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Use of D-tagatose as synergiser and flavour enhancer

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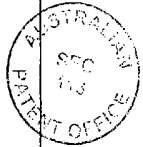
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<p>(21) International Application Number: PCT/DK99/00004 (22) International Filing Date: 5 January 1999 (05.01.99) (30) Priority Data: 60/070,480 5 January 1998 (05.01.98) US (71) Applicant (for all designated States except US): <b>Arla Foods Amba</b> <del>MD-FOODS</del> A.M.B.A. [DK/DK]; Skanderborgvej 277, DK-8260 Viby J (DK). (72) Inventors; and (75) Inventors/Applicants (for US only): ANDERSEN, Henrik [DK/DK]; Skanderborgvej 277, DK-8260 Viby J (DK). VIGH, Mads, L. [DK/DK]; Skanderborgvej 277, DK-8260 Viby J (DK). (74) Agent: HOFMAN-BANG &amp; BOUTARD, LEHMANN &amp; REE A/S; Hans Bekkevolds Allé 7, DK-2900 Hellerup (DK).</p>		<p>(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BI, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report.</p> <div data-bbox="925 862 1212 1041" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>IP AUSTRALIA 27 JUL 1999 RECEIVED</p> </div>
<p>(54) Title: USE OF D-TAGATOSE AS SYNERGISER AND FLAVOUR ENHANCER (57) Abstract D-tagatose is even in small amounts a powerful synergiser for potent sweeteners. Further, it is able to effect improvements in the quality of flavour and taste of the products in which it is used.</p>		



Use of D-tagatose as synergiser and flavour enhancer.

This invention relates to use of D-tagatose to synergise the effect of potent sweeteners used for sweetening of food formulations. D-tagatose is even in very small amounts a powerful synergiser for potent sweeteners. Further, it is able to effect improvements in the quality of taste of the food products in which it is used.

10 D-tagatose is a well-known keto-hexose which is useful as a reduced calorie food sweetening and bulking agent, and as an additive in detergent, cosmetic and pharmaceutical formulations. U.S. Patent Nos. 5,002,612 and 5,078,796 to Beeadle et al. teach processes of making D-tagatose by isomerizing a mixture containing D-galactose with a metal hydroxide in the presence of a catalyst at a relatively low temperature to form an intermediate complex, followed by neutralising with acid to yield D-tagatose.

20 D-tagatose is known as an anti-hyperglycaemic agent that can be used to inhibit formation of advanced glycosylation in products in mammals as described in U.S. Patents 5,356,879 and 5,447,917 to Zehner et al. D-tagatose also is known as a low-calorie carbohydrate sweetener, and bulking agent that can be used in the preparation of sweetened edible formulations in stead of sucrose as taught in U.S. Patent 4,786,722 to Zehner. While the invention has been described with respect to the use of D-tagatose as the sole sweetening agent, also a combination with conventionally used sweetening agents has been proposed, e.g. in combination with a minor amount of sucrose. Furthermore, it has been proposed to use D-tagatose as a bulking and sweetening agent in combination with one of the intensive sweeteners such as aspartame or saccharin. If D-tagatose should be used as sole sweetener in products its use levels will never be below 5%, proba-

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bly rarely under 8% and often 10% or more. As a bulking agent for low calorie sweeteners the use level will be over 15% for bakery products and frozen dairy products, more than 20% for chocolate and 50% for candies. US patent 4,786,722 does not teach the use of D-tagatose for the sensory impact it has on other sweeteners.

The use of low calorie sweeteners, such as potent sweeteners, is common in a variety of food products and beverage formulations. For many consumers, however, it is a problem that they do not like diet or light products sweetened with potent sweeteners because of their mouthfeel and aftertaste.

Attempts have been made over the years to improve the taste delivery of these diet or light products through the addition of small quantities of carbohydrates. Diet beverages may, on occasion, contain small quantities of fructose added to improve the taste delivery. These products generally contain approximately 1 percent fructose. Other products, particularly in Japan, may contain erythritol as an additive to improve other qualities of the food or beverage product beyond its sweetness. For example, other sensory characteristics of a food or beverage product include the flavour, mouthfeel and aftertaste of the product. Efforts have been made to add specific small molecular weight carbohydrates to diet or light beverages in an attempt to improve the sensory delivery.

