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(54) **STEVIOL GLYCOSIDE FORMULATIONS FOR FOOD AND BEVERAGES**

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(57) **ABSTRACT**

The present disclosure relates, at least in part to, the improvement of beverages and food items through utilization of rebaudioside blends that can provide optimal sweetness and taste. These sweetener formulations are similar in taste to sucrose and can allow for up to a 100% reduction in sucrose and other caloric sugars in food and beverage products.

Specification includes a Sequence Listing.

Blend 2					
	Usage/100 ml			100% Weight Composition	
Reb A 99%	0.0373			54.6920821	
Reb M 95%	0.0048			7.03812317	
Reb D 95%	0.01			14.6627566	
Reb E 95%	0.0131			19.2082111	
Reb I 95%	0.003			4.39882698	
Usage Rate	0.06820			100	
	1466.27566				
	Max Usage		PPM	100% Blend	
Reb A 99%	0.0373		373 ppm	54.69	
Reb M 95%	0.0048		48 ppm	7.04	
Reb D 95%	0.01		100 ppm	14.66	
Reb E 85%	0.0131		131 ppm	19.21	
Reb I 95%	0.003		30 ppm	4.40	
				100.00	
Replaces 100% Sugar Up to 12 Bx	682 ppm		Max Dosage		

Lemon Water
Full Sugar

	100 ml		1 Liter		Ranges
Sugar	8.79	g	87.9	g	0.9-13%
Sodium Benzoate	0.015	g	0.15	g	0.002-0.05%
Potassium Sorbate	0.015	g	0.15	g	0.002-0.05%
Citric Acid	0.12		1.2		0.002-0.50%
Natural Lemon Flavor	0.1	ml	1	ml	0.005-0.50%
Water	94.27736	ml	942.7736	ml	85-99%
			1000	ml	

FIG. 1A

Lemon Water
Zero Calorie, Reb M 95%

	100 ml		1 Liter		Ranges
Reb M 95%	0.033	g	0.33	g	0.001-0.05%
Sodium Benzoate	0.015	g	0.15	g	0.002-0.5%
Potassium Sorbate	0.015	g	0.15	g	0.002-0.05%
Citric Acid	0.12		1.2		0.002-0.50%
Natural Lemon Flavor	0.1	ml	1	ml	0.005-0.50%
Water	99.78491	ml	997.8491	ml	89-99.8%
			1000	ml	

FIG. 1B

Lemon Water

Zero Calorie, Reb D 95%

	100 ml		1 Liter		Ranges
Reb D 95%	0.03	g	0.3	g	0.001-0.05%
Sodium Benzoate	0.015	g	0.15	g	0.002-0.05%
Potassium Sorbate	0.015	g	0.15	g	0.002-0.05%
Citric Acid	0.12		1.2		0.002-0.50%
Natural Lemon Flavor	0.1	ml	1	ml	0.005-0.50%
Water	99.78679	ml	997.8679	ml	89-99.8%
			1000	ml	

FIG. 1C

Lemon Water

Zero Calorie, Blend 2

	100 ml		1 Liter		Ranges
Blend 2	0.06	g	0.6	g	0.001-0.0682%
Sodium Benzoate	0.015	g	0.15	g	0.002-0.05%
Potassium Sorbate	0.015	g	0.15	g	0.002-0.05%
Citric Acid	0.12		1.2		0.002-0.50%
Natural Lemon Flavor	0.1	ml	1	ml	0.005-0.50%
Water	99.76792	ml	997.6792	ml	89-99.8%
			1000	ml	

FIG. 1D

Cola
Full Sugar

Ingredients	Usage				1 Liter		
Caffeine Anhydrous	0.0096	g	0.0096	g	0.096	g	0.001-0.02%
Potassium Benzoate	0.004	g	0.0040	g	0.04	g	0.0005-0.01%
Sucrose	9.86	g	9.8600	g	98.6	g	2-16%
			0.0000				
			0.0000				
Phosphoric Acid 85%	0.03	ml	0.0300	ml	0.3	ml	0.002-0.07%
Nat Cola Flavor	0.1	ml	0.1000	ml	1	ml	0.002-0.50%
			0.0000				
Caramel Color	0.05	ml	0.0500	ml	0.5	ml	0-0.15%
			0.0000				
Carbonated Water	93.6101887		93.6102	ml	936.1019	ml	80-98%
					1000	ml	

FIG. 2A

Cola
80% Reduced Sugar, Reb M 95%

Ingredients	Usage				1 Liter		Ranges
Caffeine Anhydrous	0.0096	g	0.0096	g	0.096	g	0.001-0.02%
Potassium Benzoate	0.004	g	0.0040	g	0.04	g	0.0005-0.01%
Sucrose	1.914	g	1.9140	g	19.14	g	0-8.5%
Reb M 95%	0.033	g	0.0330	g	0.33	g	0.001-0.05%
Phosphoric Acid 85%	0.03	ml	0.0300	ml	0.3	ml	0.002-0.07%
Nat Cola Flavor	0.1	ml	0.1000	ml	1	ml	0.002-0.50%
Caramel Color	0.05	ml	0.0500	ml	0.5	ml	0-0.15%
Carbonated Water	98.5869182		98.5869	ml	985.8692	ml	88-99%
					1000	ml	

FIG. 2B

Cola

80% Reduced Sugar, Reb D 95%

Ingredients	Usage				1 Liter		Ranges
Caffeine Anhydrous	0.0096	g	0.0096	g	0.096	g	0.001-0.02%
Potassium Benzoate	0.004	g	0.0040	g	0.04	g	0.0005-0.01%
Sucrose	1.914	g	1.9140	g	19.14	g	0-8.5%
Reb D 95%	0.028	g	0.0280	g	0.28	g	0.001-0.05%
Phosphoric Acid 85%	0.03	ml	0.0300	ml	0.3	ml	0.002-0.07%
Nat Cola Flavor	0.1	ml	0.1000	ml	1	ml	0.002-0.50%
Caramel Color	0.05	ml	0.0500	ml	0.5	ml	0-0.15%
Carbonated Water	98.5900629		98.5901	ml	985.9006	ml	88-99%
					1000	ml	

FIG. 2C

Cola

80% Reduced Sugar, Blend 2

Ingredients	Usage				1 Liter		Ranges
Caffeine Anhydrous	0.0096	g	0.0096	g	0.096	g	0.001-0.02%
Potassium Benzoate	0.004	g	0.0040	g	0.04	g	0.0005-0.01%
Sucrose	0	g	0.0000	g	0	g	0-8.5%
Blend 2	0.0682	g	0.0682	g	0.682	g	0.001-0.06825%
Phosphoric Acid 85%	0.03	ml	0.0300	ml	0.3	ml	0.002-0.07%
Nat Cola Flavor	0.1	ml	0.1000	ml	1	ml	0.002-0.50%
Caramel Color	0.05	ml	0.0500	ml	0.5	ml	0-0.15%
Carbonated Water	98.7685535		99.7686	ml	997.6855	ml	88-99%
					1000	ml	

FIG. 2D

Orange Soda

Full Sugar

Ingredients	Usage				1 Liter		Ranges
Sodium Benzoate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Sucrose	9.86	g	9.8600	g	98.6	g	2-16%
Potassium Sorbate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Citric Acid	0.12	g	0.1200	g	1.2	g	0.002-0.50%
Natural Orange Flavor	0.1	ml	0.1000	ml	1	ml	0.005-0.50%
Yellow #5 1.00% w/w water	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Red #40 1.0% w/w water	0.05	ml	0.0500	ml	0.5	ml	0.0001-0.25%
Natural Cloud Emulsion	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Carbonated Water	98.7685535		93.3544	ml	933.544 / 1000	ml / ml	68-98%

FIG. 3A

Orange Soda
Zero Calorie, Reb M 95%

Ingredients	Usage				1 Liter		Rangers
Sodium Benzoate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Reb M 95%	0.035	g	0.0350	g	0.35	g	0.001-0.05%
Potassium Sorbate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Citric Acid	0.12	g	0.1200	g	1.2	g	0.002-0.50%
Natural Orange Flavor	0.1	ml	0.1000	ml	1	ml	0.005-0.50%
Yellow #5 1.00% w/w water	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Red #40 1.00% w/w water	0.05	ml	0.0500	ml	0.5	ml	0.001-0.25%
Natural Cloud Emulsion	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Carbonated Water	99.5336478		99.5336	ml	995.3365 / 1000	ml / ml	87-99.8%

FIG. 3B

Orange Soda
Zero Calorie, Reb D 95%

Ingredients	Usage				1 Liter		Ranges
Sodium Benzoate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Reb D 95%	0.03	g	0.0300	g	0.3	g	0.001-0.05%
Potassium Sorbate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Citric Acid	0.12	g	0.1200	g	1.2	g	0.002-0.50%
Natural Orange Flavor	0.1	ml	0.1000	ml	1	ml	0.005-0.50%
Yellow #5 1.00% w/w water	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Red #40 1.00% w/w water	005	ml	0.0500	ml	0.5	ml	0.001-0.25%
Natural Cloud Emulsion	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Carbonated Water	99.5336478		99.5368	ml	995.3679 / 1000	ml / ml	87-99.8%

FIG. 3C

Orange Soda
Zero Calorie, Blend 2

Ingredients	Usage				1 Liter		Ranges
Sodium Benzoate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Blend 2	0.0682	g	0.0682	g	0.682	g	0.001-0682%
Potassium Sorbate	0.015	g	0.0150	g	0.15	g	0.0005-0.01%
Citric Acid	0.12	g	0.1200	g	1.2	g	0.002-0.50%
Natural Orange Flavor	0.1	ml	0.1000	ml	1	ml	0.005-0.50%
Yellow #5 1.00% w/w water	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Red #40 1.00% w/w water	0.05	ml	0.0500	ml	0.5	ml	0.001-0.25%
Natural Cloud Emulsion	0.1	ml	0.1000	ml	1	ml	0.001-0.50%
Carbonated Water	99.5127673		99.5128	ml	995.1277 / 1000	ml / ml	87-99.8%

FIG. 3D

Chocolate Milk
Full Suger

	100 mls		1 Liter		Ranges
Sucrose	7.15	g	71.9	g	2-13%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4%
2% Milk	94.89308	ml	948.9308	ml	80-99%
			1000	ml	

FIG. 4A

Chocolate Milk
60% Reduced Sugar, Reb M 95%

	100 mls		1 Liter		Ranges
Sucrose	2.88	g	28.8	g	0-12%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Reb M 95%	0.03	g	0.3	g	0.001-0.05%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4%
2% Milk	97.58491	ml	975.8491	ml	85-99%
			1000	ml	

FIG. 4B

Chocolate Milk
60% Reduced Sugar, Reb D 95%

	100 mls		1 Liter		Ranges
Sucrose	2.88	g	28.8	g	0-12%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Reb D 95%	0.03	g	0.3	g	0.001-0.05%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4%
2% Milk	97.58491	ml	975.8491	ml	85-99%
			1000	ml	

FIG. 4C

Chocolate Milk
60% Reduced Sugar, Blend 2

	100 mls		1 Liter		Ranges
Sucrose	2.88	g	28.8	g	0-12%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Blend 2	0.05	g	0.5	g	0.001-0682%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4%
2% Milk	97.57233	ml	975.7233	ml	85-99%
			1000	ml	

FIG. 4D

Chocolate Almond Milk
Full Sugar Control

	100 mls		1 Liter		Ranges
Sucrose	7.19	g	71.9	g	2-13%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4g
Silk Unsweetened Almond Milk	94.89308	ml	948.9308	ml	80-99%
			1000	ml	

FIG. 5A

Chocolate Almond Milk
60% Reduced Sugar, Reb M

	100 mls		1 Liter		Ranges
Sucrose	2.88	g	28.8	g	0-12%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Reb M	0.03	g	0.3	g	0.001-0.05%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4%
Silk Unsweetened Almond Milk	97.58491	ml	975.8491	ml	85-99%
			1000	ml	

FIG. 5B

Chocolate Almond Milk
60% Reduced Sugar, Reb D

	100 mls		1 Liter		Ranges
Sucrose	2.88	g	28.8	g	0-12%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Reb D	0.03	g	0.3	g	0.001-0.05%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4%
Silk Unsweetened Almond Milk	97.58491	ml	975.8491	ml	85-99%
			1000	ml	

FIG. 5C

Chocolate Almond Milk
60% Reduced Sugar, Blend 2

	100 mls		1 Liter		Ranges
Sucrose	2.88	g	28.8	g	0-12%
Cocoa Powder	0.7	g	7	g	0.005-1.5%
Salt	0.08	g	0.8	g	0.005-0.12%
Blend 2	0.05	g	0.3	g	0.001-0.0682%
Vanilla Extract	0.1	g	1	g	0.02-0.4%
Chocolate Flavor	0.05	g	0.5	g	0.01-0.4%
Silk Unsweetened Almond Milk	97.57233	ml	975.7233	ml	85-99%
			1000	ml	

FIG. 5D

Vanilla Yogurt
Sugar

	100 g		1000 grams		Ranges
Sucrose	8	g	80	g	2-14%
Vanilla Extract	0.2	g	2	g	0.001-1%
25 Fat Greek Yogurt	91.8	g	918	g	85-7.99%
			1000	g	

FIG. 6A

Vanilla Yogurt
80% Reduced Sugar, Reb M 95%

	100 g		1000 grams		Ranges
Sucrose	16	g	16	g	0-7%
Reb M 95%	0.038	g	0.38	g	0.001-0.08%
Vanilla Extract	0.2	g	2	g	0.001-1%
25 Fat Greek Yogurt	98.162	g	981.62	g	92-99.99%
			1000	g	

FIG. 6B

Vanilla Yogurt
80% Reduced Sugar, Reb D 95%

	100 g		1000 grams		Ranges
Sucrose	1.6	g	16	g	0-7%
Reb D 95%	0.038	g	0.38	g	0.001-0.08%
Vanilla Extract	0.2	g	2	g	0.001-1%
25 Fat Greek Yogurt	98.162	g	981.62	g	92-99.99%
			1000	g	

FIG. 6C

Vanilla Yogurt
80% Reduced Sugar, Blend 2

	100 g		1000 grams		Ranges
Sucrose	1.6	g	16	g	0-7%
Blend 2	0.065	g	0.65	g	0.001-0.08%
Vanilla Extract	0.2	g	2	g	0.001-1%
25 Fat Greek Yogurt	98.135	g	981.35	g	92-99.99%
			1000	g	

FIG. 6D

Banana Mini Muffin
Full Sugar

	Usage		100 gm Weight		Ranges
Butter	73.59	g	8.495827	g	4-13%
Sucrose	187.5	g	21.4652	g	11-33%
Eggs	60	g	6.926887	g	2-13%
Flour	187.5	g	21.64652	g	11-33%
Baking Soda	4.8	g	0.554151	g	0.05-1%
Baking Powder	4.8	g	0.554151	g	0.05-1 %
Bananas	348	g	40.17594	g	20-60%
Total	866.19	g	100	g	

FIG. 7A

Banana Mini Muffin
80% Reduced Sugar, Reb M 95%

	Usage		100 gm Weight		Ranges
Butter	73.59	g	8.495693	g	4-13%
Sucrose	37.5	g	4.329236	g	0-18%
Eggs	60	g	6.926778	g	2-13%
Reb M 95%	0.36	g	0.041561	g	0.001-0.0700%
Unsweetened Apple Sauce	149.6536	g	17.27695	g	7-28%
Flour	187.5	g	21.64618	g	11-33%
Baking Soda	4.8	g	0.554142	g	0.05-1%
Baking Powder	4.8	g	0.554142	g	0.05-1%
Bananas	348	g	40.17531	g	20-60%
Total	866.2036	g	100	g	

FIG. 7B

Banana Mini Muffin
80% Reduced Sugar, Reb D 95%Full Sugar

	Usage		100 gm Weight		Ranges
Butter	73.59	g	8.495751	g	4-13%
Sucrose	37.5	g	4.329286	g	0-18%
Eggs	60	g	6.926858	g	2-13%
Reb D 95%	0.35	g	0.040407	g	0.001-0.0700%
Unsweetened Apple Sauce	149.6536	g	17.27715	g	7-28%
Flour	187.5	g	21.64643	g	11-33%
Baking Soda	4.8	g	0.554149	g	0.05-1%
Baking Powder	4.8	g	0.554149	g	0.05-1%
Bananas	348	g	40.17578	g	20--60%
Total	866.1936	g	100	g	

FIG. 7C

Banana Mini Muffin
80% Reduced Sugar, Blend 2

	Usage		100 gm Weight		Ranges
Butter	73.59	g	8.493536	g	4-13%
Sucrose	37.5	g	4.328137	g	0-18%
Eggs	60	g	6.925019	g	2-13%
Blend 2	0.58	g	0.066942	g	0.001-0.0100%
Unsweetened Apple Sauce	149.6536	g	17.27257	g	7-28%
Flour	187.5	g	21.64068	g	11-33%
Baking Soda	4.8	g	0.554002	g	0.05-1%
Baking Powder	4.8	g	0.554002	g	0.05-1%
Bananas	348	g	40.16511	g	20-60%
Total	866.4236	g	100	g	

FIG. 7D

Vanilla Butter Cookies
Full Sugar

	Usage		100 gm Weight		Ranges
Butter	227	g	28.90247	g	18-38%
Sucrose	200	g	25.46473	g	15-35%
Eggs	80	g	7.639419	g	2.6-12.6%
Flour	290	g	36.92386	g	12.4-64.34%
Baking Powder	1.2	g	0.152788	g	0.02-0.3%
Salt	3	g	0.381971	g	0.02-0.5%
Vanilla Extract	4.2	g	0.534759	g	0.02-1.2%
Total	785.4	g	100	g	

FIG. 8A

Vanilla Butter Cookies
80% Red Sugar, Reb M 95%

	Usage		100 gm Weight		Ranges
Butter	227	g	36.33861	g	21-51%
Sucrose	40	g	6.403278	g	0-23%
Eggs	60	g	9.604918	g	4-15%
Flour	290	g	46.42377	g	9-75%
Reb M 95%	0.28	g	0.044823	g	0.001-0.08%
Baking Powder	1.2	g	0.192098	g	0.02-0.3%
Salt	2	g	0.320164	g	0.02-0.5%
Vanilla Extract	4.2	g	0.672344	g	0.02-1.2%
Total	624.68	g	100	g	

FIG. 8B

Vanilla Butter Cookies
80% Red Sugar, Reb D 95%

	Usage		100 gm Weight		Ranges
Butter	227	g	36.33861	g	21-51%
Sucrose	40	g	6.403278	g	0-23%
Eggs	60	g	9.604918	g	4-15%
Flour	290	g	46.42377	g	9-75%
Reb D 95%	0.28	g	0.044823	g	0.001-0.08%
Baking Powder	1.2	g	0.192098	g	0.02-0.3%
Salt	2	g	0.320164	g	0.02-0.5%
Vanilla Extract	4.2	g	0.672344	g	0.02-1.2%
Total	624.68	g	100	g	

FIG. 8C

Vanilla Butter Cookies
80% Red Sugar, Blend 2

	Usage		100 gm Weight		Ranges
Butter	227	g	36.33011	g	21-51%
Sucrose	40	g	6.401781	g	0-23%
Eggs	60	g	9.602671	g	4-15%
Flour	290	g	46.41291	g	9-75%
Blend 2	0.42615	g	0.068203	g	0.001-0.08%
Baking Powder	1.2	g	0.192053	g	0.02-0.3%
Salt	2	g	0.320089	g	0.02-0.5%
Vanilla Extract	4.2	g	0.672187	g	0.02-1.2%
Total	624.8262	g	100	g	

FIG. 8D

Ketchup
Full Sugar

	Usage		100 gm Weight		Ranges
Tomato Paste	170	g	31.97713	g	28-34%
Light Corn Syrup	164	g	30.84852	g	27-33%
White Vinegar	119	g	22.38399	g	19-25%
Water	59.15	g	11.12616	g	1-26%
Granulated Sugar	12.5	g	2.351259	g	0-4%
Salt	6	g	1.128604	g	0-2%
Onion Powder	0.58	g	0.109098	g	0-0.5%
Garlic Powder	0.4	g	0.07524	g	0.-0.5%
Total	531.63	g	100	g	

FIG. 9A

Ketchup
Zero Added Sugar, Reb M 95%

	Usage		100 gm Weight		Ranges
Tomato Paste	253	g	47.58949	g	32-47%
Light Corn Syrup	0	g	0	g	0-29%
White Vinegar	150	g	28.21511	g	22-28%
Water	120.41	g	22.64921	g	12.8-23%
Granulated Sugar	0	g	0	g	0-2.2%
Salt	7	g	1.316705	g	0-2%
Onion Powder	0.58	g	0.109098	g	0.01-1%
Garlic Powder	0.4	g	0.07524	g	
Reb M	0.24	g	0.045144	g	0.001-0.08%
Total	531.63	g	100	g	

FIG. 9B

Ketchup
Zero Added Sugar, Reb D 95%

	Usage		100 gm Weight		Ranges
Tomato Paste	253	g	47.58949	g	32-47%
Light Corn Syrup	0	g	0	g	0-29%
White Vinegar	150	g	28.21511	g	22-28%
Water	120.41	g	22.64921	g	12.8-23%
Granulated Sugar	0	g	0	g	0-2.2%
Salt	7	g	1.316705	g	0-2%
Onion Powder	0.58	g	0.109098	g	0.00-0.05%
Garlic Powder	0.4	g	0.07524	g	0.00-00.05%
Reb D	0.24	g	0.045144	g	0.001-0.08%
Total	531.63	g	100	g	

FIG. 9C

Ketchup
Zero Added Sugar, Blend 2

	Usage		100 gm Weight		Ranges
Tomato Paste	253	g	47.58949	g	32-47%
Light Corn Syrup	0	g	0	g	0-29%
White Vinegar	150	g	28.21511	g	22-28%
Water	120.29	g	22.62664	g	12.8-23%
Granulated Sugar	0	g	0	g	0-2.2%
Salt	7	g	1.316705	g	0-2%
Onion Powder	0.58	g	0.109098	g	0.00-0.05%
Garlic Powder	0.4	g	0.07524	g	0.00-00.05%
Blend 2	0.36	g	0.067716	g	0.001-0.08%
Total	531.63	g	100	g	

FIG. 9D

Natural Peanut Butter
Full Sugar

	Usage		100 gm Weight		Ranges
Sucrose	25	g	7.886435	g	2-12%
Dry Roasted Peanuts	292	g	92.11356	g	88-98%
Total	317	g	100	g	

FIG. 10A

Natural Peanut Butter
80% Reduced Sugar, Reb M 95%

	Usage		100 gm Weight		Ranges
Sucrose	5	g	1.682822	g	0-7.1%
Dry Roasted Peanuts	292	g	98.27679	g	90-99.99%
Reb M 95%	0.12	g	0.040388	g	0.001-0.08%
Total	297.12	g	100	g	

FIG. 10B

Natural Peanut Butter
80% Reduced Sugar, Reb D 95%

	Usage		100 gm Weight		Ranges
Sucrose	5	g	1.682822	g	0-7.1%
Dry Roasted Peanuts	292	g	98.27679	g	90-99.99%
Reb D 95%	0.12	g	0.040388	g	0.001-0.08%
Total	297.12	g	100	g	

FIG. 10C

Natural Peanut Butter
80% Reduced Sugar, Blend 2

	Usage		100 gm Weight		Ranges
Sucrose	5	g	1.682482	g	0-7.1%
Dry Roasted Peanuts	292	g	98.25695	g	90-99.99%
Blend 2	0.18	g	0.060569	g	0.001-0.08%
Total	297.18	g	100	g	

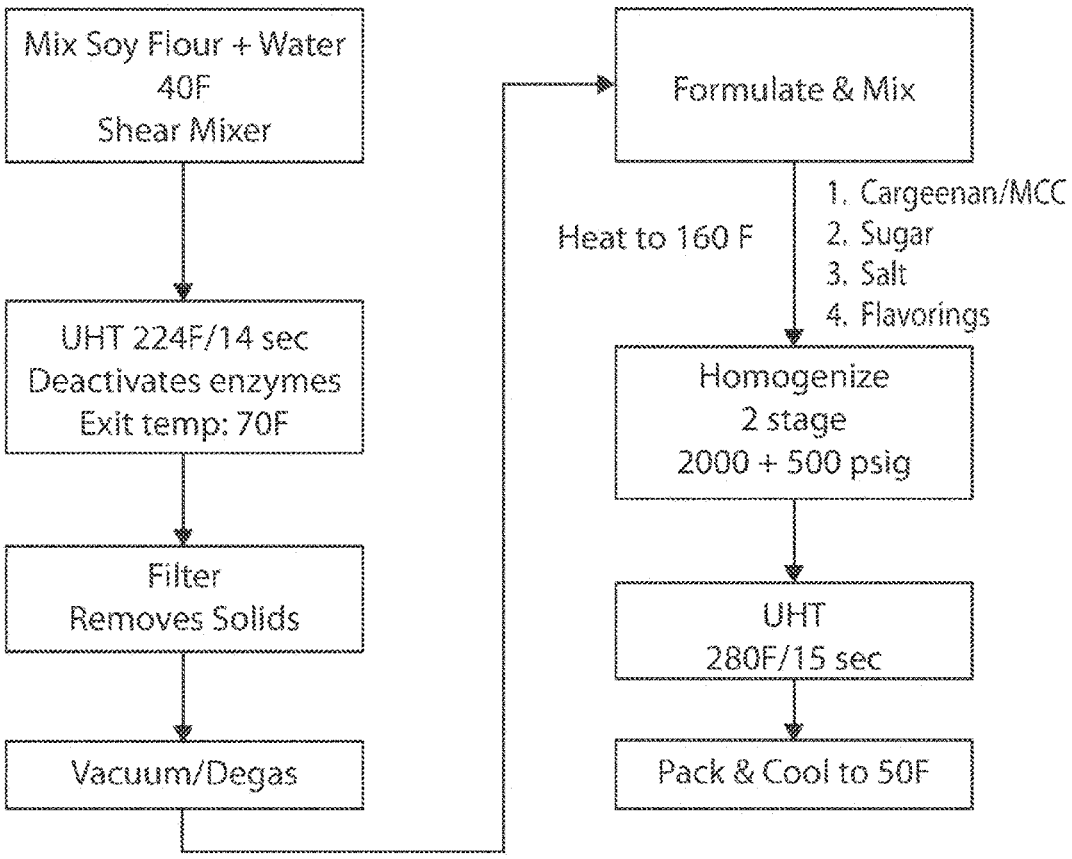
FIG. 10D

Blend 2						
	Usage/100 ml			100% Weight Composition		
Reb A 99%	0.0373			54.6920821		
Reb M 95%	0.0048			7.03812317		
Reb D 95%	0.01			14.6627566		
Reb E 95%	0.0131			19.2082111		
Reb I 95%	0.003			4.39882698		
Usage Rate	0.06820			100		
	1466.27566					
	Max Usage		PPM	100% Blend		
Reb A 99%	0.0373		373 ppm	54.69		
Reb M 95%	0.0048		48 ppm	7.04		
Reb D 95%	0.01		100 ppm	14.66		
Reb E 85%	0.0131		131 ppm	19.21		
Reb I 95%	0.003		30 ppm	4.40		
				100.00		
Replaces 100% Sugar Up to 12 Bx	682 ppm		Max Dosage			

FIG. 11A

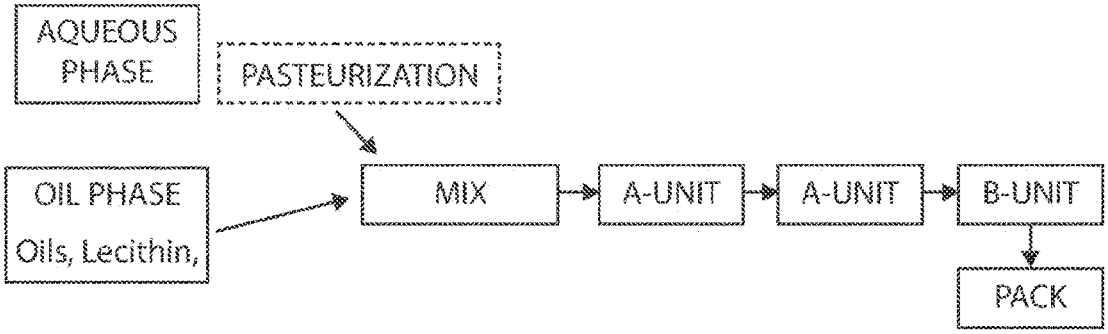
Blend 1			
Usage/100			
	ml	ppm	100 kg
Reb A 99%	0.005	500	8.33333333
Reb M 95%	0.035	350	58.3333333
Reb D 95%	0.01	100	16.6666667
Reb E 95%	0.01	100	16.6666667
			100
Usage Rate	0.06000		

FIG. 11B



*Sugars here represent either full sucrose or full/partial replacement with a rebaudioside formulation of the invention.

FIG. 12



*Preservatives here include the use of a rebaudioside formulation of the invention for taste considerations.

FIG. 13

Companion Animal Feed (Dog)

	Usage		100 gm Weight		
Zero Added Sugar, Blend 2		Dog Food			
Raw Beef (ground or diced)	2268	g	73.869	g	
Egg (complete with Shell)	405	g	13.19	g	
Rice (Uncooked)	375	g	12.21	g	
Omega-3 Fatty Acid Supple.	14	g	0.455	g	
Digestive Enzyme Supple.	3.5	g	0.114	g	
Blend 2	0.15	g	0.005	g	
	3070.65	Total	100		

FIG. 14

Zero Calorie Lemon Water

Lemon Water
Full Sugar Control

Cane Sugar	87.90 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	1.200 gm
Nat Lemon WONF	1.000 ml
Water	942.774 ml
	1000.000 ml

Brix	8.50
Calories	84 Calories/8 fl oz serving

Lemon Water
Zero Calorie
Blend 2 Bev

Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	1.200 gm
Blend 2 Bev	0.600 gm
Nat Lemon WONF	1.000 ml
Water	997.679 ml
	1000.000 ml

Brix	No Added Sugars
Calories	0 Calories/8 fl oz serving

FIG. 15

Reduced Sugar Lemonades

Lemonade
Full Sugar Control

Cane Sugar	114.400 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Lemon Jc Conc	3.500 ml
Citric Acid	1.200 gm
Yellow #5 1% w/w water	0.200 ml
Nat Cloud Emulsion	1.000 ml
Nat Lemon WONF	2.000 ml
Water	920.407 ml
	1000.000 ml

Lemonade
Zero Added Sugar
Blend 2 Juice

Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Lemon Jc Conc	3.500 ml
Blend 2 Juice	15.000 gm
Citric Acid	1.200 gm
Yellow #5 1% w/w water	0.200 ml
Nat Cloud Emulsion	1.000 ml
Nat Lemon WONF	2.000 ml
Water	982.923 ml
	1000.000 ml

FIG. 16

Peach Juice Drink Sugar Reduction

Peach Juice Drink Full Sugar Control	
Peach Jc Conc 65 Brix	1.620 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	66.500 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #6 1% w/w water	1.000 gm
Nat Peach WONF	1.000 gm
Nat Gamma Deca Lactone 0.1% Soln	0.500 gm
Water	916.400 gm
	1000.000 gm

Brix	7.50
Added Sugars	13.7g/200 ml
Added Calories	55 Calories/200 ml

Peach Juice Drink 33% Reduced Sugar, Flavor	
Peach Jc Conc 65 Brix	1.620 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	44.600 gm
Natural Flavor 1	3.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #6 1% w/w water	1.000 gm
Nat Peach WONF	1.000 gm
Nat Gamma Deca Lactone 0.1% Soln	0.500 gm
Water	935.300 gm
	1000.000 gm

Brix	5.30
Added Sugars	9.08g/200 ml
Added Calories	36 Calories/200 ml

Peach Juice Drink 50% Reduced Sugar, Flavor	
Peach Jc Conc 65 Brix	1.620 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	33.300 gm
Natural Flavor 2	5.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #6 1% w/w water	1.000 gm
Nat Peach WONF	1.000 gm
Nat Gamma Deca Lactone 0.1% Soln	0.500 gm
Water	944.600 gm
	1000.000 gm

Brix	4.18
Added Sugars	6.85g/200 ml
Added Calories	27 Calories/200 ml

FIG. 17

Peach Juice Drink Sugar Reduction

Peach Juice Drink *80% Reduced Sugar, Blend 2 Juice*	
Peach Jc Conc 65 Brix	1.620 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	13.300 gm
Blend 2 Juice	51.600 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #6 1% w/w water	1.000 gm
Nat Peach WONF	1.000 gm
Nat Gamma Deca Lactone 0.1% Soln	0.500 gm
Water	918.000 gm
	1000.000 gm

Brix	2.18
Added Sugars	2.7g/200 ml
Added Calories	15 Calories/200 ml 11 Calories from Sugar 4 Calories from Allulose

Peach Juice Drink *Zero Added Sugar, Blend 2 Juice*	
Peach Jc Conc 65 Brix	1.620 gm
Apple Jc Conc 70 Brix	10.680 gm
Blend 2 Juice	70.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #6 1% w/w water	1.000 gm
Nat Peach WONF	1.000 gm
Nat Gamma Deca Lactone 0.1% Soln	0.500 gm
Water	912.900 gm
	1000.000 gm

Brix	0.85
Added Sugars	0g
Added Calories	5 Calories/200 ml (From Allulose)

FIG. 18

Lemonade Sugar Reduction

Lemonade
Full Sugar Control

Lemon Jc Conc 52 Brix	0.900 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	67.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #5 1% w/w water	1.000 gm
Nat Lemon WONF	2.000 gm
Nat Cloud	1.000 gm
Water	915.120 gm
	1000.000 gm

Brix	7.50
Added Sugars	13.7g/200 ml
Added Calories	55 Calories/200 ml

Lemonade
33% Reduced Sugar, Flavor

Lemon Jc Conc 52 Brix	0.900 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	44.890 gm
Natural Flavor 1	3.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #5 1% w/w water	1.000 gm
Nat Lemon WONF	1.000 gm
Nat Cloud	1.000 gm
Water	935.230 gm
	1000.000 gm

Brix	5.30
Added Sugars	9.08g/200 ml
Added Calories	36 Calories/200 ml

Lemonade
50% Reduced Sugar, Flavor

Lemon Jc Conc 52 Brix	0.900 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	33.500 gm
Natural Flavor 2	5.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #5 1% w/w water	1.000 gm
Nat Lemon WONF	1.000 gm
Nat Cloud	1.000 gm
Water	944.620 gm
	1000.000 gm

Brix	4.18
Added Sugars	6.85g/200 ml
Added Calories	27 Calories/200 ml

FIG. 19

Lemonade Sugar Reduction

Lemonade *80% Reduced Sugar, Blend 2 Juice*	
Lemon Jc Conc 52 Brix	0.900 gm
Apple Jc Conc 70 Brix	10.680 gm
Cane Sugar	13.400 gm
Blend 2 Juice	51.600 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #5 1% w/w water	1.000 gm
Nat Lemon WONF	1.000 gm
Nat Cloud	1.000 gm
Water	918.120 gm
	1000.000 gm

Brix	2.18
Added Sugars	2.7g/200 ml
Added Calories	15 Calories/200 ml 11 Calories from Sugar 4 Calories from Allulose

Lemonade *Zero Added Sugar, Blend 2 Juice*	
Lemon Jc Conc 65 Brix	0.900 gm
Apple Jc Conc 70 Brix	10.680 gm
Blend 2 Juice	70.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Yellow #5 1% w/w water	1.000 gm
Nat Lemon WONF	1.000 gm
Nat Cloud	1.000 gm
Water	913.120 gm
	1000.000 gm

Brix	0.85
Added Sugars	0g
Added Calories	5 Calories/200 ml (From Allulose)

FIG. 20

Orange CSD

Orange CSD
Full Sugar Control 9.5 Brix

Cane Sugar	98.600 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	1.500 gm
Natural Orange Flvr	2.000 ml
Yellow 5 1% w/w Water	1.000 ml
Red 40 1% w/w Water	1.000 ml
Natural Cloud Emulsion	1.000 ml
Carbonated Water	931.855 ml
	1000.000 ml

Brix	9.5 Brix
Added Sugars	46.6g/16 fl oz
Added Calories	168 Cal/16 fl oz

Orange CSD
Zero Calorie
CSD

Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Blend 2 CSD	3.000 gm
Citric Acid	1.500 gm
Natural Orange Flvr	2.000 ml
Yellow 5 1% w/w Water	1.000 ml
Red 40 1 % w/w Water	1.000 ml
Natural Cloud Emulsion	1.000 ml
Carbonated Water	991.981 ml
	1000.000 ml

Added Sugars	0g/16 fl oz
Added Calories	0 Cal/16 fl oz

FIG. 21

Peach Sparkling Water Sugar Reduction

Peach Sparkling Water
Full Sugar Control
1+4 Syrup

Cane Sugar	260.000 gm
Sodium Benzoate	0.300 gm
Potassium Sorbate	0.300 gm
Citric Acid	5.000 gm
Nat Peach WONF	4.000 ml
Nat Gamma Deca Lactone 0.1% Soln	2.000 ml
Water	826.956 ml
	1000.000 ml

Brix	5.2
Added Sugars	10.4g/200 ml
Added Calories	42 Calories/200 ml

Peach Sparkling Water
40% Reduced Sugar, Flavor
1+4 Syrup

Cane Sugar	156.000 gm
Natural Flavor 2	12.500 ml
Sodium Benzoate	0.300 gm
Potassium Sorbate	0.300 gm
Citric Acid	5.000 gm
Nat Peach WONF	4.000 ml
Nat Gamma Deca Lactone 0.1% Soln	2.000 ml
Water	879.865 ml
	1000.000 ml

Brix	3.1
Added Sugars	6.2g/200 ml
Added Calories	25 Calories/200 ml

FIG. 22

Peach Sparkling Water Sugar Reduction

Peach Sparkling Water
80% Reduced Sugar, Blend 2 CSD
1+4 Syrup

Cane Sugar	52.000 gm
Sodium Benzoate	0.300 gm
Potassium Sorbate	0.300 gm
Citric Acid	5.000 gm
Blend 2 CSD	158.000 gm
Nat Peach WONF	4.000 ml
Nat Gamma Deca Lactone 0.1% Soln	2.000 ml
Water	858.403 ml
	1000.000 ml

Brix	1
Added Sugars	2g/200 ml
Added Calories	8 Calories/200 ml
	2.4 Calories from Allulose

Peach Sparkling Water
Zero Added Sugar, Blend 2 CSD
1+4 Syrup

Blend 2 CSD	259.000 gm
Sodium Benzoate	0.300 gm
Potassium Sorbate	0.300 gm
Citric Acid	5.000 gm
Nat Peach WONF	4.000 ml
Nat Gamma Deca Lactone 0.1% Soln	2.000 ml
Water	827.585 ml
	1000.000 ml

Added Sugars	0g/200 ml
Added Calories	4 Calories/200 ml from Allulose

FIG. 23

Reduced Sugar Hard Lemonades

Hard Lemonade
Full Sugar Control, 5% ABV

Cane Sugar	104.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Grain Neut Spirits 95% ABV	52.631 ml
Citric Acid	2.000 gm
Yellow #5 1% w/w water	0.200 ml
Vitamin Energy Premix	1.000 ml
Nat Cloud Emulsion	2.000 ml
Nat Lemon WONF	877.314 ml
Water	1000.000 ml

Brix	10.00
Added Sugars	37g/12 fl oz serving
Calories	132 Calories/12 fl oz serving

Hard Lemonade
80% Reduced Sugar, 5% ABV
Blend 2 Spirits

Cane Sugar	20.800 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Grain Neut Spirits 95% ABV	52.631 ml
Blend 2 Spirits	0.600 ml
Citric Acid	2.500 gm
Yellow #5 1% w/w water	0.200 ml
Nat Cloud Emulsion	1.000 ml
Nat Lemon WONF	2.000 ml
Water	928.949 ml
	1000.000 ml

Brix	0
Added Sugars	7.4g/12 fl oz serving
Calories	26 Calories/12 fl oz serving

FIG. 24

Peach Energy Drink Sugar Reduction

Peach Energy Drink *Full Sugar Control* *1+4 Syrup*	
Cane Sugar	520.000 gm
Sodium Benzoate	0.750 gm
Potassium Sorbate	0.750 gm
Citric Acid	10.000 gm
Caffeine Nat	1.610 gm
Taurine	5.000 gm
Yellow #6 1% w/w water	5.000 ml
Vitamin Energy Premix	0.537 gm
Nat Clouding Agent	5.000 ml
Nat Peach WONF	5.000 ml
Nat Gamma Deca Lactone 0.1% Soln	4.000 ml
Water	642.532 ml
	1000.000 ml

Brix Diluted	10.00
Added Sugars	25.8g/8.4 fl oz
Added Calories	103 Calories/8.4 fl oz.

Peach Energy Drink *Zero Added Sugar, Blend 2 Energy* *1+4 Syrup*	
Blend 2 Energy	10.000 gm
Sodium Benzoate	0.750 gm
Potassium Sorbate	0.750 gm
Citric Acid	10.000 gm
Caffeine Nat	1.610 gm
Taurine	5.000 gm
Yellow #6 1% w/w water	5.000 ml
Vitamin Energy Premix	0.537 gm
Nat Clouding Agent	5.000 ml
Nat Peach WONF	5.000 ml
Nat Gamma Deca Lactone 0.1% Soln	4.000 ml
Water	962.983 ml
	1000.000 ml

Brix Diluted	0
Added Sugars	0g/8.4 fl oz
Added Calories	0 Calories/8.4 fl oz.

FIG. 25

Peach Energy Drink Sugar Reduction

Peach Energy Drink
Full Sugar Control
1+4 Syrup

Cane Sugar	520.000 gm
Sodium Benzoate	0.750 gm
Potassium Sorbate	0.750 gm
Citric Acid	10.000 gm
Caffeine Nat	1.610 gm
Taurine	5.000 gm
Yellow #6 1% w/w water	5.000 ml
Vitamin Energy Premix	0.537 gm
Nat Clouding Agent	5.000 ml
Nat Peach WONF	5.000 ml
Nat Gamma Deca Lactone 0.1% Soln	4.000 ml
Water	642.532 ml
	1000.000 ml

Brix Diluted	10.00
Added Sugars	25.8g/8.4 fl oz
Added Calories	103 Calories/8.4 fl oz.

