modifications and variations of this invention provided that they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A device for delivering an elutable substance to a foodstuff comprising an elongate body comprising at least one surface, wherein at least a portion of the surface of the body is porous and the elutable substance affixed to at least a portion of the porous surface.

2. A device according to claim 1, wherein the elutable substance is selected from the group consisting of a high intensity sweetener, a nutritive sweetener, a sugar alcohol, a flavor, a drug substance, a vitamin, a mineral, and combinations thereof.

3. A device according to claim 2, wherein the elutable substance is a high intensity sweetener.

4. A device according to claim 3, wherein the high intensity sweetener is selected from the group consisting of aspartame, acesulfame, alitame, brazzein, cyclamic acid, dihydrochalcones, extract of Dioscorophyllum cumminisii, extract of the fruit of Pentadiplandra brazzeana, glycyrhrizin, hemadulcin, monellin, mogrosid, neotame, neohesperidin, saccharin, sucralose, stevia, thaumatin, salts, derivatives, and combinations thereof.

5. A device according to claim 4, wherein the amount of high intensity sweetener present on the porous surface of the body is sufficient to provide from about one-quarter to 4 teaspoons of sucrose equivalent sweetness.

6. A device according to claim 5, wherein the amount of high intensity sweetener present on the porous surface of the body is sufficient to provide about 3 teaspoons of sucrose equivalent sweetness.

7. A device according to claim 4, wherein the high intensity sweetener is sucralose.

8. A device according to claim 7, wherein the amount of sucralose present on the porous surface of the body is sufficient to provide from about one-quarter to 4 teaspoons of sucrose equivalent sweetness.

9. A device according to claim 8, wherein the amount of sucralose present on the porous surface of the body is sufficient to provide about 3 teaspoons of sucrose equivalent sweetness.

10. A device according to claim 1, wherein at least a portion of the body is made from a material selected from wood, a porous plastic, and a porous mineral material.

11. A device according to claim 10, wherein at least a portion of the body is made from wood.

12. A device according to claim 1, wherein the body comprises a first end and a second end and a plurality of surfaces, such that the body has a length (z) equal to the distance between the first and second ends, a width (x), and a depth (y).

13. A device according to claim 12, wherein the body provides a greater surface area per unit length than a cylindrical-shaped rod having similar dimensions.

14. A device according to claim 12, wherein the body provides greater mixing action than a cylindrical shaped rod having similar dimensions.

15. A device according to claim 12, wherein the length (z), width (x), and depth (y) of the body are defined by the following equations:

\[ x_1 = a_1, y_1 \]
\[ x_2 = a_2, y_2 \]
\[ y_2 = c \cdot y_1 \]
\[ z = b(y_1, a_1, a_2) \]

wherein

- \( x_1 \) and \( y_1 \) are the width and depth, respectively, of the first end of the body;
- \( x_2 \) and \( y_2 \) are the width and depth, respectively, of the second end of the body;
- \( a_1 \) and \( a_2 \) are both from about 0.05 to about 20;
- \( b \) is greater than about 10; and
- \( c \) is not more than 100.

16. A device according to claim 15, wherein \( a_1 \) is from about 0.25 to about 4, \( a_2 \) is from about 0.25 to about 4, \( b \) is about 20, and \( c \) is about 1.

17. A device according to claim 12, wherein the body has a shape that is selected from the group consisting of a triangular prism, a rectangular prism, a pentagonal prism, a hexagonal prism, an octagonal prism, a nonagonal prism, a decagonal prism, an elliptical cylinder, and a spoon.

18. A device according to claim 17, wherein the body is a rectangular prism.

19. A device according to claim 1, wherein the body further comprises:

1. first and second ends and a plurality of sides that separate the first and second ends by a length (L) and radiate out from a central axis running longitudinally through the center of the body; wherein adjacent sides meet in a point and form a star when viewed as a cross-section through a plane perpendicular to the central axis, wherein the length of the body is greater
than a diameter of a circle whose center is bisected by the central axis and whose perimeter lies along the points of the star; or

(2) first and second ends and a plurality of sides that separate the first and second ends by a length (L), wherein a plurality of teeth extend out from a central axis running longitudinally through the center of the body, each tooth comprising at least three adjacent sides of the body that are configured to form at least first and second lateral faces rising from a trough and a forward face interconnecting the lateral faces, the teeth form a gear-like form when viewed as a cross-section through a plane perpendicular to the central axis, and wherein the length of the body is greater than a diameter of a circle whose center is bisected by the central axis and whose perimeter lies along the forward face of each tooth.