Efforts continue to identify a low-calorie sweetener to deliver sucrose-identical sensory characteristics in edible food products, and particularly with respect to beverages. Low-calorie potent sweeteners generally permit the development of diet or light products through an ability to elicit sufficient sweetness at a very low con-

centration of the sweetener, but they are generally unable to mimic other sensory characteristics of sucrose, particularly mouthfeel/body. In addition, artificial sweeteners to date have not been able to deliver the  
5 full, rounded, sweetness typical of sucrose and other small molecular weight carbohydrates. Accordingly, there is a continuing need to identify a low-calorie sweetener which provides both the sweetness characteristics of sucrose and other important sensory characteristics such as  
10 mouthfeel, flavour, and aftertaste.

It has now been found that D-tagatose is not only able to effect flavour improvements in the quality of food and beverage formulations, particularly in diet/light beverages, but that its use is highly synergistic with potent  
15 sweeteners. The synergistic effect of D-tagatose with low calorie potent sweeteners is present even at very low addition rates. The use of D-tagatose is able to replace significant quantities of potent sweeteners, even when it  
20 is added at concentrations well below its measured sweet taste threshold.

Not only does the use of D-tagatose have benefits in diet or light beverages from a synergy standpoint, other important qualitative benefits from the use of D-tagatose  
25 can be realised in these types of products. Subtle, but consistent, benefits have been observed through the use of D-tagatose with respect to flavour, aftertaste, and mouthfeel of beverages containing as little as 0.2% D-tagatose.  
30

Thus the invention relates to the use of D-tagatose both as a synergiser and as a flavour enhancer for potent sweeteners.

The benefits of the use of D-tagatose with one or more potent sweeteners can be realised with concentrations of D-tagatose of about 0.01 to about 5% weight/volume based on the total composition. The amount of potent sweetener  
5 in the total composition will typically range from about 5 ppm to about 4000 ppm (mg/kg of total composition) depending on the sweetener used. The weight ratio of D-tagatose to potent sweetener in the sweetener composition according to the present invention ranges from 1:5 to  
10 10,000:1. The particular ratio selected is dependent on the potent sweetener(s) used and the desired level of sweetness and other sensory characteristics. The use of D-tagatose also has been shown to provide benefits as a component in table-top sweetener formulations containing  
15 a potent sweetener.

Synergistic combinations of sweeteners including D-tagatose can be obtained by using about 0.01 to about 5.0% (w/v), preferably from about 0.05 to 2% (w/v), and  
20 most preferably from about 0.1 to about 1% (w/v) of D-tagatose. The amount will depend on the desired level of both sweetness and other sensory characteristics including mouthfeel, aftertaste, and flavour.

25 The beneficial effects of this invention can be realised when D-tagatose is used in conjunction with one or more potent sweeteners. These potent sweeteners are well known in the art and are sometimes referred to as high intensity sweeteners. Potent sweeteners include  
30 cyclamate, saccharin, aspartame, acesulfame-K, neohesperidin dihydrochalcone, glycyrrhizin, rebaudioside, mogroside, monellin, thaumatin, alitame, neotame, stevioside and sucralose. The potent sweeteners can be used as sole potent sweetener or as a mixture of  
35 more potent sweeteners, usually two or three. It is



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preferably a mixture of aspartame, acesulfame-K and cyclamate.

5 The desired weight ratio of D-tagatose to potent sweetener(s) will depend on the sweetener or sweetener combination, and the sweetness and other characteristics desired in the final product. Potent sweeteners vary greatly in their potency, ranging from about 30x sucrose for cyclamate to about 8000x sucrose for neotame. In  
10 general, the weight ratio of D-tagatose to potent sweetener in the sweetener composition according to the present invention will range between 1:5 and 10,000 : 1 , typically between 1:1 and 1000:1, and preferably between 4:1 and 200:1, depending on the particular potent  
15 sweetener(s) selected. Thus, if D-tagatose is blended with cyclamate, and D-tagatose was added to a beverage in an amount of 0.2% (w/v), approximately the same amount of cyclamate would be required to deliver an acceptable amount of sweetness. In this case, a ratio of 1:1 would  
20 be appropriate. If D-tagatose was combined with neotame in an amount of 1% (w/v) of the total composition, the concentration of neotame required for similar sweetness levels would be about 0.001%, or a ratio of 1000:1.