Peach Energy Drink
Zero Added Sugar, Blend 2 Energy
1+4 Syrup

Blend 2 Energy	410.000 gm
Sodium Benzoate	0.750 gm
Potassium Sorbate	0.750 gm
Citric Acid	10.000 gm
Caffeine Nat	1.610 gm
Taurine	5.000 gm
Yellow #6 1% w/w water	5.000 ml
Vitamin Energy Premix	0.537 gm
Nat Clouding Agent	5.000 ml
Nat Peach WONF	5.000 ml
Nat Gamma Deca Lactone 0.1% Soln	4.000 ml
Water	711.411 ml
	1000.000 ml

Brix Diluted	0
Added Sugars	0g/8.4 fl oz
Added Calories	8 Calories/8.4 fl oz. (Allulose)

FIG. 26

Mango Whey Protein Drink Sugar Reduction

Mango Whey Protein Drink Full Sugar Control	
Cane Sugar	100.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Whey Protein Isolate	35.000 gm
4% Pectin Solution	100.000 gm
Yellow #5 1% w/w water	1.000 gm
Nat Mango WONF	2.000 gm
Water	759.700 gm
	1000.000 gm
Brix	10.00
Protein	7g/8 fl oz

Mango Whey Protein Drink 60% Reduced Sugar Blend 2 Hi Pro	
Cane Sugar	40.000 gm
Sodium Benzoate	0.150 gm
Potassium Sorbate	0.150 gm
Citric Acid	2.000 gm
Whey Protein Isolate	35.000 gm
4% Pectin Solution	100.000 gm
Yellow #5 1% w/w water	1.000 gm
Blend 2 HiPro	2.000 gm
Nat Mango WONF	2.000 gm
Water	817.700 gm
	1000.000 gm
Brix	4.00
Protein	7g/8 fl oz

FIG. 27

Mango Pea Protein Drink Sugar Reduction

Mango Pea Protein Drink
Full Sugar Control

Cane Sugar	100.000 gm
Sodium Benzoate	0.200 gm
Potassium Sorbate	0.200 gm
Citric Acid	2.000 gm
Pea Protein Tru Pro 2000	18.800 gm
4% Pectin Solution YM-115L	100.000 gm
Yellow #5 1% w/w water	1.000 gm
Nat Mango WONF	2.000 gm
Water	775.800 gm
	1000.000 gm
Brix	10.00
Protein	4g/8 fl oz

Mango Pea Protein Drink
60% Reduced Sugar
Blend 2 Pea Pro

Cane Sugar	40.000 gm
Sodium Benzoate	0.200 gm
Potassium Sorbate	0.200 gm
Citric Acid	2.000 gm
Pea Protein Tru Pro 2000	18.800 gm
4% Pectin Solution YM-115L	100.000 gm
Yellow #5 1% w/w water	1.000 gm
Blend 2 PeaPro	1.300 gm
Nat Mango WONF	2.000 gm
Water	834.500 gm
	1000.000 gm
Brix	4.00
Protein	4g/8 fl oz

FIG. 28

Chocolate Almond Breeze Sugar Reduction

Chocolate Almond Breeze Full Sugar Control Cane Sugar Sweetened

Cane Sugar	80.000 gm
AB Chocolate UnSw	948.374 gm
	1000.000 ml
Added Sugars	17.3g/8 fl oz
Added Calories	69 Cal/8 fl oz

Chocolate Almond Breeze 60% Reduced Added Sugar Blend 2 LoPro

Cane Sugar	32.000 gm
Blend 2 LoPro	6.000 gm
AB Chocolate Unsw	976.101 ml
	1000.000 ml
Added Sugars	7.68g/8 fl oz
Added Calories	31 Cal/8 fl oz

Chocolate Almond Breeze 100% Reduced Added Sugar Blend 2 LoPro

Blend 2 LoPro	6.200 gm
Nat Chocolate WONF	0.500 ml
AB Chocolate Unsw	995.601 ml
	1000.000 ml

FIG. 29

Chocolate Soymilk Sugar Reduction

Chocolate Soymilk
Full Sugar Control
Cane Sugar Sweetened

Cane Sugar	71.900 gm
Cocoa Powder	7.000 gm
Salt	0.800 gm
Vanilla Extract	1.000 ml
Nat Chocolate WONF	0.500 ml
Silk Soymilk Plain Unsw	948.374 ml
	1000.000 ml
Added Sugars	17.3g/ 8 fl oz
Added Calories	69 Cal/8 fl oz

Chocolate Soymilk
60% Reduced Added Sugar
Blend 2 LoPro

Cane Sugar	28.800 gm
Cocoa Powder	7.000 gm
Salt	0.800 gm
Blend 2 LoPro	5.000 gm
Vanilla Extract	1.000 ml
Nat Chocolate WONF	0.500 ml
Silk Soymilk Plain Unsw	958.836 ml
	1000.000 ml
Added Sugars	6.9g/ 8 fl oz
Added Calories	28 Cal/8 fl oz

FIG. 30

Strawberry Filling Sugar Reduction

Strawberry Filling
Full Sugar Control

Cane Sugar	148.000 gm
Corn Starch	37.121 gm
Strawberries	569.705 gm
Nat Strawberry Flavor	0.516 gm
Water	245.174 gm
	1000.000 gm

Strawberry Filling
80% Reduced Sugar
Blend 2

Cane Sugar	29.701 gm
Blend 2 Fruit	43.160 gm
Corn Starch	37.127 gm
Strawberries	569.793 gm
Nat Strawberry Flavor	0.516 gm
Water	319.703 gm
	1000.000 gm

FIG. 31

Strawberry Juice Milk Smoothie Sugar Reduction

Strawberry Juice Milk Smoothie
Full Sugar Control

Strawberry Jc Conc 65 Brix	1.230 gm
Apple Jc Conc 70 Brix	14.790 gm
Cane Sugar	88.800 gm
2% Milk	100.000 gm
Citric Acid	2.000 gm
Red #40 1% w/w water	1.500 gm
Nat Strawberry WONF	2.000 gm
Pectin YM-115L 4% Soln	100.000 gm
Water	689.680 gm
	1000.000 gm

Brix	10.00
Added Sugars	22.6g/ 8 fl oz serving
Added Calories	90 Calories/8 fl oz serving

Strawberry Juice Milk Smoothie
60% Reduced Sugar, Blend 2 Smoothie

Strawberry Jc Conc 65 Brix	1.230 gm
Apple Jc Conc 70 Brix	14.790 gm
Cane Sugar	35.520 gm
Blend 2 Smoothie	30.200 gm
2% Milk	100.000 gm
Citric Acid	2.000 gm
Red #40 1% w/w water	1.500 gm
Nat Strawberry WONF	2.000 gm
Pectin YM-115L 4% Soln	100.000 gm
Water	712.760 gm
	1000.000 gm

Brix	4.67
Added Sugars	8.5g/ 8 fl oz serving
Added Calories	36.9 Calories/8 fl oz serving
	34 Calories from Sugar
	2.9 Calories from

FIG. 32

Orange Juice Milk Smoothie Sugar Reduction

Orange Juice Milk Smoothie
Full Sugar Control

Orange Jc Conc 65 Brix	1.820 gm
Apple Jc Conc 70 Brix	14.790 gm
Cane Sugar	88.500 gm
2% Milk	100.000 gm
Citric Acid	2.000 gm
Yellow #6 1% w/w water	1.500 gm
Nat Orange WONF	2.000 gm
Pectin YM-115L 4% Soln	100.000 gm
Water	689.390 gm
	1000.000 gm

Brix	10.00
Added Sugars	22.6g/ 8 fl oz serving
Added Calories	90 Calories/8 fl oz serving

Orange Juice Milk Smoothie
80% Reduced Sugar, Blend 2 Smoothie

Orange Jc Conc 65 Brix	1.820 gm
Apple Jc Conc 70 Brix	14.790 gm
Cane Sugar	17.700 gm
Blend 2 Smoothie	52.000 gm
2% Milk	100.000 gm
Citric Acid	2.000 gm
Yellow #6 1% w/w water	1.500 gm
Nat Orange WONF	2.000 gm
Pectin YM-115L 4% Soln.	100.000 gm
Water	708.190 gm
	1000.000 gm

Brix	2.92
Added Sugars	4.2g/ 8 fl oz serving
Added Calories	21.8 Calories/8 fl oz serving
	17 Calories from Sugar
	4.8 Calories from Allulose

FIG. 33

Mango Juice Milk Smoothie Sugar Reduction

Mango Juice Milk Smoothie Full Sugar Control		Mango Juice Milk Smoothie Zero Added Sugar, Blend 2 Smoothie	
Mango Puree Conc 28 Brix	4.640 gm	Mango Puree Conc 28 Brix	4.640 gm
Apple Jc Conc 70 Brix	14.790 gm	Apple Jc Conc 70 Brix	14.790 gm
Cane Sugar	88.300 gm	Blend 2 Smoothie	72.000 gm
2% Milk	100.000 gm	2% Milk	100.000 gm
Citric Acid	2.000 gm	Citric Acid	2.000 gm
Yellow #5 1% w/w water	3.000 gm	Yellow #5 1% w/w water	3.000 gm
Nat Mango WONF	2.000 gm	Nat Mango WONF	2.000 gm
Pectin YM-115L 4% Soln	100.000 gm	Pectin YM-115L 4% Soln	100.000 gm
Water	685.270 gm	Water	701.570 gm
	1000.000 gm		1000.000 gm

Brix	10.00	Brix	1.17
Added Sugars	22.6g/ 8 fl oz serving	Added Sugars	0g/ 8 fl oz serving
Added Calories	90 Calories/8 fl oz serving	Added Calories	6.7 Calories/8 fl oz serving 6.7 Calories from Allulose

FIG. 34

Chocolate Milk Sugar Reduction

Chocolate Milk
Full Sugar Control
Cane Sugar Sweetened

Cane Sugar	71.900 gm
Cocoa Powder	7.000 gm
Salt	0.800 gm
Vanilla Extract	1.000 ml
Nat Chocolate WONF	0.500 ml
2% Milk	948.374 ml
	1000.000 ml
Added Sugars	17.3g/8 fl oz
Added Calories	69 Cal/8 fl oz

Chocolate Milk
60% Reduced Added Sugar
Blend 2 Dairy

Cane Sugar	28.800 gm
Cocoa Powder	7.000 gm
Salt	0.800 gm
Blend 2 Dairy	3.500 gm
Vanilla Extract	1.000 ml
Nat Chocolate WONF	0.500 ml
2% Milk	973.280 ml
	1000.000 ml
Added Sugars	6.9g/8 fl oz
Added Calories	28 Cal/8 fl oz

FIG. 35

Chocolate Sauce Sugar Reduction

Chocolate Sauce
Full Sugar Control

Cane Sugar	498.554 gm
Whole Milk	398.843 gm
Flour	13.503 gm
Salt	1.576 gm
Cocoa Powder	83.092 gm
Nat Chocolate Flvr	1.105 gm
	1000.000 gm

Chocolate Sauce
60% Reduced Sugar
Blend 2 Swt Saice

Cane Sugar	199.422 gm
Whole Milk	605.230 gm
Flour	15.511 gm
Salt	1.576 gm
Cocoa Powder	83.092 gm
Blend 2 Dessert Sauce	94.061 gm
Nat Chocolate Flvr	1.108 gm
	1000.000 gm

FIG. 36

Vanilla Yogurt Sugar Reduction

Vanilla Yogurt
Full Sugar Control

Cane Sugar	80.000 gm
Vanilla Extract	1.000 gm
2% Fat Fage Yogurt	919.000 gm
	1000.000 gm

Added Sugars	18.2g/cup
Added Calories	73 Cal/cup
Cup	227g

Vanilla Yogurt
80% Reduced Sugar
Blend 2 Yogurt

Cane Sugar	16.000 gm
Blend 2 Yogurt	2.650 gm
Vanilla Extract	1.000 gm
2% Fat Fage Yogurt	980.350 gm
	1000.000 gm

Added Sugars	3.6g/cup
Added Calories	14.5 Cal/cup
Cup	227g

FIG. 37

Vanilla Pea Protein Yogurt Sugar Reduction

Vanilla Yogurt
Full Sugar Control
Cane Sugar Sweetened

Cane Sugar	80.000 gm
Pea Protein TruPro 2000	18.550 gm
Vanilla Extract	3.000 gm
2% Fat Fage Yogurt	898.450 gm
	1000.000 gm

Added Sugars	18.2g/cup
Added Calories	73 Cal/cup
Added Protein	3g/cup
Cup	227g

Vanilla Yogurt
80% Reduced Sugar
Blend 2 Yogurt Pro

Cane Sugar	16.000 gm
Pea Protein TruPro 2000	18.550 gm
Blend 2 Yogurt Pro	4.000 gm
Vanilla Extract	3.000 gm
2% Fat Fage Yogurt	958.450 gm
	1000.000 gm

Added Sugars	3.6g/cup
Added Calories	14.5 Cal/cup
Added Protein	3g/cup
Cup	227g

FIG. 38

80% Reduced Sugar Soy Vanilla Ice Cream

Vanilla Ice Cream Full Sugar Control	
Cane Sugar	17.116 gm
Heavy Whipping Cream	41.078 gm
Half and Half Cream	41.079 gm
Vanilla Extract	0.727 gm
	100.000 gm
Added Sugars	17.1g/100gm
Calories	68 Added Calories/100gm

Vanilla Ice Cream 80% Reduced Sugar Blend 2 IC	
Cane Sugar	3.423 gm
Heavy Whipping Cream	42.528 gm
Half and Half Cream	42.528 gm
Blend 2 IC	9.000 gm
Vegetable Glycerin	1.769 gm
Vanilla Extract	0.752 gm
	100.000 gm
Added Sugars	3.4g/100gm
Calories	18 Added Calories/100gm

FIG. 39

80% Reduced Sugar Soy Vanilla Ice Cream

Soy Vanilla Ice Cream
Full Sugar Control

Cane Sugar	16.410 gm
Heavy Whipping Cream	39.572 gm
Half and Half Cream	39.571 gm
Soy Protein Supro XT219	3.430 gm
Vanilla Extract	1.017 gm
	100.000 gm

Added Sugars	16.410g/100gm
Calories	66 Added Calories/100gm
Protein	7g/Cup

Vanilla Ice Cream
80% Reduced Sugar
Blend 2 IC

Cane Sugar	3.282 gm
Heavy Whipping Cream	40.315 gm
Half and Half Cream	40.315 gm
Soy Protein Supro XT219	3.430 gm
Blend 2 IC	10.000 gm
Vegetable Glycerin	1.641 gm
Vanilla Extract	1.017 gm
	100.000 gm

Added Sugars	3.282g/100gm
Calories	17 Added Calories/100gm
Protein	7g/Cup

FIG. 40

Zero Added Sugar Mango Sherbet

Mango Sherbet Full Sugar Control		*Mango Sherbet Zero Aded Sugar Blend 2 Dessert*	
Frozen Mango	49.657 gm	Frozen Mango	50.687 gm
Cane Sugar	14.605 gm	Blend 2 Dessert	8.860 gm
Whole Milk	31.158 gm	Whole Milk	35.779 gm
Lime Juice SS	4.420 gm	Lime Juice SS	4.512 gm
Sodium Chloride	0.058 gm	Sodium Chloride	0.059 gm
Nat Mango WONF	0.102 gm	Nat Mango WONF	0.103 gm
	100.000 gm		100.000 gm

Sugars from Fruit	6.837g/100gm	Sugars from Fruit	6.975g/100gm
Sugars from Milk	1.511g/100gm	Sugars from Milk	1.735g/100gm
Added Sugars	14.6g/100gm	Added Sugars	0g/100gm
Total Sugar Calories	92 Calories/100gm	Total Sugar Calories	38 Calories/100gm

FIG. 41

Zero Added Sugar Pea Protein Mango Sherbet

Mango Sherbet
Full Sugar Control

Frozen Mango	49.657 gm
Cane Sugar	14.605 gm
Silk Soymilk Plain Unsweetened	26.935 gm
Beta Carotene Orange Color	0.005 gm
Pea Protein TruPro 2000	3.743 gm
Lime Juice SS	4.800 gm
Sodium Chloride	0.058 gm
Nat Mango WONF	0.200 gm
	100.000 gm

Sugars from Fruit	6.837g/100gm
Added Sugars	14.6g/100gm
Total Sugar Calories	86 Calories/100gm
Protein	7g/Cup

Mango Sherbet
Zero Aded Sugar
Blend 2 Dessert

Frozen Mango	50.687 gm
Blend 2 Dessertr	8.500 gm
Silk Soymilk Plain Unsweetened	32.007 gm
Beta Carotene Orange Color	0.005 gm
Pea Protein TruPro 2000	3.743 gm
Lime Juice SS	4.800 gm
Sodium Chloride	0.058 gm
Nat Mango WONF	0.200 gm
	100.000 gm

Sugars from Fruit	6.975g/100gm
Added Sugars	0g/100gm
Total Sugar Calories	38 Calories/100gm
Protein	7g/Cup

FIG. 42

Vanilla Butter Cookies Sugar Reduction

Vanilla Butter Cookies
Full Sugar Control

Cane Sugar	254.700 gm
Butter	289.100 gm
Eggs	76.400 gm
Vanilla Extract	5.300 gm
Flour	369.200 gm
Baking Powder	1.500 gm
Salt	3.800 gm
	1000.000 gm

Vanilla Butter Cookies
80% Reduced Sugar
Blend 2 Cookie

Cane Sugar	50.929 gm
Butter	319.116 gm
Eggs	76.394 gm
Blend 2 Cookie	130.000 gm
Vanilla Extract	5.348 gm
Flour	414.139 gm
Baking Powder	1.528 gm
Salt	2.546 gm
	1000.000 gm

FIG. 43

Banana Mini Muffins Sugar Reduction

Banana Mini Muffin
Full Sugar Control

Cane Sugar	216.465 gm
Butter	84.958 gm
Eggs	69.269 gm
Bananas	401.759 gm
Flour	216.465 gm
Baking Powder	5.542 gm
Baking Soda	5.542 gm
	1000.000 gm

Banana Mini Muffin
80% Reduced Sugar
Blend 2 Cake

Cane Sugar	43.293 gm
Butter	84.958 gm
Eggs	69.269 gm
Blend 2 Cake	173.200 gm
Bananas	401.759 gm
Flour	216.437 gm
Baking Powder	5.542 gm
Baking Soda	5.542 gm
	1000.000 gm

FIG. 44

Cranberry Granola Bar Sugar Reduction

Cranberry Granola Bar
Full Sugar Control

Rolled Oats	203.400 gm
Soy Protein Isolate	56.700 gm
Salt	5.200 gm
Cranberries, Dried	219.600 gm
Crisped Rice	121.800 gm
Dried Coconut, Sweetened	60.800 gm
Maltrin T250	80.000 gm
Honey	60.000 gm
Brown Sugar	60.000 gm
Sugar	60.000 gm
Vegetable Glycerin	35.000 gm
Canola Oil	20.000 gm
Water	17.500 gm
	1000.000 gm

Cranberry Granola Bar
Zero Added Sugars

Rolled Oats	203.400 gm
Soy Protein Isolate	56.700 gm
Salt	5.200 gm
Cranberries, Dried	219.600 gm
Crisped Rice	121.800 gm
Dried Coconut, Sweetened	60.800 gm
Maltrin T250	80.000 gm
Honey	60.000 gm
Blend 2 Bar	121.000 gm
Vegetable Glycerin	35.000 gm
Canola Oil	20.000 gm
Water	16.500 gm
	1000.000 gm

FIG. 45

Cinnamon Granola Crunch Sugar Reduction

Cinnamon Granola Crunch Full Sugar Control		*Cinnamon Granola Crunch Zero Added Sugars*	
Rolled Oats	489.300 gm	Rolled Oats	489.300 gm
Maltrin M180	101.600 gm	Maltrin M180	101.600 gm
Instant Pure-Cote B792	84.400 gm	Instant Pure-Cote B792	84.400 gm
Cinnamon	8.200 gm	Cinnamon	8.200 gm
Salt	8.200 gm	Salt	8.200 gm
Sugar	80.000 gm	SugarBlend 2 Cereal	80.000 gm
Vanilla Taste Modifier	2.000 gm	Vanilla Taste Modifier	2.000 gm
Water	171.900 gm	Water	171.900 gm
Canola Oil	54.400 gm	Canola Oil	54.400 gm
	1000.000 gm		1000.000 gm

FIG. 46

Reduced Sugar Tomato Ketchup

Tomato Ketchup
Full Sugar Control

Tomato Paste	319.771 gm
Light Corn Syrup	308.485 gm
White Vinegar	223.840 gm
Water	111.262 gm
Cane Sugar	23.513 gm
Onion Powder	1.091 gm
Garlic Powder	0.752 gm
Salt	11.286 gm
	1000.000 gm

Tomato Ketchup
50% Reduced Added Sugar
Blend 2 Condiment

Tomato Paste	319.771 gm
Light Corn Syrup	154.243 gm
White Vinegar	231.364 gm
Water	154.737 gm
Cane Sugar	11.756 gm
Blend 2 Condiment	115.000 gm
Onion Powder	1.091 gm
Garlic Powder	0.752 gm
Salt	11.286 gm
	1000.000 gm

Tomato Ketchup
Zero Added Sugar
Blend 2 Condiment

Tomato Paste	376.202 gm
White Vinegar	244.531 gm
Water	192.257 gm
Blend 2 Condiment	172.000 gm
Onion Powder	1.091 gm
Garlic Powder	0.752 gm
Salt	13.167 gm
	1000.000 gm

FIG. 47

Reduced Sugar Creamy French Dressing

Creamy French Dressing
Full Sugar Control

NSA Tomato Ketchup	287.910 gm
Mayonnaise	212.241 gm
Red Wine Vinegar	153.417gm
Cane Sugar	120.590 gm
Worcestershire Sauce	10.464 gm
Vegetable Oil	201.166 gm
Paprika	4.245 gm
Onion Powder	2.215 gm
Garlic Powder	2.215 gm
Kosher Salt	5.537 gm
	1000.000 gm

Creamy French Dressing
50% Reduced Sugar
Blend 2 Dressings

NSA Tomato Ketchup	287.910 gm
Mayonnaise	212.241 gm
Red Wine Vinegar	153.417gm
Cane Sugar	60.295 gm
Blend 2 Dressings	60.400 gm
Worcestershire Sauce	10.464 gm
Vegetable Oil	201.061 gm
Paprika	4.245 gm
Onion Powder	2.215 gm
Garlic Powder	2.215 gm
Kosher Salt	5.537 gm
	1000.000 gm

Creamy French Dressing
100% Reduced Sugar
Blend 2 Dressings

NSA Tomato Ketchup	287.910 gm
Mayonnaise	212.241 gm
Red Wine Vinegar	153.417gm
Blend 2 Dressings	120.800 gm
Worcestershire Sauce	10.464 gm
Vegetable Oil	200.956 gm
Paprika	4.245 gm
Onion Powder	2.215 gm
Garlic Powder	2.215 gm
Kosher Salt	5.537 gm
	1000.000 gm

FIG. 48

Reduced Sugar Tomato Ketchup

Tomato Ketchup Full Sugar Control	
Tomato Paste	319.771 gm
Light Corn Syrup	308.485 gm
White Vinegar	223.840 gm
Water	111.262 gm
Cane Sugar	23.513 gm
Onion Powder	1.091 gm
Garlic Powder	0.752 gm
Salt	11.286 gm
	1000.000 gm

Tomato Ketchup Zero Added Sugar Blend 2 Condiment	
Tomato Paste	376.202 gm
White Vinegar	244.531 gm
Water	192.257 gm
Blend 2 Condiment	172.000 gm
Onion Powder	1.091 gm
Garlic Powder	0.752 gm
Salt	13.167 gm
	1000.000 gm

FIG. 49

Reduced Sugar Creamy French Dressing

Creamy French Dressing Full Sugar Control		*Creamy French Dressing Zero Added Sugar Blend 2 Dressings*	
Ketchup	287.910 gm	NSA Tomato Ketchup	287.910 gm
Mayonnaise	212.241 gm	Mayonnaise	212.241 gm
Red Wine Vinegar	153.417 gm	Red Wine Vinegar	153.417 gm
Cane Sugar	120.590 gm	Blend 2 Dressing	120.800 gm
Worcestershire Sauce	10.464 gm	Worcestershire Sauce	10.464 gm
Vegetable Oil	201.166 gm	Vegetable Oil	200.956 gm
Paprika	4.245 gm	Paprika	4.245 gm
Onion Powder	2.215 gm	Onion Powder	2.215 gm
Garlic Powder	2.215 gm	Garlic Powder	2.215 gm
Kosher Salt	5.537 gm	Kosher Salt	5.537 gm
	1000.000 gm		1000.000 gm

FIG. 50

Reduced Sugar BBQ Sauce

BBQ Sauce
Full Sugar Control

Ketchup	274.491 gm
Dry Mustard	19.489 gm
Brown Sugar Dark	365.988 gm
Red Wine Vinegar	115.250 gm
White Wine Vinegar	38.416 gm
Water	147.157 gm
Worcestershire Sauce	20.739 gm
Paprika	2.769 gm
Black Pepper	1.061 gm
Kosher Salt	14.640 gm
	1000.000 gm

BBQ Sauce
Blend 2 Sav Sauce

NSA Ketchup	274.491 gm
Dry Mustard	19.489 gm
Maltrin M180	16.347 gm
PureGel B994	5.112 gm
Blend 2 Sav Sauce	248.000 gm
Red Wine Vinegar	115.250 gm
White Wine Vinegar	38.416 gm
Water	243.686 gm
Worcestershire Sauce	20.739 gm
Paprika	2.769 gm
Black Pepper	1.061 gm
Kosher Salt	14.640 gm
	1000.000 gm

FIG. 51

STEVIOL GLYCOSIDE FORMULATIONS FOR FOOD AND BEVERAGES

RELATED APPLICATIONS

[0001] This Application claims the benefit under 35 U.S. C. § 119(e) of U.S. Provisional Application No. 62/916,126, entitled "STEVIOL GLYCOSIDE FORMULATIONS FOR FOOD AND BEVERAGES," filed on Oct. 16, 2019, and U.S. Provisional Application No. 62/931,769, entitled "STEVIOL GLYCOSIDE FORMULATIONS FOR FOOD AND BEVERAGES," filed on Nov. 6, 2019, the entire contents of each of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present disclosure relates, at least in part, to the use of low or non-caloric sweetener compositions based on steviol glycosides, such as those derived from natural sources, as well as edible foods, including beverages, with such sweetener compositions. More specifically provided are particular formulations of rebaudiosides that elicit a pleasant sensory experience upon consumption.

BACKGROUND

[0003] One of the main obstacles for the widespread use of *Stevia* sweeteners are their undesirable taste attributes. Alternative sweeteners and methods for their production are needed.

SUMMARY

[0004] Many studies have focused on the connection of sugar consumption with obesity and other pathologies such as diabetes. Consumers and food companies alike are interested in calorie reduction through the use of sugar alternatives. There is also significant interest in the reduction of calories for companion animals or the use of sweeteners to make certain feed products more palatable.

[0005] Non-caloric natural and synthetic high-potency sweeteners often possess flavor profiles that are not as desirable to consumers as natural caloric sweeteners. Thus, it is desirable to develop improved non- or low-caloric sweeteners that can be substituted for sugar and that have a desirable taste profile. The species *Stevia rebaudiana* ("*Stevia*") is the source of certain naturally occurring sweet steviol glycosides. Considerable research and development has focused on the use of sweet steviol glycosides of *Stevia* as non-caloric sweeteners, but there is a continuing interest in finding desirable mixes of *Stevia*-derived glycosides known as rebaudiosides, for use in a variety of food including beverage products.

[0006] Rebaudioside A is found to be between 150 and 320 times sweeter than sucrose, but has an anise or 'licorice' off-flavor that makes it among the least favorite compounds to use. Other desirable steviol glycosides include Rebaudioside D and Rebaudioside M, but each of the various steviol glycosides have their limitations in terms of taste, solubility or off-flavor and the optimal mix for use in various food products including beverages has not yet been found.

[0007] Methods for of the production of various rebaudioside molecules from *Stevia* and from Rebaudioside A, are described in, for example, U.S. Published Patent Applications 20170181452 and 20180037600, and U.S. Pat. Nos. 9,522,929, 10,010,099, 10,081,826, 10,253,344, all of which methods of production, including the compositions used and produced, are incorporated by reference herein. A need exists to provide a large-scale stable supply of the most desirable tasting *Stevia rebaudiosides* and to use those rebaudiosides in compositions that optimize the flavor of the food sweetened by them while restricting or controlling calorie content.

[0008] Surprisingly, steviol glycoside formulations that improve the solubility of the rebaudiosides used and lower the use of sucrose in food products while improving flavor and masking bitterness, have been found.

[0009] The present disclosure, in some aspects, provide steviol glycoside formulations containing a combination of rebaudiosides that provide a taste profile similar to sugar from onset of sweetness to sweetness linger, as determined through, e.g., the use of a panel of tasters for each of the formulations, by means of a sensory evaluation, as well as evaluation of its physical characteristics and capacity to replace a food/feed stuff made with a full or normal complement of sucrose. Where initial sensory testing of some blends in non-carbonated beverages detected slightly less sweet than full sugar product and some bitterness in aftertaste, the steviol glycoside formulations described herein were re-balanced to increase sweetness and reduce bitterness.

[0010] The present disclosure encompasses production of the steviol rebaudioside formulations to modify the taste perception of food products such that they, for example, exhibit enhanced sweetness, improved onset of sweetness, improved time and intensity of sweetness, and maskedbitterness and/or off notes.

[0011] The present disclosure relates, at least in part, to *Stevia* rebaudioside-based sweetener blends containing highly purified steviol glycosides. These blends include rebaudioside formulations comprising combinations and subsets of A, M, D, E, and I in varying quantities, and exhibit taste characteristics similar to sugar sweetener systems in, for example, carbonated (e.g., Cola and Non-Cola Carbonated) and non-carbonated beverages and concentrates, protein-based products, liquid dairy, yogurt, condiments, baked goods, jams, jellies and spreads. Additionally, the formulations can provide a higher solubility than the individual use of Rebaudioside M or Rebaudioside D with a taste profile closer to sucrose than individual rebaudiosides, such as specifically, Rebaudioside M or Rebaudioside D alone.

[0012] Therefore, further provided herein are the usage of the rebaudioside formulations in the production of food products, including beverages, for human consumption and feed production for animals and aquaculture. In some embodiments, the formulations contain multiple steviol glycosides, which comprises from about 0.1 wt. % to about 5.5 wt. %, preferably 1.0 wt. % to about 2.9 wt. % of the total food composition. In addition, other added elements in such food compositions can include erythritol and/or hydrocolloids such as pectin or gum Arabic.

[0013] Moreover, further provided herein are methods for optimizing food formulations to optimize health improvements in end consumers, in the form of a food item with a less dense calorie profile while retaining a desirable taste profile. This is also true for companion animals that may benefit from a calorie reduction in their daily diets. For animals produced for market the compositions provided herein can be used for changing the taste profile of lower

quality feed or enhancing the flavor of feed containing nutrients that may be needed but that have bitterness or off-flavor.

[0014] In some embodiments, the rebaudioside blends provided allow for up to 100% sugar reduction in a wide-range of food products, including beverage products, with higher solubility characteristics than individual rebaudiosides and other known blends, while maintaining a desired flavor and taste profile and providing an onset of sweetness that is similar or almost identical to that of table sugar.

[0015] In some embodiments, the rebaudiosides may be produced by genetically modified microbes designed to produce sufficient quantities of steviol glycosides. It is apparent that this may be done with a much more limited geographic footprint than that needed for the production/breeding of *Stevia rebaudiana* plants.

[0016] Methods of improving the caloric profile of food for the elderly and the unwell, relative to the nutrients are also provided. In nutrition drinks designed for weight loss and/or nutrient delivery, the taste characteristics of the formulations provided are very similar to table sugar allowing for up to 100% sugar reduction in food products, including beverage products, while improving overall solubility and masking enhanced bitterness or off-flavors.

[0017] Further provided herein are commercially valuable processes for producing a low- or no-calorie composite sweetener composition comprising various *Stevia* rebaudiosides (See, e.g., FIG. **11**) and uses thereof in various food products, including beverage and feed products.

[0018] Some aspects of the present disclosure provide steviol glycoside formulations consisting essentially of 40-60wt. % rebaudioside A (Reb A), 15-30 wt. % rebaudioside E (Reb E), 10-17 wt. % rebaudioside D (Reb D), and 5-10 wt. % rebaudioside M (Reb M).

[0019] Some aspects of the present disclosure provide steviol glycoside formulations consisting essentially of 40-60 wt. % rebaudioside A (Reb A), 15-30 wt. % rebaudioside E (Reb E), 10-17 wt. % rebaudioside D (Reb D), 5-10 wt. % rebaudioside M (Reb M), and 2-8 wt. % rebaudioside I (Reb I).

[0020] In some embodiments, Reb A is present in a concentration of 300-600 ppm, Reb E is present in a concentration of 50-200 ppm, Reb D is present in a concentration of 50-200 ppm, Reb M is present in a concentration of 200-500 ppm.

[0021] In some embodiments, Reb A is present in a concentration of 200-500 ppm, Reb E is present in a concentration of 50-300 ppm, Reb D is present in a concentration of 50-300 ppm, Reb M is present in a concentration of 5-100 ppm, and Reb I is present in a concentration of 5-50 ppm.

[0022] Other aspects of the present disclosure provide steviol glycoside formulations consisting essentially of rebaudioside A (Reb A), rebaudioside E (Reb E), rebaudioside D (Reb D), and rebaudioside M (Reb M), wherein Reb A is present in an amount of 300-600 ppm; Reb E is present in an amount of from 50-250 ppm; Reb D is present in an amount of 10-200 ppm; and/or Reb M is present in an amount of 10-150 ppm.

[0023] In some embodiments, the steviol glycoside formulation further comprises rebaudioside I (Reb I) in an amount of 1-50 ppm.

[0024] Further provided herein are steviol glycoside formulations consisting essentially of 500 ppm Reb A, 350 ppm Reb M, 100 ppm Reb D, and 100 ppm Reb E.

[0025] Further provided herein are steviol glycoside formulations consisting essentially of 373 ppm Reb A, 48 ppm Reb M, 100 ppm Reb D, 131 ppm Reb E, and 30 ppm Reb I.

[0026] In some embodiments, at least one rebaudioside is made by a genetically modified microbe.

[0027] Orally consumable product comprising the steviol glycoside formulation or the sweetener described herein are also provided.

[0028] In some embodiments, the orally consumable product is selected from the group consisting of a food composition, a beverage product, a dietary supplement, a nutraceutical, an edible gel mix, an edible gel composition, a pharmaceutical composition, a dental and oral hygiene composition, and an animal feed. In some embodiments, the orally consumable product is a dental and oral hygiene composition. In some embodiments, the dental and oral hygiene composition is a toothpaste.

[0029] In some embodiments, the steviol glycoside formulation is present in a concentration of 50-800 ppm. In some embodiments, the steviol glycoside formulation is present in the range of 0.0003% to 1.0% by weight of the total weight of the orally consumable product.

[0030] In some embodiments, the orally consumable product is a pharmaceutical composition. In some embodiments, the steviol glycoside formulation is present in a concentration of 50-800 ppm. In some embodiments, the steviol glycoside formulation is present in the range of 0.0004% to 1.25% by weight of the total weight of the orally consumable product.

[0031] In some embodiments, the orally consumable product is a beverage. In some embodiments, the beverage is a carbonated or non-carbonated beverage. In some embodiments, the beverage is selected from the group consisting of a soft drink, a fountain beverage, a frozen and ready-to-drink beverage, coffee, tea, a dairy beverage, a powdered soft drink, a liquid concentrate, flavored water, enhanced water, fruit juice, a fruit juice flavored drink, a sport drink, and an energy drink. In some embodiments, the steviol glycoside formulation is present in a concentration of 65-800 ppm. In some embodiments, the steviol glycoside formulation is present in the range of 0.0005% to 1.0% by weight of the total weight of the orally consumable product.

[0032] In some embodiments, the orally consumable product is a food composition. In some embodiments, the food composition is selected from the group consisting of spreads, margarines, sports products, nutrition bars, infant formulas, mayonnaise, confectionary composition, a condiment, a chewing gum, a cereal composition, a baked good, a dairy product, and a tabletop sweetener composition. In some embodiments, the food composition is a yogurt. In some embodiments, the food composition is frozen. In some embodiments, the food composition is ice cream. In some embodiments, the steviol glycoside formulation is present in a concentration of 50-700 ppm. In some embodiments, the steviol glycoside formulation is present in the range of 0.0005% to 1.0% by weight of the total weight of the orally consumable product.

[0033] In some embodiments, the orally consumable product further comprises a component selected from the group consisting of sucrose, aroma compounds, flavoring compounds and mixtures thereof,

[0034] In some embodiments, the orally consumable product comprises tocopherols in an amount of at least 5 ppm.

[0035] In some embodiments, the orally consumable product further comprises at least one stabilizing agent selected from the group consisting of citric acid, sodium benzoate, t-butyl hydroquinone, ascorbyl palmitate, propyl gallate, and combinations thereof.

[0036] In some embodiments, the orally consumable product further comprises a moisture containing ingredient. In some embodiments, the moisture ingredient is an emulsion. In some embodiments, the orally consumable product further comprises a chelating agent.

[0037] In some embodiments, the orally consumable product is an animal feed product for livestock, companion animals and/or aquaculture. In some embodiments, the livestock is cattle, swine and/or poultry. In some embodiments, the steviol glycoside formulation is present in a concentration of 50-800 ppm. In some embodiments, the orally consumable product further comprises a hydrocolloid or erythritol.

[0038] Also provided herein are compositions in any one of the figures.

[0039] Further provided herein are methods for creating or enhancing a sweetening effect in an orally consumable product comprising adding an amount of the steviol glycoside formulation or the sweetener described herein sufficient to produce the desired degree of sweetness to the orally consumable product.

[0040] Further provided herein are sweeteners comprising rebaudioside I (Reb I) produced by a reaction mixture comprising a steviol glycoside; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine dipospho glycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of any one of SEQ ID NOs: 1-4.

[0041] In some embodiments, the reaction mixture further comprises a sucrose synthase comprising the amino acid sequence of SEQ ID NO: 8. In some embodiments, the steviol glycoside is rebaudioside A.

[0042] In some embodiments, the sweetener further comprises one or more steviol glycoside selected from the group consisting of: rebaudioside E (Reb E), rebaudioside A (Reb A), rebaudioside M (Reb M), and rebaudioside D (Reb D). In some embodiments, the sweetener further comprises Reb E, Reb A, Reb M, and Reb D.

[0043] In some embodiments, the Reb E is produced by a reaction mixture comprising stevioside, rebaudioside KA, or rubusoside; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine dipospho glycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of any one of SEQ ID NOs: 1, 5, and 7.

[0044] In some embodiments, the Reb A is produced by a reaction mixture comprising stevioside or rebaudioside D; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine dipospho glycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of SEQ ID NO: 1.

[0045] In some embodiments, the Reb M is produced by a reaction mixture comprising stevioside or rebaudioside D; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine dipospho glycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of SEQ ID NO: 1 or SEQ ID NO: 7.

[0046] In some embodiments, the Reb D is produced by a reaction mixture comprising rebaudioside A or rebaudioside E; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine dipospho glycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of any one of SEQ ID NOs: 1, 5, and 7.

[0047] In some embodiments, the reaction mixture further comprises a sucrose synthase comprising the amino acid sequence of SEQ ID NO: 8.

[0048] In some embodiments, the sweetener comprises 40-60 wt. % Reb A, 15-30 wt. % Reb E, 10-17 wt. % Reb D, 5-10 wt. % Reb M, and 2-8 wt. % Reb I.

[0049] In some embodiments, Reb A is present in a concentration of 200-500 ppm, Reb E is present in a concentration of 50-300 ppm, Reb D is present in a concentration of 50-300 ppm, Reb M is present in a concentration of 5-100 ppm, and Reb I is present in a concentration of 5-50 ppm.

[0050] Other features and advantages of this disclosure will become apparent in the following detailed description of preferred embodiments of this disclosure, taken with reference to the accompanying figures, or will otherwise be apparent to one or ordinary skill in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051] FIGS. **1**A-**1**D depict the use for a lemon water, respectively, of sucrose, Reb M, Reb D and the formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (Blend 2), FIGS. **1**B-**1**D representing a 100% sugar reduction in non-carbonated beverages including both liquid and dry concentrates.

[0052] FIGS. **2**A-**2**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **2**D, Blend 2) for cola, FIGS. **2**B-**2**D representing up to a 100% sugar reduction in cola carbonates.

[0053] FIGS. **3**A-**3**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **3**D, Blend 2) for carbonated orange soda, FIGS. **3**B-**3**D representing up to a 100% sugar reduction in a carbonated orange soda.

[0054] FIGS. **4**A-**4**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **4**D, Blend 2) for chocolate milk, FIGS. **4**B-**4**D representing up to a 100% sugar reduction in a chocolate milk drink. Specifically, FIGS. **4**B-**4**D show the use of the current formulations in chocolate milk providing up to a 100% sugar reduction in dairy applications (liquid and powdered).

[0055] FIGS. **5**A-**5**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **5**D, Blend 2) for chocolate almond milk, FIGS. **5**B-**5**D repre-

senting up to a 100% sugar reduction in a chocolate milk drink. Specifically, FIGS. **5**B-**5**D show the use of the current formulations in chocolate almond milk providing up to a 100% sugar reduction in dairy applications (liquid and powdered).

[0056] FIGS. **6**A-**6**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **6**D, Blend 2) for vanilla yogurt, FIGS. **6**B-**6**D representing up to a 100% sugar reduction in vanilla yogurt. Specifically, FIGS. **6**B-**6**D show the use of the current formulations in vanilla yogurt providing up to a 100% sugar reduction in yogurt (fruited and non-fruited).

[0057] FIGS. **7**A-**7**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **7**D, Blend 2) for chocolate almond milk, FIGS. **7**B-**7**D representing up to a 100% sugar reduction in banana mini muffins. Specifically, FIGS. **7**B-**7**D show the use of the current formulations in banana mini muffins providing up to a 100% sugar reduction in cakes, pastries, muffins, pies, breads and desserts.