20. A device according to claim 19, wherein the length (L) and diameter (d) of the body are defined by the following equations:

\[ 0.01d_1/d_2 < 100 \]
\[ L/(d_1 + d_2/2) > 10 \]

wherein \( d_1 \) is the diameter of a circle of a cross-section at the first end of the body and \( d_2 \) is the diameter of a circle of a cross-section at the second end of the body.

21. A device according to claim 20, wherein \( d_1/d_2 \) is about 1 and \( L/(d_1 + d_2/2) \) is about 20.

22. A device according to claim 19, wherein the dimensions of the body are defined by the following equations:

\[ x_1 = y_1 \]
\[ x_2 = y_2 \]
\[ y = \text{constant} \]
\[ z = b(y_1 + y_2) \]

wherein \( x \) is the distance between two adjacent points of the cross-sectional star or apaxes of the teeth of the cross-sectional gear formed by cross-sections taken at the first and second ends, respectively (a) or the distance between the apaxes of two adjacent teeth of the cross-sectional gear at a cross-section taken at the first and second ends, respectively (b);

\( y_1 \) and \( y_2 \), respectively represent the distance between two points on adjacent sides that form an apex of the star in cross-sectional form with respect to the first and second ends, wherein the two points are equidistant between the apex of the star and the central axis of the body in (a) the distance from the bottom of a trough to the apex of a tooth of a gear in a cross-section taken at the first and second ends of the body, respectively;

\( a_1 \) and \( a_2 \) each equal from about 0.05 to about 20;

\( b \) is greater than about 10; and

\( c \) is up to about 100.

23. A device according to claim 22, wherein \( a_1 \) is from about 0.25 to about 4, \( a_2 \) is from about 0.25 to about 4, \( b \) is about 20, and \( c \) is about 1.

24. A device according to claim 19, wherein a cross-section of the body forms a star having from 1 to 25 points.

25. A device according to claim 24, wherein a cross-section of the body forms a star having from 1 to 6 points.

26. A device according to claim 25, wherein a cross-section of the body forms a star having 3 points.

27. A device according to claim 19, wherein a cross-section of the body forms a gear having 2 to 25 teeth.

28. A device according to claim 27, wherein a cross-section of the body forms a gear having from 2 to 15 teeth.

29. A device according to claim 28, wherein a cross-section of the body forms a gear having 3 teeth.

30. A device according to claim 19, wherein the points of the cross-sectional star or apaxes of the teeth of the cross-sectional gear are of the same length.

31. A device according to claim 19, wherein the points of the cross-sectional star or apaxes of the teeth of the cross-sectional gear are of different lengths.

32. A device according to claim 1, wherein the body further comprises first and second ends, a central axis running longitudinally through the center of the body, and two or more blades that are integrally connected to one of the ends of the body, each blade having a first and second surface and an apex.

33. A device according to claim 32, wherein the dimensions of the body are defined by the following equations:

\[ x = ay \]
\[ z = by \]

wherein

\( x \) is the distance between apaxes of two adjacent blades;\n
\( y \) is the distance between the first and second surfaces of the blades at a point equidistant from the central axis and the apex of the blade;\n
\( z \) is the distance from the first end of the body portion to the second end;\n
\( a \) is from about 1 to about 100; and\n
\( b \) is greater than about 10.