25 Other ratios that are suitable for other potent sweeteners within the scope of the present invention will be apparent to those skilled in the art. Taking acesulfame-K, for example, at about 150x sucrose, 0.05% D-tagatose may be combined with 0.05% acesulfame-K (1:1  
30 ratio), or 5.0% D-tagatose may be combined with 0.01% acesulfame-K (500:1 ratio). For aspartame at about 200x sucrose, 0.05% D-tagatose may be combined with 0.04% aspartame (ratio of 1.25:1), or 5% D-tagatose with 0.01% aspartame (500:1 ratio). The ratio between D-tagatose and  
35 aspartame or acesulfame-K is about 1:1 to about 500:1, preferably about 4:1 to about 200:1. For sucralose at



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about 600x sucrose, 0.05% D-tagatose could be used with 0.02% sucralose (2.5:1 ratio) or 5% D-tagatose could be used with 0.005% sucralose (1000:1 ratio). For alitame at about 2000x sucrose, 0.05% D-tagatose would be  
5 combined with 0.005% alitame (10:1 ratio) or 5% D-tagatose would be combined with 0.0025% alitame ((2000:1) ratio. As is evident from these exemplary ratios, reducing the amount of D-tagatose from 5% generally will require the amount of potent sweetener to be increased.

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Similarly, the amount of the components of the sweetener composition in an edible food product will vary depending on the potent sweetener used and the sweetness and other characteristics desired in the final product. In a  
15 typical beverage formulation, for example, at 5% D-tagatose, a concentration of about 5 ppm of potent sweeteners such as thaumatin, alitame or neotame would be suitable. If the potent sweetener were cyclamate, at 5% D-tagatose, the cyclamate would suitably be present at  
20 500 ppm. With D-tagatose present at 0.1%, the concentrations of these potent sweeteners would be present at a concentration of about 10 ppm and 1,000 ppm respectively. Determination of appropriate concentrations to achieve results consistent with the  
25 teachings of this invention is within the skill of the art.

When D-tagatose is used in conjunction with one or more potent sweeteners, it has been observed that it is able  
30 to replace significant quantities of those other sweeteners, even when it is added at concentrations well below its measured sweet taste threshold. A surprising amount of potent sweetener saving is made possible by the use of D-tagatose, much more than would be expected given  
35 its sweetness intensity at the level of use.



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A sweetener composition according to the present invention can be used with a great variety edible products including fruit, dairy products, a variety of beverages including juices and carbonated beverages, bakery products, confections, and the like. For example, it can be added to a beverage formulation to obtain the desired balance of sweetness and other sensory characteristics of the beverage. The use of D-tagatose in combination with a potent sweetener is particularly effective in improving the mouthfeel of a beverage. In using the sweetening composition according to the present invention, it may be incorporated in the edible food product to be sweetened in any appropriate manner. For example, it may be added directly to the product to be sweetened or it may be first combined with a diluent and then added to the product or any component of the ultimate product at any stage in the manufacturing process.

Therefore, the invention concerns an additive for sweetening and improving the mouthfeel of a beverage containing D-tagatose and at least one of the mentioned sweeteners. The beverage can for example be soft drinks, coffee, tee and chocolate. A special effect is seen in a soft drink by adding an additive of the invention in such an amount that the concentration of D-tagatose in the soft drink is 0.01 to 5.0 percent, preferred 0.5 to 2.0 percent and most preferred 0.1 to 1.0 percent by weight/volume.

In order to demonstrate the synergistic effects and other benefits derived from the use of D-tagatose in combination with one or more potent sweeteners, several experiments were performed.



Experiment 1

Sweetness Equivalence Of D-tagatose Relative To Aspartame

5 The sweetness of D-tagatose relative to aspartame was determined according to the following procedure.

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A group of six panellists were presented with a range of aspartame standard and a randomly coded solution containing D-tagatose. The panellists were asked to taste the randomly coded solution and estimate that sweetness relative to the standards. Each concentration of D-tagatose was tested in duplicate.

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The following concentrations of D-tagatose were evaluated compared to aspartame:

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D-Tagatose, %	Sweetness Equivalence Aspartame, ppm
0.00	0
0.20	17
0.40	21
0.60	28
0.80	38
1.00	43

### Experiment 2

5

As will be described below, the quantitative sweetness synergy that can be achieved by mixing D-tagatose with aspartame and a combination of aspartame and acesulfame-K mixtures was first estimated. These mixtures were then used in conjunction with typical beverage flavour systems (cola and lemon/lime) where, in addition to quantifying the sweetness synergy, determinations were made of the impact on product mouthfeel, flavour and aftertaste.