[0058] FIGS. **8**A-**8**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **8**D, Blend 2) for vanilla butter cookies, FIGS. **8**B-**8**D representing up to a 100% sugar reduction in vanilla butter cookies. Specifically, FIGS. **8**B-**8**D show the use of the current formulations in banana mini muffins providing up to a 100% sugar reduction in cookies, crackers and snacks.

[0059] FIGS. **9**A-**9**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **9**D, Blend 2) in ketchup, FIGS. **9**B-**9**D representing up to a 100% sugar reduction in vanilla butter cookies. Specifically, FIGS. **9**B-**9**D show the use of the current formulations in ketchup providing up to a 100% sugar reduction in condiments.

[0060] FIGS. **10**A-**10**D depict the use, respectively, of sucrose, Reb M, Reb D and the present formulations comprising Reb M, Reb D, Reb E, Reb A and Reb I (FIG. **10**D, Blend 2) in peanut butter, FIGS. **10**B-**10**D representing up to a 100% sugar reduction in peanut butter. Specifically, FIGS. **10**B-**10**D show the use of the current formulations in ketchup providing up to a 100% sugar reduction in fruit preps, jams, jellies, nut butters and spreads.

[0061] FIGS. **11**A-**11**B show exemplary formulations broken down into individual components and relative amounts.

[0062] FIG. **12** shows a process flow diagram for the production of soymilk.

[0063] FIG. **13** shows a process flow diagram for the production of margarine.

[0064] FIG. **14** shows the use of a sweetener system in companion animal feed comprising a rebaudioside blend comparable to up to a 100% sugar reduction in such feed.

[0065] FIG. **15** shows a full sugar lemon water composition and a zero-calorie lemon water composition containing Blend 2 described herein.

[0066] FIG. **16** shows a full sugar lemonade composition and a reduced calorie lemonade composition containing Blend 2 described herein.

[0067] FIG. **17** shows peach juice drinks with full sugar or reduced sugar (33% reduction or 50% reduction).

[0068] FIG. **18** shows a reduced sugar peach juice drink (80% reduction) and a zero-calorie peach juice drink containing Blend 2 described herein.

[0069] FIG. **19** shows lemonade compositions with full sugar or reduced sugar (33% reduction or 50% reduction).

[0070] FIG. **20** shows reduced sugar lemonade composition (80% reduction) and a zero-calorie lemonade composition containing Blend 2 described herein.

[0071] FIG. **21** shows a full sugar orange carbonated soft drink (CSD) composition and a zero-calorie orange CSD containing Blend 2 described herein.

[0072] FIG. **22** shows peach sparkling water with full sugar or reduced sugar (40% reduction).

[0073] FIG. **23** shows reduced peach sparkling water (80% reduction) and a zero-calorie peach sparkling water containing Blend 2 described herein.

[0074] FIG. **24** shows a full sugar hard lemonade composition and a reduced sugar hard lemonade containing Blend 2 described herein.

[0075] FIG. **25** shows a full sugar peach energy drink and a zero-calorie peach energy drink containing Blend 2 described herein.

[0076] FIG. **26** shows a full sugar peach energy drink and a zero-calorie peach energy drink containing Blend 2 described herein.

[0077] FIG. **27** shows a full sugar mango whey protein drink and a reduced sugar (60% reduction) mango whey protein drink containing Blend 2 described herein.

[0078] FIG. **28** shows a full sugar mango whey protein drink and a reduced sugar (60% reduction) mango whey protein drink containing Blend 2 described herein.

[0079] FIG. **29** shows a full sugar chocolate almond breeze composition, a reduced sugar (60% reduction) chocolate almond breeze composition containing Blend 2 described herein, and a 100% reduced sugar chocolate almond breeze composition containing Blend 2 described herein.

[0080] FIG. **30** shows a full sugar chocolate soymilk composition and a reduced sugar (60% reduction) chocolate soymilk composition containing Blend 2 described herein.

[0081] FIG. **31** shows a full sugar strawberry filing and a reduced sugar (80% reduction) strawberry filing containing Blend 2 described herein.

[0082] FIG. **32** shows a full sugar strawberry juice milk smoothie and a reduced sugar (60% reduction) strawberry juice milk smoothie containing Blend 2 described herein.

[0083] FIG. **33** shows a full sugar orange juice milk smoothie and a reduced sugar (80% reduction) orange juice milk smoothie containing Blend 2 described herein.

[0084] FIG. **34** shows a full sugar mango juice milk smoothie and a 100% reduced sugar mango juice milk smoothie containing Blend 2 described herein.

[0085] FIG. **35** shows a full sugar chocolate milk and a reduced sugar (60% reduction) chocolate milk containing Blend 2 described herein.

[0086] FIG. **36** shows a full sugar chocolate sauce and a reduced sugar (60% reduction) chocolate sauce containing Blend 2 described herein.

[0087] FIG. **37** shows a full sugar vanilla yogurt and a reduced sugar (80% reduction) vanilla yogurt containing Blend 2 described herein.

[0088] FIG. **38** shows a full sugar vanilla pea protein yogurt and a reduced sugar (80% reduction) vanilla pea protein yogurt containing Blend 2 described herein.

[0089] FIG. **39** shows a full sugar vanilla ice cream and a reduced sugar (80% reduction) vanilla ice cream containing Blend 2 described herein.

[0090] FIG. **40** shows a full sugar soy vanilla ice cream and a reduced sugar (80% reduction) soy vanilla ice cream containing Blend 2 described herein.

[0091] FIG. **41** shows a full sugar mango sherbet and a 100% reduced sugar mango sherbet containing Blend 2 described herein.

[0092] FIG. **42** shows a full sugar pea protein mango sherbet and a 100% reduced sugar pea protein mango sherbet containing Blend 2 described herein.

[0093] FIG. **43** shows a full sugar vanilla butter cookie composition and a reduced sugar (80% reduction) vanilla butter cookie composition containing Blend 2 described herein.

[0094] FIG. **44** shows a full sugar banana mini muffin composition and a reduced sugar (80% reduction) banana mini muffin composition containing Blend 2 described herein.

[0095] FIG. **45** shows a full sugar cranberry granola bar composition and a 100% reduced sugar cranberry granola bar composition containing Blend 2 described herein.

[0096] FIG. **46** shows a full sugar cinnamon granola crunch composition and a 100% reduced sugar cinnamon granola crunch composition containing Blend 2 described herein.

[0097] FIG. **47** shows a full sugar tomato ketchup composition, a reduced sugar (50% reduction) tomato ketchup composition containing Blend 2 described herein, and a 100% reduced sugar tomato ketchup composition containing Blend 2 described herein.

[0098] FIG. **48** shows a full sugar creamy French dressing composition, a reduced sugar (50% reduction) creamy French dressing composition containing Blend 2 described herein, and a 100% reduced sugar creamy French dressing composition containing Blend 2 described herein.

[0099] FIG. **49** shows a full sugar tomato ketchup composition and a 100% reduced sugar tomato ketchup composition containing Blend 2 described herein.

[0100] FIG. **50** shows a full sugar creamy French dressing composition and a 100% reduced sugar creamy French dressing composition containing Blend 2 described herein.

[0101] FIG. **51** shows a full sugar BBQ sauce composition and a 100% reduced sugar BBQ sauce composition containing Blend 2 described herein.

DETAILED DESCRIPTION

Definitions

[0102] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the disclosure belongs. Although any methods and materials similar to or equivalent to those described herein may be used in the practice or testing of the present disclosure, the preferred materials and methods are described below.

[0103] As used herein, "synthetic" or "organically synthesized" or "chemically synthesized" or "organically synthesizing" or "chemically synthesizing" or "organic synthesis" or "chemical synthesis" are used to refer to preparing the compounds through a series of chemical reactions; this does not include extracting the compound, for example, from a natural source.

[0104] The term "orally consumable product" as used herein refers to any beverage, food product, dietary supplement, nutraceutical, pharmaceutical composition, dental hygienic composition and cosmetic product which are contacted with the mouth of man or animal, including substances that are taken into and subsequently ejected from the mouth and substances which are drunk, eaten, swallowed, or otherwise ingested; and that are considered safe for human or animal consumption when used in a generally acceptable range of concentrations.

[0105] The term "food product" or "food composition" as used herein includes fruits, vegetables, juices, meat products such as ham, bacon and sausage; egg products, fruit concentrates, gelatins and gelatin-like products such as jams, jellies, preserves, and the like; milk products such as ice cream, sour cream, yogurt, and sherbet; icings, syrups including molasses; corn, wheat, rye, soybean, oat, rice and barley products, cereal products, nut meats and nut products, cakes, cookies, confectionaries such as candies, gums, fruit flavored drops, and chocolates, chewing gum, mints, creams, icing, ice cream, pies and breads. "Food product" also refers to condiments such as herbs, spices and seasonings, flavor enhancers, such as monosodium glutamate. "Food product" further also includes prepared packaged products, such as dietetic sweeteners, liquid sweeteners, tabletop flavorings, granulated flavor mixes which upon reconstitution with water provide non-carbonated drinks, instant pudding mixes, instant coffee and tea, coffee whiteners, malted milk mixes, pet foods, livestock feed, tobacco, and materials for baking applications, such as powdered baking mixes for the preparation of breads, cookies, cakes, pancakes, donuts and the like. "Food product" also includes diet or low-calorie food and beverages containing little or no sucrose.

[0106] As used herein, the term "sweetness intensity" refers to the relative strength of sweet sensation as can be observed or experienced by an individual, e.g., a human, or a degree or amount of sweetness detected by a taster, for example on a Brix scale.

[0107] As used herein, the term "enhancing the sweetness" refers to the effect of rebaudiosides in increasing, augmenting, intensifying, accentuating, magnifying, and/or potentiating the sensory perception of one or more sweetness characteristics of an orally consumable product as provided herein as compared to a corresponding orally consumable product that does not contain the rebaudiosides.

[0108] As used herein, the term "off-taste(s)" refers to an amount or degree of taste that is not characteristically or usually found or expected in an orally consumable product. For example, an off-taste is an undesirable taste of a sweetened consumable, such as, a bitter taste, a licorice-like taste, a metallic taste, an aversive taste, an astringent taste, a delayed sweetness onset, a lingering sweet aftertaste, and the like, etc.

[0109] As used herein, the term "wt. %" refers to the weight % of a compound (e.g., a rebaudioside) relative to the total weight of all compounds (e.g., all rebaudiosides) in a composition, such as a steviol glycoside formulation.

[0110] As used herein, the term "ppm" refers to part(s) per million by weight, for example, the weight of a compound, such as rebaudioside V and/or rebaudioside W (in milligrams) per kilogram, of a composition, such as an orally consumable product, containing such compound (i.e., mg/kg) or the weight of a compound, such as rebaudioside

V and/or rebaudioside W (in milligrams) per liter, of a composition, such as an orally consumable product, containing such compound (i.e., mg/L); or by volume, for example the volume of a compound, such as a rebaudioside (in milliliters) per liter, of a composition, such as an orally consumable product containing such compound (i.e., ml/L).

[0111] As used herein, the term "sweetness intensity" refers to the relative strength of a sweet sensation as can observed or experienced by an individual, e.g., a human, or a degree or amount of sweetness detected by a taster, for example on a Brix scale.

[0112] As used herein, the term "carbohydrate sweetener" includes caloric sweeteners, such as, sucrose, fructose, glucose, high fructose corn syrup (containing fructose and glucose), xylose, arabinose, rhamnose, and sugar alcohols, such as erythritol, xylitol, mannitol, sorbitol, and inositol.

[0113] As used herein, the term "flavoring" or the like refers to any food-grade material that may be added to or present in an orally consumable product to provide a desired flavor.

[0114] The term "isolated" is used according to its ordinary and customary meaning as understood by a person of ordinary skill in the art, and when used in the context of an isolated nucleic acid or an isolated polypeptide, is used without limitation to refer to a nucleic acid or polypeptide that, by the hand of man, exists apart from its native environment and is therefore not a product of nature. An isolated nucleic acid or polypeptide can exist in a purified form or can exist in a non-native environment such as, for example, in a transgenic host cell.

[0115] The terms "recombinant," "heterologous," and "exogenous," when used herein in connection with polynucleotides, are used according to their ordinary and customary meanings as understood by a person of ordinary skill in the art, and are used without limitation to refer to a polynucleotide (e.g., a DNA sequence or a gene) that originates from a source foreign to the particular host cell or, if from the same source, is modified from its original form. Thus, a heterologous gene in a host cell includes a gene that is endogenous to the particular host cell but has been modified through, for example, the use of site-directed mutagenesis or other recombinant techniques. The terms also include non-naturally occurring multiple copies of a naturally occurring DNA sequence. Thus, the terms refer to a DNA segment that is foreign or heterologous to the cell, or homologous to the cell but in a position or form within the host cell in which the element is not ordinarily found.

[0116] Similarly, the terms "recombinant," "heterologous," and "exogenous," when used herein in connection with a polypeptide or amino acid sequence, means a polypeptide or amino acid sequence that originates from a source foreign to the particular host cell or, if from the same source, is modified from its original form. Thus, recombinant DNA segments can be expressed in a host cell to produce a recombinant polypeptide.

[0117] As used herein, the singular form "a", "an", and "the" includes plural references unless indicated otherwise.

[0118] Reference to "about" a value or parameter herein refers to the usual error range for the respective value readily known to the skilled person in this technical field. Reference to "about" for a value or parameter herein includes (and describes) aspects that are directed to that value or parameter per se. For example, description referring to "about X" includes description of "X."

Steviol Glycosides and Methods of Producing

[0119] Steviol glycosides can be isolated from *Stevia rebaudiana* leaves. Steviol glycosides are used as high intensity, low-calorie sweeteners and are significantly sweeter than sucrose. As natural sweeteners, different steviol gly?cosides have different degrees of sweetness and after-taste. For example, stevioside is 100-150 times sweeter than sucrose with bitter after-taste. Rebaudioside C is between 40-60 times sweeter than sucrose. Dulcoside A is about 30 times sweeter than sucrose.

[0120] Naturally occurring steviol glycosides share the same basic steviol structure, but differ in the content of carbohydrate residues (e.g., glucose, rhamnose and xylose residues) at the C13 and C19 positions. Steviol glycosides with known structures include, steviol, stevioside, rebaudioside A, rebaudioside B, rebaudioside C, rebaudioside D, rebaudioside E, rebaudioside F, rebaudioside M, rebaudioside I, and dulcoside A. Structures of examples of steviol glycosides are provided in Table 1.

TABLE 1

Examples of Steviol Glycosides.

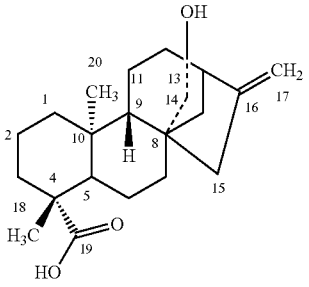
Name	Structure	Molecular Formula	Molecular Weight
Steviol		$C_{20}H_{30}O_3$	318

TABLE 1-continued

Examples of Steviol Glycosides.

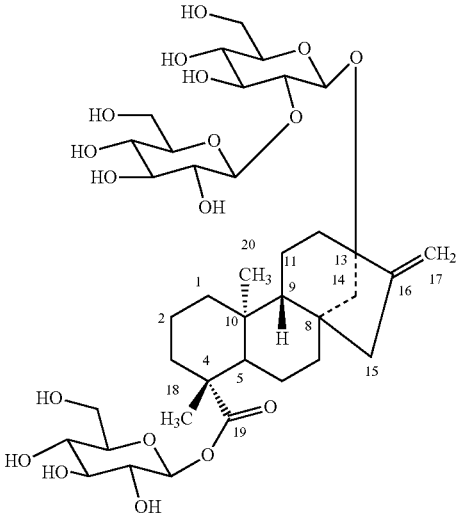
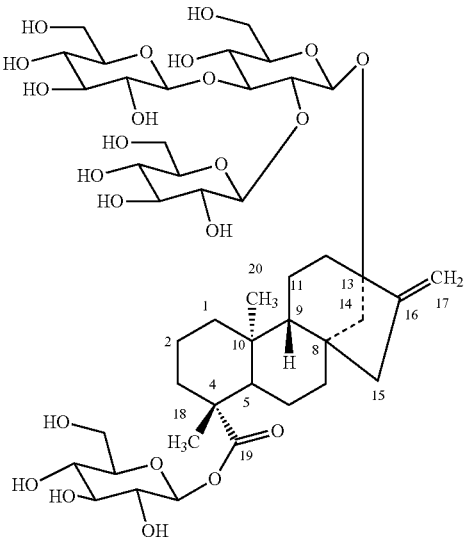
Name	Structure	Molecular Formula	Molecular Weight
Stevioside		$C_{38}H_{60}O_{18}$	804
Rebaudioside A		$C_{44}H_{70}O_{23}$	966

TABLE 1-continued

Examples of Steviol Glycosides.

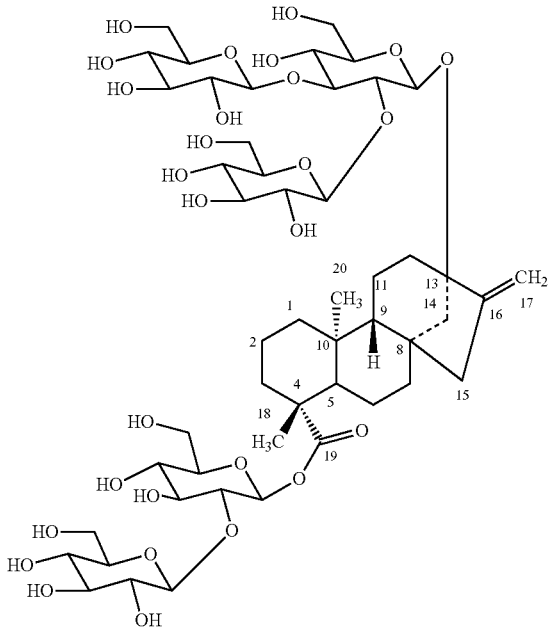
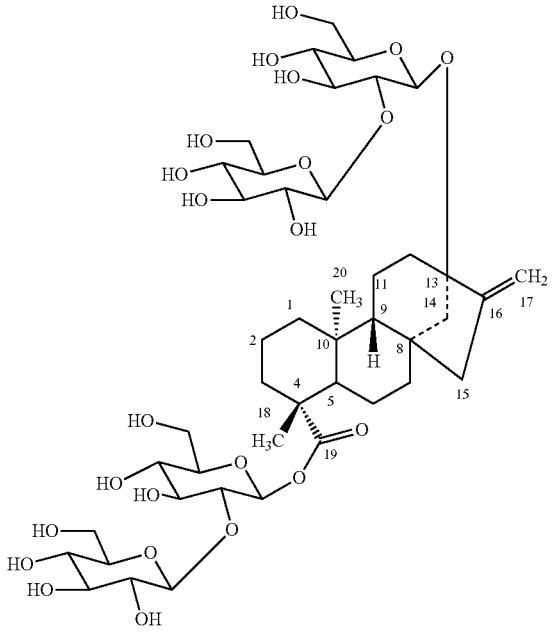
Name	Structure	Molecular Formula	Molecular Weight
Rebaudioside D		$C_{50}H_{80}O_{28}$	1128
Rebaudioside E		$C_{44}H_{70}O_{23}$	966

TABLE 1-continued

Examples of Steviol Glycosides.

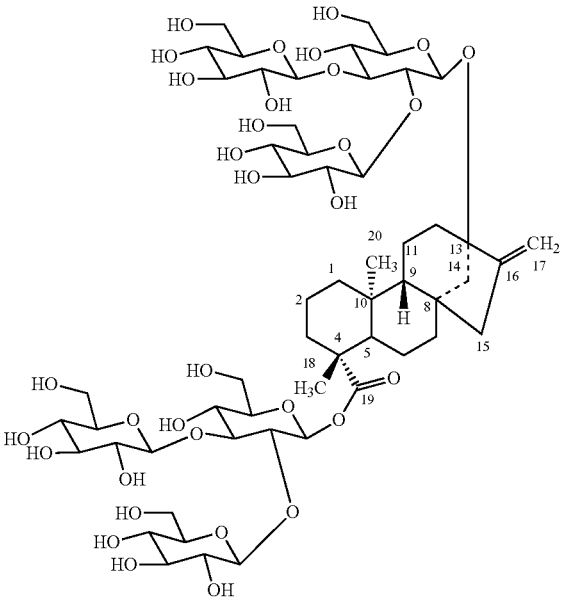
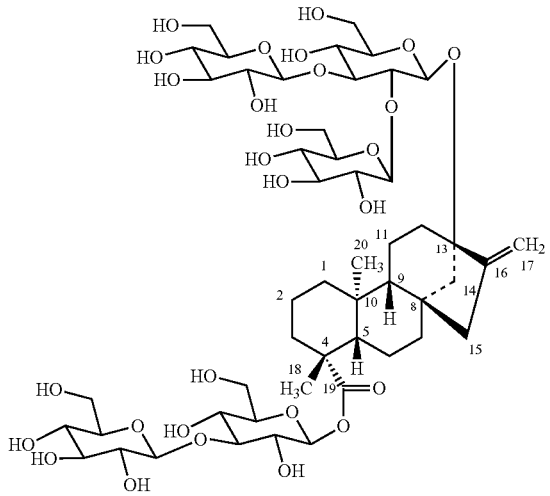
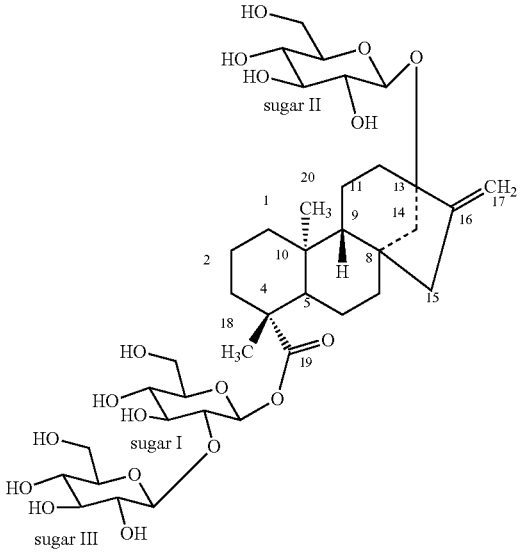
Name	Structure	Molecular Formula	Molecular Weight
Rebaudioside M		$C_{56}H_{90}O_{33}$	1291.3
Rebaudioside I		$C_{50}H_{80}O_{28}$	1129.15

TABLE 1-continued

Examples of Steviol Glycosides.

Name	Structure	Molecular Formula	Molecular Weight
Rebaudioside KA		$C_{38}H_{60}O_{18}$	804

[0121] The majority of steviol glycosides are formed by several glycosylation reactions of steviol, which are typically catalyzed by the UDP-glycosyltransferases (UGTs) using uridine 5'-diphosphoglucose (UDP-glucose) as a donor of the sugar moiety. UGTs in plants make up a very diverse group of enzymes that transfer a glucose residue from UDP-glucose to steviol. For example, glycosylation of the C-3' of the C-13-O-glucose of stevioside yields rebaudioside A; and glycosylation of the C-2' of the 19-O-glucose of the stevioside yields rebaudioside E. Further glycosylation of rebaudioside A (at C-2'-19-O-glucose) or rebaudioside E (at C-3'-13-O-glucose) produces rebaudioside D.

[0122] Any suitable technique known in the art for isolating and/or purifying compounds, such as rebaudiosides from plants, such as *Stevia*, may be used. For example, rebaudiosides can be isolated and/or purified from *Stevia* plant material utilizing one or more of the techniques described in U.S. Pat. Nos. 3,723,410; 4,082,858; 4,361,697; 4,599,403; 5,112,610; 5,962,678; 8,299,224; 8,414,951; U.S. Patent Application Publication Nos. 2006/0083838; 2006/0134292; 2007/0082103; 2008/0300402; and Chaturvedula, VSP and Prakash, I, Eur. Chem. Bull. 2013, 2(5), 298-302. Such techniques are incorporated herein by reference. Alternatively, the compounds can be recombinantly produced or chemically synthesized using methods well known to those of skill in the art.

[0123] In some embodiments, glycosides from leaves, such as rebaudiosides, can be extracted using either water or organic solvent extraction. Supercritical fluid extraction and steam distillation can also be used. In other embodiments, rebaudiosides can be recovered from *Stevia* plants using membrane technology. In some embodiments, production of an extract typically includes extraction of plant material with water or an water-organic solvent mixture, precipitation of high molecular weight substances, deionization and decolorization, purification on specific macroporous polymeric adsorbents, concentration, and drying.

[0124] In other embodiments, extracts of *Stevia* leaves may be purified to concentrate a selected component of the *Stevia* extract. For example, column chromatography may be used to isolate rebaudiosides from the other diterpene glycosides. In some embodiments, following chromatographic separation, the produced rebaudioside may optionally be recrystallized at least once, or at least twice, or at least three times, to obtain a *Stevia* extract containing a desired level of purity of the rebaudioside.

[0125] In some embodiments, a *Stevia* extract used in the steviol glycoside formulations provided herein has a purity of about 50% to about 100% by weight, about 55% to about 100% by weight, about 60% to about 100% by weight, about 65% to about 100% by weight, about 70% to about 100% by weight, about 75% to about 100% by weight, about 80% to about 100% by weight, about 85% to about 100% by weight, about 86% to about 100% by weight, about 87% to about 100% by weight, about 88% to about 100% by weight, about 89% to about 100% by weight, about 90% to about 100% by weight, about 91% to about 100% by weight, about 92% to about 100% by weight, about 93% to about 100% by weight, about 94% to about 100% by weight, about 95% to about 100% by weight, about 96% to about 100% by weight, about 97% to about 100% by weight, about 98% to about 100% by weight, or about 99% to about 100% by weight.

[0126] Alternatively, a *Stevia* extract used in the steviol glycoside formulations provided herein has a purity of about 50% to about 100% by weight, about 50% to about 99% by weight, about 50% to about 98% by weight, about 50% to about 97% by weight, about 50% to about 96% by weight, about 50% to about 95% by weight, about 50% to about 94% by weight, about 50% to about 93% by weight, about 50% to about 92% by weight, about 50% to about 91% by weight,

about 50% to about 90% by weight, about 50% to about 85% by weight, about 50% to about 80% by weight, about 50% to about 75% by weight, about 50% to about 70% by weight, about 50% to about 65% by weight, about 50% to about 60% by weight, or about 50% to about 55% by weight. For example, a *Stevia* extract used in a steviol glycoside formulation provided herein may have a purity of about 50%, about 55%, about 60%, about 65%, about 70%, about 75%, about 80%, about 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or about 100% by weight, including any range in between these values.

[0127] The purity of rebaudiosides, such as those extracted, isolated, and/or purified from *Stevia* plants, can be assayed using any suitable method known in the art. For example, chromatography, such as HPLC, may be used to test the purity of rebaudioside extracts.

[0128] In some embodiments, production of the steviol glycosides used herein can be accomplished through the utilization of microbial strains to produce various rebaudiosides in high yield and purity to allow commercial incorporation into food products (See, e.g., U.S. Pat. Nos. 9,988,414, 9,522,929, 10,010,099, 10,010,101, 10,081,826, 10,253,344 all of which, including the methods of production, are incorporated herein by reference).

[0129] In some embodiments, rebaudiosides may be produced by recombinantly expressing enzymes in a microbial system (e.g., a host cell) capable of producing steviol. In general, such enzymes include: an UDP-glycosyltransferase, a beta glycosidase, a rhamnosyltransferase, a copalyl diphosphate synthase (CPS), a kaurene synthase (KS) and a geranylgeranyl diphosphate to synthase (GGPPS) enzyme, and functional fragments or variants thereof. In some embodiments, this can occur in a microbial strain that expresses an endogenous isoprenoid synthesis pathway, such as the non-mevalonate (MEP) pathway or the mevalonic acid pathway (MVA). In some embodiments, the microbial system (e.g., a host cell) further expresses additional enzymes (e.g., sucrose synthase or SUS).

[0130] In some embodiments, the host cell is selected from the group consisting of *Escherichia; Salmonella; Bacillus; Acinetobacter; Streptomyces; Corynebacterium; Methylosinus; Methylomonas; Rhodococcus; Pseudomonas; Rhodobacter; Synechocystis; Saccharomyces; Zygosaccharomyces; Kluyveromyces; Candida; Hansenula; Debaryomyces; Mucor; Pichia; Torulopsis; Aspergillus; Arthrobotlys; Brevibacteria; Microbacterium; Arthrobacter; Citrobacter; Klebsiella; Pantoea; Corynebacterium; Clostridium* (e.g., *Clostridium acetobutylicum*). In some embodiments, the host cell is a cell isolated from plants selected from the group consisting of soybean; rapeseed; sunflower; cotton; corn; tobacco; alfalfa; wheat; barley; oats; sorghum; rice; broccoli; cauliflower; cabbage; parsnips; melons; carrots; celery; parsley; tomatoes; potatoes; strawberries; peanuts; grapes; grass seed crops; sugar beets; sugar cane; beans; peas; rye; flax; hardwood trees; softwood trees; forage grasses; *Arabidopsis thaliana*; rice (*Oryza sativa*); *Hordeum yulgare*; switchgrass (*Panicum vigratum*); *Brachypodium* spp.; *Brassica* spp.; and *Crambe abyssinica*. In some embodiments, the cell is a bacterial cell, such as *E. coli*, or a yeast cell, such as a *Saccharomyces* cell, *Pichia* cell, or a *Yarrowia* cell. In some embodiments, the cell is an algal cell or a plant cell.

[0131] In some embodiments, rebaudiosides of the formulations provided herein are produced in a reaction mixture including a start compound (e.g., any natural or synthetic compound capable of being converted into a steviol glycoside compound in a reaction catalyzed by one or more enzymes); a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP) and uridine diphosphate-glucose (UDP-glucose); and the one or more enzymes, such as a UDP-glycosyltransferase.

[0132] Suitable UDP-glycosyltransferases for producing rebaudiosides in either a microbial system or an in vitro reaction mixture include any UGT known in the art as capable of catalyzing one or more reactions in the biosynthesis of steviol glycoside compounds, such as, without limitation, EUGT11 (GenBank Accession No. AC133334), HV1 (GenBank Accession No. BAJ98242.1), UGT76G1 (Genbank Accession No. AAR06912.1), UGT85C2 (GenBank Accession No. AAR06916.1), UGT74G1 (GenBank Accession No. AAR06920.1), or the functional homologs, fragments, or variants thereof.

[0133] In some embodiments, the UDP-glycosyltransferase used in any one of the methods described herein is UGT76G1, or any functional fragments or variants thereof. Uridine diphospho glycosyltransferase (UGT76G1) is a UGT with a 1,3-13-O-glucose glycosylation activity that can produce related glycoside (rebaudioside A and D). UGT76G1 also has 1,3-19-O-glucose glycosylation activity that can produce rebaudioside G from rubusoside, and rebaudioside M from rebaudioside D. Amino acid sequences of UGT76G1 and variants (e.g., UGT76G1 CP1, CP1, and L200A mutants) are provided in Table 2.

[0134] In some embodiments, the UDP-glycotransferase used in any one of the methods described herein is EUGT11, or any functional fragments or variants thereof. EUGT11 is a UGT having 1,2-19-O-glucose and 1,2-13-O-glucose glycosylation activity. EUGT11 is known to catalyze the production of stevioside to rebaudioside E and rebaudioside A to rebaudioside D. EUGT11 also has 1,2-19-O-glucose glycosylation activity. Amino acid sequences of EUGT11 and variants (e.g., EUGT11 CP1 mutant) are provided in Table 2.

[0135] In some embodiments, the UDP-glycotransferase used in any one of the methods described herein is HV1, or any functional fragments or variants thereof. HV1 is a UGT with a 1,2-19-O-glucose glycosylation activity that can produce related steviol glycosides (rebaudioside E, D and Z). HV1 also can convert Reb KA to Reb E. Amino acid sequences of HV1 and variants are provided in Table 2.

[0136] In some embodiments, the UGT used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 70% at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% and even 100% identical to the amino acid sequence set forth in any one of SEQ ID NOs:1-7. In some embodiments, the UGT used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 80% identical to the amino acid sequence set forth in any one of SEQ ID NOs:1-7. In some embodiments, the UGT used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% to the amino acid sequence set forth in

any one of SEQ ID NOs: 1-7. In some embodiments, the UGT used for producing the rebaudiosides as described herein comprises the amino acid sequence of any one of SEQ ID NOs: 1-7.

[0137] In some embodiments, the reaction mixture further comprises additional enzymes (e.g., sucrose synthase or SUS) to improve the efficiency or modify the outcome of the overall biosynthesis of steviol glycoside compounds. For example, the additional enzyme may regenerate the UDP-glucose needed for the glycosylation reaction by converting the UDP produced from the glycosylation reaction back to UDP-glucose (using, for example, sucrose as a donor of the glucose residue), thus improving the efficiency of the glycosylation reaction.

[0138] Suitable sucrose synthase domains can be for example, an *Arabidopsis* sucrose synthase 1; an *Arabidopsis* sucrose synthase 3 and a *Vigna* radiate sucrose synthase. A particularly suitable sucrose synthase domain can be, for example, *Arabidopsis* sucrose synthase 1. A particularly suitable *Arabidopsis* sucrose synthase 1 is *Arabidopsis thaliana* sucrose synthase 1 (AtSUS1). A particularly suitable sucrose synthase 1 domain can be, for example, a sucrose synthase 1 having the amino acid sequence of SEQ ID NO: 8.

[0139] In some embodiments, the SUS used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 70% at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% and even 100% identical to the amino acid sequence set forth in SEQ ID NO: 8. In some embodiments, the SUS used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 80% identical to the amino acid sequence set forth in SEQ ID NO: 8. In some embodiments, the SUS used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% to the amino acid sequence set forth in SEQ ID NO: 8. In some embodiments, the SUS used for producing the rebaudiosides as described herein comprises the amino acid sequence of SEQ ID NO: 8.

[0140] Sucrose synthase catalyzes the chemical reaction between UDP-glucose and D-fructose to produce UDP and sucrose. Sucrose synthase is a glycosyltransferase. The systematic name of this enzyme class is UDP-glucose:D-fructose 2-alpha-D -glucosyltransferase. Other names in common use include UDP glucose-fructose glucosyltransferase, sucrose synthetase, sucrose-UDP glucosyltransferase, sucrose-uridine diphosphate glucosyltransferase, and uridine diphosphoglucose-fructose glucosyltransferase. Addition of the sucrose synthase to the reaction mixture that includes a uridine diphospho glycosyltransferase creates a "UGT-SUS coupling system". In the UGT-SUS coupling system, UDP-glucose can be regenerated from UDP and sucrose, which allows for omitting the addition of extra UDP-glucose to the reaction mixture or using UDP in the reaction mixture. Suitable sucrose synthase for use in the methods described herein include *Arabidopsis* sucrose synthase I, an *Arabidopsis* sucrose synthase 3 and a *Vigna* radiate sucrose synthase. In some embodiments of any one of the methods or compositions provided herein, the sucrose synthase or sucrose synthase domain is an *Arabidopsis thaliana* sucrose synthase I. In some embodiments, the UDP-glycotransferase used in any one of the methods described herein is a UGT-sucrose synthase fusion enzyme. In some embodiments, the UDP-glycotransferase used in any one of the methods described herein is a UGT76G1-sucrose synthase fusion enzyme. In some embodiments, the UDP-glycotransferase used in any one of the methods described herein is a EUGT11-sucrose synthase fusion enzyme. In some embodiments, the UDP-glycotransferase used in any one of the methods described herein is a HV1-sucrose synthase fusion enzyme. Amino acid sequences of examples of UGT-SUS fusion enzymes are provided in Table 2.

[0141] In some embodiments, the UGT-SUS fusion enzyme used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 70% at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% and even 100% identical to the amino acid sequence set forth in any one of SEQ ID NOs: 9-11. In some embodiments, the UGT-SUS fusion enzyme used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 80% identical to the amino acid sequence set forth in any one of SEQ ID NOs: 9-11. In some embodiments, the UGT-SUS fusion enzyme used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% to the amino acid sequence set forth in any one of SEQ ID NOs: 9-11. In some embodiments, the UGT-SUS fusion enzyme used for producing the rebaudiosides as described herein comprises the amino acid sequence of any one of SEQ ID NOs: 9-11.

[0142] In some embodiments, the rebaudiosides are produced in a reaction mixture including a start compound (e.g., any natural or synthetic compound capable of being converted into a steviol glycoside compound in a reaction catalyzed by one or more UDP-glucosyltransferases) and a beta glucosidase. Examples of beta glucosidases for use in this method include, without limitation, beta glucosidase 1 from *Pichia pastoris*, beta glucosidase 2 from *Pichia pastoris*, beta glucosidase 3 from *Pichia pastoris*, beta glucosidase 4 from *Pichia pastoris*, or any functional variants thereof.

[0143] In some embodiments, the beta glucosidase used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 70% at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% and even 100% identical to the amino acid sequence set forth in any one of SEQ ID NOs: 12-15. In some embodiments, the beta glucosidase used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 80% identical to the amino acid sequence set forth in any one of SEQ ID NOs: 12-15. In some embodiments, the beta glucosidase used for producing the rebaudiosides as described herein comprises an amino acid sequence that is at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% to the amino acid sequence set forth in any one of SEQ ID NOs: 12-15. In some embodiments, the

beta glucosidase used for producing the rebaudiosides as described herein comprises the amino acid sequence of any one of SEQ ID NOs: 12-15.

[0144] Nucleic acid sequences encoding any one of the enzymes described herein are also provided in Table 2. As known by those skilled in the art, the nucleic acid sequence encoding enzymes can be codon optimized for expression in a suitable host organism such as, for example, bacteria and yeast.

[0145] Standard recombinant DNA and molecular cloning techniques used here are well known in the art and are described, for example, by Sambrook, J., Fritsch, E. F. and Maniatis, T. MOLECULAR CLONING: A LABORATORY MANUAL, 2nd ed.; Cold Spring Harbor Laboratory: Cold Spring Harbor, N.Y., 1989 (hereinafter "Maniatis"); and by Silhavy, T. J., Bennan, M. L. and Enquist, L. W. EXPERIMENTS WITH GENE FUSIONS; Cold Spring Harbor Laboratory: Cold Spring Harbor, N.Y., 1984; and by Ausubel, F. M. et al., IN CURRENT PROTOCOLS IN MOLECULAR BIOLOGY, published by Greene Publishing and Wiley-Interscience, 1987; (the entirety of each of which is hereby incorporated herein by reference).