34. A device according to claim 33, wherein \( a \) is about 10 and \( b \) is about 20.

35. A device according to claim 32, wherein the body has from 2 to 8 blades.

36. A device according to claim 35, wherein the body has 3 blades.

37. A device according to claim 1, wherein the body is in the shape of a spiral.

38. A device according to claim 12, wherein the body is hollow along at least a portion of its length.

39. A device according to claim 12, wherein the body is hollow along about one-half of its length.

40. A device for delivering an edible substance to a foodstuff comprising a wooden body in the shape of a rectangular-prism, the body having first and second ends wherein the distance between the first and second ends is about 6 inches, the body further having a width of about one-quarter inch and a depth of about one-thirty-second of an inch, wherein sucrose is disposed on a surface of the body in an amount sufficient to deliver about 3 teaspoons of sucrose-equivalent sweetness to a foodstuff.

41. A method of producing a device for delivering a sweetener comprising:

(a) providing a body having a first end and a second end, wherein at least a part of the body is porous;
(b) contacting at least a portion of the porous part of the body with a solution or slurry comprising an elutable substance dissolved or dispersed in a solvent; and

c) allowing the solution or slurry to dry to a surface of the body of the device, wherein upon contacting a surface of the body of the device with a foodstuff, the sweetener composition is dispersed into the foodstuff.

42. A method according to claim 41, wherein the solution or slurry comprises from about 0.1% to about 30% of the elutable substance by weight.

43. A method according to claim 42, wherein the solution or slurry comprises from about 5% to about 30% of the elutable substance by weight.

44. A method according to claim 43, wherein the solution or slurry comprises from about 15% to about 30% of the elutable substance by weight.

45. A method according to claim 41, wherein at least a portion of the porous part of the body is contacted with the solution or slurry for about 1 minute to about 30 minutes.

46. A method according to claim 45, wherein at least a portion of the porous part of the body is contacted with the solution or slurry for about 5 minutes.

47. A method according to claim 41, wherein at least a portion of the porous part of the body is allowed to dry for about 1 minute to about 30 minutes at a temperature from about 100°F to about 300°F.

48. A method according to claim 47, wherein at least a portion of the porous part of the body is allowed to dry for about 10 minutes at a temperature of about 160°F.

49. A method according to claim 41, wherein the elutable substance is selected from the group consisting of aspartame, acesulfame, alitame, brazzein, cyclamic acid, dihydrochalcones, extract of Dioscorophyllum cumminii, extract of the fruit of Pentadiandra brazzeana, glycyrrhizin, hernandulcin, monellin, mogroside, neotame, neohesperidin, saccharin, sucralose, stevia, thaumatin, salts, derivatives, and combinations thereof.

50. A method according to claim 49, wherein the elutable substance is a high intensity sweetener.

51. A method according to claim 50, wherein the high intensity sweetener is selected from the group consisting of aspartame, acesulfame, alitame, brazzein, cyclamic acid, dihydrochalcones, extract of Dioscorophyllum cumminii, extract of the fruit of Pentadiandra brazzeana, glycyrrhizin, hernandulcin, monellin, mogroside, neotame, neohesperidin, saccharin, sucralose, stevia, thaumatin, salts, derivatives, and combinations thereof.

52. A method according to claim 50, wherein the amount of high intensity sweetener present on a surface of the body is sufficient to provide from about one-quarter to 4 teaspoons of sucrose equivalent sweetness.

53. A method according to claim 52, wherein the amount of high intensity sweetener present on a surface of the body is sufficient to provide about 3 teaspoons of sucrose equivalent sweetness.

54. A method according to claim 50, wherein the high intensity sweetener is sucralose.

55. A method according to claim 54, wherein the solution or slurry comprises about 20% by weight of sucralose.

56. A method according to claim 54, wherein the amount of sucralose present on a surface of the body is sufficient to provide from about one-quarter to 4 teaspoons of sucrose equivalent sweetness.

57. A method according to claim 56, wherein the amount of sucralose present on a surface of the body is sufficient to provide about 3 teaspoons of sucrose equivalent sweetness.

58. A method according to claim 41, wherein the body is made from a material selected from wood, a porous plastic, and a porous mineral material.

59. A method according to claim 58, wherein the body is made from wood.

60. A method according to claim 41, further comprising carrying out step (b) under a pressure greater than atmospheric pressure.

* * * * *