10

15 Materials used in this experiment, the procedures used, and the results obtained are reported below:

#### (i) Model Beverage System

20 The model system in which this Phase of the experiment was conducted is a simple citrate buffer formulated at pH 3.2. The formulation was as follows:

Citric acid (anhydrous)	0.14g
25 Trisodium citrate	0.04g
Water	to 100 ml

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This model system was selected because of its relevance to beverage formulations, while not being subject to the sensory complications induced by added flavours.

5 (ii) Formulated Beverage Compositions

(a) Lemon and Lime Formulation

Ingredients	% (RTD = ready to drink)
Citric acid	0.310
10 Lemon/lime flavour	0.085
Sodium citrate	0.031
Sodium benzoate	0.018
Sweeteners	see below
Water	to 100%

15

Reference Sweetener Blends

Aspartame	550ppm
Aspartame	200ppm
Acesulfame-K	200ppm

20

(b) Cola Formulation

Ingredients	% (RTD)
Cola flavour:	0.340
Phosphoric acid (85%)	0.100
25 Sodium citrate	0.031
Sodium benzoate	0.018
Citric acid	0.018
Sweeteners	see below
Water	to 100%

30

Reference Sweetener Blends

Aspartame	525ppm
Aspartame	600ppw
Acesulfame-K	50ppm

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(iii) Sensory Procedures

The sensory procedures adopted in this experiment utilised panellists fully experienced in standard sensory evaluation procedures who had been screened for their sensory acuity and ability to rank different sweetener concentrations according to their relative sweetness intensities.

Equi-sweetness concentrations of all solutions were established using an established sweetness matching procedure. This procedure involved the sweetness intensity comparison of, for example, a reference 11% sucrose model soft drink buffer against that of a series of sweetener test solutions whose sweetener concentrations differed in a step-wise manner and the subsequent identification of that test product whose sweetness intensity matched precisely the sweetness of the reference solution. Evaluations were carried out in duplicate, with appropriate standard controls employed to eliminate such effects as adaptation, carry-over and order effects.

Qualitative effects of adding D-tagatose to near-market beverages were described by reference to the equi-sweet control beverages. Panellists were instructed to comment on any differences between reference and test products in sweetness impact, time-intensity profile, mouthfeel, after-tastes including bitterness, degree of lingering sweetness and overall taste quality and acceptability.

There are no generally accepted sensory methods designed to qualify "mouthfeel". However, the following approach was adopted so as to derive an estimate of the impact of D-tagatose addition on the mouthfeel of 'diet' beverages.

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Reference cola and lemon/lime beverages sweetened with sucrose (11 %; w/v) and sodium saccharin (0.040%; w/v) were accorded mouthfeel intensity scores of 10 and 1, respectively. Panellists were then instructed to score the mouthfeel of test beverages relative to these reference beverages. Mouthfeel values recorded represent the average scores of all panellists.

(iv) Sweetener Concentrations

10

The concentrations of the following sweeteners equi-sweet to 11% sucrose in the model beverage system were established:

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aspartame;  
aspartame:acesulfame-K (1:1);  
aspartame:acesulfame-K(2:1);  
aspartame:acesulfame-K (12:1);

20

Sucrose at 11% was used as reference standard due to it being a general average sweetness equivalence for North American beverages.

25

D-Tagatose was added at 0.2%, 0.5%, 1.0% and 1.5%, while simultaneously reducing the concentration of the low-calorie sweeteners so that equi-sweetness was maintained. These concentrations were selected so as to span the likely maximum use level.

30

These findings were then applied to fully formulated beverages prepared to be close appropriations of commercial beverage products. Cola and lemon/lime carbonated beverage formulations were developed and sweetened with market relevant sweetening systems, as follows:

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Diet/Light Cola	Aspartame
	Aspartame:acesulfame-K
Diet/Light Lemon/Lime	Aspartame
	Aspartame:acesulfame-K

5

The concentrations of D-tagatose identified from the model system study as inducing beneficial sweetness synergy and sweet taste quality effects were added and the level of potent sweetener adjusted to ensure equi-sweetness. The overall taste quality of the reference products and those which contained D-tagatose were compared.

The sensory impact of D-tagatose addition to the model system and formulated beverages is presented in the following Tables.