TABLE 2

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
UGT76G1 WT Amino Acid	MENKTETTVRRRRRIILFPVPFQGHINPIL QLANVLYSKGFSITIFHTNFNKPKTSNYPH FTFRFILDNDPQDERISNLPTHGPLAGMRI PIINEHGADELRRELELLMLASEEDEEVSC LITDALWYFAQSVADSLNLRRLVLMTSSLF NFHAHVSLPQFDELGYLDPDDKTRLEEQAS GFPMLKVKDIKSAYSNWQILKEILGKMIKQ TKASSGVIWNSFKELEESELETVIREIPAP SFLIPLPKHLTASSSSLLDHDRTVFQWLDQ QPPSSVLYVSFGSTSEVDEKDFLEIARGLV DSKQSFLWVVRPGFVKGSTWVEPLPDGFLG ERGRIVKWVPQQEVLAHGAIGAFWTHSGWN STLESVCEGVPMIFSDFGLDQPLNARYMSD VLKVGVYLENGWERGEIANAIRRVMVDEEG EYIRQNARVLKQKADVSLMKGGSSYESLES LVSYISSL (SEQ ID NO: 1)
UGT76G1 L200A Amino Acid	MENKTETTVRRRRRIILFPVPFQGHINPIL QLANVLYSKGFSITIFHTNFNKPKTSNYPH FTFRFILDNDPQDERISNLPTHGPLAGMRI PIINEHGADELRRELELLMLASEEDEEVSC LITDALWYFAQSVADSLNLRRLVLMTSSLF NFHAHVSLPQFDELGYLDPDDKTRLEEQAS GFPMLKVKDIKSAYSNWQIAKEILGKMIKQ TKASSGVIWNSFKELEESELETVIREIPAP SFLIPLPKHLTASSSSLLDHDRTVFQWLDQ QPPSSVLYVSFGSTSEVDEKDFLEIARGLV DSKQSFLWVVRPGFVKGSTWVEPLPDGFLG ERGRIVKWVPQQEVLAHGAIGAFWTHSGWN STLESVCEGVPMIFSDFGLDQPLNARYMSD VLKVGVYLENGWERGEIANAIRRVMVDEEG EYIRQNARVLKQKADVSLMKGGSSYESLES LVSYISSL (SEQ ID NO: 2)
UGT76G1 CP1 Amino Acid	MNWQILKEILGKMIKQTKASSGVIWNSFKE LEESELETVIREIPAPSFLIPLPKHLTASS SSLLDHDRTVFQWLDQQPPSSVLYVSFGST SEVDEKDFLEIARGLVDSKQSFLWVVRPGF VKGSTWVEPLPDGFLGERGRIVKWVPQQEV LAHGAIGAFWTHSGWNSTLESVCEGVPMIF SDFGLDQPLNARYMSDVLKVGVYLENGWER GEIANAIRRVMVDEEGEYIRQNARVLKQKA DVSLMKGGSSYESLESLVSYISSLENKTET TVRRRRRIILFPVPFQGHINPILQLANVLY SKGFSITIFHTNFNKPKTSNYPHFTFRFIL DNDPQDERISNLPTHGPLAGMRIPIINEHG ADELRRELELLMLASEEDEEVSCLITDALW YFAQSVADSLNLRRLVLMTSSLFNFHAHVS LPQFDELGYLDPDDKTRLEEQASGFPMLKV KDIKSAYS (SEQ ID NO: 3)
UGT76G1 CP2 Amino Acid	MNWQILKEILGKMIKQTKASSGVIWNSFKE LEESELETVIREIPAPSFLIPLPKHLTASS SSLLDHDRTVFQWLDQQPPSSVLYVSFGST SEVDEKDFLEIARGLVDSKQSFLWVVRPGF VKGSTWVEPLPDGFLGERGRIVKWVPQQEV LAHGAIGAFWTHSGWNSTLESVCEGVPMIF SDFGLDQPLNARYMSDVLKVGVYLENGWER GEIANAIRRVMVDEEGEYIRQNARVLKQKA DVSLMKGGSSYESLESLVSYISSLYKDDSG YSSSYAAAAGMENKTETTVRRRRRIILFPV PFQGHINPILQLANVLYSKGFSITIFHTNF NKPKTSNYPHFTFRFILDNDPQDERISNLP THGPLAGMRIPIINEHGADELRRELELLML ASEEDEEVSCLITDALWYFAQSVADSLNLR RLVLMTSSLFNFHAHVSLPQFDELGYLDPD DKTRLEEQASGFPMLKVKDIKSAYS (SEQ ID NO: 4)
EUGT11 WT Amino Acid	MDSGYSSSYAAAAGMHVVICPWLAFGHLLP CLDLAQRLASRGHRVSFVSTPRNISRLPPV RPALAPLVAFVALPLPRVEGLPDGAESTND VPHDRPDMVELHRRAFDGLAAPFSEFLGTA CADWVIVDVFHHWAAAAALEHKVPCAMMLL GSAHMIASIADRRLERAETESPAAAGQGRP AAAPTFEVARMKLIRTKGSSGMSLAERFSL TLSRSSLVVGRSCVEFEPETVPLLSTLRGK PITFLGLMPPLHEGRREDGEDATVRWLDAQ PAKSVVYVALGSEVPLGVEKVHELALGLEL AGTRFLWALRKPTGVSDADLLPAGFEERTR GRGVVATRWVPQMSILAHAAVGAFLTHCGW NSTIEGLMFGHPLIMLPIFGDQGPNARLIE AKNAGLQVARNDGDGSFDREGVAAAIRAVA VEEESSKVFQAKAKKLQEIVADMACHERYI DGFIQQLRSYKD (SEQ ID NO: 5)
EUGT11 CP1 Amino Acid	MGSSGMSLAERFSLTLSRSSLVVGRSCVEF EPETVPLLSTLRGKPITFLGLMPPLHEGRR EDGEDATVRWLDAQPAKSVVYVALGSEVPL GVEKVHELALGLELAGTRFLWALRKPTGVS DADLLPAGFEERTRGRGVVATRWVPQMSIL AHAAVGAFLTHCGWNSTIEGLMFGHPLIML PIFGDQGPNARLIEAKNAGLQVARNDGDGS FDREGVAAAIRAVAVEEESSKVFQAKAKKL QEIVADMACHERYIDGFIQQLRSYKDDSGY SSSYAAAAGMHVVICPWLAFGHLLPCLDLA QRLASRGHRVSFVSTPRNISRLPPVRPALA PLVAFVALPLPRVEGLPDGAESTNDVPHDR PDMVELHRRAFDGLAAPFSEFLGTACADWV IVDVFHHWAAAAALEHKVPCAMMLLGSAHM IASIADRRLERAETESPAAAGQGRPAAAPT FEVARMKLIRTK (SEQ ID NO: 6)
HV1 glycosyl transferase amino acid	MDGNSSSSPLHVVICPWLALGHLLPCLDIA ERLASRGHRVSFVSTPRNIARLPPLRPAVA PLVDFVALPLPHVDGLPEGAESTNDVPYDK FELHRKAFDGLAAPFSEFLRAACAEGAGSR PDWLIVDTFHHWAAAAAVENKVPCVMLLLG AATVIAGFARGVSEHAAAAVGKERPAAEAP SFETERRKLMTTQNASGMTVAERYFLTLMR SDLVAIRSCAEWEPESVAALTTLAGKPVVP

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	LGLLPPSPEGGRGVSKEDAAVRWLDAQPAK SVVYVALGSEVPLRAEQVHELALGLELSGA RFLWALRKPTDAPDAAVLPPGFEERTRGRG LVVTGWVPQIGVLAHGAVAAFLTHCGWNST IEGLLFGHPLIMLPISSDQGPNARLMEGRK VGMQVPRDESDGSFRREDVAATVRAVAVEE DGRRVFTANAKKMQEIVADGACHERCIDGF IQQLRSYKA (SEQ ID NO: 7)
SUS1 WT from *Arabidopsis thaliana*, Amino Acid	MANAERMITRVHSQRERLNETLVSERNEVL ALLSRVEAKGKGILQQNQIIAEFEALPEQT RKKLEGGPFFDLLKSTQEAIVLPPWVALAV RPRPGVWEYLRVNLHALVVEELQPAEFLHF KEELVDGVKNGNFTLELDFEPFNASIPRPT LHKYIGNGVDFLNRHLSAKLFHDKESLLPL LKFLRLHSHQGKNLMLSEKIQNLNTLQHTL RKAEEYLAELKSETLYEEFEAKFEEIGLER GWGDNAERVLDMIRLLLDLLEAPDPCTLET FLGRVPMVFNVVILSPHGYFAQDNVLGYPD TGGQVVYILDQVRALEIEMLQRIKQQGLNI KPRILILTRLLPDAVGTTCGERLERVYDSE YCDILRVPFRTEKGIVRKWISRFEVWPYLE TYTEDAAVELSKELNGKPDLIIGNYSDGNL VASLLAHKLGVTQCTIAHALEKTKYPDSDI YWKKLDDKYHFSCQFTADIFAMNHTDFIIT STFQEIAGSKETVGQYESHTAFTLPGLYRV VHGIDVFDPKFNIVSPGADMSIYFPYTEEK RRLTKFHSEIEELLYSDVENKEHLCVLKDK KKPILFTMARLDRVKNLSGLVEWYGKNTRL RELANLVVVGGDRRKESKDNEEKAEMKKMY DLIEEYKLNGQFRWISSQMDRVRNGELYRY ICDTKGAFVQPALYEAFGLTVVEAMTCGLP TFATCKGGPAEIIVHGKSGFHIDPYHGDQA ADTLADFFTKCKEDPSHWDEISKGGLQRIE EKYTWQIYSQRLLTLTGVYGFWKHVSNLDR LEARRYLEMFYALKYRPLAQAVPLAQDD (SEQ ID NO: 8)
UGT76G1-AtSUS1 fusion enzyme, amino acid	MENKTETTVRRRRRIILFPVPFQGHINPIL QLANVLYSKGFSITIFHTNFNKPKTSNYPH FTFRFILDNDPQDERISNLPTHGPLAGMRI PIINEHGADELRRELELLMLASEEDEEVSC LITDALWYFAQSVADSLNLRRLVLMTSSLF NFHAHVSLPQFDELGYLDPDDKTRLEEQAS GFPMLKVKDIKSAYSNWQILKEILGKMIKQ TKASSGVIWNSFKELEESELETVIREIPAP SFLIPLPKHLTASSSSLLDHDRTVFQWLDQ QPPSSVLYVSFGSTSEVDEKDFLEIARGLV DSKQSFLWVVRPGFVKGSTWVEPLPDGFLG ERGRIVKWVPQQEVLAHGAIGAFWTHSGWN STLESVCEGVPMIFSDFGLDQPLNARYMSD VLKVGVYLENGWERGEIANAIRRVMVDEEG EYIRQNARVLKQKADVSLMKGGSSYESLES LVSYISSLGSGANAERMITRVHSQRERLNE TLVSERNEVLALLSRVEAKGKGILQQNQII AEFEALPEQTRKKLEGGPFFDLLKSTQEAI VLPPWVALAVRPRPGVWEYLRVNLHALVVE ELQPAEFLHFKEELVDGVKNGNFTLELDFE PFNASIPRPTLHKYIGNGVDFLNRHLSAKL FHDKESLLPLLKFLRLHSHQGKNLMLSEKI QNLNTLQHTLRKAEEYLAELKSETLYEEFE AKFEEIGLERGWGDNAERVLDMIRLLLDLL EAPDPCTLETFLGRVPMVFNVVILSPHGYF AQDNVLGYPDTGGQVVYILDQVRALEIEML QRIKQQGLNIKPRILILTRLLPDAVGTTCG ERLERVYDSEYCDILRVPFRTEKGIVRKWI SRFEVWPYLETYTEDAAVELSKELNGKPDL IIGNYSDGNLVASLLAHKLGVTQCTIAHAL EKTKYPDSDIYWKKLDDKYHFSCQFTADIF AMNHTDFIITSTFQEIAGSKETVGQYESHT AFTLPGLYRVVHGIDVFDPKFNIVSPGADM

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	SIYFPYTEEKRRLTKFHSEIEELLYSDVEN KEHLCVLKDKKKPILFTMARLDRVKNLSGL VEWYGKNTRLRELANLVVVGGDRRKESKDN EEKAEMKKMYDLIEEYKLNGQFRWISSQMD RVRNGELYRYICDTKGAFVQPALYEAFGLT VVEAMTCGLPTFATCKGGPAEIIVHGKSGF HIDPYHGDQAADTLADFFTKCKEDPSHWDE ISKGGLQRIEEKYTWQIYSQRLLTLTGVYG FWKHVSNLDRLEARRYLEMFYALKYRPLAQ AVPLAQDDWT (SEQ ID NO: 9)
EUGT11-AtSUS1 fusion enzyme, amino acid	MDSGYSSSYAAAAGMHVVICPWLAFGHLLP CLDLAQRLASRGHRVSFVSTPRNISRLPPV RPALAPLVAFVALPLPRVEGLPDGAESTND VPHDRPDMVELHRRAFDGLAAPFSEFLGTA CADWVIVDVFHHWAAAAALEHKVPCAMMLL GSAHMIASIADRRLERAETESPAAAGQGRP AAAPTFEVARMKLIRTKGSSGMSLAERFSL TLSRSSLVVGRSCVEFEPETVPLLSTLRGK PITFLGLMPPLHEGRREDGEDATVRWLDAQ PAKSVVYVALGSEVPLGVEKVHELALGLEL AGTRFLWALRKPTGVSDADLLPAGFEERTR GRGVVATRWVPQMSILAHAAVGAFLTHCGW NSTIEGLMFGHPLIMLPIFGDQGPNARLIE AKNAGLQVARNDGDGSFDREGVAAAIRAVA VEEESSKVFQAKAKKLQEIVADMACHERYI DGFIQQLRSYKDGSGANAERMITRVHSQRE RLNETLVSERNEVLALLSRVEAKGKGILQQ NQIIAEFEALPEQTRKKLEGGPFFDLLKST QEAIVLPPWVALAVRPRPGVWEYLRVNLHA LVVEELQPAEFLHFKEELVDGVKNGNFTLE LDFEPFNASIPRPTLHKYIGNGVDFLNRHL SAKLFHDKESLLPLLKFLRLHSHQGKNLML SEKIQNLNTLQHTLRKAEEYLAELKSETLY EEFEAKFEEIGLERGWGDNAERVLDMIRLL LDLLEAPDPCTLETFLGRVPMVFNVVILSP HGYFAQDNVLGYPDTGGQVVYILDQVRALE IEMLQRIKQQGLNIKPRILILTRLLPDAVG TTCGERLERVYDSEYCDILRVPFRTEKGIV RKWISRFEVWPYLETYTEDAAVELSKELNG KPDLIIGNYSDGNLVASLLAHKLGVTQCTI AHALEKTKYPDSDIYWKKLDDKYHFSCQFT ADIFAMNHTDFIITSTFQEIAGSKETVGQY ESHTAFTLPGLYRVVHGIDVFDPKFNIVSP GADMSIYFPYTEEKRRLTKFHSEIEELLYS DVENKEHLCVLKDKKKPILFTMARLDRVKN LSGLVEWYGKNTRLRELANLVVVGGDRRKE SKDNEEKAEMKKMYDLIEEYKLNGQFRWIS SQMDRVRNGELYRYICDTKGAFVQPALYEA FGLTVVEAMTCGLPTFATCKGGPAEIIVHG KSGFHIDPYHGDQAADTLADFFTKCKEDPS HWDEISKGGLQRIEEKYTWQIYSQRLLTLT GVYGFWKHVSNLDRLEARRYLEMFYALKYR PLAQAVPLAQDD (SEQ ID NO: 10)
HV1-AtSUS1 fusion enzyme, amino acid	MDGNSSSSPLHVVICPWLALGHLLPCLDIA ERLASRGHRVSFVSTPRNIARLPPLRPAVA PLVDFVALPLPHVDGLPEGAESTNDVPYDK FELHRKAFDGLAAPFSEFLRAACAEGAGSR PDWLIVDTFHHWAAAAAVENKVPCVMLLLG AATVIAGPARGVSEHAAAAVGKERPAAEAP SFETERRKLMTTQNASGMTVAERYFLTLMR SDLVAIRSCAEWEPESVAALTTLAGKPVVP LGLLPPSPEGGRGVSKEDAAVRWLDAQPAK SVVYVALGSEVPLRAEQVHELALGLELSGA RFLWALRKPTDAPDAAVLPPGFEERTRGRG LVVTGWVPQIGVLAHGAVAAFLTHCGWNST IEGLLFGHPLIMLPISSDQGPNARLMEGRK VGMQVPRDESDGSFRREDVAATVRAVAVEE DGRRVFTANAKKMQEIVADGACHERCIDGF

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	IQQLRSYKAGSGANAERMITRVHSQRERLN ETLVSERNEVLALLSRVEAKGKGILQQNQI IAEFEALPEQTRKKLEGGPFFDLLKSTQEA IVLPPWVALAVRPRPGVWEYLRVNLHALVV EELQPAEFLHFKEELVDGVKNGNFTLELDF EPFNASIPRPTLHKYIGNGVDFLNRHLSAK LFHDKESLLPLLKFLRLHSHQGKNLMLSEK IQNLNTLQHTLRKAEEYLAELKSETLYEEF EAKFEEIGLERGWGDNAERVLDMIRLLLDL LEAPDPCTLETFLGRVPMVFNVVILSPHGY FAQDNVLGYPDTGGQVVYILDQVRALEIEM LQRIKQQGLNIKPRILILTRLLPDAVGTTC GERLERVYDSEYCDILRVPFRTEKGIVRKW ISRFEVWPYLETYTEDAAVELSKELNGKPD LIIGNYSDGNLVASLLAHKLGVTQCTIAHA LEKTKYPDSDIYWKKLDDKYHFSCQFTADI FAMNHTDFIITSTFQEIAGSKETVGQYESH TAFTLPGLYRVVHGIDVFDPKFNIVSPGAD MSIYFPYTEEKRRLTKFHSEIEELLYSDVE NKEHLCVLKDKKKPILFTMARLDRVKNLSG LVEWYGKNTRLRELANLVVVGGDRRKESKD NEEKAEMKKMYDLIEEYKLNGQFRWISSQM DRVRNGELYRYICDTKGAFVQPALYEAFGL TVVEAMTCGLPTFATCKGGPAEIIVHGKSG FHIDPYHGDQAADTLADFFTKCKEDPSHWD EISKGGLQRIEEKYTWQIYSQRLLTLTGVY GFWKHVSNLDRLEARRYLEMFYALKYRPLA QAVPLAQDD (SEQ ID NO: 11)
Beta-glucosidase 1 from *Pichia pastoris*, amino acid	MTQLDVESLIQELTLNEKVQLLSGSDFWHT TPVRRLGIPKMRLSDGPNGVRGTKFFNGVP TACFPCGTGLGATFDKELLKEAGSLMADEA KAKAASVVLGPTANIARGPNGGRGFESFGE DPVVNGLSSAAMINGLQGKYLAATMKHYVC NDLEMDRNCIDAQVSHRALREVYLLPFQIA VRDANPRAIMTAYNKANGEHVSQSKFLLDE VLRKEWGWDGLLMSDWFGVYDAKSSITNGL DLEMPGPPQCRVHSATDHAINSGEIHINDV DERVRSLLSLINYCHQSGVTEEDPETSDNN TPETIEKLRKISRESIVLLKDDDRNRSILP LKKSDKIAVIGNNAKQAAYCGGGSASVLSY HTTTPFDSIKSRLEDSNTPAYTIGADAYKN LPPLGPQMTDSDGKPGFDAKFFVGSPTSKD RKLIDHFQLTNSQVFLVDYYNEQIPENKEF YVDVEGQFIPEEDGTYNFGLTVFGTGRLFV DDKLVSDSSQNQTPGDSFFGLAAQEVIGSI HLVKGKAYKIKVLYGSSVTRTYEIAASVAF EGGAFTFGAAKQRNEDEELARAVEIAKAND KVVLCIGLNQDFESEGFDRPDIKIPGATNK MVSAVLKANPNTVIVNQTGTPVEMPWASDA PVILQAWFGGSEAGTAIADVLFGDYNPSGK LTVTFPLRFEDNPAYLNFQSNKQACWYGED VYVGYRYYETIDRPVLFPFGHGLSFTEFDF TDMFVRLEEENLEVEVVVRNTGKYDGAEVV QLYVAPVSPSLKRPIKELKEYAKIFLASGE AKTVHLSVPIKYATSFFDEYQKKWCSEKGE YTILLGSSSADIKVSQSITLEKTTFWKGL (SEQ ID NO: 12)

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
Beta-glucosidase 2 from *Pichia pastoris*, amino acid	MKSQLIFMALASLVASAPLEHQQQHHKHEK RAVVTQTVTVAAGQTAAAGSAQAVVTSSAA PASVASSAAASASSSSSSYTSGASGDLSSF KDGTIKCSEFPSGDGVVSVSWLGFGGWSSI MNLQGGTSESCENGYYCSYACEAGYSKTQW PSNQPSDGRSVGGLLCKDGLLYRSNTAFDT LCVPGKGTASVENNVSKGISICRTDYPGSE NMCVPTWVDAGNSNTLTVVDEDNYYEWQGL KTSAQYYVNNAGVSVEDGCIWGDESSGVGN WAPLVLGAGSTGGLTYLSLIPNPNNKKAPN FNVKIVATDGSSINGDCKYENGIFVGSSTD GCTVTVTSGSAKLVFY (SEQ ID NO: 13)
Beta-glucosidase 3 from *Pichia pastoris*, amino acid	MQVKSIVNLLLACSLAVARPLEHAHHQHDK RGVVVVTKTIVVDGSTVEATAAAQVQEHAE TFAESTPSAVVSSSSAPSSASSASAPASSG SFSAGTKGVTYSPYQAGGGCKTAEEVASDL SQLTGYEIIRLYGVDCNQVENVFKAKAPGQ KLFLGIFFVDAIESGVSAIASAVKSYGSWD DVHTVSVGNELVNNGEATVSQIGQYVSTAK SALRSAGFTGPVLSVDTFIAVINNPGLCDF ADEYVAVNAHAFFDGGIAASGAGDWAAEQI QRVSSACGGKDVLIVESGWPSKGDTNGAAV PSKSNQQAAVQSLGQKIGSSCIAFNAFNDY WKADGPFNAEKYWGILDS (SEQ ID NO: 14)
Beta-glucosidase 4 from *Pichia pastoris*, amino acid	MLSTILNIFILLLFIQASLQAPIPVVTKYV TEGIAVVTETNVRVVTKTIPIVQVLISDGA TYTHTLTTVSTAEENGNFQPITTTSIVNKE VVVPTSVTPNTQQTRPTQVDTTQNNADTPA APTPSPTTSSNNGVFTTYSTTRSVVTSVVV VGPDGSPIENTGQTANPTTTAPTTSTTAAR TTSSTSTTPTASSTPGGNHPRSIVYSPYSD SSQCKDATTIETDLEFIASKGISAVRIYGN DCNYLTVVLPKCASLGLKVNQGFWIGPSGV DSIDDAVQEFIQAVNGNNGFNWDLFELITV GNEAISAGYVSASSLISKIKEVSSILSSAG YTGPITTAEPPNVYEDYGDLCSTDVMSIVG VNAHSYFNTLFAASDSGSFVKSQIEVVQKA CSRSDITIIETGYPSQGATNGKNVPSKENQ KTAIFSIPEVVGTDVTILSTYDDLWKDPGP YGIEQFFGAIDLFS (SEQ ID NO: 15)
UGT76G1 WT DNA	ATGGAGAATAAGACAGAAACAACCGTAAGA CGGAGGCGGAGGATTATCTTGTTCCCTGTA CCATTTCAGGGCCATATTAATCCGATCCTC CAATTAGCAAACGTCCTCTACTCCAAGGGA TTTTCAATAACAATCTTCCATACTAACTTT AACAAGCCTAAAACGAGTAATTATCCTCAC TTTACATTCAGGTTCATTCTAGACAACGAC CCTCAGGATGAGCGTATCTCAAATTTACCT ACGCATGGCCCCTTGGCAGGTATGCGAATA CCAATAATCAATGAGCATGGAGCCGATGAA CTCCGTCGCGAGTTAGAGCTTCTCATGCTC GCAAGTGAGGAAGACGAGGAAGTTTCGTGC CTAATAACTGATGCGCTTTGGTACTTCGCC CAATCAGTCGCAGACTCACTGAATCTACGC CGTTTGGTCCTTATGACAAGTTCATTATTC AACTTTCACGCACATGTATCACTGCCGCAA TTTGACGAGTTGGGTTACCTGGACCCGGAT GACAAAACGCGATTGGAGGAACAAGCGTCG GGCTTCCCCATGCTGAAAGTCAAAGATATT AAGAGCGCTTATAGTAATTGGCAAATTCTG AAAGAAATTCTCGGAAAAATGATAAAGCAA ACCAAAGCGTCCTCTGGAGTAATCTGGAAC TCCTTCAAGGAGTTAGAGGAATCTGAACTT GAAACGGTCATCAGAGAAATCCCCGCTCCC TCGTTCTTAATTCCACTACCCAAGCACCTT

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	ACTGCAAGTAGCAGTTCCCTCCTAGATCAT
	GACCGAACCGTGTTTCAGTGGCTGGATCAG
	CAACCCCCGTCGTCAGTTCTATATGTAAGC
	TTTGGGAGTACTTCGGAAGTGGATGAAAAG
	GACTTCTTAGAGATTGCGCGAGGGCTCGTG
	GATAGCAAACAGAGCTTCCTGTGGGTAGTG
	AGACCGGGATTCGTTAAGGGCTCGACGTGG
	GTCGAGCCGTTGCCAGATGGTTTTCTAGGG
	GAGAGAGGGAGAATCGTGAAATGGGTTCCA
	CAGCAAGAGGTTTTGGCTCACGGAGCTATA
	GGGGCCTTTTGGACCCACTCTGGTTGGAAT
	TCTACTCTTGAAAGTGTCTGTGAAGGCGTT
	CCAATGATATTTTCTGATTTTGGGCTTGAC
	CAGCCTCTAAACGCTCGCTATATGTCTGAT
	GTGTTGAAGGTTGGCGTGTACCTGGAGAAT
	GGTTGGGAAAGGGGGGAAATTGCCAACGCC
	ATACGCCGGGTAATGGTGGACGAGGAAGGT
	GAGTACATACGTCAGAACGCTCGGGTTTTA
	AAACAAAAAGCGGACGTCAGCCTTATGAAG
	GGAGGTAGCTCCTATGAATCCCTAGAATCC
	TTGGTAAGCTATATATCTTCGTTATAA
	(SEQ ID NO: 16)
UGT76G1 L200A DNA	ATGGAGAATAAGACAGAAACAACCGTAAGA
	CGGAGGCGGAGGATTATCTTGTTCCCTGTA
	CCATTTCAGGGCCATATTAATCCGATCCTC
	CAATTAGCAAACGTCCTCTACTCCAAGGGA
	TTTTCAATAACAATCTTCCATACTAACTTT
	AACAAGCCTAAAACGAGTAATTATCCTCAC
	TTTACATTCAGGTTCATTCTAGACAACGAC
	CCTCAGGATGAGCGTATCTCAAATTTACCT
	ACGCATGGCCCCTTGGCAGGTATGCGAATA
	CCAATAATCAATGAGCATGGAGCCGATGAA
	CTCCGTCGCGAGTTAGAGCTTCTCATGCTC
	GCAAGTGAGGAAGACGAGGAAGTTTCGTGC
	CTAATAACTGATGCGCTTTGGTACTTCGCC
	CAATCAGTCGCAGACTCACTGAATCTACGC
	CGTTTGGTCCTTATGACAAGTTCATTATTC
	AACTTTCACGCACATGTATCACTGCCGCAA
	TTTGACGAGTTGGGTTACCTGGACCCGGAT
	GACAAAACGCGATTGGAGGAACAAGCGTCG
	GGCTTCCCCATGCTGAAAGTCAAAGATATT
	AAGAGCGCTTATAGTAATTGGCAAATTGCG
	AAAGAAATTCTCGGAAAAATGATAAAGCAA
	ACCAAAGCGTCCTCTGGAGTAATCTGGAAC
	TCCTTCAAGGAGTTAGAGGAATCTGAACTT
	GAAACGGTCATCAGAGAAATCCCCGCTCCC
	TCGTTCTTAATTCCACTACCCAAGCACCTT
	ACTGCAAGTAGCAGTTCCCTCCTAGATCAT
	GACCGAACCGTGTTTCAGTGGCTGGATCAG
	CAACCCCCGTCGTCAGTTCTATATGTAAGC
	TTTGGGAGTACTTCGGAAGTGGATGAAAAG
	GACTTCTTAGAGATTGCGCGAGGGCTCGTG
	GATAGCAAACAGAGCTTCCTGTGGGTAGTG
	AGACCGGGATTCGTTAAGGGCTCGACGTGG
	GTCGAGCCGTTGCCAGATGGTTTTCTAGGG
	GAGAGAGGGAGAATCGTGAAATGGGTTCCA
	CAGCAAGAGGTTTTGGCTCACGGAGCTATA
	GGGGCCTTTTGGACCCACTCTGGTTGGAAT
	TCTACTCTTGAAAGTGTCTGTGAAGGCGTT
	CCAATGATATTTTCTGATTTTGGGCTTGAC
	CAGCCTCTAAACGCTCGCTATATGTCTGAT
	GTGTTGAAGGTTGGCGTGTACCTGGAGAAT
	GGTTGGGAAAGGGGGGAAATTGCCAACGCC
	ATACGCCGGGTAATGGTGGACGAGGAAGGT
	GAGTACATACGTCAGAACGCTCGGGTTTTA
	AAACAAAAAGCGGACGTCAGCCTTATGAAG
	GGAGGTAGCTCCTATGAATCCCTAGAATCC
	TTGGTAAGCTATATATCTTCGTTATAA
	(SEQ ID NO: 17)

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
UGT76G1 CP1 DNA	ATGAACTGGCAAATCCTGAAAGAAATCCTG
	GGTAAAATGATCAAACAAACCAAAGCGTCG
	TCGGGCGTTATCTGGAACTCCTTCAAAGAA
	CTGGAAGAATCAGAACTGGAAACCGTTATT
	CGCGAAATCCCGGCTCCGTCGTTCCTGATT
	CCGCTGCCGAAACATCTGACCGCGAGCAGC
	AGCAGCCTGCTGGATCACGACCGTACGGTC
	TTTCAGTGGCTGGATCAGCAACCGCCGTCA
	TCGGTGCTGTATGTTTCATTCGGTAGCACC
	TCTGAAGTCGATGAAAAAGACTTTCTGGAA
	ATCGCTCGCGGCCTGGTGGATAGTAAACAG
	TCCTTCCTGTGGGTGGTTCGTCCGGGTTTT
	GTGAAAGGCAGCACGTGGGTTGAACCGCTG
	CCGGATGGCTTCCTGGGTGAACGCGGCCGT
	ATTGTCAAATGGGTGCCGCAGCAAGAAGTG
	CTGGCACATGGTGCTATCGGCGCGTTTTGG
	ACCCACTCTGGTTGGAACAGTACGCTGGAA
	TCCGTTTGCGAAGGTGTCCCGATGATTTTC
	AGCGATTTTGGCCTGGACCAGCCGCTGAAT
	GCCCGCTATATGTCTGATGTTCTGAAAGTC
	GGTGTGTACCTGGAAAACGGTTGGGAACGT
	GGCGAAATTGCGAATGCCATCCGTCGCGTT
	ATGGTCGATGAAGAAGGCGAATACATTCGC
	CAGAACGCTCGTGTCCTGAAACAAAAAGCG
	GACGTGAGCCTGATGAAAGGCGGTAGCTCT
	TATGAATCACTGGAATCGCTGGTTAGCTAC
	ATCAGTTCCCTGGAAAATAAAACCGAAACC
	ACGGTGCGTCGCCGTCGCCGTATTATCCTG
	TTCCCGGTTCCGTTTCAGGGTCATATTAAC
	CCGATCCTGCAACTGGCGAATGTTCTGTAT
	TCAAAAGGCTTTTCGATCACCATCTTCCAT
	ACGAACTTCAACAAACCGAAAACCAGTAAC
	TACCCGCACTTTACGTTCCGCTTTATTCTG
	GATAACGACCCGCAGGATGAACGTATCTCC
	AATCTGCCGACCCACGGCCCGCTGGCCGGT
	ATGCGCATTCCGATTATCAATGAACACGGT
	GCAGATGAACTGCGCCGTGAACTGGAACTG
	CTGATGCTGGCCAGTGAAGAAGATGAAGAA
	GTGTCCTGTCTGATCACCGACGCACTGTGG
	TATTTCGCCCAGAGCGTTGCAGATTCTCTG
	AACCTGCGCCGTCTGGTCCTGATGACGTCA
	TCGCTGTTCAATTTTCATGCGCACGTTTCT
	CTGCCGCAATTTGATGAACTGGGCTACCTG
	GACCCGGATGACAAAACCCGTCTGGAAGAA
	CAAGCCAGTGGTTTTCCGATGCTGAAAGTC
	AAAGACATTAAATCCGCCTATTCGTAA
	(SEQ ID NO: 18)
UGT76G1 CP2 DNA	ATGAACTGGCAAATCCTGAAAGAAATCCTG
	GGTAAAATGATCAAACAAACCAAAGCGTCG
	TCGGGCGTTATCTGGAACTCCTTCAAAGAA
	CTGGAAGAATCAGAACTGGAAACCGTTATT
	CGCGAAATCCCGGCTCCGTCGTTCCTGATT
	CCGCTGCCGAAACATCTGACCGCGAGCAGC
	AGCAGCCTGCTGGATCACGACCGTACGGTC
	TTTCAGTGGCTGGATCAGCAACCGCCGTCA
	TCGGTGCTGTATGTTTCATTCGGTAGCACC
	TCTGAAGTCGATGAAAAAGACTTTCTGGAA
	ATCGCTCGCGGCCTGGTGGATAGTAAACAG
	TCCTTCCTGTGGGTGGTTCGTCCGGGTTTT
	GTGAAAGGCAGCACGTGGGTTGAACCGCTG
	CCGGATGGCTTCCTGGGTGAACGCGGCCGT
	ATTGTCAAATGGGTGCCGCAGCAAGAAGTG
	CTGGCACATGGTGCTATCGGCGCGTTTTGG
	ACCCACTCTGGTTGGAACAGTACGCTGGAA
	TCCGTTTGCGAAGGTGTCCCGATGATTTTC
	AGCGATTTTGGCCTGGACCAGCCGCTGAAT
	GCCCGCTATATGTCTGATGTTCTGAAAGTC
	GGTGTGTACCTGGAAAACGGTTGGGAACGT
	GGCGAAATTGCGAATGCCATCCGTCGCGTT
	ATGGTCGATGAAGAAGGCGAATACATTCGC

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	CAGAACGCTCGTGTCCTGAAACAAAAAGCG
	GACGTGAGCCTGATGAAAGGCGGTAGCTCT
	TATGAATCACTGGAATCGCTGGTTAGCTAC
	ATCAGTTCCCTGTACAAAGATGACAGCGGT
	TATAGCAGCAGCTATGCGGCGGCGGCGGGT
	ATGGAAAATAAAACCGAAACCACGGTGCGT
	CGCCGTCGCCGTATTATCCTGTTCCCGGTT
	CCGTTTCAGGGTCATATTAACCCGATCCTG
	CAACTGGCGAATGTTCTGTATTCAAAAGGC
	TTTTCGATCACCATCTTCCATACGAACTTC
	AACAAACCGAAAACCAGTAACTACCCGCAC
	TTTACGTTCCGCTTTATTCTGGATAACGAC
	CCGCAGGATGAACGTATCTCCAATCTGCCG
	ACCCACGGCCCGCTGGCCGGTATGCGCATT
	CCGATTATCAATGAACACGGTGCAGATGAA
	CTGCGCCGTGAACTGGAACTGCTGATGCTG
	GCCAGTGAAGAAGATGAAGAAGTGTCCTGT
	CTGATCACCGACGCACTGTGGTATTTCGCC
	CAGAGCGTTGCAGATTCTCTGAACCTGCGC
	CGTCTGGTCCTGATGACGTCATCGCTGTTC
	AATTTTCATGCGCACGTTTCTCTGCCGCAA
	TTTGATGAACTGGGCTACCTGGACCCGGAT
	GACAAAACCCGTCTGGAAGAACAAGCCAGT
	GGTTTTCCGATGCTGAAAGTCAAAGACATT
	AAATCCGCCTATTCGTAA
	(SEQ ID NO: 19)
EUGT11	ATGGATTCGGGTTACTCTTCCTCCTATGCG
WT	GCGGCTGCGGGTATGCACGTTGTTATCTGT
DNA	CCGTGGCTGGCTTTTGGTCACCTGCTGCCG
	TGCCTGGATCTGGCACAGCGTCTGGCTTCA
	CGCGGCCATCGTGTCAGCTTCGTGTCTACC
	CCGCGCAATATTTCGCGTCTGCCGCCGGTT
	CGTCCGGCACTGGCTCCGCTGGTTGCATTT
	GTCGCTCTGCCGCTGCCGCGCGTGGAAGGT
	CTGCCGGATGGTGCGGAAAGTACCAACGAC
	GTGCCGCATGATCGCCCGGACATGGTTGAA
	CTGCACCGTCGTGCATTCGATGGTCTGGCA
	GCACCGTTTTCCGAATTTCTGGGTACGGCG
	TGCGCCGATTGGGTGATCGTTGACGTCTTT
	CATCACTGGGCGGCGGCGGCGGCGCTGGAA
	CATAAAGTTCCGTGTGCAATGATGCTGCTG
	GGCTCAGCTCACATGATTGCGTCGATCGCA
	GACCGTCGCCTGGAACGTGCAGAAACCGAA
	AGTCCGGCTGCGGCCGGCCAGGGTCGCCCG
	GCAGCTGCGCCGACCTTCGAAGTGGCCCGC
	ATGAAACTGATTCGTACGAAAGGCAGCTCT
	GGTATGAGCCTGGCAGAACGCTTTAGTCTG
	ACCCTGTCCCGTAGTTCCCTGGTGGTTGGT
	CGCAGTTGCGTTGAATTTGAACCGGAAACC
	GTCCCGCTGCTGTCCACGCTGCGTGGTAAA
	CCGATCACCTTTCTGGGTCTGATGCCGCCG
	CTGCATGAAGGCCGTCGCGAAGATGGTGAA
	GACGCAACGGTGCGTTGGCTGGATGCACAG
	CCGGCTAAAAGCGTCGTGTATGTCGCCCTG
	GGCTCTGAAGTGCCGCTGGGTGTGGAAAAA
	GTTCACGAACTGGCACTGGGCCTGGAACTG
	GCTGGCACCCGCTTCCTGTGGGCACTGCGT
	AAACCGACGGGTGTGAGCGATGCGGACCTG
	CTGCCGGCCGGTTTTGAAGAACGTACCCGC
	GGCCGTGGTGTTGTCGCAACGCGTTGGGTC
	CCGCAAATGAGCATTCTGGCGCATGCCGCA
	GTGGGCGCCTTTCTGACCCACTGTGGTTGG
	AACAGCACGATCGAAGGCCTGATGTTTGGT
	CACCCGCTGATTATGCTGCCGATCTTCGGC
	GATCAGGGTCCGAACGCACGTCTGATTGAA
	GCGAAAAATGCCGGCCTGCAAGTTGCGCGC
	AACGATGGCGACGGTTCTTTCGACCGTGAG
	GGTGTGGCTGCGGCCATTCGCGCAGTGGCT
	GTTGAAGAAGAATCATCGAAAGTTTTTCAG

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	GCGAAAGCCAAAAAACTGCAAGAAATCGTC
	GCGGATATGGCCTGCCACGAACGCTACATT
	GATGGTTTCATTCAGCAACTGCGCTCCTAC
	AAAGACTAA
	(SEQ ID NO: 20)
EUGT11	ATGGGTAGCTCGGGCATGTCCCTGGCGGAA
CP1	CGCTTTTCGCTGACGCTGAGTCGCTCATCC
DNA	CTGGTTGTTGGTCGCAGTTGTGTTGAATTT
	GAACCGGAAACCGTTCCGCTGCTGTCTACG
	CTGCGCGGCAAACCGATTACCTTCCTGGGT
	CTGATGCCGCCGCTGCATGAAGGCCGTCGC
	GAAGATGGTGAAGACGCCACGGTGCGTTGG
	CTGGATGCTCAGCCGGCGAAATCGGTGGTT
	TATGTCGCACTGGGCAGCGAAGTGCCGCTG
	GGTGTCGAAAAAGTGCACGAACTGGCCCTG
	GGCCTGGAACTGGCAGGCACCCGCTTTCTG
	TGGGCACTGCGTAAACCGACGGGCGTTAGC
	GATGCTGACCTGCTGCCGGCGGGTTTCGAA
	GAACGCACCCGCGGCCGTGGTGTCGTGGCC
	ACCCGTTGGGTGCCGCAAATGTCCATTCTG
	GCTCATGCGGCCGTTGGCGCATTTCTGACC
	CACTGCGGTTGGAACAGCACGATCGAAGGC
	CTGATGTTTGGTCATCCGCTGATTATGCTG
	CCGATCTTCGGCGATCAGGGTCCGAACGCA
	CGCCTGATCGAAGCCAAAAATGCAGGCCTG
	CAAGTTGCGCGTAACGATGGCGACGGTAGC
	TTTGACCGCGAAGGTGTCGCAGCTGCGATT
	CGTGCTGTGGCGGTTGAAGAAGAAAGCAGC
	AAAGTCTTCCAGGCCAAAGCGAAAAAACTG
	CAAGAAATCGTGGCTGATATGGCGTGTCAT
	GAACGCTATATTGACGGCTTTATCCAGCAA
	CTGCGTTCTTACAAAGATGACAGTGGCTAT
	AGTTCCTCATACGCCGCAGCTGCGGGTATG
	CATGTTGTCATTTGCCCGTGGCTGGCGTTT
	GGTCACCTGCTGCCGTGTCTGGATCTGGCA
	CAGCGCCTGGCATCTCGCGGTCACCGTGTT
	TCGTTCGTCAGCACCCCGCGCAATATCAGT
	CGTCTGCCGCCGGTTCGTCCGGCGCTGGCG
	CCGCTGGTTGCGTTCGTTGCACTGCCGCTG
	CCGCGTGTGGAAGGTCTGCCGGATGGTGCC
	GAATCGACCAACGACGTTCCGCATGATCGT
	CCGGACATGGTCGAACTGCATCGTCGCGCC
	TTTGATGGCCTGGCCGCACCGTTTAGCGAA
	TTTCTGGGTACGGCCTGCGCAGATTGGGTC
	ATTGTGGACGTTTTTCACCACTGGGCGGCG
	GCGGCGGCGCTGGAACATAAAGTGCCGTGT
	GCGATGATGCTGCTGGGTTCCGCCCACATG
	ATTGCTTCAATCGCGGATCGTCGCCTGGAA
	CGTGCCGAAACCGAAAGTCCGGCGGCGGCA
	GGCCAGGGTCGTCCGGCGGCGGCACCGACC
	TTTGAAGTGGCACGTATGAAACTGATTCGC
	ACGAAATAA
	(SEQ ID NO: 21)
HV1	ATGGATGGTAACTCCTCCTCCTCGCCGCTG
glycosyl	CATGTGGTCATTTGTCCGTGGCTGGCTCTG
transferase	GGTCACCTGCTGCCGTGTCTGGATATTGCT
DNA	GAACGTCTGGCGTCACGCGGCCATCGTGTC
	AGTTTTGTGTCCACCCCGCGCAACATTGCC
	CGTCTGCCGCCGCTGCGTCCGGCTGTTGCA
	CCGCTGGTTGATTTCGTCGCACTGCCGCTG
	CCGCATGTTGACGGTCTGCCGGAGGGTGCG
	GAATCGACCAATGATGTGCCGTATGACAAA
	TTTGAACTGCACCGTAAGGCGTTCGATGGT
	CTGGCGGCCCCGTTTAGCGAATTTCTGCGT
	GCAGCTTGCGCAGAAGGTGCAGGTTCTCGC
	CCGGATTGGCTGATTGTGGACACCTTTCAT
	CACTGGGCGGCGGCGGCGGCGGTGGAAAAC
	AAAGTGCCGTGTGTTATGCTGCTGCTGGGT
	GCAGCAACGGTGATCGCTGGTTTCGCGCGT
	GGTGTTAGCGAACATGCGGCGGCGGCGGTG