In Table 1, equi-sweet sweetener concentrations are presented. As the concentration of D-tagatose is increased, the amount of low-calorie sweetener needed to maintain equi-sweetness is reduced. The reduction is larger than expected from Experiment 1. It is noted, for example, that 0.2% D-tagatose is able to replace 50 ppm aspartame, where 17 ppm was expected, and 1% D-tagatose spares 170 ppm aspartame, where 43 was expected. Thus, it is clear that there is substantial synergy between D-tagatose and aspartame.

The performance of D-tagatose in fully formulated cola and lemon/lime beverages is presented in Table 2. Again, equi-sweet concentrations were determined following addition of 1.0% and 0.2% D-tagatose.

The sensory effects following D-tagatose addition to formulated beverages are described in Tables 3-6. Panel-

lists evaluated the effects of two levels of D-tagatose on "flavour", "aftertaste" and "mouthfeel" attributes.

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TABLE 1  
 Model Soft Drink System: Blends Equi-sweet To 11% Sucrose

Sweetener Blend Concentration (ppm)	Concentration of D-Tagatose (% w/v)				
	0.0%	0.2%	0.5%	1.0%	1.5%
APM	610	560	515	440	375
APM: Ace-K 1:1	170:170	155:155	140:140	130:130	115:115
APM: Ace-K 2:1	230:115	205:102.5	185:92.5	160:80	140:70
APM: Ace-K 12:1	445:37.1	420:35.0	405:33.8	360:30	360:30

TABLE 2  
Sweetness Synergy of Blends In Soft Drink Formulations  
A. Lemon/Lime

Sweetener Blend	Reference Concentration (ppm)	Concentration Of D-Tagatose	
		0.2%	1.0%
APM	550	506	395
APM: Ace-K 1:1	200:200	182:182	153:153

5

B. Cola

Sweetener Blend	Reference Concentration (ppm)	Concentration Of D-Tagatose	
		0.2%	1.0%
APM	525	483	375
APM: Ace-K 12:1	600:50	564:47	526:43.8

TABLE 3  
Sensory Evaluation of Aspartame Sweetened, Lemon/Lime Beverage

Code	Concentration of D-Tagatose $\frac{\text{g}}{\text{g}}$	Comments			Mouth-feel Score
		Flavour	Aftertaste	Mouthfeel	
Reference		Sharp fresh flavour, slightly "peely" in nature.	Slight bitterness in aftertaste.	Quite full.	8
	0.2	Fresher, cleaner flavour profile. More depth of flavour.	Cleaner aftertaste with no bitterness.	Comparable to the reference.	8
	1.0	Fresher flavour profile. More acidic.	Very clean, no bitterness.	Warmer and fuller than the reference and fully sucrose sweetened product.	12

TABLE 4. Sensory Evaluation of Aspartame: Acesulfame-K Sweetened Lemon/Line Beverage

Code	Concentration of D-Tagatose	Comments			Mouthfeel Score
		Flavour	Aftertaste	Mouthfeel	
Reference		Sharp, oily flavour.	Lingering sweetness in aftertaste. Also bitter, drying and metallic.	Not as full as aspartame reference.	5.5
	0.2	Fresher, sharper and fuller flavoured than reference.	Cleaner and less metallic aftertaste.	Fuller than the reference.	7
	1.0	More rounded, less peaky flavour profile. More acidic.	Still slightly bitter but the bitterness is more integrated into the flavour profile.	Fuller and warmer than the reference and fully sucrose sweetened product.	11

TABLE 5  
Sensory Evaluation of Aspartame Sweetened Cola Beverage

Code	Concentration of D-Tagatose %	Comments			Mouthfeel Score
		Flavour	Aftertaste	Mouthfeel	
Reference		Sweet, phosphoric flavour.	Some lingering sweetness in aftertaste.	Acceptable.	6.5
	0.2	Flat flavoured. More lemony than the reference.	Similar to reference.	Fuller than the reference.	7.5
	1.0	Sharper and spicier than the reference.	Similar to reference.	Fuller than the reference.	8.5

TABLE 6  
Sensory Evaluation of Aspartame:Acesulfame-K (12:1) Sweetened Cola Beverage

Code	Concentration of D-Tagatose §	Comments			Mouthfeel Score
		Flavour	Aftertaste	Mouthfeel	
Reference		Very sweet. Fuller, spicier cola flavour than the aspartame reference.	Lingering sweetness in aftertaste.	Quite full, possibly due to the sweetness intensity.	8
	0.2	Sharper and more acidic. Less sickly sweet. More balanced flavour and sweetness.	Less lingering sweetness. Very slightly drying.	Fuller than the reference.	10
	1.0	More rounded and balanced flavour profile.	Cleaner aftertaste with less lingering sweetness.	Slightly more mouthfeel than the reference.	8.5

On the basis of this experiment, it can be concluded that D-tagatose induces some remarkable sensory effects when blended with potent sweeteners. D-tagatose appears to enhance sweetness in a unique manner. Addition of levels  
5 as low as 1%, at which concentration D-tagatose is barely sweet, effect a 20-25% reduction in the concentration of aspartame needed to maintain unchanged the perceived sweetness levels in beverage formulations. Even the addition of 0.2% D-tagatose has been observed to permit an  
10 almost 10% reduction in the concentration level of aspartame. This co-operation appears to be unique since such low levels of additional sweetness induce such a significant effect on perceived sweetness levels.

15 In addition to sweetness, other benefits are derived from the use of D-tagatose. For example, at 0.2% addition to beverages, it generally exhibits a positive effect on product mouthfeel. Panellists consistently referred to the test product as having a mouthfeel perceived to be  
20 fuller than the equivalent reference beverage. Since absence of mouthfeel is generally considered to be a consequence of the use of potent sweeteners as substitutes for sucrose/high fructose syrups, it provides one way of addressing what has been considered a strong negative to  
25 consumers of diet or light beverages.

It has been found that D-tagatose, when added to 'diet' beverages at concentrations as low as 0.2% where this increase in soluble solids, by itself, is not sufficient  
30 to cause any perceived increase in mouthfeel, enhances the perceived mouthfeel and body of such diet beverages. This enhanced mouthfeel and body is thought to be due, at least in part, to the ability of D-tagatose to convert the overall taste profile of diet beverages closer to  
35 those of regular, full-calorie beverages in keeping with a sweetness profile closer to that of sucrose. Accord-

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ingly, the mouthfeel and body of a D-tagatose containing beverage is also closer to that of a sucrose sweetened beverage.

- 5 Additional experiments have been performed to further evaluate the sensory consequences of incorporating D-tagatose into beverages and table-top sweeteners.

While the above embodiments of the present invention are  
10 illustrative, it can be readily appreciated that it would be possible to deviate from those embodiments of the present invention without departing from the spirit of the invention. As will be readily understood by those skilled in the art, the invention is capable of many  
15 modifications and improvements within the scope and spirit thereof. Accordingly, it will be understood that the invention is not to be limited by the specific embodiments but only by the scope of the appended claims.

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The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that that prior art forms part of the common general knowledge in Australia.

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Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or  
10 step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Use of 5.0% or less of D-tagatose to synergise the effect of a potent sweetener or a mixture of potent sweeteners.  
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2. Use of 5.0% or less of D-tagatose as a flavour enhancer for a potent sweetener or a mixture of potent sweeteners.
3. Use according to claim 1 or 2, characterised in that D-tagatose is used in an amount so that the weight ratio between D-tagatose and potent sweetener is about 1:5 to about 10,000:1.  
10
4. Use according to claim 3, characterised in that weight ratio between D-tagatose and potent sweetener is 1:1 to 1,000:1.  
15
5. Use according to claim 1 or 2, characterized in that the potent sweetener is selected from the group consisting of aspartame, acesulfame-K, saccharin, cyclamate, thaumatin, alitame, neotame, stevioside, sucralose, neohesperidin, dihydrochalcone, glycyrrhizin, rebaudioside, mogroside and monellin and a mixtures thereof.  
20
6. Use according to claim 1 or 2, characterised in that the potent sweetener is a binary or tertiary mixture.
- 25 7. Use according to claim 5, characterised in that the potent sweetener is aspartame.
8. Use according to claim 5, characterised in that the potent sweetener is acesulfame-K.



9. Use according to claim 5, characterised in that the potent sweetener is alitame.
10. Use according to claim 5, characterised in that the potent sweetener is cyclamate.
- 5 11. Use according to claim 5, characterised in that the potent sweetener is neotame.
12. Use according to claim 5, characterised in that the potent sweetener is saccharin.
- 10 13. Use according to claim 5, characterised in that the potent sweetener is sucralose.
14. Use according to claim 6, characterised in that the potent sweetener is a mixture of aspartame and acesulfame-K.
- 15 15. Use according to claim 6, characterised in that the potent sweetener is a mixture of aspartame, acesulfame-K and cyclamate.
16. Use according to claim 7, characterised in that the ratio between D-tagatose and aspartame is about 1:1 to about 500:1.
- 20 17. Use according to claim 16 wherein the ratio between D-tagatose and aspartame is about 4:1 to about 200:1.
18. Use according to claim 8, characterised in that the ratio between D-tagatose and acesulfame-K is about 1:1 to about 500:1.
- 25 19. Use according to claim 18 wherein the ratio is between D-tagatose and acesulfame-K is about 4:1 to about



200:1.