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	GGTAAAGAACGTCCGGCTGCGGAAGCCCCG
	AGTTTTGAAACCGAACGTCGCAAGCTGATG
	ACCACGCAGAATGCCTCCGGCATGACCGTG
	GCAGAACGCTATTTCCTGACGCTGATGCGT
	AGCGATCTGGTTGCCATCCGCTCTTGCGCA
	GAATGGGAACCGGAAAGCGTGGCAGCACTG
	ACCACGCTGGCAGGTAAACCGGTGGTTCCG
	CTGGGTCTGCTGCCGCCGAGTCCGGAAGGC
	GGTCGTGGCGTTTCCAAAGAAGATGCTGCG
	GTCCGTTGGCTGGACGCACAGCCGGCAAAG
	TCAGTCGTGTACGTCGCACTGGGTTCGGAA
	GTGCCGCTGCGTGCGGAACAAGTTCACGAA
	CTGGCACTGGGCCTGGAACTGAGCGGTGCT
	CGCTTTCTGTGGGCGCTGCGTAAACCGACC
	GATGCACCGGACGCCGCAGTGCTGCCGCCG
	GGTTTCGAAGAACGTACCCGCGGCCGTGGT
	CTGGTTGTCACGGGTTGGGTGCCGCAGATT
	GGCGTTCTGGCTCATGGTGCGGTGGCTGCG
	TTTCTGACCCACTGTGGCTGGAACTCTACG
	ATCGAAGGCCTGCTGTTCGGTCATCCGCTG
	ATTATGCTGCCGATCAGCTCTGATCAGGGT
	CCGAATGCGCGCCTGATGGAAGGCCGTAAA
	GTCGGTATGCAAGTGCCGCGTGATGAATCA
	GACGGCTCGTTTCGTCGCGAAGATGTTGCC
	GCAACCGTCCGCGCCGTGGCAGTTGAAGAA
	GACGGTCGTCGCGTCTTCACGGCTAACGCG
	AAAAAGATGCAAGAAATTGTGGCCGATGGC
	GCATGCCACGAACGTTGTATTGACGGTTTT
	ATCCAGCAACTGCGCAGTTACAAGGCGTAA
	(SEQ ID NO: 22)
SUS1 WT from *Arabidopsis thaliana*, DNA	ATGGCAAACGCTGAACGTATGATTACCCGT
	GTCCACTCCCAACGCGAACGCCTGAACGAA
	ACCCTGGTGTCGGAACGCAACGAAGTTCTG
	GCACTGCTGAGCCGTGTGGAAGCTAAGGGC
	AAAGGTATTCTGCAGCAAAACCAGATTATC
	GCGGAATTTGAAGCCCTGCCGGAACAAACC
	CGCAAAAAGCTGGAAGGCGGTCCGTTTTTC
	GATCTGCTGAAATCTACGCAGGAAGCGATC
	GTTCTGCCGCCGTGGGTCGCACTGGCAGTG
	CGTCCGCGTCCGGGCGTTTGGGAATATCTG
	CGTGTCAACCTGCATGCACTGGTGGTTGAA
	GAACTGCAGCCGGCTGAATTTCTGCACTTC
	AAGGAAGAACTGGTTGACGGCGTCAAAAAC
	GGTAATTTTACCCTGGAACTGGATTTTGAA
	CCGTTCAATGCCAGTATCCCGCGTCCGACG
	CTGCATAAATATATTGGCAACGGTGTGGAC
	TTTCTGAATCGCCATCTGAGCGCAAAGCTG
	TTCCACGATAAAGAATCTCTGCTGCCGCTG
	CTGAAATTCCTGCGTCTGCATAGTCACCAG
	GGCAAGAACCTGATGCTGTCCGAAAAAATT
	CAGAACCTGAATACCCTGCAACACACGCTG
	CGCAAGGCGGAAGAATACCTGGCCGAACTG
	AAAAGTGAAACCCTGTACGAAGAATTCGAA
	GCAAAGTTCGAAGAAATTGGCCTGGAACGT
	GGCTGGGGTGACAATGCTGAACGTGTTCTG
	GATATGATCCGTCTGCTGCTGGACCTGCTG
	GAAGCACCGGACCCGTGCACCCTGGAAACG
	TTTCTGGGTCGCGTGCCGATGGTTTTCAAC
	GTCGTGATTCTGTCCCCGCATGGCTATTTT
	GCACAGGACAATGTGCTGGGTTACCCGGAT
	ACCGGCGGTCAGGTTGTCTATATTCTGGAT
	CAAGTTCGTGCGCTGGAAATTGAAATGCTG
	CAGCGCATCAAGCAGCAAGGCCTGAACATC
	AAACCGCGTATTCTGATCCTGACCCGTCTG
	CTGCCGGATGCAGTTGGTACCACGTGCGGT
	GAACGTCTGGAACGCGTCTATGACAGCGAA
	TACTGTGATATTCTGCGTGTCCCGTTTCGC
	ACCGAAAAGGGTATTGTGCGTAAATGGATC
	AGTCGCTTCGAAGTTTGGCCGTATCTGGAA
	ACCTACACGGAAGATGCGGCCGTGGAACTG
	TCCAAGGAACTGAATGGCAAACCGGACCTG

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	ATTATCGGCAACTATAGCGATGGTAATCTG
	GTCGCATCTCTGCTGGCTCATAAACTGGGT
	GTGACCCAGTGCACGATTGCACACGCTCTG
	GAAAAGACCAAATATCCGGATTCAGACATC
	TACTGGAAAAAGCTGGATGACAAATATCAT
	TTTTCGTGTCAGTTCACCGCGGACATTTTT
	GCCATGAACCACACGGATTTTATTATCACC
	AGTACGTTCCAGGAAATCGCGGGCTCCAAA
	GAAACCGTGGGTCAATACGAATCACATACC
	GCCTTCACGCTGCCGGGCCTGTATCGTGTG
	GTTCACGGTATCGATGTTTTTGACCCGAAA
	TTCAATATTGTCAGTCCGGGCGCGGATATG
	TCCATCTATTTTCCGTACACCGAAGAAAAG
	CGTCGCCTGACGAAATTCCATTCAGAAATT
	GAAGAACTGCTGTACTCGGACGTGGAAAAC
	AAGGAACACCTGTGTGTTCTGAAAGATAAA
	AAGAAACCGATCCTGTTTACCATGGCCCGT
	CTGGATCGCGTGAAGAATCTGTCAGGCCTG
	GTTGAATGGTATGGTAAAAACACGCGTCTG
	CGCGAACTGGCAAATCTGGTCGTGGTTGGC
	GGTGACCGTCGCAAGGAATCGAAAGATAAC
	GAAGAAAAGGCTGAAATGAAGAAAATGTAC
	GATCTGATCGAAGAATACAAGCTGAACGGC
	CAGTTTCGTTGGATCAGCTCTCAAATGGAC
	CGTGTGCGCAATGGCGAACTGTATCGCTAC
	ATTTGCGATACCAAGGGTGCGTTTGTTCAG
	CCGGCACTGTACGAAGCTTTCGGCCTGACC
	GTCGTGGAAGCCATGACGTGCGGTCTGCCG
	ACCTTTGCGACGTGTAAAGGCGGTCCGGCC
	GAAATTATCGTGCATGGCAAATCTGGTTTC
	CATATCGATCCGTATCACGGTGATCAGGCA
	GCTGACACCCTGGCGGATTTCTTTACGAAG
	TGTAAAGAAGACCCGTCACACTGGGATGAA
	ATTTCGAAGGGCGGTCTGCAACGTATCGAA
	GAAAAATATACCTGGCAGATTTACAGCCAA
	CGCCTGCTGACCCTGACGGGCGTCTACGGT
	TTTTGGAAACATGTGTCTAATCTGGATCGC
	CTGGAAGCCCGTCGCTATCTGGAAATGTTT
	TACGCACTGAAGTATCGCCCGCTGGCACAA
	GCCGTTCCGCTGGCACAGGACGACTAA
	(SEQ ID NO: 23)
UGT76G1-AtSUS1 fusion enzyme, DNA	ATGGAGAATAAGACAGAAACAACCGTAAGA
	CGGAGGCGGAGGATTATCTTGTTCCCTGTA
	CCATTTCAGGGCCATATTAATCCGATCCTC
	CAATTAGCAAACGTCCTCTACTCCAAGGGA
	TTTTCAATAACAATCTTCCATACTAACTTT
	AACAAGCCTAAAACGAGTAATTATCCTCAC
	TTTACATTCAGGTTCATTCTAGACAACGAC
	CCTCAGGATGAGCGTATCTCAAATTTACCT
	ACGCATGGCCCCTTGGCAGGTATGCGAATA
	CCAATAATCAATGAGCATGGAGCCGATGAA
	CTCCGTCGCGAGTTAGAGCTTCTCATGCTC
	GCAAGTGAGGAAGACGAGGAAGTTTCGTGC
	CTAATAACTGATGCGCTTTGGTACTTCGCC
	CAATCAGTCGCAGACTCACTGAATCTACGC
	CGTTTGGTCCTTATGACAAGTTCATTATTC
	AACTTTCACGCACATGTATCACTGCCGCAA
	TTTGACGAGTTGGGTTACCTGGACCCGGAT
	GACAAAACGCGATTGGAGGAACAAGCGTCG
	GGCTTCCCCATGCTGAAAGTCAAAGATATT
	AAGAGCGCTTATAGTAATTGGCAAATTCTG
	AAAGAAATTCTCGGAAAAATGATAAAGCAA
	ACCAAAGCGTCCTCTGGAGTAATCTGGAAC
	TCCTTCAAGGAGTTAGAGGAATCTGAACTT
	GAAACGGTCATCAGAGAAATCCCCGCTCCC
	TCGTTCTTAATTCCACTACCCAAGCACCTT
	ACTGCAAGTAGCAGTTCCCTCCTAGATCAT
	GACCGAACCGTGTTTCAGTGGCTGGATCAG
	CAACCCCCGTCGTCAGTTCTATATGTAAGC
	TTTGGGAGTACTTCGGAAGTGGATGAAAAG
	GACTTCTTAGAGATTGCGCGAGGGCTCGTG

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	GATAGCAAACAGAGCTTCCTGTGGGTAGTG
	AGACCGGGATTCGTTAAGGGCTCGACGTGG
	GTCGAGCCGTTGCCAGATGGTTTTCTAGGG
	GAGAGAGGGAGAATCGTGAAATGGGTTCCA
	CAGCAAGAGGTTTTGGCTCACGGAGCTATA
	GGGGCCTTTTGGACCCACTCTGGTTGGAAT
	TCTACTCTTGAAAGTGTCTGTGAAGGCGTT
	CCAATGATATTTTCTGATTTTGGGCTTGAC
	CAGCCTCTAAACGCTCGCTATATGTCTGAT
	GTGTTGAAGGTTGGCGTGTACCTGGAGAAT
	GGTTGGGAAAGGGGGGAAATTGCCAACGCC
	ATACGCCGGGTAATGGTGGACGAGGAAGGT
	GAGTACATACGTCAGAACGCTCGGGTTTTA
	AAACAAAAAGCGGACGTCAGCCTTATGAAG
	GGAGGTAGCTCCTATGAATCCCTAGAATCC
	TTGGTAAGCTATATATCTTCGTTAGGTTCT
	GGTGCAAACGCTGAACGTATGATAACGCGC
	GTCCACAGCCAACGTGAGCGTTTGAACGAA
	ACGCTTGTTTCTGAGAGAAACGAAGTCCTT
	GCCTTGCTTTCCAGGGTTGAAGCCAAAGGT
	AAAGGTATTTTACAACAAAACCAGATCATT
	GCTGAATTCGAAGCTTTGCCTGAACAAACC
	CGGAAGAAACTTGAAGGTGGTCCTTTCTTT
	GACCTTCTCAAATCCACTCAGGAAGCAATT
	GTGTTGCCACCATGGGTTGCTCTAGCTGTG
	AGGCCAAGGCCTGGTGTTTGGGAATACTTA
	CGAGTCAATCTCCATGCTCTTGTCGTTGAA
	GAACTCCAACCTGCTGAGTTTCTTCATTTC
	AAGGAAGAACTCGTTGATGGAGTTAAGAAT
	GGTAATTTCACTCTTGAGCTTGATTTCGAG
	CCATTCAATGCGTCTATCCCTCGTCCAACA
	CTCCACAAATACATTGGAAATGGTGTTGAC
	TTCCTTAACCGTCATTTATCGGCTAAGCTC
	TTCCATGACAAGGAGAGTTTGCTTCCATTG
	CTTAAGTTCCTTCGTCTTCACAGCCACCAG
	GGCAAGAACCTGATGTTGAGCGAGAAGATT
	CAGAACCTCAACACTCTGCAACACACCTTG
	AGGAAAGCAGAAGAGTATCTAGCAGAGCTT
	AAGTCCGAAACACTGTATGAAGAGTTTGAG
	GCCAAGTTTGAGGAGATTGGTCTTGAGAGG
	GGATGGGGAGACAATGCAGAGCGTGTCCTT
	GACATGATACGTCTTCTTTTGGACCTTCTT
	GAGGCGCCTGATCCTTGCACTCTTGAGACT
	TTTCTTGGAAGAGTACCAATGGTGTTCAAC
	GTTGTGATCCTCTCTCCACATGGTTACTTT
	GCTCAGGACAATGTTCTTGGTTACCCTGAC
	ACTGGTGGACAGGTTGTTTACATTCTTGAT
	CAAGTTCGTGCTCTGGAGATAGAGATGCTT
	CAACGTATTAAGCAACAAGGACTCAACATT
	AAACCAAGGATTCTCATTCTAACTCGACTT
	CTACCTGATGCGGTAGGAACTACATGCGGT
	GAACGTCTCGAGAGAGTTTATGATTCTGAG
	TACTGTGATATTCTTCGTGTGCCCTTCAGA
	ACAGAGAAGGGTATTGTTCGCAAATGGATC
	TCAAGGTTCGAAGTCTGGCCATATCTAGAG
	ACTTACACCGAGGATGCTGCGGTTGAGCTA
	TCGAAAGAATTGAATGGCAAGCCTGACCTT
	ATCATTGGTAACTACAGTGATGGAAATCTT
	GTTGCTTCTTTATTGGCTCACAAACTTGGT
	GTCACTCAGTGTACCATTGCTCATGCTCTT
	GAGAAAACAAAGTACCCGGATTCTGATATC
	TACTGGAAGAAGCTTGACGACAAGTACCAT
	TTCTCATGCCAGTTCACTGCGGATATTTTC
	GCAATGAACCACACTGATTTCATCATCACT
	AGTACTTTCCAAGAAATTGCTGGAAGCAAA
	GAAACTGTTGGGCAGTATGAAAGCCACACA
	GCCTTTACTCTTCCCGGATTGTATCGAGTT
	GTTCACGGGATTGATGTGTTTGATCCCAAG
	TTCAACATTGTCTCTCCTGGTGCTGATATG
	AGCATCTACTTCCCTTACACAGAGGAGAAG
	CGTAGATTGACTAAGTTCCACTCTGAGATC
	GAGGAGCTCCTCTACAGCGATGTTGAGAAC

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	AAAGAGCACTTATGTGTGCTCAAGGACAAG
	AAGAAGCCGATTCTCTTCACAATGGCTAGG
	CTTGATCGTGTCAAGAACTTGTCAGGTCTT
	GTTGAGTGGTACGGGAAGAACACCCGCTTG
	CGTGAGCTAGCTAACTTGGTTGTTGTTGGA
	GGAGACAGGAGGAAAGAGTCAAAGGACAAT
	GAAGAGAAAGCAGAGATGAAGAAAATGTAT
	GATCTCATTGAGGAATACAAGCTAAACGGT
	CAGTTCAGGTGGATCTCCTCTCAGATGGAC
	CGGGTAAGGAACGGTGAGCTGTACCGGTAC
	ATCTGTGACACCAAGGGTGCTTTTGTCCAA
	CCTGCATTATATGAAGCCTTTGGGTTAACT
	GTTGTGGAGGCTATGACTTGTGGTTTACCG
	ACTTTCGCCACTTGCAAAGGTGGTCCAGCT
	GAGATCATTGTGCACGGTAAATCGGGTTTC
	CACATTGACCCTTACCATGGTGATCAGGCT
	GCTGATACTCTTGCTGATTTCTTCACCAAG
	TGTAAGGAGGATCCATCTCACTGGGATGAG
	ATCTCAAAAGGAGGGCTTCAGAGGATTGAG
	GAGAAATACACTTGGCAAATCTATTCACAG
	AGGCTCTTGACATTGACTGGTGTGTATGGA
	TTCTGGAAGCATGTCTCGAACCTTGACCGT
	CTTGAGGCTCGCCGTTACCTTGAAATGTTC
	TATGCATTGAAGTATCGCCCATTGGCTCAG
	GCTGTTCCTCTTGCACAAGATGATTGA
	(SEQ ID NO: 24)
EUGT11-AtSUS1 fusion enzyme, DNA	ATGGATTCGGGTTACTCTTCCTCCTATGCG
	GCGGCTGCGGGTATGCACGTTGTTATCTGT
	CCGTGGCTGGCTTTTGGTCACCTGCTGCCG
	TGCCTGGATCTGGCACAGCGTCTGGCTTCA
	CGCGGCCATCGTGTCAGCTTCGTGTCTACC
	CCGCGCAATATTTCGCGTCTGCCGCCGGTT
	CGTCCGGCACTGGCTCCGCTGGTTGCATTT
	GTCGCTCTGCCGCTGCCGCGCGTGGAAGGT
	CTGCCGGATGGTGCGGAAAGTACCAACGAC
	GTGCCGCATGATCGCCCGGACATGGTTGAA
	CTGCACCGTCGTGCATTCGATGGTCTGGCA
	GCACCGTTTTCCGAATTTCTGGGTACGGCG
	TGCGCCGATTGGGTGATCGTTGACGTCTTT
	CATCACTGGGCGGCGGCGGCGGCGCTGGAA
	CATAAAGTTCCGTGTGCAATGATGCTGCTG
	GGCTCAGCTCACATGATTGCGTCGATCGCA
	GACCGTCGCCTGGAACGTGCAGAAACCGAA
	AGTCCGGCTGCGGCCGGCCAGGGTCGCCCG
	GCAGCTGCGCCGACCTTCGAAGTGGCCCGC
	ATGAAACTGATTCGTACGAAAGGCAGCTCT
	GGTATGAGCCTGGCAGAACGCTTTAGTCTG
	ACCCTGTCCCGTAGTTCCCTGGTGGTTGGT
	CGCAGTTGCGTTGAATTTGAACCGGAAACC
	GTCCCGCTGCTGTCCACGCTGCGTGGTAAA
	CCGATCACCTTTCTGGGTCTGATGCCGCCG
	CTGCATGAAGGCCGTCGCGAAGATGGTGAA
	GACGCAACGGTGCGTTGGCTGGATGCACAG
	CCGGCTAAAAGCGTCGTGTATGTCGCCCTG
	GGCTCTGAAGTGCCGCTGGGTGTGGAAAAA
	GTTCACGAACTGGCACTGGGCCTGGAACTG
	GCTGGCACCCGCTTCCTGTGGGCACTGCGT
	AAACCGACGGGTGTGAGCGATGCGGACCTG
	CTGCCGGCCGGTTTTGAAGAACGTACCCGC
	GGCCGTGGTGTTGTCGCAACGCGTTGGGTC
	CCGCAAATGAGCATTCTGGCGCATGCCGCA
	GTGGGCGCCTTTCTGACCCACTGTGGTTGG
	AACAGCACGATCGAAGGCCTGATGTTTGGT
	CACCCGCTGATTATGCTGCCGATCTTCGGC
	GATCAGGGTCCGAACGCACGTCTGATTGAA
	GCGAAAAATGCCGGCCTGCAAGTTGCGCGC
	AACGATGGCGACGGTTCTTTCGACCGTGAG
	GGTGTGGCTGCGGCCATTCGCGCAGTGGCT
	GTTGAAGAAGAATCATCGAAAGTTTTTCAG
	GCGAAAGCCAAAAAACTGCAAGAAATCGTC
	GCGGATATGGCCTGCCACGAACGCTACATT

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	GATGGTTTCATTCAGCAACTGCGCTCCTAC
	AAAGACGGTTCTGGTGCAAACGCTGAACGT
	ATGATAACGCGCGTCCACAGCCAACGTGAG
	CGTTTGAACGAAACGCTTGTTTCTGAGAGA
	AACGAAGTCCTTGCCTTGCTTTCCAGGGTT
	GAAGCCAAAGGTAAAGGTATTTTACAACAA
	AACCAGATCATTGCTGAATTCGAAGCTTTG
	CCTGAACAAACCCGGAAGAAACTTGAAGGT
	GGTCCTTTCTTTGACCTTCTCAAATCCACT
	CAGGAAGCAATTGTGTTGCCACCATGGGTT
	GCTCTAGCTGTGAGGCCAAGGCCTGGTGTT
	TGGGAATACTTACGAGTCAATCTCCATGCT
	CTTGTCGTTGAAGAACTCCAACCTGCTGAG
	TTTCTTCATTTCAAGGAAGAACTCGTTGAT
	GGAGTTAAGAATGGTAATTTCACTCTTGAG
	CTTGATTTCGAGCCATTCAATGCGTCTATC
	CCTCGTCCAACACTCCACAAATACATTGGA
	AATGGTGTTGACTTCCTTAACCGTCATTTA
	TCGGCTAAGCTCTTCCATGACAAGGAGAGT
	TTGCTTCCATTGCTTAAGTTCCTTCGTCTT
	CACAGCCACCAGGGCAAGAACCTGATGTTG
	AGCGAGAAGATTCAGAACCTCAACACTCTG
	CAACACACCTTGAGGAAAGCAGAAGAGTAT
	CTAGCAGAGCTTAAGTCCGAAACACTGTAT
	GAAGAGTTTGAGGCCAAGTTTGAGGAGATT
	GGTCTTGAGAGGGGATGGGGAGACAATGCA
	GAGCGTGTCCTTGACATGATACGTCTTCTT
	TTGGACCTTCTTGAGGCGCCTGATCCTTGC
	ACTCTTGAGACTTTTCTTGGAAGAGTACCA
	ATGGTGTTCAACGTTGTGATCCTCTCTCCA
	CATGGTTACTTTGCTCAGGACAATGTTCTT
	GGTTACCCTGACACTGGTGGACAGGTTGTT
	TACATTCTTGATCAAGTTCGTGCTCTGGAG
	ATAGAGATGCTTCAACGTATTAAGCAACAA
	GGACTCAACATTAAACCAAGGATTCTCATT
	CTAACTCGACTTCTACCTGATGCGGTAGGA
	ACTACATGCGGTGAACGTCTCGAGAGAGTT
	TATGATTCTGAGTACTGTGATATTCTTCGT
	GTGCCCTTCAGAACAGAGAAGGGTATTGTT
	CGCAAATGGATCTCAAGGTTCGAAGTCTGG
	CCATATCTAGAGACTTACACCGAGGATGCT
	GCGGTTGAGCTATCGAAAGAATTGAATGGC
	AAGCCTGACCTTATCATTGGTAACTACAGT
	GATGGAAATCTTGTTGCTTCTTTATTGGCT
	CACAAACTTGGTGTCACTCAGTGTACCATT
	GCTCATGCTCTTGAGAAAACAAAGTACCCG
	GATTCTGATATCTACTGGAAGAAGCTTGAC
	GACAAGTACCATTTCTCATGCCAGTTCACT
	GCGGATATTTTCGCAATGAACCACACTGAT
	TTCATCATCACTAGTACTTTCCAAGAAATT
	GCTGGAAGCAAAGAAACTGTTGGGCAGTAT
	GAAAGCCACACAGCCTTTACTCTTCCCGGA
	TTGTATCGAGTTGTTCACGGGATTGATGTG
	TTTGATCCCAAGTTCAACATTGTCTCTCCT
	GGTGCTGATATGAGCATCTACTTCCCTTAC
	ACAGAGGAGAAGCGTAGATTGACTAAGTTC
	CACTCTGAGATCGAGGAGCTCCTCTACAGC
	GATGTTGAGAACAAAGAGCACTTATGTGTG
	CTCAAGGACAAGAAGAAGCCGATTCTCTTC
	ACAATGGCTAGGCTTGATCGTGTCAAGAAC
	TTGTCAGGTCTTGTTGAGTGGTACGGGAAG
	AACACCCGCTTGCGTGAGCTAGCTAACTTG
	GTTGTTGTTGGAGGAGACAGGAGGAAAGAG
	TCAAAGGACAATGAAGAGAAAGCAGAGATG
	AAGAAAATGTATGATCTCATTGAGGAATAC
	AAGCTAAACGGTCAGTTCAGGTGGATCTCC
	TCTCAGATGGACCGGGTAAGGAACGGTGAG
	CTGTACCGGTACATCTGTGACACCAAGGGT
	GCTTTTGTCCAACCTGCATTATATGAAGCC
	TTTGGGTTAACTGTTGTGGAGGCTATGACT
	TGTGGTTTACCGACTTTCGCCACTTGCAAA
	GGTGGTCCAGCTGAGATCATTGTGCACGGT

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	AAATCGGGTTTCCACATTGACCCTTACCAT
	GGTGATCAGGCTGCTGATACTCTTGCTGAT
	TTCTTCACCAAGTGTAAGGAGGATCCATCT
	CACTGGGATGAGATCTCAAAAGGAGGGCTT
	CAGAGGATTGAGGAGAAATACACTTGGCAA
	ATCTATTCACAGAGGCTCTTGACATTGACT
	GGTGTGTATGGATTCTGGAAGCATGTCTCG
	AACCTTGACCGTCTTGAGGCTCGCCGTTAC
	CTTGAAATGTTCTATGCATTGAAGTATCGC
	CCATTGGCTCAGGCTGTTCCTCTTGCACAA
	GATGATTGA
	(SEQ ID NO: 25)
HV1-AtSUS1 fusion enzyme, DNA	ATGGATGGTAACTCCTCCTCCTCGCCGCTG
	CATGTGGTCATTTGTCCGTGGCTGGCTCTG
	GGTCACCTGCTGCCGTGTCTGGATATTGCT
	GAACGTCTGGCGTCACGCGGCCATCGTGTC
	AGTTTTGTGTCCACCCCGCGCAACATTGCC
	CGTCTGCCGCCGCTGCGTCCGGCTGTTGCA
	CCGCTGGTTGATTTCGTCGCACTGCCGCTG
	CCGCATGTTGACGGTCTGCCGGAGGGTGCG
	GAATCGACCAATGATGTGCCGTATGACAAA
	TTTGAACTGCACCGTAAGGCGTTCGATGGT
	CTGGCGGCCCCGTTTAGCGAATTTCTGCGT
	GCAGCTTGCGCAGAAGGTGCAGGTTCTCGC
	CCGGATTGGCTGATTGTGGACACCTTTCAT
	CACTGGGCGGCGGCGGCGGCGGTGGAAAAC
	AAAGTGCCGTGTGTTATGCTGCTGCTGGGT
	GCAGCAACGGTGATCGCTGGTTTCGCGCGT
	GGTGTTAGCGAACATGCGGCGGCGGCGGTG
	GGTAAAGAACGTCCGGCTGCGGAAGCCCCG
	AGTTTTGAAACCGAACGTCGCAAGCTGATG
	ACCACGCAGAATGCCTCCGGCATGACCGTG
	GCAGAACGCTATTTCCTGACGCTGATGCGT
	AGCGATCTGGTTGCCATCCGCTCTTGCGCA
	GAATGGGAACCGGAAAGCGTGGCAGCACTG
	ACCACGCTGGCAGGTAAACCGGTGGTTCCG
	CTGGGTCTGCTGCCGCCGAGTCCGGAAGGC
	GGTCGTGGCGTTTCCAAAGAAGATGCTGCG
	GTCCGTTGGCTGGACGCACAGCCGGCAAAG
	TCAGTCGTGTACGTCGCACTGGGTTCGGAA
	GTGCCGCTGCGTGCGGAACAAGTTCACGAA
	CTGGCACTGGGCCTGGAACTGAGCGGTGCT
	CGCTTTCTGTGGGCGCTGCGTAAACCGACC
	GATGCACCGGACGCCGCAGTGCTGCCGCCG
	GGTTTCGAAGAACGTACCCGCGGCCGTGGT
	CTGGTTGTCACGGGTTGGGTGCCGCAGATT
	GGCGTTCTGGCTCATGGTGCGGTGGCTGCG
	TTTCTGACCCACTGTGGCTGGAACTCTACG
	ATCGAAGGCCTGCTGTTCGGTCATCCGCTG
	ATTATGCTGCCGATCAGCTCTGATCAGGGT
	CCGAATGCGCGCCTGATGGAAGGCCGTAAA
	GTCGGTATGCAAGTGCCGCGTGATGAATCA
	GACGGCTCGTTTCGTCGCGAAGATGTTGCC
	GCAACCGTCCGCGCCGTGGCAGTTGAAGAA
	GACGGTCGTCGCGTCTTCACGGCTAACGCG
	AAAAAGATGCAAGAAATTGTGGCCGATGGC
	GCATGCCACGAACGTTGTATTGACGGTTTT
	ATCCAGCAACTGCGCAGTTACAAGGCGGGT
	TCTGGTGCAAACGCTGAACGTATGATAACG
	CGCGTCCACAGCCAACGTGAGCGTTTGAAC
	GAAACGCTTGTTTCTGAGAGAAACGAAGTC
	CTTGCCTTGCTTTCCAGGGTTGAAGCCAAA
	GGTAAAGGTATTTTACAACAAAACCAGATC
	ATTGCTGAATTCGAAGCTTTGCCTGAACAA
	ACCCGGAAGAAACTTGAAGGTGGTCCTTTC
	TTTGACCTTCTCAAATCCACTCAGGAAGCA
	ATTGTGTTGCCACCATGGGTTGCTCTAGCT
	GTGAGGCCAAGGCCTGGTGTTTGGGAATAC
	TTACGAGTCAATCTCCATGCTCTTGTCGTT
	GAAGAACTCCAACCTGCTGAGTTTCTTCAT
	TTCAAGGAAGAACTCGTTGATGGAGTTAAG

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	AATGGTAATTTCACTCTTGAGCTTGATTTC
	GAGCCATTCAATGCGTCTATCCCTCGTCCA
	ACACTCCACAAATACATTGGAAATGGTGTT
	GACTTCCTTAACCGTCATTTATCGGCTAAG
	CTCTTCCATGACAAGGAGAGTTTGCTTCCA
	TTGCTTAAGTTCCTTCGTCTTCACAGCCAC
	CAGGGCAAGAACCTGATGTTGAGCGAGAAG
	ATTCAGAACCTCAACACTCTGCAACACACC
	TTGAGGAAAGCAGAAGAGTATCTAGCAGAG
	CTTAAGTCCGAAACACTGTATGAAGAGTTT
	GAGGCCAAGTTTGAGGAGATTGGTCTTGAG
	AGGGGATGGGGAGACAATGCAGAGCGTGTC
	CTTGACATGATACGTCTTCTTTTGGACCTT
	CTTGAGGCGCCTGATCCTTGCACTCTTGAG
	ACTTTTCTTGGAAGAGTACCAATGGTGTTC
	AACGTTGTGATCCTCTCTCCACATGGTTAC
	TTTGCTCAGGACAATGTTCTTGGTTACCCT
	GACACTGGTGGACAGGTTGTTTACATTCTT
	GATCAAGTTCGTGCTCTGGAGATAGAGATG
	CTTCAACGTATTAAGCAACAAGGACTCAAC
	ATTAAACCAAGGATTCTCATTCTAACTCGA
	CTTCTACCTGATGCGGTAGGAACTACATGC
	GGTGAACGTCTCGAGAGAGTTTATGATTCT
	GAGTACTGTGATATTCTTCGTGTGCCCTTC
	AGAACAGAGAAGGGTATTGTTCGCAAATGG
	ATCTCAAGGTTCGAAGTCTGGCCATATCTA
	GAGACTTACACCGAGGATGCTGCGGTTGAG
	CTATCGAAAGAATTGAATGGCAAGCCTGAC
	CTTATCATTGGTAACTACAGTGATGGAAAT
	CTTGTTGCTTCTTTATTGGCTCACAAACTT
	GGTGTCACTCAGTGTACCATTGCTCATGCT
	CTTGAGAAAACAAAGTACCCGGATTCTGAT
	ATCTACTGGAAGAAGCTTGACGACAAGTAC
	CATTTCTCATGCCAGTTCACTGCGGATATT
	TTCGCAATGAACCACACTGATTTCATCATC
	ACTAGTACTTTCCAAGAAATTGCTGGAAGC
	AAAGAAACTGTTGGGCAGTATGAAAGCCAC
	ACAGCCTTTACTCTTCCCGGATTGTATCGA
	GTTGTTCACGGGATTGATGTGTTTGATCCC
	AAGTTCAACATTGTCTCTCCTGGTGCTGAT
	ATGAGCATCTACTTCCCTTACACAGAGGAG
	AAGCGTAGATTGACTAAGTTCCACTCTGAG
	ATCGAGGAGCTCCTCTACAGCGATGTTGAG
	AACAAAGAGCACTTATGTGTGCTCAAGGAC
	AAGAAGAAGCCGATTCTCTTCACAATGGCT
	AGGCTTGATCGTGTCAAGAACTTGTCAGGT
	CTTGTTGAGTGGTACGGGAAGAACACCCGC
	TTGCGTGAGCTAGCTAACTTGGTTGTTGTT
	GGAGGAGACAGGAGGAAAGAGTCAAAGGAC
	AATGAAGAGAAAGCAGAGATGAAGAAAATG
	TATGATCTCATTGAGGAATACAAGCTAAAC
	GGTCAGTTCAGGTGGATCTCCTCTCAGATG
	GACCGGGTAAGGAACGGTGAGCTGTACCGG
	TACATCTGTGACACCAAGGGTGCTTTTGTC
	CAACCTGCATTATATGAAGCCTTTGGGTTA
	ACTGTTGTGGAGGCTATGACTTGTGGTTTA
	CCGACTTTCGCCACTTGCAAAGGTGGTCCA
	GCTGAGATCATTGTGCACGGTAAATCGGGT
	TTCCACATTGACCCTTACCATGGTGATCAG
	GCTGCTGATACTCTTGCTGATTTCTTCACC
	AAGTGTAAGGAGGATCCATCTCACTGGGAT
	GAGATCTCAAAAGGAGGGCTTCAGAGGATT
	GAGGAGAAATACACTTGGCAAATCTATTCA
	CAGAGGCTCTTGACATTGACTGGTGTGTAT
	GGATTCTGGAAGCATGTCTCGAACCTTGAC
	CGTCTTGAGGCTCGCCGTTACCTTGAAATG
	TTCTATGCATTGAAGTATCGCCCATTGGCT
	CAGGCTGTTCCTCTTGCACAAGATGATTAA
	(SEQ ID NO: 26)

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
Beta-glucosidase 1 from *Pichia pastoris*, DNA	ATGACCCAACTGGATGTGGAGAGCCTGATT
	CAAGAGCTGACCCTGAACGAAAAGGTGCAA
	CTGCTGAGCGGTAGCGACTTCTGGCATACC
	ACCCCGGTTCGTCGTCTGGGCATCCCGAAG
	ATGCGTCTGAGCGACGGTCCGAACGGCGTT
	CGTGGTACCAAATTCTTTAACGGTGTTCCG
	ACCGCGTGCTTCCCGTGCGGTACCGGTCTG
	GGCGCGACCTTTGACAAGGAACTGCTGAAA
	GAGGCGGGTAGCCTGATGGCGGATGAAGCG
	AAAGCGAAAGCGGCGAGCGTGGTTCTGGGT
	CCGACCGCGAACATTGCGCGTGGTCCGAAC
	GGTGGCCGTGGCTTCGAGAGCTTCGGCGAG
	GACCCGGTGGTTAACGGTCTGAGCAGCGCG
	GCGATGATCAACGGCCTGCAGGGCAAGTAC
	ATTGCGGCGACCATGAAACACTATGTTTGC
	AACGATCTGGAAATGGACCGTAACTGCATT
	GACGCGCAAGTTAGCCACCGTGCGCTGCGT
	GAGGTGTACCTGCTGCCGTTCCAAATCGCG
	GTGCGTGATGCGAACCCGCGTGCGATTATG
	ACCGCGTATAACAAGGCGAACGGCGAACAC
	GTTAGCCAGAGCAAATTCCTGCTGGACGAA
	GTGCTGCGTAAGGAGTGGGGCTGGGATGGT
	CTGCTGATGAGCGACTGGTTTGGTGTTTAC
	GATGCGAAAAGCAGCATCACCAACGGCCTG
	GACCTGGAGATGCCGGGTCCGCCGCAGTGC
	CGTGTGCACAGCGCGACCGATCACGCGATC
	AACAGCGGCGAAATCCACATTAACGATGTT
	GACGAGCGTGTGCGTAGCCTGCTGAGCCTG
	ATTAACTACTGCCACCAAAGCGGTGTTACC
	GAGGAAGATCCGGAAACCAGCGACAACAAC
	ACCCCGGAAACCATCGAGAAGCTGCGTAAA
	ATCAGCCGTGAGAGCATTGTGCTGCTGAAG
	GACGATGACCGTAACCGTAGCATTCTGCCG
	CTGAAGAAAAGCGACAAAATCGCGGTTATT
	GGTAACAACGCGAAACAAGCGGCGTATTGC
	GGTGGCGGTAGCGCGAGCGTGCTGAGCTAT
	CACACCACCACCCCGTTCGACAGCATCAAG
	AGCCGTCTGGAAGATAGCAACACCCCGGCG
	TACACCATTGGTGCGGACGCGTATAAAAAC
	CTGCCGCCGCTGGGTCCGCAAATGACCGAT
	AGCGACGGCAAGCCGGGTTTTGATGCGAAA
	TTCTTTGTTGGCAGCCCGACCAGCAAGGAT
	CGTAAACTGATCGACCACTTCCAGCTGACC
	AACAGCCAAGTTTTTCTGGTGGACTACTAT
	AACGAACAGATCCCGGAAAACAAGGAGTTC
	TACGTTGACGTGGAGGGTCAATTTATTCCG
	GAGGAAGATGGCACCTATAACTTCGGTCTG
	ACCGTGTTTGGTACCGGCCGTCTGTTCGTT
	GATGACAAACTGGTTAGCGACAGCAGCCAG
	AACCAAACCCCGGGCGATAGCTTCTTTGGT
	CTGGCGGCGCAGGAAGTGATCGGCAGCATT
	CACCTGGTGAAGGGTAAAGCGTACAAGATC
	AAAGTTCTGTATGGCAGCAGCGTGACCCGT
	ACCTACGAAATTGCGGCGAGCGTTGCGTTT
	GAGGGCGGTGCGTTCACCTTTGGTGCGGCG
	AAACAGCGTAACGAAGACGAGGAAATCGCG
	CGTGCGGTGGAGATTGCGAAGGCGAACGAC
	AAAGTGGTTCTGTGCATCGGCCTGAACCAA
	GATTTCGAAAGCGAGGGTTTTGATCGTCCG
	GACATCAAGATTCCGGGCGCGACCAACAAA
	ATGGTTAGCGCGGTGCTGAAGGCGAACCCG
	AACACCGTTATTGTGAACCAGACCGGTACC
	CCGGTTGAGATGCCGTGGGCGAGCGATGCG
	CCGGTGATCCTGCAAGCGTGGTTTGGCGGT
	AGCGAGGCGGGTACCGCGATTGCGGATGTT
	CTGTTTGGCGACTACAACCCGAGCGGCAAG
	CTGACCGTGACCTTCCCGCTGCGTTTTGAG
	GATAACCCGGCGTACCTGAACTTCCAGAGC
	AACAAACAAGCGTGCTGGTATGGCGAAGAC
	GTTTACGTGGGTTATCGTTACTATGAGACC
	ATCGATCGTCCGGTGCTGTTCCCGTTTGGT

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	CACGGCCTGAGCTTCACCGAGTTCGATTTT ACCGACATGTTTGTTCGTCTGGAGGAAGAG AACCTGGAAGTTGAGGTGGTTGTGCGTAAC ACCGGCAAGTACGACGGTGCGGAAGTGGTG CAGCTGTATGTTGCGCCGGTTAGCCCGAGC CTGAAACGTCCGATCAAGGAACTGAAAGAG TACGCGAAAATTTTCCTGGCGAGCGGTGAA GCGAAGACCGTTCACCTGAGCGTGCCGATC AAATACGCGACCAGCTTCTTTGATGAGTAT CAAAAGAAATGGTGCAGCGAAAAGGGCGAG TATACCATTCTGCTGGGTAGCAGCAGCGCG GACATCAAAGTTAGCCAAAGCATCACCCTG GAAAAAACCACCTTCTGGAAAGGTCTGTAA (SEQ ID NO: 27)
Beta-glucosidase 2 from *Pichia pastoris*, DNA	ATGAAAAGCCAGCTGATCTTTATGGCTTTG GCCTCCCTTGTAGCAAGTGCACCGCTGGAA CACCAGCAGCAGCATCATAAACATGAGAAA CGCGCCGTAGTTACGCAGACAGTAACTGTT GCGGCGGGCCAGACAGCAGCAGCGGGTTCC GCCCAGGCAGTTGTTACCTCAAGCGCGGCG CCAGCATCCGTTGCTTCAAGTGCGGCCGCG TCTGCTAGCTCATCTTCTTCCAGCTATACC TCTGGCGCTTCAGGCGATCTTAGTAGTTTC AAAGATGGTACTATTAAATGTTCAGAATTC CCATCAGGGGATGGCGTGGTGTCCGTCTCT TGGTTAGGCTTCGGCGGCTGGTCTAGTATT ATGAATCTGCAGGGTGGTACTTCAGAGAGT TGTGAGAACGGCTATTATTGTTCATATGCA TGTGAAGCCGGTTATAGCAAAACACAGTGG CCATCTAACCAGCCGTCAGATGGGAGATCA GTGGGAGGGTTGCTGTGTAAAGATGGCCTG TTATATCGCTCCAATACAGCGTTCGATACA TTATGTGTGCCTGGAAAAGGTACAGCATCC GTGGAGAATAATGTGTCTAAAGGTATTTCC ATTTGTAGAACGGATTATCCGGGGTCTGAA AACATGTGCGTCCCGACGTGGGTCGATGCC GGTAACTCAAACACCTTGACAGTGGTAGAT GAAGATAATTATTATGAATGGCAGGGCCTT AAAACTAGTGCTCAGTATTATGTGAATAAC GCCGGTGTTAGTGTTGAAGATGGGTGCATC TGGGGCGATGAGTCCAGCGGCGTTGGAAAC TGGGCGCCGTTGGTTTTGGGGGCCGGTTCC ACGGGGGGTCTGACCTATCTGTCTCTGATT CCGAATCCAAACAACAAAAAAGCACCGAAT TTTAACGTAAAAATCGTGGCCACGGATGGA AGTTCAATTAACGGAGATTGCAAATATGAA AATGGGATCTTTGTCGGTTCTTCAACCGAT GGCTGCACGGTAACTGTTACCTCAGGTAGT GCAAAACTGGTTTTTTATTAA (SEQ ID NO: 28)
Beta-glucosidase 3 from *Pichia pastoris*, DNA	ATGCAGGTTAAATCTATTGTTAATTTACTG CTTGCCTGTTCCTTGGCTGTGGCGCGTCCG TTGGAACACGCTCACCATCAGCATGATAAA CGCGGCGTTGTAGTAGTAACGAAAACCATC GTCGTTGATGGTAGCACAGTTGAGGCTACC GCCGCTGCTCAGGTGCAGGAGCATGCAGAA ACCTTTGCAGAATCAACCCCGTCAGCCGTC GTTTCCAGTTCATCCGCCCCTTCATCAGCA AGCTCAGCTTCCGCTCCAGCTAGTTCAGGT TCTTTTTCAGCTGGTACCAAAGGCGTGACA TATTCTCCATATCAGGCCGGTGGTGGGTGT AAAACAGCGGAAGAAGTGGCATCCGATCTG TCACAGCTTACCGGTTATGAAATTATTCGG CTTTATGGCGTAGATTGCAACCAGGTTGAG AACGTGTTTAAAGCCAAAGCCCCTGGCCAG AAACTTTTTTTGGGTATCTTTTTTGTGGAT GCCATCGAGTCTGGCGTATCAGCTATCGCA AGTGCCGTTAAATCCTATGGTTCTTGGGAT GATGTACACACTGTATCTGTTGGCAACGAG CTGGTGAACAATGGCGAAGCCACTGTTAGC

TABLE 2-continued

Examples of enzymes used for synthesizing rebaudiosides

Name	Sequences
	CAGATTGGACAGTATGTTAGTACGGCCAAA TCAGCCTTACGCTCTGCCGGTTTCACAGGG CCAGTATTGTCTGTTGATACTTTTATTGCA GTGATTAACAATCCGGGGCTGTGTGATTTC GCGGATGAATATGTTGCTGTGAACGCCCAT GCGTTCTTCGATGGGGGTATTGCTGCCTCA GGGGGGGGCGATTGGGCGGCAGAGCAGATC CAGCGCGTCTCCAGTGCGTGCGGCGGGAAA GATGTCTTAATTGTAGAAAGCGGTTGGCCG TCTAAAGGAGATACGAACGGCGCCGCAGTG CCGTCAAAATCCAATCAGCAGGCTGCAGTC CAGAGTCTTGGCCAGAAAATTGGGAGCTCA TGCATTGCCTTTAACGCATTTAATGATTAT TGGAAAGCCGATGGTCCGTTCAACGCCGAA AAATATTGGGGGATCCTTGATAGTTAA (SEQ ID NO: 29)
Beta-glucosidase 4 from *Pichia pastoris*, DNA	ATGCTGTCCACAATTCTGAATATTTTTATT CTTCTGTTATTCATCCAGGCGTCTCTTCAG GCGCCTATTCCGGTGGTGACCAAATATGTG ACCGAAGGTATTGCCGTTGTGACTGAAACC AATGTGCGGGTTGTTACTAAAACCATTCCG ATTGTGCAGGTGCTGATCTCCGATGGTGCA ACCTATACTCATACCCTGACGACAGTGTCA ACGGCGGAAGAAAATGGCAACTTCCAGCCT ATTACCACGACATCTATTGTCAACAAAGAA GTTGTAGTACCAACAAGCGTAACCCCGAAT ACCCAGCAGACGCGTCCGACCCAGGTAGAT ACCACACAGAACAATGCGGATACACCAGCG GCGCCTACACCATCACCTACTACTAGTTCA AACAACGGCGTGTTCACCACATATTCCACA ACACGTAGCGTAGTCACTAGTGTAGTCGTA GTCGGACCGGATGGAAGCCCTATTGAAAAT ACTGGACAGACAGCAAACCCTACTACAACT GCCCCAACTACAAGCACTACTGCTGCCCGG ACCACAAGCAGTACGTCCACCACACCTACC GCTAGCTCTACGCCAGGAGGTAATCATCCA CGTAGCATCGTCTATTCTCCATATTCCGAT AGCAGTCAGTGTAAAGATGCGACAACGATC GAAACCGATCTTGAGTTCATTGCCTCTAAA GGCATCAGCGCGGTACGTATTTATGGCAAT GATTGTAACTATCTTACAGTTGTTTTGCCT AAATGTGCCAGTCTGGGATTAAAAGTGAAT CAGGGCTTTTGGATTGGTCCAAGTGGAGTA GATAGCATCGATGATGCAGTACAGGAGTTT ATTCAGGCAGTCAACGGCAACAACGGCTTT AATTGGGATTTATTCGAATTAATTACCGTC GGAAACGAAGCAATCAGTGCCGGTTATGTT TCAGCGAGCTCCCTGATTTCCAAAATTAAA GAAGTATCTAGCATTCTGAGCTCCGCGGGT TATACTGGTCCAATTACCACAGCCGAACCG CCTAACGTATATGAGGATTATGGCGATCTG TGCTCAACCGATGTAATGTCCATCGTGGGT GTAAACGCGCATTCCTATTTTAATACCCTT TTTGCGGCCTCCGATTCAGGTTCATTTGTG AAATCACAGATCGAAGTAGTCCAGAAAGCA TGCTCACGTTCCGATATTACTATTATTGAA ACCGGGTATCCGTCCCAGGGAGCTACCAAT GGAAAAAACGTTCCTAGTAAAGAGAATCAG AAAACAGCGATTTTTTCAATCTTTGAGGTC GTTGGAACAGATGTAACTATTCTTAGTACT TATGATGATTTGTGGAAAGATCCTGGACCG TATGGGATTGAACAGTTTTTTGGTGCGATC GATCTTTTTTCTTAA (SEQ ID NO: 30)

Rebaudioside A

[0146] Rebaudioside A is a steviol glycoside produced in *Stevia* plants. Rebaudioside A has the molecular formula

$C_{44}H_{70}O_{23}$ and the IUPAC name, 13-[(2-O-β-D-glucopyranosyl -3-O-β-D-glucopyranosyl-β-D-glucopyranosyl)oxy]-ent-kaur-16-en-19-oic acid β-D -glucopyranosyl ester.