20. Use according to any one of the preceding claims in a liquid in such an amount that the concentration of D-tagatose in the liquid is 0.01 to 5.0 percent by weight/volume.
21. Use according to claim 20 in such an amount that the concentration of D-tagatose in the liquid is 0.05 to 2.0 percent.
22. Use according to claim 21 wherein the concentration of D-tagatose in the liquid is 0.1 to 1.0 percent by weight/volume.
23. Use according to claim 20 or 21, characterised in that the liquid is a beverage.
24. Use according to claim 23, characterised in that the beverage is a diet cola.
25. Use according to any one of the preceding claims of a sweetener composition comprising D-tagatose and at least one potent sweetener in a beverage in such an amount that the concentration of D-tagatose in the liquid is 0.01 to 5.0 percent by weight/volume.
26. Use according to claim 25 in a beverage in such an amount that the concentration of D-tagatose in the beverage is 0.05 to 2.0 percent.
27. Use according to claim 26 wherein the D-tagatose in the beverage is 0.1 to 1.0 percent by weight/volume.
28. An additive for sweetening and improving the mouth-feel



of a beverage, characterised in that it is a composition comprising 5.0% or less of D-tagatose and at least one potent sweetener.

- 5 29. An additive according to claim 28, characterised in that weight ratio between D-tagatose and potent sweetener is about 1:5 to about 10,000:1.
30. An additive according to claim 29, characterised in that weight ratio between D-tagatose and potent sweetener is about 1:1 to about 1,000:1.
- 10 31. An additive according to claim 28, characterised in that the potent sweetener is selected from the group consisting of aspartame, acesulfame-K, saccharin, cyclamate, thaumatin, alitame, neotame, stevioside, sucralose, neohesperidin, dihydrochalcone, 15 glycyrrhizin, rebaudioside, mogroside and monellin and a mixtures thereof.
32. An additive according to claim 28, characterised in that the potent sweetener is a binary or a tertiary mixture.
- 20 33. An additive according to claim 28, characterised in that the potent sweetener is aspartame.
34. An additive according to claim 28, characterised in that the potent sweetener is acesulfame-K.
- 25 35. An additive according to claim 28, characterised in that the potent sweetener is alitame.
36. An additive according to claim 28, characterised in that the potent sweetener is cyclamate.



37. An additive according to claim 28, characterised in that the potent sweetener is neotame.
38. An additive according to claim 28, characterised in that the potent sweetener is saccharin.
- 5 39. An additive according to claim 28, characterised in that the potent sweetener is sucralose.
40. An additive according to claim 32, characterised in that the potent sweetener is a mixture of aspartame and acesulfame-K.
- 10 41. An additive according to claim 32, characterised in that the potent sweetener is a mixture of aspartame, acesulfame-K and cyclamate.
42. An additive according to claim 33, characterised in that the ratio between D-tagatose and aspartame is about 1:1 to about 500:1.
- 15 43. An additive according to claim 42 wherein the ratio between D-tagatose and aspartame is about 4:1 to about 200:1.
44. An additive according to claim 34, characterised in that the ratio between D-tagatose and acesulfame-K is about 1:1 to about 500:1.
- 20 45. An additive according to claim 44 wherein the ratio between D-tagatose and acesulfame-K is about 4:1 to about 200:1.
- 25 46. An additive according to any one of claims 28 to 45, characterised in that the beverage is selected from the



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group consisting of soft drinks, coffee, tea or chocolate.

47. A Soft drink, characterised in that it contains an additive according to any one of claims 28 to 45 in such an amount that the amount of D-tagatose is 0.01 to 5.0% by weight/volume.
48. A soft drink according to claim 47 wherein the amount of D-tagatose is 0.5 to 2.0 percent by weight/volume.
49. A soft drink according to claim 48 wherein the amount of D-tagatose is 0.1 to 1.0 percent by weight/volume.

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