[0147] Rebaudioside A may be purified from *Stevia* leaf extracts, or recombinantly or synthetically produced. In some embodiments, rebaudioside A is produced via covalently coupling a glucose to stevioside by UGT76G1 or UGT76G1-SUS fusion enzyme. In some embodiments, rebaudioside A is produced from a reaction mixture comprising stevioside, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and UGT76G1 (e.g., SEQ ID NO: 1) or UGT76G1-SUS fusion enzyme (e.g., SEQ ID NO: 9), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

[0148] In some embodiments, rebaudioside A is produced via covalently coupling a glucose to rebaudioside D by EUGT11, HV1, EUGT11-SUS fusion enzyme, or HV1-SUS fusion enzyme. In some embodiments, rebaudioside A is produced from a reaction mixture comprising rebaudioside D, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and EUGT11 (e.g., SEQ ID NO: 5), HV1 (e.g., SEQ ID NO: 7), EUGT11-SUS fusion enzyme (e.g., SEQ ID NO: 10), or HV1-SUS fusion enzyme (e.g., SEQ ID NO: 11), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

[0149] In some embodiments, rebaudioside A is produced via removing a glucosyl group from Reb I (at position C19) or Reb D (at position C13) by a beta-glucosidase. In some embodiments, rebaudioside A is produced from a reaction mixture comprising Reb I or Reb D and a beta glucosidase.

Rebaudioside D

[0150] Rebaudioside D has the molecular formula $C_{50}H_{80}O_{28}$ and the IUPAC name, [4,5-dihydroxy-6-(hydroxymethyl)-3-[3,4,5-trihydroxy-6-(hydroxymethypoxan-2-yl]oxyoxan -2-yl]13-[5-hydroxy-6-(hydroxymethyl)-3,4-bis[[3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxy] oxan-2-yl]oxy-5,9-dimethyl-14-methylidenetetracyclo[11.2.1.$0^{1,10}$.$0^{4,9}$]hexadecane-5-carboxylate.

[0151] In some embodiments, rebaudioside D is produced via covalently coupling a glucose to rebaudioside E UGT76G1 or aa UTG76G1-SUS fusion enzyme. In some embodiments, rebaudioside D is produced from a reaction mixture comprising rebaudioside E, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and UGT76G1 (e.g., SEQ ID NO: 1) or UGT76G1-SUS fusion enzyme (e.g., SEQ ID NO: 9), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

[0152] In some embodiments, rebaudioside D is produced via covalently coupling a glucose to rebaudioside A by EUGT11, HV1, EUGT11-SUS fusion enzyme, or HV1-SUS fusion enzyme. In some embodiments, rebaudioside D is produced from a reaction mixture comprising rebaudioside A, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and EUGT11 (e.g., SEQ ID NO: 5), HV1 (e.g., SEQ ID NO: 7), EUGT11-SUS fusion enzyme (e.g., SEQ ID NO: 10), or HV1-SUS fusion enzyme (e.g., SEQ ID NO: 11), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

[0153] In some embodiments, rebaudioside D is produced via covalently coupling two glucoses to stevioside. For example, a glucose is covalently coupled to the stevioside to produce rebaudioside A and/or rebaudioside E. A glucose can then be covalently coupled to the rebaudioside A and/or rebaudioside E to produce rebaudioside D. In some embodiments, rebaudioside D is produced by a reaction mixture comprising stevioside; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof; and a combination of UGT76G1 (e.g., SEQ ID NO: 1) or UGT76G1-SUS fusion enzyme (e.g., SEQ ID NO: 9) and HV1 (e.g., SEQ ID NO: 7) or HV1-SUS fusion enzyme (e.g., SEQ ID NO: 11), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

Rebaudioside E

[0154] Rebaudioside E is a steviol glycoside produced in *Stevia* plants. Rebaudioside E has the molecular formula $C_{44}H_{70}O_{23}$ and the IUPAC name, [(2S,3R,4S,5S,6R)-4,5-dihydroxy -6-(hydroxymethyl)-3-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxyoxan-2-yl] (1R,4S,5R,9S,10R,13S)-13-[(2S,3R,4S,5S,6R)-4,5-dihydroxy-6-(hydroxymethyl)-3-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxyoxan -2-yl]oxy-5,9-dimethyl-14-methylidenetetracyclo[11.2.1.$0^{1,10}$.$0^{4,9}$] hexadecane-5-carboxylate.

[0155] Rebaudioside E may be purified from *Stevia* leaf extracts, or recombinantly or synthetically produced. In some embodiments, rebaudioside E is produced via covalently coupling one or more glucoses to stevioside, rubusoside, or rebaudioside KA by an UDP-glycosyltransferase selected from the group consisting of HV1, EUGT11, UGT76G1, a HV1-SUS fusion enzyme, a EUGT11-SUS fusion enzyme, and a UTG76G1-SUS fusion enzyme.

[0156] In some embodiments, rebaudioside E is produced via covalently coupling a glucose to rebaudioside KA by the HV1, EUGT11, HV1-SUS fusion enzyme, or EUGT11-SUS fusion enzyme. In some embodiments, rebaudioside E is produced from a reaction mixture comprising rebaudioside KA, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and EUGT11 (e.g., SEQ ID NO: 5), HV1 (e.g., SEQ ID NO: 7), EUGT11-SUS fusion enzyme (e.g., SEQ ID NO: 10), or HV1-SUS fusion enzyme (e.g., SEQ ID NO: 11), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

[0157] In some embodiments, rebaudioside E is produced via covalently coupling a glucose to stevioside by the HV1, EUGT11, HV1-SUS fusion enzyme, or EUGT11-SUS fusion enzyme. In some embodiments, rebaudioside E is produced from a reaction mixture comprising stevioside, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and EUGT11 (e.g., SEQ ID NO: 5), HV1 (e.g., SEQ ID NO: 7), EUGT11-SUS fusion enzyme (e.g., SEQ ID NO: 10), or HV1-SUS fusion enzyme (e.g., SEQ ID NO: 11), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

[0158] In some embodiments, rebaudioside E is produced via covalently coupling two glucoses to rubusoside by the HV1, EUGT11, HV1-SUS fusion enzyme, or EUGT11-SUS fusion enzyme. For example, a glucose is covalently coupled to the rubusoside to produce rebaudioside KA. A glucose can

then be covalently coupled to the rebaudioside KA to produce rebaudioside E. In some embodiments, rebaudioside E is produced from a reaction mixture comprising rubusoside, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and EUGT11 (e.g., SEQ ID NO: 5), HV1 (e.g., SEQ ID NO: 7), EUGT11-SUS fusion enzyme (e.g., SEQ ID NO: 10), or HV1-SUS fusion enzyme (e.g., SEQ ID NO: 11), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

Rebaudioside M

[0159] Rebaudioside M has the molecular formula $C_{56}H_{90}O_{33}$ and the IUPAC name, 13-[(2-O-β-D-glucopyranosyl-3-O-β-D-glucopyranosyl-β-D-glucopyranosyl)oxy] ent-kaur-16-en -19-oic acid-[(2-O-β-D-glucopyranosyl-3-O-β-D-glucopyranosyl-β-D-glucopyranosyl)ester.

[0160] In some embodiments, rebaudioside M is produced via covalently coupling one or more glucoses to stevioside, rebaudioside A, rebaudioside E, or rebaudioside D by an UDP-glycosyltransferase selected from the group consisting of HV1, UGT76G1, a HV1-SUS fusion enzyme, and a UTG76G1-SUS fusion enzyme.

[0161] In some embodiments, rebaudioside M is produced via covalently coupling a glucose to rebaudioside D by the UGT76G1 or UGT76G1-SUS fusion enzyme. In some embodiments, rebaudioside M is produced from a reaction mixture comprising rebaudioside D, substrates selected from the group consisting of sucrose, uridine diphosphate (UDP), uridine diphosphate-glucose (UDP-glucose), and combinations thereof, and UGT76G1 (e.g., SEQ ID No: 1) or UGT76G1-SUS fusion enzyme (e.g., SEQ ID NO: 9), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

[0162] For example, a glucose is covalently coupled to the stevioside to produce rebaudioside A and/or rebaudioside E. A glucose can then be covalently coupled to the rebaudioside A and/or rebaudioside E to produce rebaudioside D, and a glucose can then be covalently coupled to the rebaudioside D to produce rebaudioside M.

Rebaudioside I

[0163] Rebaudioside I has the molecular formula $C_{50}H_{80}O_{28}$ and the IUPAC name, 13-[(2-O-β-D-glucopyranosyl-3-O-β-D-glucopyranosyl)-β-D-glucopyranosypoxy]-ent-kaur-16-en-19oic acid-(3-O-β-D-glucopyranosyl)-β-D-glucopyranosyl), ester.

[0164] In some embodiments, rebaudioside I is produced via covalently coupling a glucose to a steviol glycoside (e.g., rebaudioside A) by an UGT76G1, a UTG76G1-SUS fusion enzyme, or UGT76G1 variants such as UGT76G1 CP1, UGT76G1 CP2, and UGT76G1 L200A. In some embodiments, rebaudioside I produced by a reaction mixture comprising a steviol glycoside (e.g., rebaudioside A); a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and UGT76G1 (e.g., SEQ ID No: 1), UGT76G1-SUS fusion enzyme (e.g., SEQ ID NO: 9), UTG76G1 CP1 variant (e.g., SEQ ID NO: 3), UTG76G1 CP2 variant (e.g., SEQ ID NO: 4), or UTG76G1 L200A variant (e.g., SEQ ID NO: 2), with or without additional sucrose synthase (e.g., SEQ ID NO: 8).

Steviol Glycoside Formulations

[0165] Provided herein, in some aspects, are steviol glycoside formulations containing a combination of rebaudiosides that provide a taste profile similar to sugar throughout the entire taste profile, from onset of sweetness to sweetness linger, as determined through, e.g., the use of a panel of tasters, by means of a sensory evaluation, as well as evaluation of its physical characteristics and capacity to replace a food/feed stuff made with a full or normal complement of sucrose.

[0166] Where initial sensory testing of some blends in non-carbonated beverages detected slightly less sweet than full sugar product and some bitterness in aftertaste, the steviol glycoside formulations described herein were rebalanced to increase sweetness and reduce bitterness.

[0167] Measuring the perceived sweetness of a solution is typically done by calculating its sucrose equivalence. The sucrose equivalence value is the standard used to measure sweetness as compared to the baseline standard of sucrose—table sugar. All sweeteners, including sugarless and high intensity sweeteners, are measured against sucrose. Sucrose equivalence may be defined as the amount of sweetener required to impart the comparable or equivalent level of sweetness perceived from a given amount of sucrose. One method of measuring the perceived sweetness of a solution is to match it with a stock sucrose solution of known concentration. For example, the blend of interest is added at a predetermined concentration to a water solution. A number of expert panel members then taste the solution and compare it to a battery of stock sucrose solutions ranging from 0.5% to 10% at increments of 0.5%. Each panel member decides which sucrose solution is equally sweet in comparison to the solution containing the test blend. The formulations provided herein were designed to provide a taste sensation equivalent to those same food products using sucrose.

[0168] In some embodiments, the steviol glycoside formulation comprises rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M. In some embodiments, the steviol glycoside formulation comprises rebaudioside A, rebaudioside D, rebaudioside E, rebaudioside M, and rebaudioside I. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, rebaudioside M, and rebaudioside I.

[0169] In some embodiments, the steviol glycoside formulation consists essentially of about 40-60 wt. % rebaudioside A (e.g., about 40 wt. %, about 45 wt. %, about 50 wt. %, about 55 wt. %, or about 60 wt. %), about 15-30 wt. % rebaudioside E (e.g., about 15 wt. %, about 20 wt. %, about 25 wt. %, or about 30 wt. %), about 10-17 wt. % rebaudioside D (e.g., about 10 wt. %, about 15 wt. %, or about 17 wt. %), and/or about 5-10 wt. % rebaudioside M (e.g., about 5 wt. %, about 8 wt. %, or about 10 wt. %). "wt. %" means the % of the weight of the particular anhydrous rebaudioside of the weight of all anhydrous rebaudiosides in the formulation.

[0170] In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, and comprises about 40-60 wt. %, 40-55 wt. %, 40-50 wt. %, 40-45 wt. %, 46-60 wt. %, 45-55 wt. %, 45-50 wt. %, 50-60 wt. %, 50-55 wt. %, or 55-60 wt. %, of rebaudioside A. In

some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises about 15-30 wt. %, 15-25 wt. %, 15-20 wt. %, 20-30 wt. %, 20-25 wt. %, or 25-30 wt. % of rebaudioside E. In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises 10-17 wt. %, 10-15 wt. %, or 15-17 wt. % of rebaudioside D. In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises 5-10 wt. %, 5-8 wt. %, or 8-10 wt. % of rebaudioside M. In some embodiments, the steviol glycoside formulation described herein comprises 5-10 wt. %, 5-8 wt. %, or 8-10 wt. % of rebaudioside M. In some embodiments, the steviol glycoside formulation described herein consists essentially of about 58.33 wt. % of rebaudioside A, about 8.33 wt. % of rebaudioside M, about 16.67 wt. % of rebaudioside D, and about 16.67 wt. % of rebaudioside E.

[0171] In some embodiments, the steviol glycoside formulation consists essentially of about 40-60 wt. % rebaudioside A (e.g., about 40 wt. %, about 45 wt. %, about 50 wt. %, about 55 wt. %, or about 60 wt. %), about 15-30 wt. % rebaudioside E (e.g., about 15 wt. %, about 20 wt. %, about 25 wt. %, or about 30 wt. %), about 10-17 wt. % rebaudioside D (e.g., about 10 wt. %, about 15 wt. %, or about 17 wt. %), about 5-10 wt. % rebaudioside M (e.g., about 5 wt. %, about 8 wt. %, or about 10 wt. %), and/or about 2-8 wt. % rebaudioside I. In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises about 40-60 wt. %, 40-55 wt. %, 40-50 wt. %, 40-45 wt. %, 46-60 wt. %, 45-55 wt. %, 45-50 wt. %, 50-60 wt. %, 50-55 wt. %, or 55-60 wt. %, of rebaudioside A. In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises about 15-30 wt. %, 15-25 wt. %, 15-20 wt. %, 20-30 wt. %, 20-25 wt. %, or 25-30 wt. % of rebaudioside E. In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises about 10-17 wt. %, 10-15 wt. %, or 15-17 wt. % of rebaudioside D. In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises about 5-10 wt. %, 5-8 wt. %, or 8-10 wt. % of rebaudioside M. In some embodiments, the steviol glycoside formulation described herein consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M and comprises about 2-8 wt. %, 5-8 wt. %, or 2-5 wt. % of rebaudioside I. In some embodiments, the steviol glycoside formulation described herein consists essentially of about 54.69 wt. % of rebaudioside A, about 7.04 wt. % of rebaudioside M, about 14.66 wt. % of rebaudioside D, about 19.21 wt. % of rebaudioside E, and about 4.4 wt. % of rebaudioside I.

[0172] In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside A is present in a concentration of about 300-600 ppm (e.g., about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, or about 600 ppm), rebaudioside E is present in a concentration of about 50-200 ppm (e.g., about 50 ppm, about 100 pm, about 150 ppm, or about 200 ppm), rebaudioside D is present in a concentration of about 50-200 ppm (e.g., about 50 ppm, about 100 pm, about 150 ppm, or about 200 ppm), and/or rebaudioside M is present in a concentration of about 200-500 ppm (e.g., about 200 ppm, about 250 ppm, about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, or about 500 ppm). In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside A is present in a concentration of about 300-600 ppm, 300-550 ppm, 300-500 ppm, 300-450 ppm, 300-400 ppm, 300-350 ppm, 350-600 ppm, 350-550 ppm, 350-500 ppm, 350-450 ppm, 350-400 ppm, 400-600 ppm, 400-550 ppm, 400-500 ppm, 400-450 ppm, 450-600 ppm, 450-550 ppm, 450-500 ppm, 500-600 ppm, 500-550 ppm, or 550-600 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside E is present in a concentration of about 50-200 ppm, 50-150 ppm, 50-100 ppm, 100-200 ppm, 100-150 ppm, or 150-200 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside D is present in a concentration of about 50-200 ppm, 50-150 ppm, 50-100 ppm, 100-200 ppm, 100-150 ppm, or 150-200 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside M is present in a concentration of about 200-500 ppm, 200-450 ppm, 200-400 ppm, 200-350 ppm, 200-300 ppm, 200-250 ppm, 250-500 ppm, 250-450 ppm, 250-400 ppm, 250-350 ppm, 250-300 ppm, 300-500 ppm, 300-450 ppm, 300-400 ppm, 300-350 ppm, 350-500 ppm, 350-400 ppm, 400-500 ppm, 400-450 ppm, or 450-500 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside A is present in a concentration of about 500 ppm, rebaudioside M is present in a concentration of about 350 ppm, rebaudioside D is present in a concentration of about 100 ppm, and rebaudioside E is present in a concentration of about 100 ppm.

[0173] In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside A is present in a concentration of about 200-500 ppm (e.g., about 200 ppm, about 250 ppm, about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, or about 500 ppm), rebaudioside E is present in a concentration of about 50-300 ppm (e.g., about 50 ppm, about 100 pm, about 150 ppm, about 200 ppm, about 250 ppm, or about 300 ppm), rebaudioside D is present in a concentration of about 50-300 ppm (e.g., about 50 ppm, about 100 pm, about 150 ppm, about 200 ppm, about 250 ppm, or about 300 ppm), rebaudioside M is present in a concentration of about 5-100 ppm (e.g., about 5 ppm, about 50 ppm, or about 100 ppm), and/or rebaudioside I is present in a concentration of about 5-50 ppm (e.g., about 5 ppm or about 50 ppm). In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside A is present in a concentration of about 200-500 ppm, 200-450 ppm, 200-400

ppm, 200-350 ppm, 200-300 ppm, 200-250 ppm, 250-500 ppm, 250-450 ppm, 250-400 ppm, 250-350 ppm, 250-300 ppm, 300-500 ppm, 300-450 ppm, 300-400 ppm, 300-350 ppm, 350-500 ppm, 350-400 ppm, 400-500 ppm, 400-450 ppm, or 450-500 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside E is present in a concentration of about 50-300 ppm, 50-250 ppm, 50-150 ppm, 50-100 ppm, 100-300 ppm, 100-250 ppm, 100-200 ppm, 100-150 ppm, 150-300 ppm, 150-250 ppm, 150-200 ppm, 200-300 ppm, 200-250 ppm, or 250-300 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside D is present in a concentration of about 50-300 ppm, 50-250 ppm, 50-150 ppm, 50-100 ppm, 100-300 ppm, 100-250 ppm, 100-200 ppm, 100-150 ppm, 150-300 ppm, 150-250 ppm, 150-200 ppm, 200-300 ppm, 200-250 ppm, or 250-300 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside M is present in a concentration of about 5-100 ppm, 1-50 ppm, or 50-100 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside I is present in a concentration of about 5-50 ppm, 5-25 ppm, or 25-50 ppm. In some embodiments, the steviol glycoside formulation consists essentially of rebaudioside A, rebaudioside D, rebaudioside E, and rebaudioside M, wherein rebaudioside A is present in a concentration of about 373 ppm, rebaudioside M is present in a concentration of about 48 ppm, rebaudioside D is present in a concentration of about 100 ppm, rebaudioside E is present in a concentration of about 131 ppm, and rebaudioside I is present in a concentration of about 30 ppm.

[0174] In some embodiments, the steviol glycoside formulation consisting essentially of rebaudioside A, rebaudioside E, rebaudioside D and rebaudioside M, wherein Reb A is present in an amount of about 300-600 ppm (e.g., about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, or about 600 ppm); Reb E is present in an amount of from about 50-250 ppm (e.g., about 50 ppm, about 100 pm, about 150 ppm, about 200 ppm, or about 250 ppm); Reb D is present in an amount of about 10-200 ppm (e.g., about 10 ppm, about 50 ppm, about 100 pm, about 150 ppm, or about 200 ppm); and/or Reb M is present in an amount of about 10-150 ppm (e.g., about 10 ppm, about 50 ppm, about 100 pm, or about 150 ppm). In some embodiments, the steviol glycoside formulation consisting essentially of rebaudioside A, rebaudioside E, rebaudioside D, rebaudioside M, and rebaudioside I, wherein Reb A is present in an amount of about 300-600 ppm (e.g., about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, or about 600 ppm); Reb E is present in an amount of from about 50-250 ppm (e.g., about 50 ppm, about 100 pm, about 150 ppm, about 200 ppm, or about 250 ppm); Reb D is present in an amount of about 10-200 ppm (e.g., about 10 ppm, about 50 ppm, about 100 pm, about 150 ppm, or about 200 ppm); Reb M is present in an amount of about 10-150 ppm (e.g., about 10 ppm, about 50 ppm, about 100 ppm, or about 150 ppm); and/or Reb I is present in an amount of about 1-50 ppm (e.g., about 1 ppm, about 10 ppm, about 25 ppm, or about 50 ppm).

Orally Consumable Products

[0175] The steviol glycoside formulations described herein provide more consistent and more stable low or non-caloric sweetening compositions not previously available for food or feed manufacturers. The use of the steviol glycoside formulations described herein have been found to maintain the sensory qualities, the shelf-life and the solubility profile of orally consumable products. Any one of the steviol glycoside formulations described herein can be used for the production of baked goods, dairy products, spreads, margarines, sports products, nutrition bars and infant formulas, feed, aquaculture, nutraceuticals and medicinal products. In each, the enhanced nutritional content or off-flavors can be masked with the steviol glycoside formulations described herein.

[0176] In some embodiments, any one of the steviol glycoside formulations described herein may be used for creating or enhancing a sweetening effect of an orally consumable products. In some embodiments, methods of creating or enhancing a sweetening effect of an orally consumable product comprises adding an amount of any one of the steviol glycoside formulations described herein sufficient to produce the desired degree of sweetness to the orally consumable product.

[0177] Accordingly, other aspects of the present disclosure provide orally consumable products comprising any one of the steviol glycoside formulations described herein. In some embodiments, the orally consumable product is selected from the group consisting of a food composition, a beverage product, a dietary supplement, a nutraceutical, an edible gel mix, an edible gel composition, a pharmaceutical composition, a dental and oral hygiene composition, and an animal feed.

[0178] In some embodiments, the orally consumable product comprising any one of the steviol glycoside formulations described herein is a dental and oral hygiene composition. Examples of suitable dental and oral hygiene compositions can be, for example, toothpastes, tooth polishes, dental floss, mouthwashes, mouth rinses, dentrifices, mouth sprays, mouth refreshers, plaque rinses, dental pain relievers, and the like. In some embodiments, the dental and oral hygiene composition is a toothpaste. In some embodiments, in a dental and oral hygiene composition, the steviol glycoside formulation is present in a concentration of about 50-800 ppm (e.g., about 50 ppm, about 100 ppm, about 150 ppm, about 200 ppm, about 250 ppm, about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, about 600 ppm, about 650 ppm, about 700 ppm, about 750 ppm, or about 800 ppm). In some embodiments, in a dental and oral hygiene composition, the steviol glycoside formulation is present in the range of about 0.0003% to about 1.0% (e.g., about 0.0003%, about 0.0005%, about 0.001%, about 0.005%, about 0.1%, about 0.2%, about 0.3%, about 0.4%, about 0.5%, about 0.6%, about 0.7%, about 0.8%, about 0.9%, or about 1.0%) by weight of the total weight of the dental and oral hygiene composition.

[0179] In some embodiments, the orally consumable product comprising any one of the steviol glycoside formulations described herein is a pharmaceutical composition. In some embodiments, the pharmaceutical composition comprises

any one of the steviol glycoside formulations described herein, and further comprises one or more pharmaceutically acceptable excipients. In some embodiments, pharmaceutical compositions of the present disclosure can be used to formulate pharmaceutical drugs containing one or more active agents that exert a biological effect. Accordingly, in some embodiments, pharmaceutical compositions of the present disclosure can contain one or more active agents that exert a biological effect. Suitable active agents are well known in the art (e.g., The Physician's Desk Reference). Such compositions can be prepared according to procedures well known in the art, for example, as described in Remington's Pharmaceutical Sciences, Mack Publishing Co., Easton, Pa., USA.

[0180] In some embodiments, in a pharmaceutical composition, the steviol glycoside formulation is present in a concentration of about 50-800 ppm (e.g., about 50 ppm, about 100 ppm, about 150 ppm, about 200 ppm, about 250 ppm, about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, about 600 ppm, about 650 ppm, about 700 ppm, about 750 ppm, or about 800 ppm). In some embodiments, in a pharmaceutical composition, the steviol glycoside formulation is present in the range of about 0.0004% to about 1.25% (e.g., about 0.0004%, about 0.0005%, about 0.001%, about 0.005%, about 0.1%, about 0.2%, about 0.3%, about 0.4%, about 0.5%, about 0.6%, about 0.7%, about 0.8%, about 0.9%, about 1.0%, about 1.1%, about 1.2%, or about 1.25%) by weight of the total weight of the pharmaceutical composition.

[0181] In some embodiments, the orally consumable product comprising any one of the steviol glycoside formulations described herein is a beverage (e.g., a carbonated beverage product or a non-carbonated beverage product). The beverage can also be, for example, a soft drink, a fountain beverage, a frozen beverage; a ready-to-drink beverage; a frozen and ready-to-drink beverage, coffee, tea, a dairy beverage, a powdered soft drink, a liquid concentrate, flavored water, enhanced water, fruit juice, a fruit juice flavored drink, a sport drink, or an energy drink, isotonic drinks, low-calorie drinks, zero-calorie drinks, vegetable juices, juice drinks, dairy drinks, yoghurt drinks, alcohol beverages, and powdered beverages.

[0182] In some embodiments, the beverage of the present disclosure comprises any one of the steviol glycoside formulations described herein, and further comprises one or more beverage ingredients such as, for example, acidulants, fruit juices and/or vegetable juices, pulp, etc., flavorings, coloring, preservatives, vitamins, minerals, electrolytes, erythritol, tagatose, glycerine, and carbon dioxide. The beverages described herein may be provided in any suitable form, such as a beverage concentrate and a carbonated, ready-to-drink beverage.

[0183] In certain embodiments, the beverages of the present disclosure can have any of numerous different specific formulations or constitutions. The formulation of a beverage of the present disclosure can vary to a certain extent, depending upon such factors as the product's intended market segment, its desired nutritional characteristics, flavor profile, and the like. For example, in certain embodiments, it can generally be an option to add further ingredients to the formulation of a particular beverage product. For example, additional (i.e., more and/or other) sweeteners can be added, flavorings, electrolytes, vitamins, fruit juices or other fruit products, tastents, masking agents and the like, flavor enhancers, and/or carbonation typically may be added to any such formulations to vary the taste, mouthfeel, nutritional characteristics, etc.

[0184] In some embodiments, in a beverage, the steviol glycoside formulation is present in a concentration of about 65-800 ppm (e.g., about 65 ppm, about 100 ppm, about 150 ppm, about 200 ppm, about 250 ppm, about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, about 600 ppm, about 650 ppm, about 700 ppm, about 750 ppm, or about 800 ppm). In some embodiments, in a beverage, the steviol glycoside formulation is present in the range of about 0.0005% to about 1% (e.g., about 0.0005%, about 0.001%, about 0.005%, about 0.1%, about 0.2%, about 0.3%, about 0.4%, about 0.5%, about 0.6%, about 0.7%, about 0.8%, about 0.9%, or about 1.0%) by weight of the total weight of the beverage.

[0185] In some embodiments, the orally consumable product comprising any one of the steviol glycoside formulations described herein is a food composition. A "food composition" refers to any solid or liquid ingestible material that can, but need not, have a nutritional value and be intended for consumption by humans and animals. Examples of suitable food product compositions can be, for example, confectionary compositions, such as candies, mints, fruit flavored drops, cocoa products, chocolates, and the like; condiments, such as ketchup, mustard, mayonnaise, and the like; chewing gums; cereal compositions; baked goods, such as breads, cakes, pies, cookies, and the like; dairy products, such as milk, cheese, cream, ice cream, sour cream, yogurt, sherbet, and the like; tabletop sweetener compositions; soups; stews; convenience foods; meats, such as ham, bacon, sausages, jerky, and the like; gelatins and gelatin-like products such as jams, jellies, preserves, and the like; fruits; vegetables; egg products; icings; syrups including molasses; snacks; nut meats and nut products; and animal feed. Other non-limiting examples of food compositions include bakery products, cookies, biscuits, baking mixes, cereals, confectioneries, candies, toffees, chewing gum, dairy products, flavored milk, yoghurts, flavored yoghurts, cultured milk, soy sauce and other soy base products, salad dressings, mayonnaise, vinegar, frozen-desserts, meat products, fish-meat products, bottled and canned foods, tabletop sweeteners, fruits and vegetables, herbs, spices and seasonings, natural and synthetic flavors, and flavor enhancers, such as monosodium glutamate, prepared packaged products, such as dietetic sweeteners, liquid sweeteners, granulated flavor mixes, pet foods, livestock feed, tobacco, and materials for baking applications, such as powdered baking mixes for the preparation of breads, cookies, cakes, pancakes, donuts and the like.

[0186] In some embodiments, the food composition is selected from the group consisting of spreads, margarines, sports products, nutrition bars, infant formulas, mayonnaise, confectionary composition, a condiment, a chewing gum, a cereal composition, a baked good, a dairy product, and a tabletop sweetener composition. In some embodiments, the food composition is a food composition included in Table 3. In some embodiments, the food composition is a yogurt. In some embodiments, the food composition is frozen. In some embodiments, the food composition is ice cream.

TABLE 3

Examples of food compositions

BEVERAGES	DAIRY PRODUCTS	BAKING	PREPARED FOODS	OIL BASED PRODUCTS	SNACK FOODS
Soy milks	Cheeses	Breads	Entrees	Salad	Granola
Smoothies	Cream	Rolls	Side Dishes	Dressing	Cereals
Fruit Juices	Cheeses	Cakes	Soups	Mayonnaise	Snack/
Dairy Drinks	Sour Cream	Pastries	Sauces	Margarine/	Nutritional
	Yogurt	Cookies	Processed	Spreads	Bars
	Yogurt	Crackers	Meats	Shortening	Confectionary
	Drinks	Muffins	Processed		
	Non-Dairy		Fish		
	Creamers		Pet Foods		
	Dips				

[0187] Food compositions described herein include any preparations or compositions which are suitable for consumption and are used for nutrition or enjoyment purposes. They are generally products which are intended to be eaten by humans or animals and introduced into the body through the mouth, to remain there for a certain time and then either be eaten (e.g. ready-to-eat foodstuffs or feeds, see also herein below) or removed (e.g. chewing gums). Such products include any substances or products which in the processed, partially processed or unprocessed state are to be ingested by humans or animals. They also include substances which are added to orally consumable products during their manufacture, preparation or treatment and which are intended to be introduced into the human or animal oral cavity.

[0188] The food compositions according to the disclosure also include substances which in the unchanged, treated or prepared state are to be swallowed by a human or animal and then digested; in this respect, the orally consumable products according to the disclosure also include casings, coatings or other encapsulations which are to be swallowed at the same time or which may be expected to be swallowed. The expression "food composition" covers ready-to-eat foodstuffs, beverages and feeds, that is to say foodstuffs, beverages or feeds that are already complete in terms of the substances that are important for the taste. The expressions "ready-to-eat foodstuff" and "ready-to-eat feed" also include drinks as well as solid or semi-solid ready-to-eat foodstuffs or feeds. Examples which may be mentioned are frozen products, which must be thawed and heated to eating temperature before they are eaten. Products such as yoghurt or ice-cream as well as chewing gums or hard caramels are also included among the ready-to-eat foodstuffs or feeds of the current disclosure. SAME WITH THE ABOVE TWO PARAGRAPHS.

[0189] In some embodiments, in a food composition, the steviol glycoside formulation is present in a concentration of about 50-700 ppm (e.g., about 50 ppm, about 100 ppm, about 150 ppm, about 200 ppm, about 250 ppm, about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, about 600 ppm, about 650 ppm, or about 700 ppm). In some embodiments, in a food composition, the steviol glycoside formulation is present in the range of about 0.0005% to about 1% (e.g., about 0.0005%, about 0.001%, about 0.005%, about 0.1%, about 0.2%, about 0.3%, about 0.4%, about 0.5%, about 0.6%, about 0.7%, about 0.8%, about 0.9%, or about 1.0%) by weight of the total weight of the food composition.

[0190] In some embodiments, the orally consumable product comprising any one of the steviol glycoside formulations described herein is an animal feed product for livestock, companion animals and/or aquaculture. In some embodiments, the livestock is cattle, swine and/or poultry. In some embodiments, in an animal feed product, the steviol glycoside formulation is present in a concentration of about 50-800 ppm (e.g., about 50 ppm, about 100 ppm, about 150 ppm, about 200 ppm, about 250 ppm, about 300 ppm, about 350 ppm, about 400 ppm, about 450 ppm, about 500 ppm, about 550 ppm, about 600 ppm, about 650 ppm, about 700 ppm, about 750 ppm, or about 800 ppm). In some embodiments, the animal feed product further comprises a hydrocolloid or erythritol.

[0191] In some embodiments, any one of the orally consumable products described herein further comprises a component selected from the group consisting of sucrose, aroma compounds, flavoring compounds and mixtures thereof. In some embodiments, any one of the orally consumable products described herein further comprises tocopherols in an amount of at least about 5 ppm. In some embodiments, any one of the orally consumable products described herein further comprises at least one stabilizing agent selected from the group consisting of citric acid, sodium benzoate, t-butyl hydroquinone, ascorbyl palmitate, propyl gallate, and combinations thereof. In some embodiments, any one of the orally consumable products described herein further comprises a moisture containing ingredient. In some embodiments, the moisture ingredient is an emulsion. In some embodiments, any one of the orally consumable products described herein further comprises a chelating agent.

[0192] In some embodiments, any one of the orally consumable products described herein can also have at least one additional sweetener. The at least one additional sweetener can be a natural high intensity sweetener, for example. The additional sweetener can be selected from a *Stevia* extract, a steviol glycoside, stevioside, rebaudioside B, rebaudioside C, rebaudioside D, rebaudioside F, dulcoside A, rubusoside, steviolbioside, sucrose, high fructose corn syrup, fructose, glucose, xylose, arabinose, rhamnose, erythritol, xylitol, mannitol, sorbitol, inositol, AceK, aspartame, neotame, sucralose, saccharine, naringin dihydrochalcone (NarDHC), neohesperidin dihydrochalcone (NDHC), rubusoside, mogroside IV, siamenoside I, mogroside V, monatin, thaumatin, monellin, brazzein, L-alanine, glycine, Lo Han Guo, hernandulcin, phyllodulcin, trilobtain, and combinations thereof. In some embodiments, any one of the orally con-

sumable products described herein does not have a sweetener in addition to a steviol glycoside formulation provided herein.

[0193] In some embodiments, any one of the orally consumable products described herein can also have at least one additive. The additive can be, for example, a carbohydrate, a polyol, an amino acid or salt thereof, a polyamino acid or salt thereof, a sugar acid or salt thereof, a nucleotide, an organic acid, an inorganic acid, an organic salt, an organic acid salt, an organic base salt, an inorganic salt, a bitter compound, a flavorant, a flavoring ingredient, an astringent compound, a protein, a protein hydrolysate, a surfactant, an emulsifier, a flavonoids, an alcohol, a polymer, and combinations thereof.

[0194] As used herein, "dietary supplement(s)" refers to compounds intended to supplement the diet and provide nutrients, such as vitamins, minerals, fiber, fatty acids, amino acids, etc. that may be missing or may not be consumed in sufficient quantities in a diet. Any suitable dietary supplement known in the art may be used. Examples of suitable dietary supplements can be, for example, nutrients, vitamins, minerals, fiber, fatty acids, herbs, botanicals, amino acids, and metabolites.

[0195] As used herein, "nutraceutical(s)" refers to compounds, which includes any food or part of a food that may provide medicinal or health benefits, including the prevention and/or treatment of disease or disorder (e.g., fatigue, insomnia, effects of aging, memory loss, mood disorders, cardiovascular disease and high levels of cholesterol in the blood, diabetes, osteoporosis, inflammation, autoimmune disorders, etc.). Any suitable nutraceutical known in the art may be used. In some embodiments, nutraceuticals can be used as supplements to food and beverages and as pharmaceutical formulations for enteral or parenteral applications which may be solid formulations, such as capsules or tablets, or liquid formulations, such as solutions or suspensions.

[0196] In some embodiments, dietary supplements and nutraceuticals can further contain protective hydrocolloids (such as gums, proteins, modified starches), binders, film-forming agents, encapsulating agents/materials, wall/shell materials, matrix compounds, coatings, emulsifiers, surface active agents, solubilizing agents (oils, fats, waxes, lecithins, etc.), adsorbents, carriers, fillers, co-compounds, dispersing agents, wetting agents, processing aids (solvents), flowing agents, taste-masking agents, weighting agents, jellyfying agents, gel-forming agents, antioxidants and antimicrobials.

[0197] As used herein, a "gel" refers to a colloidal system in which a network of particles spans the volume of a liquid medium. Although gels mainly are composed of liquids, and thus exhibit densities similar to liquids, gels have the structural coherence of solids due to the network of particles that spans the liquid medium. For this reason, gels generally appear to be solid, jelly-like materials. Gels can be used in a number of applications. For example, gels can be used in foods, paints, and adhesives. Gels that can be eaten are referred to as "edible gel compositions." Edible gel compositions typically are eaten as snacks, as desserts, as a part of staple foods, or along with staple foods. Examples of suitable edible gel compositions can be, for example, gel desserts, puddings, jams, jellies, pastes, trifles, aspics, marshmallows, gummy candies, and the like. In some embodiments, edible gel mixes generally are powdered or granular solids to which a fluid may be added to form an edible gel composition. Examples of suitable fluids can be, for example, water, dairy fluids, dairy analogue fluids, juices, alcohol, alcoholic beverages, and combinations thereof. Examples of suitable dairy fluids can be, for example, milk, cultured milk, cream, fluid whey, and mixtures thereof. Examples of suitable dairy analogue fluids can be, for example, soy milk and non-dairy coffee whitener.

[0198] As used herein, the term "gelling ingredient" refers to any material that can form a colloidal system within a liquid medium. Examples of suitable gelling ingredients can be, for example, gelatin, alginate, carageenan, gum, pectin, konjac, agar, food acid, rennet, starch, starch derivatives, and combinations thereof. It is well known to those in the art that the amount of gelling ingredient used in an edible gel mix or an edible gel composition can vary considerably depending on a number of factors such as, for example, the particular gelling ingredient used, the particular fluid base used, and the desired properties of the gel.

[0199] Gel mixes and gel compositions of the present disclosure can be prepared by any suitable method known in the art. In some embodiments, edible gel mixes and edible gel compositions of the present disclosure can be prepared using other ingredients in addition to the gelling agent. Examples of other suitable ingredients can be, for example, a food acid, a salt of a food acid, a buffering system, a bulking agent, a sequestrant, a cross-linking agent, one or more flavors, one or more colors, and combinations thereof.

[0200] In certain embodiments that can be combined with any of the preceding embodiments, the orally consumable products can further include one or more additives selected from a carbohydrate, a polyol, an amino acid or salt thereof, a poly-amino acid or salt thereof, a sugar acid or salt thereof, a nucleotide, an organic acid, an inorganic acid, an organic salt, an organic acid salt, an organic base salt, an inorganic salt, a bitter compound, a flavorant, a flavoring ingredient, an astringent compound, a protein, a protein hydrolysate, a surfactant, an emulsifier, a flavonoids, an alcohol, a polymer, and combinations thereof.

[0201] The compositions can be used "as-is" or in combination with other sweeteners, flavors and food ingredients. For use in domestic applications, particularly as a replacement for sugar in beverage sweetening, it is desirable in some embodiments that the compositions according to the present disclosure include a bulking agent so that an equivalent sweetness to that provided by, for example, a teaspoonful of sugar is provided by an amount which can conveniently be handled. Any suitable soluble and edible material can be used, for example, a carbohydrate such as sucrose itself, especially transformed sugar of low density, dextrose, or sorbitol or a dextrin such as spray-dried maltodextrin. While the substances will add to the caloric value of the composition, the total will still be considerably smaller than that of the amount of sugar providing an equivalent sweetness. Alternatively, the sweetening composition may be prepared in a tablet form.

[0202] Compositions provided herein are usually stable at pH values in the range of from 2 to 10, especially 3 to 8. Dry compositions, such as powders, granules or tablets can be stable indefinitely when stored under dry conditions at room temperature. Compositions in the form of aqueous solutions can be stable indefinitely when frozen. If a preservative such as benzoic acid or its salts, sulphur dioxide or sodium meta-bisulphite is added to such a composition, it may be stored almost indefinitely at room temperature. The compositions therefore can have a long shelf-life when incorpo-

rated into soft drinks or fruit juices, or other similar food compositions containing preservatives. The limitation on the use of sugar may also positively contribute to the long shelf-life of the products provided herein.

Food Additives Flavor Enhancement or Aroma Enhancement

[0203] Food compositions comprising the inventive formulations provided herein may further comprise components selected from the group consisting of additional sweeteners or sweet-tasting compounds, aroma compounds, flavoring compounds, and their mixtures. Such additives may also specifically include hydrocolloids such as pectins, gelatin, carrageenan, or gums (Arabic, guar, locust bean) for dressings, jams, jellies, confections and the like. Other additives to food, feed or beverage compositions include chelating agents whose addition is designed to protect against enzymatic reactions and may specifically include ethylenediaminetetraacetic acid (EDTA).

[0204] Aroma compounds and flavor enhancing agents are well known in the art can be added to the compositions provided herein. These flavoring agents can be chosen from synthetic flavoring liquids and/or oils derived from plants leaves, flowers, or fruits. Representative flavoring liquids include: artificial, natural or synthetic fruit flavors such as eucalyptus, lemon, orange, banana, grape, lime, apricot, and grapefruit oils, fruit essences including apple, strawberry, cherry, orange, pineapple, and so forth, bean- and nut-derived flavors such as coffee, cocoa, cola, hazelnut, peanut or almond, and root-derived flavors such as licorice or ginger.

[0205] The following examples illustrate various embodiments of the disclosure. It will be understood that the disclosure is not limited to the materials, proportions, conditions and procedures set forth in the examples, which are only illustrative.

EXAMPLES

Example 1

[0206] According to the present disclosure, the creation of food products incorporating the sweetening blends provided herein can be provided in several food category (FIGS. **1**A-**10**D). Food or beverages that can contain the inventive rebaudioside formulations include baked goods and baked good mixes (e.g., cakes, brownies, muffins, cookies, pastries, pies, and pie crusts), shortening and oil products (e.g., margarines, salad dressings and mayonnaise), companion animal feed, dairy products and artificial dairy products (e.g., butter, ice cream and other fat-containing frozen desserts, yogurt, and cheeses, including natural cheeses, processed cheeses, cream cheese, cottage cheese, cheese foods and cheese spread, milk, cream, sour cream, buttermilk, and coffee creamer), meat products (e.g., hamburgers, hot dogs, wieners, sausages, bologna and other luncheon meats, canned meats, including pasta/meat products, stews, sandwich spreads, and canned fish), meat analogs, tofu, and various kinds of protein spreads, sweet goods and confections (e.g., candies, chocolates, chocolate confections, frostings, and icings, syrups, cream fillings, and fruit fillings), nut butters and various kinds of soups, dips, sauces and gravies. Each of the above examples comprise different embodiments of the current disclosure. The formulations of the present disclosure are generally completely soluble in water and may be used in hot or cold food and beverages to give a sweetness equivalent to that of sugar.

[0207] The preferred formulations the present disclosure were developed with the appropriate level of a particular rebaudioside blend in order to deliver the targeted sweetness levels on a per serving basis. The amount added varied between different applications due to the differences in serving size. For ease of addition and in order to achieve homogeneous distribution at the desired dilution in edible materials, the compositions were formulated in the conventional manner with solid or liquid non-toxic carrier or diluents. For example, solid compositions may take the form of tablets or powders using edible solid carriers such as maltodextrins, starch or nutritive proteins (e.g. soy protein); or the formulations provided herein may be fixed with sucrose to provide a "fortified" sugar. Liquid compositions may take the form of aqueous solutions or of suspensions in other non-toxic liquids such as aqueous ethanol, glycerol and edible oils, and may be used, for example, for spraying.

Soy Milk

[0208] Soymilk can be prepared in different ways. In one example, a sweetening rebaudioside formulation is folded into full-fatted soy flour or added separately as needed. The soymilk is formulated by first dissolving the soy flour into water, mixing, and processing to inactivate the enzymes. The soy base is filtered to remove additional solids and degassed. The remaining ingredients are added and mixed, and the product is homogenized in a two-stage homogenizer, then processed through an Ultra High Temperature (UHT) thermal processing unit. The resulting product is packed and refrigerated with a typical shelf life of 12 weeks.

[0209] Following is a formulation as provided in Table 4. See also FIG. **12** for a process flow diagram. Note that the rebaudioside blends can be used instead of the sucrose listed. Given their potency as a sweetener, they could require a fraction of the total amount of sucrose otherwise needed and could act as a complete replacement.

TABLE 4

Vanilla Soymilk	%
Water	88.122
Enriched Soy Flour	6.786
Full Fat Soymilk.	0.600
*Sucrose - or Rebaudioside Blend at a fraction of total sugar	3.400
Carrageenan	0.022
Cellulose Gum	0.350
Salt	0.040
Calcium Carbonate	0.350
Natural and Artificial Flavors	0.330
TOTAL	100.000

[0210] The example used can also be applied to different types of homogenization and thermal processing units (direct steam, indirect steam, etc.). Different soymilk flavors, including plain, chocolate, apple, orange, berry, etc. can be prepared in the same manner.

[0211] The resulting product was found to have acceptable flavor and mouth "feel" properties in comparison to soymilk made from flour processed the same way but without a rebaudioside blend as provided herein.

[0212] Another example is to use isolated soy protein and to add a rebaudioside mixture to the isolate in lieu of sucrose. Following is a formulation as provided in Table 5.

TABLE 5

Vanilla Soymilk	%
Water	88.058
*Sucrose or Rebaudioside	3.500
Blend at a fraction of total sugar	
Isolated Soy Protein	2.700
Maltodextrin	3.500
11% Soybean Oil	1.500
Carrageenan	0.022
Cellulose gum	0.350
Salt	0.040
Natural & Artificial Flavors	0.330
TOTAL	100.000

[0213] The example provided above can also be applied to different types of homogenization and thermal processing units (direct steam, indirect steam, etc.). Different soymilk flavors, including plain, chocolate, apple, orange, berry, etc. can be prepared in the same manner.

Animal Feed

[0214] To make the animal feed (e.g., see FIG. **14**), combine all ingredients in a very large pan and add the cooled cooked white rice. Blend 9 eggs in a blender with shells, thoroughly homogenize egg and shells and add to mix. Mix well and completely with your hands until all the ingredients are thoroughly combined. The ingredients are enough for about three meat loafs. Cook meat loafs in over preheated to 350 F for about 1 hour or until done. The meatloaf can be broken into desirable amounts dependent upon dog to be fed and refrigerate/freeze the rest.

Example 2

Margarine Type Spreads

[0215] A typical margarine process is that the water, salt, sodium benzoate, and butter flavor are mixed as an aqueous phase. A milk ingredient, such as whey powder, sodium caseinate, or milk powder, is added to the aqueous phase. The oils, lecithin, mono and diglycerides, vitamins, and sweeteners, including a *Stevia* blend as provided herein, are mixed, combined with the aqueous phase, and mixed. The mixed emulsion is passed through a series of scraped surface heat exchangers, pin mixers, and resting tubes to achieve a desired fill temperature and consistency.

Example 3

Cookie Dough

[0216] disclosure sweetener blend as provided herein can also be incorporated into food products, including cookies. The recipe for vanilla butter cookies is provided in FIGS. **8**A-**8**D for such utilization.

Example 4

Reduction or Replacement of Sugar in Beverages

[0217] The lemon water examples shown in FIGS. **1**B-**1**D are created based upon the lemon water shown in FIG. **1**A (control), which is a typical lemon water constituting lemon drinks and comprises sugar (in an amount of 8.79 g), natural lemon, water, and preservatives sodium benzoate and citric acid in a total volume of 100 ml. As shown in FIG. **1**B, Rebaudioside M is added in an amount of 0.033 g. The other components are present in the same amounts in the total volume of 100 ml, with the exception of the added sugar in the example shown in FIG. **1**A.

[0218] As shown in FIG. **1**C, another exemplary formulation is created similarly to that of FIG. **1**B, with Rebaudioside M being replaced by Rebaudioside D, and again added in an amount of 0.033 g, with the other components present in the same amounts in the total volume of 100 ml.

Example 5

Use of Preferred Embodiments of the Present Formulations in Lemon Water, Replacing Sugar

[0219] FIG. **1**D shows one of the formulations provided herein replacing the components sugar, Rebaudioside M, and Rebaudioside D in the previous examples (FIGS. **1**A-**1**C).

[0220] In this example, use of one of a formulation as provided herein to make lemon water is shown in FIG. **1**D. The rebaudioside formulation, labelled Blend 2, was added to the same components of the previous example, in which the Blend 2 formulation replaced the sugar, the Rebaudioside M and the Rebaudioside D of FIGS. **1**A-**1**C. The formulation Blend 2 comprises the following components, as shown in FIG. **11**A, in the following amounts:

[0221] Rebaudioside A (99% purity), 0.0373 g

[0222] Rebaudioside M (95% purity), 0.0048 g

[0223] Rebaudioside D (95% purity), 0.01 g

[0224] Rebaudioside E (95% purity), 0.0131 g

[0225] Rebaudioside 1 (95% purity), 0.003 g for a total volume of 100 ml lemon water.

[0226] Each food or beverage provided in the examples or shown in the figures exhibits a rounded and complete flavor profile and excellent mouthfeel in comparison to full sucrose versions of the same food product or beverage.

[0227] The use of the inventive sweetener formulations can also be used for a variety of other beverages including in the preparation of juice drinks from other fruits, such as apples, lemons, apricots, cherries, pineapples, mangoes, for example. It should be noted that the data shown throughout represents the results obtained by using sweetener formulations as provided herein.

[0228] For a carbonated orange drink (See, e.g., FIGS. **3**A-**3**E) the concentrations can be: Orange concentrate (35%), citric acid (0.35%), ascorbic acid (0.05%), orange red color (0.01%), and orange flavor (0.20%), with a rebaudioside blend present at approximately (0.003%). Each rebaudioside composition (e.g., 0.03%) is blended and can dissolve completely in water (up to 100%) and can be pasteurized. The preservatives sodium citrate and/or sodium 15 benzoate can be used according to usage as known by those skilled in the art to maintain shelf-life.

[0229] It should also be noted that the protein sweeteners a formulation as provided herein when use as a sweetener for a protein composition? can slightly increase the calorific value per unit sweetness of the composition.

[0230] Typically, low- or non-caloric sweeteners based on steviol glycosides tend to have bitter and licorice aftertastes, especially rebaudioside A. Characteristics are especially

notable at concentrations above about 300 ppm. In food applications, preferred use levels are often in the range from 480 ppm to about 1000 ppm, above the range at which off flavors are noticed. At the same time, as described above, the sweetening taste of the present formulations is optimal, generally, having no bitterness and leaving no unpleasant aftertaste, commonly experienced with other sweeteners.

[0231] The inventive formulations provided herein generally are many times sweeter than sucrose and much smaller amounts are needed to produce the same sweetening effect as a given amount of sugar. Therefore, the caloric intake of the consumer is vastly reduced, making the calorie-add essentially negligible. The formulations provided herein are thus also suitable for incorporation into dietetic foods or diabetic foods.

[0232] The characteristics of attribute testing are provided Table 6 below. Table 7 below shows data from sensory testing at various time points.

TABLE 6

AROMA/FLAVOR	
Total Aroma	The total aroma intensity of the sample.
Total Flavor	The total flavor intensity of the sample, including the basic tastes.
Total Oil	The intensity of aroma/flavor of any type of oil, including oxidized oil.
Oxidized Oil	The intensity of aroma/flavor of oxidized oil, described as old oil that has undergone oxidation, characterized as cardboard, beany, painty, or fishy.
Total Off Aroma/Flavor	The intensity of aroma/flavor of believed to not intended in the product, includes oxidized oil and other off notes. The nature of the off note is to be described.
Mayonnaise/ Dairy	The intensity of the aroma/flavor associated with mayonnaise or dairy product.
Vinegar	The intensity of the aroma/flavor of white vinegar or acetic acid.
Onion/Garlic/ Herb	The intensity of aroma/flavor associated with onion, garlic, and all dried and fresh green herbs.
Sour	One of the four basic tastes, perceived primarily on the sides of the tongue; common to acids.
Salty	One of the four basic tastes, perceived primarily on the sides of the tongue; common to sodium chloride (table salt).

TABLE 7

FEELING FACTORS	
Pungent	The amount of burning or irritation of the nasal cavity produced by smelling the sample, such as with horseradish.
TEXTURE	
Viscosity by Mouth	The degree of thickness of the sample as perceived when manipulated in the mouth.
Oily Mouthcoating	The amount of coating perceived on the soft tissues of the mouth
AFTERTASTE	
Total Aftertaste	The total aftertaste intensity of the sample.

TABLE 8

SCALE REFERENCES		
	VALUE	
APPEARANCE		
Color	0.0	White (paper)
	7.5	Manila Folder
AROMA\FLAVOR		
Eggy	8.0/6.0	Chopped Hard Boiled Eggs
Vinegar Aroma	6.5	100% Heinz Distilled Vinegar solution
Vinegar Flavor	4.0	2% Heinz Distilled Vinegar solution
Sweet	2.0	2.0% Sucrose in Water
	5.0	5.0% Sucrose in Water
Sour	2.0	0.025% Citric Acid in Water
	5.0	0.04% Citric Acid in Water
Salty	2.0	0.2% Sodium Chloride in Water
	5.0	0.5% Sodium Chloride in Water
MOUTHFEEL FACTORS		
Pungent (aroma)	8.0	100% Heinz Distilled Vinegar solution
TEXTURE		
Viscosity by Mouth	8.0	50:50 mix of Lucerne Heavy Cream and Kraft Mayonnaise
	11.0	Kraft Mayonnaise
Oily Mouthfeel	8.0	Kraft Mayonnaise

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[0250] Although the foregoing disclosure has been described in some detail by way of illustration and example for purposes of understanding, it will be apparent to those skilled in the art that certain changes and modifications may be practiced. Therefore, the description and examples should not be construed as limiting the scope of the disclosure, which is delineated by the appended claims.

[0251] Accordingly, it is to be understood that embodiments providing for an improved composition of rebaudiosides for utilization in food/feed products should not be limited to the specific examples. These examples are illustrative of the general applicability of the current disclosure to a vast range of food/feed items. With the inclusion of the rebaudioside sweetener formulations provided herein, these items can be made with the same or better sensory qualities while enhancing the nutritional quality of the food produced for human or animal consumption.

[0252] Moreover, the examples provided herein are merely illustrative of the application of the principles of the disclosure. It will be evident from the foregoing description that changes in the form, methods of use, and applications of the elements of the disclosed rebaudioside formulations could be used for applications not limited to human consumption, such as referred to above, for the development of feed for use both for companion animals as well as in animal production industries generally including but not limited to: beef production; poultry production; pork production, and/or aquaculture. These variant uses may be resorted to without departing from the spirit of the disclosure, or the scope of the appended claims.

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Ala Asn Val Leu Tyr Ser Lys Gly Phe Ser Ile Thr Ile Phe His Thr
        35                  40                  45

Asn Phe Asn Lys Pro Lys Thr Ser Asn Tyr Pro His Phe Thr Phe Arg
    50                  55                  60

Phe Ile Leu Asp Asn Asp Pro Gln Asp Glu Arg Ile Ser Asn Leu Pro
65                  70                  75                  80

Thr His Gly Pro Leu Ala Gly Met Arg Ile Pro Ile Ile Asn Glu His
                85                  90                  95

Gly Ala Asp Glu Leu Arg Arg Glu Leu Glu Leu Leu Met Leu Ala Ser
            100                 105                 110

Glu Glu Asp Glu Glu Val Ser Cys Leu Ile Thr Asp Ala Leu Trp Tyr
        115                 120                 125

Phe Ala Gln Ser Val Ala Asp Ser Leu Asn Leu Arg Arg Leu Val Leu
    130                 135                 140

Met Thr Ser Ser Leu Phe Asn Phe His Ala His Val Ser Leu Pro Gln
145                 150                 155                 160

Phe Asp Glu Leu Gly Tyr Leu Asp Pro Asp Asp Lys Thr Arg Leu Glu
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                165                 170                 175

Glu Gln Ala Ser Gly Phe Pro Met Leu Lys Val Lys Asp Ile Lys Ser
            180                 185                 190

Ala Tyr Ser Asn Trp Gln Ile Leu Lys Glu Ile Leu Gly Lys Met Ile
        195                 200                 205

Lys Gln Thr Lys Ala Ser Ser Gly Val Ile Trp Asn Ser Phe Lys Glu
    210                 215                 220

Leu Glu Glu Ser Glu Leu Glu Thr Val Ile Arg Glu Ile Pro Ala Pro
225                 230                 235                 240

Ser Phe Leu Ile Pro Leu Pro Lys His Leu Thr Ala Ser Ser Ser Ser
                245                 250                 255

Leu Leu Asp His Asp Arg Thr Val Phe Gln Trp Leu Asp Gln Gln Pro
            260                 265                 270

Pro Ser Ser Val Leu Tyr Val Ser Phe Gly Ser Thr Ser Glu Val Asp
        275                 280                 285

Glu Lys Asp Phe Leu Glu Ile Ala Arg Gly Leu Val Asp Ser Lys Gln
    290                 295                 300

Ser Phe Leu Trp Val Val Arg Pro Gly Phe Val Lys Gly Ser Thr Trp
305                 310                 315                 320

Val Glu Pro Leu Pro Asp Gly Phe Leu Gly Glu Arg Gly Arg Ile Val
                325                 330                 335

Lys Trp Val Pro Gln Gln Glu Val Leu Ala His Gly Ala Ile Gly Ala
            340                 345                 350

Phe Trp Thr His Ser Gly Trp Asn Ser Thr Leu Glu Ser Val Cys Glu
        355                 360                 365

Gly Val Pro Met Ile Phe Ser Asp Phe Gly Leu Asp Gln Pro Leu Asn
    370                 375                 380

Ala Arg Tyr Met Ser Asp Val Leu Lys Val Gly Val Tyr Leu Glu Asn
385                 390                 395                 400

Gly Trp Glu Arg Gly Glu Ile Ala Asn Ala Ile Arg Arg Val Met Val
                405                 410                 415

Asp Glu Glu Gly Glu Tyr Ile Arg Gln Asn Ala Arg Val Leu Lys Gln
            420                 425                 430

Lys Ala Asp Val Ser Leu Met Lys Gly Gly Ser Ser Tyr Glu Ser Leu
        435                 440                 445

Glu Ser Leu Val Ser Tyr Ile Ser Ser Leu
    450                 455


<210> SEQ ID NO 2
<211> LENGTH: 458
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 2

Met Glu Asn Lys Thr Glu Thr Thr Val Arg Arg Arg Arg Arg Ile Ile
1               5                   10                  15

Leu Phe Pro Val Pro Phe Gln Gly His Ile Asn Pro Ile Leu Gln Leu
            20                  25                  30

Ala Asn Val Leu Tyr Ser Lys Gly Phe Ser Ile Thr Ile Phe His Thr
        35                  40                  45

Asn Phe Asn Lys Pro Lys Thr Ser Asn Tyr Pro His Phe Thr Phe Arg
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    50                  55                  60

Phe Ile Leu Asp Asn Asp Pro Gln Asp Glu Arg Ile Ser Asn Leu Pro
65                  70                  75                  80

Thr His Gly Pro Leu Ala Gly Met Arg Ile Pro Ile Ile Asn Glu His
                85                  90                  95

Gly Ala Asp Glu Leu Arg Arg Glu Leu Glu Leu Leu Met Leu Ala Ser
            100                 105                 110

Glu Glu Asp Glu Glu Val Ser Cys Leu Ile Thr Asp Ala Leu Trp Tyr
        115                 120                 125

Phe Ala Gln Ser Val Ala Asp Ser Leu Asn Leu Arg Arg Leu Val Leu
    130                 135                 140

Met Thr Ser Ser Leu Phe Asn Phe His Ala His Val Ser Leu Pro Gln
145                 150                 155                 160

Phe Asp Glu Leu Gly Tyr Leu Asp Pro Asp Asp Lys Thr Arg Leu Glu
                165                 170                 175

Glu Gln Ala Ser Gly Phe Pro Met Leu Lys Val Lys Asp Ile Lys Ser
            180                 185                 190

Ala Tyr Ser Asn Trp Gln Ile Ala Lys Glu Ile Leu Gly Lys Met Ile
        195                 200                 205

Lys Gln Thr Lys Ala Ser Ser Gly Val Ile Trp Asn Ser Phe Lys Glu
    210                 215                 220

Leu Glu Glu Ser Glu Leu Glu Thr Val Ile Arg Glu Ile Pro Ala Pro
225                 230                 235                 240

Ser Phe Leu Ile Pro Leu Pro Lys His Leu Thr Ala Ser Ser Ser Ser
                245                 250                 255

Leu Leu Asp His Asp Arg Thr Val Phe Gln Trp Leu Asp Gln Gln Pro
            260                 265                 270

Pro Ser Ser Val Leu Tyr Val Ser Phe Gly Ser Thr Ser Glu Val Asp
        275                 280                 285

Glu Lys Asp Phe Leu Glu Ile Ala Arg Gly Leu Val Asp Ser Lys Gln
    290                 295                 300

Ser Phe Leu Trp Val Val Arg Pro Gly Phe Val Lys Gly Ser Thr Trp
305                 310                 315                 320

Val Glu Pro Leu Pro Asp Gly Phe Leu Gly Glu Arg Gly Arg Ile Val
                325                 330                 335

Lys Trp Val Pro Gln Gln Glu Val Leu Ala His Gly Ala Ile Gly Ala
            340                 345                 350

Phe Trp Thr His Ser Gly Trp Asn Ser Thr Leu Glu Ser Val Cys Glu
        355                 360                 365

Gly Val Pro Met Ile Phe Ser Asp Phe Gly Leu Asp Gln Pro Leu Asn
    370                 375                 380

Ala Arg Tyr Met Ser Asp Val Leu Lys Val Gly Val Tyr Leu Glu Asn
385                 390                 395                 400

Gly Trp Glu Arg Gly Glu Ile Ala Asn Ala Ile Arg Arg Val Met Val
                405                 410                 415

Asp Glu Glu Gly Glu Tyr Ile Arg Gln Asn Ala Arg Val Leu Lys Gln
            420                 425                 430

Lys Ala Asp Val Ser Leu Met Lys Gly Gly Ser Ser Tyr Glu Ser Leu
        435                 440                 445

Glu Ser Leu Val Ser Tyr Ile Ser Ser Leu
    450                 455
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<210> SEQ ID NO 3
<211> LENGTH: 458
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 3

Met Asn Trp Gln Ile Leu Lys Glu Ile Leu Gly Lys Met Ile Lys Gln
1 5 10 15

Thr Lys Ala Ser Ser Gly Val Ile Trp Asn Ser Phe Lys Glu Leu Glu
20 25 30

Glu Ser Glu Leu Glu Thr Val Ile Arg Glu Ile Pro Ala Pro Ser Phe
35 40 45

Leu Ile Pro Leu Pro Lys His Leu Thr Ala Ser Ser Ser Ser Leu Leu
50 55 60

Asp His Asp Arg Thr Val Phe Gln Trp Leu Asp Gln Gln Pro Pro Ser
65 70 75 80

Ser Val Leu Tyr Val Ser Phe Gly Ser Thr Ser Glu Val Asp Glu Lys
85 90 95

Asp Phe Leu Glu Ile Ala Arg Gly Leu Val Asp Ser Lys Gln Ser Phe
100 105 110

Leu Trp Val Val Arg Pro Gly Phe Val Lys Gly Ser Thr Trp Val Glu
115 120 125

Pro Leu Pro Asp Gly Phe Leu Gly Glu Arg Gly Arg Ile Val Lys Trp
130 135 140

Val Pro Gln Gln Glu Val Leu Ala His Gly Ala Ile Gly Ala Phe Trp
145 150 155 160

Thr His Ser Gly Trp Asn Ser Thr Leu Glu Ser Val Cys Glu Gly Val
165 170 175

Pro Met Ile Phe Ser Asp Phe Gly Leu Asp Gln Pro Leu Asn Ala Arg
180 185 190

Tyr Met Ser Asp Val Leu Lys Val Gly Val Tyr Leu Glu Asn Gly Trp
195 200 205

Glu Arg Gly Glu Ile Ala Asn Ala Ile Arg Arg Val Met Val Asp Glu
210 215 220

Glu Gly Glu Tyr Ile Arg Gln Asn Ala Arg Val Leu Lys Gln Lys Ala
225 230 235 240

Asp Val Ser Leu Met Lys Gly Gly Ser Ser Tyr Glu Ser Leu Glu Ser
245 250 255

Leu Val Ser Tyr Ile Ser Ser Leu Glu Asn Lys Thr Glu Thr Thr Val
260 265 270

Arg Arg Arg Arg Arg Ile Ile Leu Phe Pro Val Pro Phe Gln Gly His
275 280 285

Ile Asn Pro Ile Leu Gln Leu Ala Asn Val Leu Tyr Ser Lys Gly Phe
290 295 300

Ser Ile Thr Ile Phe His Thr Asn Phe Asn Lys Pro Lys Thr Ser Asn
305 310 315 320

Tyr Pro His Phe Thr Phe Arg Phe Ile Leu Asp Asn Asp Pro Gln Asp
325 330 335

Glu Arg Ile Ser Asn Leu Pro Thr His Gly Pro Leu Ala Gly Met Arg
340 345 350

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Ile Pro Ile Ile Asn Glu His Gly Ala Asp Glu Leu Arg Arg Glu Leu
        355                 360                 365

Glu Leu Leu Met Leu Ala Ser Glu Glu Asp Glu Glu Val Ser Cys Leu
    370                 375                 380

Ile Thr Asp Ala Leu Trp Tyr Phe Ala Gln Ser Val Ala Asp Ser Leu
385                 390                 395                 400

Asn Leu Arg Arg Leu Val Leu Met Thr Ser Ser Leu Phe Asn Phe His
                405                 410                 415

Ala His Val Ser Leu Pro Gln Phe Asp Glu Leu Gly Tyr Leu Asp Pro
            420                 425                 430

Asp Asp Lys Thr Arg Leu Glu Glu Gln Ala Ser Gly Phe Pro Met Leu
        435                 440                 445

Lys Val Lys Asp Ile Lys Ser Ala Tyr Ser
    450                 455


<210> SEQ ID NO 4
<211> LENGTH: 475
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 4

Met Asn Trp Gln Ile Leu Lys Glu Ile Leu Gly Lys Met Ile Lys Gln
1               5                   10                  15

Thr Lys Ala Ser Ser Gly Val Ile Trp Asn Ser Phe Lys Glu Leu Glu
            20                  25                  30

Glu Ser Glu Leu Glu Thr Val Ile Arg Glu Ile Pro Ala Pro Ser Phe
        35                  40                  45

Leu Ile Pro Leu Pro Lys His Leu Thr Ala Ser Ser Ser Ser Leu Leu
    50                  55                  60

Asp His Asp Arg Thr Val Phe Gln Trp Leu Asp Gln Gln Pro Pro Ser
65                  70                  75                  80

Ser Val Leu Tyr Val Ser Phe Gly Ser Thr Ser Glu Val Asp Glu Lys
                85                  90                  95

Asp Phe Leu Glu Ile Ala Arg Gly Leu Val Asp Ser Lys Gln Ser Phe
            100                 105                 110

Leu Trp Val Val Arg Pro Gly Phe Val Lys Gly Ser Thr Trp Val Glu
        115                 120                 125

Pro Leu Pro Asp Gly Phe Leu Gly Glu Arg Gly Arg Ile Val Lys Trp
    130                 135                 140

Val Pro Gln Gln Glu Val Leu Ala His Gly Ala Ile Gly Ala Phe Trp
145                 150                 155                 160

Thr His Ser Gly Trp Asn Ser Thr Leu Glu Ser Val Cys Glu Gly Val
                165                 170                 175

Pro Met Ile Phe Ser Asp Phe Gly Leu Asp Gln Pro Leu Asn Ala Arg
            180                 185                 190

Tyr Met Ser Asp Val Leu Lys Val Gly Val Tyr Leu Glu Asn Gly Trp
        195                 200                 205

Glu Arg Gly Glu Ile Ala Asn Ala Ile Arg Arg Val Met Val Asp Glu
    210                 215                 220

Glu Gly Glu Tyr Ile Arg Gln Asn Ala Arg Val Leu Lys Gln Lys Ala
225                 230                 235                 240
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Asp Val Ser Leu Met Lys Gly Gly Ser Ser Tyr Glu Ser Leu Glu Ser
               245                 250                 255

Leu Val Ser Tyr Ile Ser Ser Leu Tyr Lys Asp Asp Ser Gly Tyr Ser
            260                 265                 270

Ser Ser Tyr Ala Ala Ala Ala Gly Met Glu Asn Lys Thr Glu Thr Thr
        275                 280                 285

Val Arg Arg Arg Arg Arg Ile Ile Leu Phe Pro Val Pro Phe Gln Gly
    290                 295                 300

His Ile Asn Pro Ile Leu Gln Leu Ala Asn Val Leu Tyr Ser Lys Gly
305                 310                 315                 320

Phe Ser Ile Thr Ile Phe His Thr Asn Phe Asn Lys Pro Lys Thr Ser
                325                 330                 335

Asn Tyr Pro His Phe Thr Phe Arg Phe Ile Leu Asp Asn Asp Pro Gln
            340                 345                 350

Asp Glu Arg Ile Ser Asn Leu Pro Thr His Gly Pro Leu Ala Gly Met
        355                 360                 365

Arg Ile Pro Ile Ile Asn Glu His Gly Ala Asp Glu Leu Arg Arg Glu
    370                 375                 380

Leu Glu Leu Leu Met Leu Ala Ser Glu Glu Asp Glu Glu Val Ser Cys
385                 390                 395                 400

Leu Ile Thr Asp Ala Leu Trp Tyr Phe Ala Gln Ser Val Ala Asp Ser
                405                 410                 415

Leu Asn Leu Arg Arg Leu Val Leu Met Thr Ser Ser Leu Phe Asn Phe
            420                 425                 430

His Ala His Val Ser Leu Pro Gln Phe Asp Glu Leu Gly Tyr Leu Asp
        435                 440                 445

Pro Asp Asp Lys Thr Arg Leu Glu Glu Gln Ala Ser Gly Phe Pro Met
    450                 455                 460

Leu Lys Val Lys Asp Ile Lys Ser Ala Tyr Ser
465                 470                 475


<210> SEQ ID NO 5
<211> LENGTH: 462
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 5

Met Asp Ser Gly Tyr Ser Ser Ser Tyr Ala Ala Ala Ala Gly Met His
1               5                   10                  15

Val Val Ile Cys Pro Trp Leu Ala Phe Gly His Leu Leu Pro Cys Leu
            20                  25                  30

Asp Leu Ala Gln Arg Leu Ala Ser Arg Gly His Arg Val Ser Phe Val
        35                  40                  45

Ser Thr Pro Arg Asn Ile Ser Arg Leu Pro Pro Val Arg Pro Ala Leu
    50                  55                  60

Ala Pro Leu Val Ala Phe Val Ala Leu Pro Leu Pro Arg Val Glu Gly
65                  70                  75                  80

Leu Pro Asp Gly Ala Glu Ser Thr Asn Asp Val Pro His Asp Arg Pro
                85                  90                  95

Asp Met Val Glu Leu His Arg Arg Ala Phe Asp Gly Leu Ala Ala Pro
            100                 105                 110
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Phe Ser Glu Phe Leu Gly Thr Ala Cys Ala Asp Trp Val Ile Val Asp
        115                 120                 125

Val Phe His His Trp Ala Ala Ala Ala Ala Leu Glu His Lys Val Pro
    130                 135                 140

Cys Ala Met Met Leu Leu Gly Ser Ala His Met Ile Ala Ser Ile Ala
145                 150                 155                 160

Asp Arg Arg Leu Glu Arg Ala Glu Thr Glu Ser Pro Ala Ala Ala Gly
                165                 170                 175

Gln Gly Arg Pro Ala Ala Ala Pro Thr Phe Glu Val Ala Arg Met Lys
            180                 185                 190

Leu Ile Arg Thr Lys Gly Ser Ser Gly Met Ser Leu Ala Glu Arg Phe
        195                 200                 205

Ser Leu Thr Leu Ser Arg Ser Ser Leu Val Val Gly Arg Ser Cys Val
    210                 215                 220

Glu Phe Glu Pro Glu Thr Val Pro Leu Leu Ser Thr Leu Arg Gly Lys
225                 230                 235                 240

Pro Ile Thr Phe Leu Gly Leu Met Pro Pro Leu His Glu Gly Arg Arg
                245                 250                 255

Glu Asp Gly Glu Asp Ala Thr Val Arg Trp Leu Asp Ala Gln Pro Ala
            260                 265                 270

Lys Ser Val Val Tyr Val Ala Leu Gly Ser Glu Val Pro Leu Gly Val
        275                 280                 285

Glu Lys Val His Glu Leu Ala Leu Gly Leu Glu Leu Ala Gly Thr Arg
    290                 295                 300

Phe Leu Trp Ala Leu Arg Lys Pro Thr Gly Val Ser Asp Ala Asp Leu
305                 310                 315                 320

Leu Pro Ala Gly Phe Glu Glu Arg Thr Arg Gly Arg Gly Val Val Ala
                325                 330                 335

Thr Arg Trp Val Pro Gln Met Ser Ile Leu Ala His Ala Ala Val Gly
            340                 345                 350

Ala Phe Leu Thr His Cys Gly Trp Asn Ser Thr Ile Glu Gly Leu Met
        355                 360                 365

Phe Gly His Pro Leu Ile Met Leu Pro Ile Phe Gly Asp Gln Gly Pro
    370                 375                 380

Asn Ala Arg Leu Ile Glu Ala Lys Asn Ala Gly Leu Gln Val Ala Arg
385                 390                 395                 400

Asn Asp Gly Asp Gly Ser Phe Asp Arg Glu Gly Val Ala Ala Ala Ile
                405                 410                 415

Arg Ala Val Ala Val Glu Glu Glu Ser Ser Lys Val Phe Gln Ala Lys
            420                 425                 430

Ala Lys Lys Leu Gln Glu Ile Val Ala Asp Met Ala Cys His Glu Arg
        435                 440                 445

Tyr Ile Asp Gly Phe Ile Gln Gln Leu Arg Ser Tyr Lys Asp
    450                 455                 460


<210> SEQ ID NO 6
<211> LENGTH: 462
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 6
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Met Gly Ser Ser Gly Met Ser Leu Ala Glu Arg Phe Ser Leu Thr Leu
1               5                  10                  15

Ser Arg Ser Ser Leu Val Val Gly Arg Ser Cys Val Glu Phe Glu Pro
            20                  25                  30

Glu Thr Val Pro Leu Leu Ser Thr Leu Arg Gly Lys Pro Ile Thr Phe
        35                  40                  45

Leu Gly Leu Met Pro Pro Leu His Glu Gly Arg Arg Glu Asp Gly Glu
    50                  55                  60

Asp Ala Thr Val Arg Trp Leu Asp Ala Gln Pro Ala Lys Ser Val Val
65                  70                  75                  80

Tyr Val Ala Leu Gly Ser Glu Val Pro Leu Gly Val Glu Lys Val His
                85                  90                  95

Glu Leu Ala Leu Gly Leu Glu Leu Ala Gly Thr Arg Phe Leu Trp Ala
            100                 105                 110

Leu Arg Lys Pro Thr Gly Val Ser Asp Ala Asp Leu Leu Pro Ala Gly
        115                 120                 125

Phe Glu Glu Arg Thr Arg Gly Arg Gly Val Val Ala Thr Arg Trp Val
    130                 135                 140

Pro Gln Met Ser Ile Leu Ala His Ala Ala Val Gly Ala Phe Leu Thr
145                 150                 155                 160

His Cys Gly Trp Asn Ser Thr Ile Glu Gly Leu Met Phe Gly His Pro
                165                 170                 175

Leu Ile Met Leu Pro Ile Phe Gly Asp Gln Gly Pro Asn Ala Arg Leu
            180                 185                 190

Ile Glu Ala Lys Asn Ala Gly Leu Gln Val Ala Arg Asn Asp Gly Asp
        195                 200                 205

Gly Ser Phe Asp Arg Glu Gly Val Ala Ala Ala Ile Arg Ala Val Ala
    210                 215                 220

Val Glu Glu Glu Ser Ser Lys Val Phe Gln Ala Lys Ala Lys Lys Leu
225                 230                 235                 240

Gln Glu Ile Val Ala Asp Met Ala Cys His Glu Arg Tyr Ile Asp Gly
                245                 250                 255

Phe Ile Gln Gln Leu Arg Ser Tyr Lys Asp Asp Ser Gly Tyr Ser Ser
            260                 265                 270

Ser Tyr Ala Ala Ala Ala Gly Met His Val Val Ile Cys Pro Trp Leu
        275                 280                 285

Ala Phe Gly His Leu Leu Pro Cys Leu Asp Leu Ala Gln Arg Leu Ala
    290                 295                 300

Ser Arg Gly His Arg Val Ser Phe Val Ser Thr Pro Arg Asn Ile Ser
305                 310                 315                 320

Arg Leu Pro Pro Val Arg Pro Ala Leu Ala Pro Leu Val Ala Phe Val
                325                 330                 335

Ala Leu Pro Leu Pro Arg Val Glu Gly Leu Pro Asp Gly Ala Glu Ser
            340                 345                 350

Thr Asn Asp Val Pro His Asp Arg Pro Asp Met Val Glu Leu His Arg
        355                 360                 365

Arg Ala Phe Asp Gly Leu Ala Ala Pro Phe Ser Glu Phe Leu Gly Thr
    370                 375                 380

Ala Cys Ala Asp Trp Val Ile Val Asp Val Phe His His Trp Ala Ala
385                 390                 395                 400
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Ala Ala Ala Leu Glu His Lys Val Pro Cys Ala Met Met Leu Leu Gly
                405                 410                 415

Ser Ala His Met Ile Ala Ser Ile Ala Asp Arg Arg Leu Glu Arg Ala
            420                 425                 430

Glu Thr Glu Ser Pro Ala Ala Ala Gly Gln Gly Arg Pro Ala Ala Ala
        435                 440                 445

Pro Thr Phe Glu Val Ala Arg Met Lys Leu Ile Arg Thr Lys
    450                 455                 460


<210> SEQ ID NO 7
<211> LENGTH: 459
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 7

Met Asp Gly Asn Ser Ser Ser Ser Pro Leu His Val Val Ile Cys Pro
1               5                   10                  15

Trp Leu Ala Leu Gly His Leu Leu Pro Cys Leu Asp Ile Ala Glu Arg
            20                  25                  30

Leu Ala Ser Arg Gly His Arg Val Ser Phe Val Ser Thr Pro Arg Asn
        35                  40                  45

Ile Ala Arg Leu Pro Pro Leu Arg Pro Ala Val Ala Pro Leu Val Asp
    50                  55                  60

Phe Val Ala Leu Pro Leu Pro His Val Asp Gly Leu Pro Glu Gly Ala
65                  70                  75                  80

Glu Ser Thr Asn Asp Val Pro Tyr Asp Lys Phe Glu Leu His Arg Lys
                85                  90                  95

Ala Phe Asp Gly Leu Ala Ala Pro Phe Ser Glu Phe Leu Arg Ala Ala
            100                 105                 110

Cys Ala Glu Gly Ala Gly Ser Arg Pro Asp Trp Leu Ile Val Asp Thr
        115                 120                 125

Phe His His Trp Ala Ala Ala Ala Ala Val Glu Asn Lys Val Pro Cys
    130                 135                 140

Val Met Leu Leu Leu Gly Ala Ala Thr Val Ile Ala Gly Phe Ala Arg
145                 150                 155                 160

Gly Val Ser Glu His Ala Ala Ala Ala Val Gly Lys Glu Arg Pro Ala
                165                 170                 175

Ala Glu Ala Pro Ser Phe Glu Thr Glu Arg Arg Lys Leu Met Thr Thr
            180                 185                 190

Gln Asn Ala Ser Gly Met Thr Val Ala Glu Arg Tyr Phe Leu Thr Leu
        195                 200                 205

Met Arg Ser Asp Leu Val Ala Ile Arg Ser Cys Ala Glu Trp Glu Pro
    210                 215                 220

Glu Ser Val Ala Ala Leu Thr Thr Leu Ala Gly Lys Pro Val Val Pro
225                 230                 235                 240

Leu Gly Leu Leu Pro Pro Ser Pro Glu Gly Gly Arg Gly Val Ser Lys
                245                 250                 255

Glu Asp Ala Ala Val Arg Trp Leu Asp Ala Gln Pro Ala Lys Ser Val
            260                 265                 270

Val Tyr Val Ala Leu Gly Ser Glu Val Pro Leu Arg Ala Glu Gln Val
        275                 280                 285
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His Glu Leu Ala Leu Gly Leu Glu Leu Ser Gly Ala Arg Phe Leu Trp
    290                 295                 300

Ala Leu Arg Lys Pro Thr Asp Ala Pro Asp Ala Ala Val Leu Pro Pro
305                 310                 315                 320

Gly Phe Glu Glu Arg Thr Arg Gly Arg Gly Leu Val Val Thr Gly Trp
                325                 330                 335

Val Pro Gln Ile Gly Val Leu Ala His Gly Ala Val Ala Ala Phe Leu
            340                 345                 350

Thr His Cys Gly Trp Asn Ser Thr Ile Glu Gly Leu Leu Phe Gly His
        355                 360                 365

Pro Leu Ile Met Leu Pro Ile Ser Ser Asp Gln Gly Pro Asn Ala Arg
    370                 375                 380

Leu Met Glu Gly Arg Lys Val Gly Met Gln Val Pro Arg Asp Glu Ser
385                 390                 395                 400

Asp Gly Ser Phe Arg Arg Glu Asp Val Ala Ala Thr Val Arg Ala Val
                405                 410                 415

Ala Val Glu Glu Asp Gly Arg Arg Val Phe Thr Ala Asn Ala Lys Lys
            420                 425                 430

Met Gln Glu Ile Val Ala Asp Gly Ala Cys His Glu Arg Cys Ile Asp
        435                 440                 445

Gly Phe Ile Gln Gln Leu Arg Ser Tyr Lys Ala
    450                 455


<210> SEQ ID NO 8
<211> LENGTH: 808
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 8

Met Ala Asn Ala Glu Arg Met Ile Thr Arg Val His Ser Gln Arg Glu
1               5                   10                  15

Arg Leu Asn Glu Thr Leu Val Ser Glu Arg Asn Glu Val Leu Ala Leu
            20                  25                  30

Leu Ser Arg Val Glu Ala Lys Gly Lys Gly Ile Leu Gln Gln Asn Gln
        35                  40                  45

Ile Ile Ala Glu Phe Glu Ala Leu Pro Glu Gln Thr Arg Lys Lys Leu
    50                  55                  60

Glu Gly Gly Pro Phe Phe Asp Leu Leu Lys Ser Thr Gln Glu Ala Ile
65                  70                  75                  80

Val Leu Pro Pro Trp Val Ala Leu Ala Val Arg Pro Arg Pro Gly Val
                85                  90                  95

Trp Glu Tyr Leu Arg Val Asn Leu His Ala Leu Val Val Glu Glu Leu
            100                 105                 110

Gln Pro Ala Glu Phe Leu His Phe Lys Glu Glu Leu Val Asp Gly Val
        115                 120                 125

Lys Asn Gly Asn Phe Thr Leu Glu Leu Asp Phe Glu Pro Phe Asn Ala
    130                 135                 140

Ser Ile Pro Arg Pro Thr Leu His Lys Tyr Ile Gly Asn Gly Val Asp
145                 150                 155                 160

Phe Leu Asn Arg His Leu Ser Ala Lys Leu Phe His Asp Lys Glu Ser
                165                 170                 175
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Leu Leu Pro Leu Leu Lys Phe Leu Arg Leu His Ser His Gln Gly Lys
            180                 185                 190

Asn Leu Met Leu Ser Glu Lys Ile Gln Asn Leu Asn Thr Leu Gln His
        195                 200                 205

Thr Leu Arg Lys Ala Glu Glu Tyr Leu Ala Glu Leu Lys Ser Glu Thr
    210                 215                 220

Leu Tyr Glu Glu Phe Glu Ala Lys Phe Glu Glu Ile Gly Leu Glu Arg
225                 230                 235                 240

Gly Trp Gly Asp Asn Ala Glu Arg Val Leu Asp Met Ile Arg Leu Leu
                245                 250                 255

Leu Asp Leu Leu Glu Ala Pro Asp Pro Cys Thr Leu Glu Thr Phe Leu
            260                 265                 270

Gly Arg Val Pro Met Val Phe Asn Val Val Ile Leu Ser Pro His Gly
        275                 280                 285

Tyr Phe Ala Gln Asp Asn Val Leu Gly Tyr Pro Asp Thr Gly Gly Gln
    290                 295                 300

Val Val Tyr Ile Leu Asp Gln Val Arg Ala Leu Glu Ile Glu Met Leu
305                 310                 315                 320

Gln Arg Ile Lys Gln Gln Gly Leu Asn Ile Lys Pro Arg Ile Leu Ile
                325                 330                 335

Leu Thr Arg Leu Leu Pro Asp Ala Val Gly Thr Thr Cys Gly Glu Arg
            340                 345                 350

Leu Glu Arg Val Tyr Asp Ser Glu Tyr Cys Asp Ile Leu Arg Val Pro
        355                 360                 365

Phe Arg Thr Glu Lys Gly Ile Val Arg Lys Trp Ile Ser Arg Phe Glu
    370                 375                 380

Val Trp Pro Tyr Leu Glu Thr Tyr Thr Glu Asp Ala Ala Val Glu Leu
385                 390                 395                 400

Ser Lys Glu Leu Asn Gly Lys Pro Asp Leu Ile Ile Gly Asn Tyr Ser
                405                 410                 415

Asp Gly Asn Leu Val Ala Ser Leu Leu Ala His Lys Leu Gly Val Thr
            420                 425                 430

Gln Cys Thr Ile Ala His Ala Leu Glu Lys Thr Lys Tyr Pro Asp Ser
        435                 440                 445

Asp Ile Tyr Trp Lys Lys Leu Asp Asp Lys Tyr His Phe Ser Cys Gln
    450                 455                 460

Phe Thr Ala Asp Ile Phe Ala Met Asn His Thr Asp Phe Ile Ile Thr
465                 470                 475                 480

Ser Thr Phe Gln Glu Ile Ala Gly Ser Lys Glu Thr Val Gly Gln Tyr
                485                 490                 495

Glu Ser His Thr Ala Phe Thr Leu Pro Gly Leu Tyr Arg Val Val His
            500                 505                 510

Gly Ile Asp Val Phe Asp Pro Lys Phe Asn Ile Val Ser Pro Gly Ala
        515                 520                 525

Asp Met Ser Ile Tyr Phe Pro Tyr Thr Glu Glu Lys Arg Arg Leu Thr
    530                 535                 540

Lys Phe His Ser Glu Ile Glu Glu Leu Leu Tyr Ser Asp Val Glu Asn
545                 550                 555                 560

Lys Glu His Leu Cys Val Leu Lys Asp Lys Lys Lys Pro Ile Leu Phe
                565                 570                 575

Thr Met Ala Arg Leu Asp Arg Val Lys Asn Leu Ser Gly Leu Val Glu
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            580                 585                 590

Trp Tyr Gly Lys Asn Thr Arg Leu Arg Glu Leu Ala Asn Leu Val Val
        595                 600                 605

Val Gly Gly Asp Arg Arg Lys Glu Ser Lys Asp Asn Glu Glu Lys Ala
    610                 615                 620

Glu Met Lys Lys Met Tyr Asp Leu Ile Glu Glu Tyr Lys Leu Asn Gly
625                 630                 635                 640

Gln Phe Arg Trp Ile Ser Ser Gln Met Asp Arg Val Arg Asn Gly Glu
                645                 650                 655

Leu Tyr Arg Tyr Ile Cys Asp Thr Lys Gly Ala Phe Val Gln Pro Ala
            660                 665                 670

Leu Tyr Glu Ala Phe Gly Leu Thr Val Val Glu Ala Met Thr Cys Gly
        675                 680                 685

Leu Pro Thr Phe Ala Thr Cys Lys Gly Gly Pro Ala Glu Ile Ile Val
    690                 695                 700

His Gly Lys Ser Gly Phe His Ile Asp Pro Tyr His Gly Asp Gln Ala
705                 710                 715                 720

Ala Asp Thr Leu Ala Asp Phe Phe Thr Lys Cys Lys Glu Asp Pro Ser
                725                 730                 735

His Trp Asp Glu Ile Ser Lys Gly Gly Leu Gln Arg Ile Glu Glu Lys
            740                 745                 750

Tyr Thr Trp Gln Ile Tyr Ser Gln Arg Leu Leu Thr Leu Thr Gly Val
        755                 760                 765

Tyr Gly Phe Trp Lys His Val Ser Asn Leu Asp Arg Leu Glu Ala Arg
    770                 775                 780

Arg Tyr Leu Glu Met Phe Tyr Ala Leu Lys Tyr Arg Pro Leu Ala Gln
785                 790                 795                 800

Ala Val Pro Leu Ala Gln Asp Asp
                805


<210> SEQ ID NO 9
<211> LENGTH: 1270
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 9

Met Glu Asn Lys Thr Glu Thr Thr Val Arg Arg Arg Arg Arg Ile Ile
1               5                   10                  15

Leu Phe Pro Val Pro Phe Gln Gly His Ile Asn Pro Ile Leu Gln Leu
            20                  25                  30

Ala Asn Val Leu Tyr Ser Lys Gly Phe Ser Ile Thr Ile Phe His Thr
        35                  40                  45

Asn Phe Asn Lys Pro Lys Thr Ser Asn Tyr Pro His Phe Thr Phe Arg
    50                  55                  60

Phe Ile Leu Asp Asn Asp Pro Gln Asp Glu Arg Ile Ser Asn Leu Pro
65                  70                  75                  80

Thr His Gly Pro Leu Ala Gly Met Arg Ile Pro Ile Ile Asn Glu His
                85                  90                  95

Gly Ala Asp Glu Leu Arg Arg Glu Leu Glu Leu Leu Met Leu Ala Ser
            100                 105                 110

Glu Glu Asp Glu Glu Val Ser Cys Leu Ile Thr Asp Ala Leu Trp Tyr
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        115                 120                 125

Phe Ala Gln Ser Val Ala Asp Ser Leu Asn Leu Arg Arg Leu Val Leu
    130                 135                 140

Met Thr Ser Ser Leu Phe Asn Phe His Ala His Val Ser Leu Pro Gln
145                 150                 155                 160

Phe Asp Glu Leu Gly Tyr Leu Asp Pro Asp Asp Lys Thr Arg Leu Glu
                165                 170                 175

Glu Gln Ala Ser Gly Phe Pro Met Leu Lys Val Lys Asp Ile Lys Ser
            180                 185                 190

Ala Tyr Ser Asn Trp Gln Ile Leu Lys Glu Ile Leu Gly Lys Met Ile
        195                 200                 205

Lys Gln Thr Lys Ala Ser Ser Gly Val Ile Trp Asn Ser Phe Lys Glu
    210                 215                 220

Leu Glu Glu Ser Glu Leu Glu Thr Val Ile Arg Glu Ile Pro Ala Pro
225                 230                 235                 240

Ser Phe Leu Ile Pro Leu Pro Lys His Leu Thr Ala Ser Ser Ser Ser
                245                 250                 255

Leu Leu Asp His Asp Arg Thr Val Phe Gln Trp Leu Asp Gln Gln Pro
            260                 265                 270

Pro Ser Ser Val Leu Tyr Val Ser Phe Gly Ser Thr Ser Glu Val Asp
        275                 280                 285

Glu Lys Asp Phe Leu Glu Ile Ala Arg Gly Leu Val Asp Ser Lys Gln
    290                 295                 300

Ser Phe Leu Trp Val Val Arg Pro Gly Phe Val Lys Gly Ser Thr Trp
305                 310                 315                 320

Val Glu Pro Leu Pro Asp Gly Phe Leu Gly Glu Arg Gly Arg Ile Val
                325                 330                 335

Lys Trp Val Pro Gln Gln Glu Val Leu Ala His Gly Ala Ile Gly Ala
            340                 345                 350

Phe Trp Thr His Ser Gly Trp Asn Ser Thr Leu Glu Ser Val Cys Glu
        355                 360                 365

Gly Val Pro Met Ile Phe Ser Asp Phe Gly Leu Asp Gln Pro Leu Asn
    370                 375                 380

Ala Arg Tyr Met Ser Asp Val Leu Lys Val Gly Val Tyr Leu Glu Asn
385                 390                 395                 400

Gly Trp Glu Arg Gly Glu Ile Ala Asn Ala Ile Arg Arg Val Met Val
                405                 410                 415

Asp Glu Glu Gly Glu Tyr Ile Arg Gln Asn Ala Arg Val Leu Lys Gln
            420                 425                 430

Lys Ala Asp Val Ser Leu Met Lys Gly Gly Ser Ser Tyr Glu Ser Leu
        435                 440                 445

Glu Ser Leu Val Ser Tyr Ile Ser Ser Leu Gly Ser Gly Ala Asn Ala
    450                 455                 460

Glu Arg Met Ile Thr Arg Val His Ser Gln Arg Glu Arg Leu Asn Glu
465                 470                 475                 480

Thr Leu Val Ser Glu Arg Asn Glu Val Leu Ala Leu Leu Ser Arg Val
                485                 490                 495

Glu Ala Lys Gly Lys Gly Ile Leu Gln Gln Asn Gln Ile Ile Ala Glu
            500                 505                 510

Phe Glu Ala Leu Pro Glu Gln Thr Arg Lys Lys Leu Glu Gly Gly Pro
        515                 520                 525
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Phe Phe Asp Leu Leu Lys Ser Thr Gln Glu Ala Ile Val Leu Pro Pro
    530                 535                 540

Trp Val Ala Leu Ala Val Arg Pro Arg Pro Gly Val Trp Glu Tyr Leu
545                 550                 555                 560

Arg Val Asn Leu His Ala Leu Val Val Glu Glu Leu Gln Pro Ala Glu
                565                 570                 575

Phe Leu His Phe Lys Glu Glu Leu Val Asp Gly Val Lys Asn Gly Asn
            580                 585                 590

Phe Thr Leu Glu Leu Asp Phe Glu Pro Phe Asn Ala Ser Ile Pro Arg
        595                 600                 605

Pro Thr Leu His Lys Tyr Ile Gly Asn Gly Val Asp Phe Leu Asn Arg
    610                 615                 620

His Leu Ser Ala Lys Leu Phe His Asp Lys Glu Ser Leu Leu Pro Leu
625                 630                 635                 640

Leu Lys Phe Leu Arg Leu His Ser His Gln Gly Lys Asn Leu Met Leu
                645                 650                 655

Ser Glu Lys Ile Gln Asn Leu Asn Thr Leu Gln His Thr Leu Arg Lys
            660                 665                 670

Ala Glu Glu Tyr Leu Ala Glu Leu Lys Ser Glu Thr Leu Tyr Glu Glu
        675                 680                 685

Phe Glu Ala Lys Phe Glu Glu Ile Gly Leu Glu Arg Gly Trp Gly Asp
    690                 695                 700

Asn Ala Glu Arg Val Leu Asp Met Ile Arg Leu Leu Leu Asp Leu Leu
705                 710                 715                 720

Glu Ala Pro Asp Pro Cys Thr Leu Glu Thr Phe Leu Gly Arg Val Pro
                725                 730                 735

Met Val Phe Asn Val Val Ile Leu Ser Pro His Gly Tyr Phe Ala Gln
            740                 745                 750

Asp Asn Val Leu Gly Tyr Pro Asp Thr Gly Gly Gln Val Val Tyr Ile
        755                 760                 765

Leu Asp Gln Val Arg Ala Leu Glu Ile Glu Met Leu Gln Arg Ile Lys
    770                 775                 780

Gln Gln Gly Leu Asn Ile Lys Pro Arg Ile Leu Ile Leu Thr Arg Leu
785                 790                 795                 800

Leu Pro Asp Ala Val Gly Thr Thr Cys Gly Glu Arg Leu Glu Arg Val
                805                 810                 815

Tyr Asp Ser Glu Tyr Cys Asp Ile Leu Arg Val Pro Phe Arg Thr Glu
            820                 825                 830

Lys Gly Ile Val Arg Lys Trp Ile Ser Arg Phe Glu Val Trp Pro Tyr
        835                 840                 845

Leu Glu Thr Tyr Thr Glu Asp Ala Ala Val Glu Leu Ser Lys Glu Leu
    850                 855                 860

Asn Gly Lys Pro Asp Leu Ile Ile Gly Asn Tyr Ser Asp Gly Asn Leu
865                 870                 875                 880

Val Ala Ser Leu Leu Ala His Lys Leu Gly Val Thr Gln Cys Thr Ile
                885                 890                 895

Ala His Ala Leu Glu Lys Thr Lys Tyr Pro Asp Ser Asp Ile Tyr Trp
            900                 905                 910

Lys Lys Leu Asp Asp Lys Tyr His Phe Ser Cys Gln Phe Thr Ala Asp
        915                 920                 925
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Ile Phe Ala Met Asn His Thr Asp Phe Ile Ile Thr Ser Thr Phe Gln
    930                 935                 940

Glu Ile Ala Gly Ser Lys Glu Thr Val Gly Gln Tyr Glu Ser His Thr
945                 950                 955                 960

Ala Phe Thr Leu Pro Gly Leu Tyr Arg Val Val His Gly Ile Asp Val
                965                 970                 975

Phe Asp Pro Lys Phe Asn Ile Val Ser Pro Gly Ala Asp Met Ser Ile
            980                 985                 990

Tyr Phe Pro Tyr Thr Glu Glu Lys  Arg Arg Leu Thr Lys  Phe His Ser
        995                 1000                1005

Glu Ile  Glu Glu Leu Leu Tyr  Ser Asp Val Glu Asn  Lys Glu His
    1010                1015                1020

Leu Cys  Val Leu Lys Asp Lys  Lys Lys Pro Ile Leu  Phe Thr Met
    1025                1030                1035

Ala Arg  Leu Asp Arg Val Lys  Asn Leu Ser Gly Leu  Val Glu Trp
    1040                1045                1050

Tyr Gly  Lys Asn Thr Arg Leu  Arg Glu Leu Ala Asn  Leu Val Val
    1055                1060                1065

Val Gly  Gly Asp Arg Arg Lys  Glu Ser Lys Asp Asn  Glu Glu Lys
    1070                1075                1080

Ala Glu  Met Lys Lys Met Tyr  Asp Leu Ile Glu Glu  Tyr Lys Leu
    1085                1090                1095

Asn Gly  Gln Phe Arg Trp Ile  Ser Ser Gln Met Asp  Arg Val Arg
    1100                1105                1110

Asn Gly  Glu Leu Tyr Arg Tyr  Ile Cys Asp Thr Lys  Gly Ala Phe
    1115                1120                1125

Val Gln  Pro Ala Leu Tyr Glu  Ala Phe Gly Leu Thr  Val Val Glu
    1130                1135                1140

Ala Met  Thr Cys Gly Leu Pro  Thr Phe Ala Thr Cys  Lys Gly Gly
    1145                1150                1155

Pro Ala  Glu Ile Ile Val His  Gly Lys Ser Gly Phe  His Ile Asp
    1160                1165                1170

Pro Tyr  His Gly Asp Gln Ala  Ala Asp Thr Leu Ala  Asp Phe Phe
    1175                1180                1185

Thr Lys  Cys Lys Glu Asp Pro  Ser His Trp Asp Glu  Ile Ser Lys
    1190                1195                1200

Gly Gly  Leu Gln Arg Ile Glu  Glu Lys Tyr Thr Trp  Gln Ile Tyr
    1205                1210                1215

Ser Gln  Arg Leu Leu Thr Leu  Thr Gly Val Tyr Gly  Phe Trp Lys
    1220                1225                1230

His Val  Ser Asn Leu Asp Arg  Leu Glu Ala Arg Arg  Tyr Leu Glu
    1235                1240                1245

Met Phe  Tyr Ala Leu Lys Tyr  Arg Pro Leu Ala Gln  Ala Val Pro
    1250                1255                1260

Leu Ala  Gln Asp Asp Trp Thr
    1265                1270


<210> SEQ ID NO 10
<211> LENGTH: 1272
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic
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<400> SEQUENCE: 10

```
Met Asp Ser Gly Tyr Ser Ser Ser Tyr Ala Ala Ala Ala Gly Met His
1               5                  10                  15

Val Val Ile Cys Pro Trp Leu Ala Phe Gly His Leu Leu Pro Cys Leu
            20                  25                  30

Asp Leu Ala Gln Arg Leu Ala Ser Arg Gly His Arg Val Ser Phe Val
        35                  40                  45

Ser Thr Pro Arg Asn Ile Ser Arg Leu Pro Pro Val Arg Pro Ala Leu
    50                  55                  60

Ala Pro Leu Val Ala Phe Val Ala Leu Pro Leu Pro Arg Val Glu Gly
65                  70                  75                  80

Leu Pro Asp Gly Ala Glu Ser Thr Asn Asp Val Pro His Asp Arg Pro
                85                  90                  95

Asp Met Val Glu Leu His Arg Arg Ala Phe Asp Gly Leu Ala Ala Pro
            100                 105                 110

Phe Ser Glu Phe Leu Gly Thr Ala Cys Ala Asp Trp Val Ile Val Asp
        115                 120                 125

Val Phe His His Trp Ala Ala Ala Ala Ala Leu Glu His Lys Val Pro
    130                 135                 140

Cys Ala Met Met Leu Leu Gly Ser Ala His Met Ile Ala Ser Ile Ala
145                 150                 155                 160

Asp Arg Arg Leu Glu Arg Ala Glu Thr Glu Ser Pro Ala Ala Ala Gly
                165                 170                 175

Gln Gly Arg Pro Ala Ala Ala Pro Thr Phe Glu Val Ala Arg Met Lys
            180                 185                 190

Leu Ile Arg Thr Lys Gly Ser Ser Gly Met Ser Leu Ala Glu Arg Phe
        195                 200                 205

Ser Leu Thr Leu Ser Arg Ser Ser Leu Val Val Gly Arg Ser Cys Val
    210                 215                 220

Glu Phe Glu Pro Glu Thr Val Pro Leu Leu Ser Thr Leu Arg Gly Lys
225                 230                 235                 240

Pro Ile Thr Phe Leu Gly Leu Met Pro Pro Leu His Glu Gly Arg Arg
                245                 250                 255

Glu Asp Gly Glu Asp Ala Thr Val Arg Trp Leu Asp Ala Gln Pro Ala
            260                 265                 270

Lys Ser Val Val Tyr Val Ala Leu Gly Ser Glu Val Pro Leu Gly Val
        275                 280                 285

Glu Lys Val His Glu Leu Ala Leu Gly Leu Glu Leu Ala Gly Thr Arg
    290                 295                 300

Phe Leu Trp Ala Leu Arg Lys Pro Thr Gly Val Ser Asp Ala Asp Leu
305                 310                 315                 320

Leu Pro Ala Gly Phe Glu Glu Arg Thr Arg Gly Arg Gly Val Val Ala
                325                 330                 335

Thr Arg Trp Val Pro Gln Met Ser Ile Leu Ala His Ala Ala Val Gly
            340                 345                 350

Ala Phe Leu Thr His Cys Gly Trp Asn Ser Thr Ile Glu Gly Leu Met
        355                 360                 365

Phe Gly His Pro Leu Ile Met Leu Pro Ile Phe Gly Asp Gln Gly Pro
    370                 375                 380

Asn Ala Arg Leu Ile Glu Ala Lys Asn Ala Gly Leu Gln Val Ala Arg
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385                 390                 395                 400

Asn Asp Gly Asp Gly Ser Phe Asp Arg Glu Gly Val Ala Ala Ala Ile
                405                 410                 415

Arg Ala Val Ala Val Glu Glu Glu Ser Ser Lys Val Phe Gln Ala Lys
            420                 425                 430

Ala Lys Lys Leu Gln Glu Ile Val Ala Asp Met Ala Cys His Glu Arg
        435                 440                 445

Tyr Ile Asp Gly Phe Ile Gln Gln Leu Arg Ser Tyr Lys Asp Gly Ser
    450                 455                 460

Gly Ala Asn Ala Glu Arg Met Ile Thr Arg Val His Ser Gln Arg Glu
465                 470                 475                 480

Arg Leu Asn Glu Thr Leu Val Ser Glu Arg Asn Glu Val Leu Ala Leu
                485                 490                 495

Leu Ser Arg Val Glu Ala Lys Gly Lys Gly Ile Leu Gln Gln Asn Gln
            500                 505                 510

Ile Ile Ala Glu Phe Glu Ala Leu Pro Glu Gln Thr Arg Lys Lys Leu
        515                 520                 525

Glu Gly Gly Pro Phe Phe Asp Leu Leu Lys Ser Thr Gln Glu Ala Ile
    530                 535                 540

Val Leu Pro Pro Trp Val Ala Leu Ala Val Arg Pro Arg Pro Gly Val
545                 550                 555                 560

Trp Glu Tyr Leu Arg Val Asn Leu His Ala Leu Val Val Glu Glu Leu
                565                 570                 575

Gln Pro Ala Glu Phe Leu His Phe Lys Glu Glu Leu Val Asp Gly Val
            580                 585                 590

Lys Asn Gly Asn Phe Thr Leu Glu Leu Asp Phe Glu Pro Phe Asn Ala
        595                 600                 605

Ser Ile Pro Arg Pro Thr Leu His Lys Tyr Ile Gly Asn Gly Val Asp
    610                 615                 620

Phe Leu Asn Arg His Leu Ser Ala Lys Leu Phe His Asp Lys Glu Ser
625                 630                 635                 640

Leu Leu Pro Leu Leu Lys Phe Leu Arg Leu His Ser His Gln Gly Lys
                645                 650                 655

Asn Leu Met Leu Ser Glu Lys Ile Gln Asn Leu Asn Thr Leu Gln His
            660                 665                 670

Thr Leu Arg Lys Ala Glu Glu Tyr Leu Ala Glu Leu Lys Ser Glu Thr
        675                 680                 685

Leu Tyr Glu Glu Phe Glu Ala Lys Phe Glu Glu Ile Gly Leu Glu Arg
    690                 695                 700

Gly Trp Gly Asp Asn Ala Glu Arg Val Leu Asp Met Ile Arg Leu Leu
705                 710                 715                 720

Leu Asp Leu Leu Glu Ala Pro Asp Pro Cys Thr Leu Glu Thr Phe Leu
                725                 730                 735

Gly Arg Val Pro Met Val Phe Asn Val Val Ile Leu Ser Pro His Gly
            740                 745                 750

Tyr Phe Ala Gln Asp Asn Val Leu Gly Tyr Pro Asp Thr Gly Gly Gln
        755                 760                 765

Val Val Tyr Ile Leu Asp Gln Val Arg Ala Leu Glu Ile Glu Met Leu
    770                 775                 780

Gln Arg Ile Lys Gln Gln Gly Leu Asn Ile Lys Pro Arg Ile Leu Ile
785                 790                 795                 800
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Leu Thr Arg Leu Leu Pro Asp Ala Val Gly Thr Thr Cys Gly Glu Arg
               805                 810                 815

Leu Glu Arg Val Tyr Asp Ser Glu Tyr Cys Asp Ile Leu Arg Val Pro
           820                 825                 830

Phe Arg Thr Glu Lys Gly Ile Val Arg Lys Trp Ile Ser Arg Phe Glu
       835                 840                 845

Val Trp Pro Tyr Leu Glu Thr Tyr Thr Glu Asp Ala Ala Val Glu Leu
   850                 855                 860

Ser Lys Glu Leu Asn Gly Lys Pro Asp Leu Ile Ile Gly Asn Tyr Ser
865                 870                 875                 880

Asp Gly Asn Leu Val Ala Ser Leu Leu Ala His Lys Leu Gly Val Thr
               885                 890                 895

Gln Cys Thr Ile Ala His Ala Leu Glu Lys Thr Lys Tyr Pro Asp Ser
           900                 905                 910

Asp Ile Tyr Trp Lys Lys Leu Asp Asp Lys Tyr His Phe Ser Cys Gln
       915                 920                 925

Phe Thr Ala Asp Ile Phe Ala Met Asn His Thr Asp Phe Ile Ile Thr
   930                 935                 940

Ser Thr Phe Gln Glu Ile Ala Gly Ser Lys Glu Thr Val Gly Gln Tyr
945                 950                 955                 960

Glu Ser His Thr Ala Phe Thr Leu Pro Gly Leu Tyr Arg Val Val His
               965                 970                 975

Gly Ile Asp Val Phe Asp Pro Lys Phe Asn Ile Val Ser Pro Gly Ala
           980                 985                 990

Asp Met Ser Ile Tyr Phe Pro Tyr  Thr Glu Glu Lys Arg  Arg Leu Thr
       995                 1000                1005

Lys Phe  His Ser Glu Ile Glu  Glu Leu Leu Tyr Ser  Asp Val Glu
   1010                1015                1020

Asn Lys  Glu His Leu Cys Val  Leu Lys Asp Lys Lys  Lys Pro Ile
   1025                1030                1035

Leu Phe  Thr Met Ala Arg Leu  Asp Arg Val Lys Asn  Leu Ser Gly
   1040                1045                1050

Leu Val  Glu Trp Tyr Gly Lys  Asn Thr Arg Leu Arg  Glu Leu Ala
   1055                1060                1065

Asn Leu  Val Val Val Gly Gly  Asp Arg Arg Lys Glu  Ser Lys Asp
   1070                1075                1080

Asn Glu  Glu Lys Ala Glu Met  Lys Lys Met Tyr Asp  Leu Ile Glu
   1085                1090                1095

Glu Tyr  Lys Leu Asn Gly Gln  Phe Arg Trp Ile Ser  Ser Gln Met
   1100                1105                1110

Asp Arg  Val Arg Asn Gly Glu  Leu Tyr Arg Tyr Ile  Cys Asp Thr
   1115                1120                1125

Lys Gly  Ala Phe Val Gln Pro  Ala Leu Tyr Glu Ala  Phe Gly Leu
   1130                1135                1140

Thr Val  Val Glu Ala Met Thr  Cys Gly Leu Pro Thr  Phe Ala Thr
   1145                1150                1155

Cys Lys  Gly Gly Pro Ala Glu  Ile Ile Val His Gly  Lys Ser Gly
   1160                1165                1170

Phe His  Ile Asp Pro Tyr His  Gly Asp Gln Ala Ala  Asp Thr Leu
   1175                1180                1185
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Ala Asp  Phe Phe Thr Lys Cys  Lys Glu Asp Pro Ser  His Trp Asp
    1190                 1195                 1200

Glu Ile  Ser Lys Gly Gly Leu  Gln Arg Ile Glu Glu  Lys Tyr Thr
    1205                 1210                 1215

Trp Gln  Ile Tyr Ser Gln Arg  Leu Leu Thr Leu Thr  Gly Val Tyr
    1220                 1225                 1230

Gly Phe  Trp Lys His Val Ser  Asn Leu Asp Arg Leu  Glu Ala Arg
    1235                 1240                 1245

Arg Tyr  Leu Glu Met Phe Tyr  Ala Leu Lys Tyr Arg  Pro Leu Ala
    1250                 1255                 1260

Gln Ala  Val Pro Leu Ala Gln  Asp Asp
    1265                 1270


<210> SEQ ID NO 11
<211> LENGTH: 1269
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 11

Met Asp Gly Asn Ser Ser Ser Ser Pro Leu His Val Val Ile Cys Pro
1               5                   10                  15

Trp Leu Ala Leu Gly His Leu Leu Pro Cys Leu Asp Ile Ala Glu Arg
            20                  25                  30

Leu Ala Ser Arg Gly His Arg Val Ser Phe Val Ser Thr Pro Arg Asn
        35                  40                  45

Ile Ala Arg Leu Pro Pro Leu Arg Pro Ala Val Ala Pro Leu Val Asp
    50                  55                  60

Phe Val Ala Leu Pro Leu Pro His Val Asp Gly Leu Pro Glu Gly Ala
65                  70                  75                  80

Glu Ser Thr Asn Asp Val Pro Tyr Asp Lys Phe Glu Leu His Arg Lys
                85                  90                  95

Ala Phe Asp Gly Leu Ala Ala Pro Phe Ser Glu Phe Leu Arg Ala Ala
            100                 105                 110

Cys Ala Glu Gly Ala Gly Ser Arg Pro Asp Trp Leu Ile Val Asp Thr
        115                 120                 125

Phe His His Trp Ala Ala Ala Ala Ala Val Glu Asn Lys Val Pro Cys
    130                 135                 140

Val Met Leu Leu Leu Gly Ala Ala Thr Val Ile Ala Gly Phe Ala Arg
145                 150                 155                 160

Gly Val Ser Glu His Ala Ala Ala Ala Val Gly Lys Glu Arg Pro Ala
                165                 170                 175

Ala Glu Ala Pro Ser Phe Glu Thr Glu Arg Arg Lys Leu Met Thr Thr
            180                 185                 190

Gln Asn Ala Ser Gly Met Thr Val Ala Glu Arg Tyr Phe Leu Thr Leu
        195                 200                 205

Met Arg Ser Asp Leu Val Ala Ile Arg Ser Cys Ala Glu Trp Glu Pro
    210                 215                 220

Glu Ser Val Ala Ala Leu Thr Thr Leu Ala Gly Lys Pro Val Val Pro
225                 230                 235                 240

Leu Gly Leu Leu Pro Pro Ser Pro Glu Gly Gly Arg Gly Val Ser Lys
                245                 250                 255
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Glu Asp Ala Ala Val Arg Trp Leu Asp Ala Gln Pro Ala Lys Ser Val
            260                 265                 270

Val Tyr Val Ala Leu Gly Ser Glu Val Pro Leu Arg Ala Glu Gln Val
        275                 280                 285

His Glu Leu Ala Leu Gly Leu Glu Leu Ser Gly Ala Arg Phe Leu Trp
    290                 295                 300

Ala Leu Arg Lys Pro Thr Asp Ala Pro Asp Ala Ala Val Leu Pro Pro
305                 310                 315                 320

Gly Phe Glu Glu Arg Thr Arg Gly Arg Gly Leu Val Val Thr Gly Trp
                325                 330                 335

Val Pro Gln Ile Gly Val Leu Ala His Gly Ala Val Ala Ala Phe Leu
            340                 345                 350

Thr His Cys Gly Trp Asn Ser Thr Ile Glu Gly Leu Leu Phe Gly His
        355                 360                 365

Pro Leu Ile Met Leu Pro Ile Ser Ser Asp Gln Gly Pro Asn Ala Arg
    370                 375                 380

Leu Met Glu Gly Arg Lys Val Gly Met Gln Val Pro Arg Asp Glu Ser
385                 390                 395                 400

Asp Gly Ser Phe Arg Arg Glu Asp Val Ala Ala Thr Val Arg Ala Val
                405                 410                 415

Ala Val Glu Glu Asp Gly Arg Arg Val Phe Thr Ala Asn Ala Lys Lys
            420                 425                 430

Met Gln Glu Ile Val Ala Asp Gly Ala Cys His Glu Arg Cys Ile Asp
        435                 440                 445

Gly Phe Ile Gln Gln Leu Arg Ser Tyr Lys Ala Gly Ser Gly Ala Asn
    450                 455                 460

Ala Glu Arg Met Ile Thr Arg Val His Ser Gln Arg Glu Arg Leu Asn
465                 470                 475                 480

Glu Thr Leu Val Ser Glu Arg Asn Glu Val Leu Ala Leu Leu Ser Arg
                485                 490                 495

Val Glu Ala Lys Gly Lys Gly Ile Leu Gln Gln Asn Gln Ile Ile Ala
            500                 505                 510

Glu Phe Glu Ala Leu Pro Glu Gln Thr Arg Lys Lys Leu Glu Gly Gly
        515                 520                 525

Pro Phe Phe Asp Leu Leu Lys Ser Thr Gln Glu Ala Ile Val Leu Pro
    530                 535                 540

Pro Trp Val Ala Leu Ala Val Arg Pro Arg Pro Gly Val Trp Glu Tyr
545                 550                 555                 560

Leu Arg Val Asn Leu His Ala Leu Val Val Glu Glu Leu Gln Pro Ala
                565                 570                 575

Glu Phe Leu His Phe Lys Glu Glu Leu Val Asp Gly Val Lys Asn Gly
            580                 585                 590

Asn Phe Thr Leu Glu Leu Asp Phe Glu Pro Phe Asn Ala Ser Ile Pro
        595                 600                 605

Arg Pro Thr Leu His Lys Tyr Ile Gly Asn Gly Val Asp Phe Leu Asn
    610                 615                 620

Arg His Leu Ser Ala Lys Leu Phe His Asp Lys Glu Ser Leu Leu Pro
625                 630                 635                 640

Leu Leu Lys Phe Leu Arg Leu His Ser His Gln Gly Lys Asn Leu Met
                645                 650                 655

Leu Ser Glu Lys Ile Gln Asn Leu Asn Thr Leu Gln His Thr Leu Arg
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           660                 665                 670

Lys Ala Glu Glu Tyr Leu Ala Glu Leu Lys Ser Glu Thr Leu Tyr Glu
        675                 680                 685

Glu Phe Glu Ala Lys Phe Glu Glu Ile Gly Leu Glu Arg Gly Trp Gly
    690                 695                 700

Asp Asn Ala Glu Arg Val Leu Asp Met Ile Arg Leu Leu Leu Asp Leu
705                 710                 715                 720

Leu Glu Ala Pro Asp Pro Cys Thr Leu Glu Thr Phe Leu Gly Arg Val
                725                 730                 735

Pro Met Val Phe Asn Val Val Ile Leu Ser Pro His Gly Tyr Phe Ala
            740                 745                 750

Gln Asp Asn Val Leu Gly Tyr Pro Asp Thr Gly Gly Gln Val Val Tyr
        755                 760                 765

Ile Leu Asp Gln Val Arg Ala Leu Glu Ile Glu Met Leu Gln Arg Ile
    770                 775                 780

Lys Gln Gln Gly Leu Asn Ile Lys Pro Arg Ile Leu Ile Leu Thr Arg
785                 790                 795                 800

Leu Leu Pro Asp Ala Val Gly Thr Thr Cys Gly Glu Arg Leu Glu Arg
                805                 810                 815

Val Tyr Asp Ser Glu Tyr Cys Asp Ile Leu Arg Val Pro Phe Arg Thr
            820                 825                 830

Glu Lys Gly Ile Val Arg Lys Trp Ile Ser Arg Phe Glu Val Trp Pro
        835                 840                 845

Tyr Leu Glu Thr Tyr Thr Glu Asp Ala Ala Val Glu Leu Ser Lys Glu
    850                 855                 860

Leu Asn Gly Lys Pro Asp Leu Ile Ile Gly Asn Tyr Ser Asp Gly Asn
865                 870                 875                 880

Leu Val Ala Ser Leu Leu Ala His Lys Leu Gly Val Thr Gln Cys Thr
                885                 890                 895

Ile Ala His Ala Leu Glu Lys Thr Lys Tyr Pro Asp Ser Asp Ile Tyr
            900                 905                 910

Trp Lys Lys Leu Asp Asp Lys Tyr His Phe Ser Cys Gln Phe Thr Ala
        915                 920                 925

Asp Ile Phe Ala Met Asn His Thr Asp Phe Ile Ile Thr Ser Thr Phe
    930                 935                 940

Gln Glu Ile Ala Gly Ser Lys Glu Thr Val Gly Gln Tyr Glu Ser His
945                 950                 955                 960

Thr Ala Phe Thr Leu Pro Gly Leu Tyr Arg Val Val His Gly Ile Asp
                965                 970                 975

Val Phe Asp Pro Lys Phe Asn Ile Val Ser Pro Gly Ala Asp Met Ser
            980                 985                 990

Ile Tyr Phe Pro Tyr Thr Glu Glu  Lys Arg Arg Leu Thr  Lys Phe His
        995                 1000                1005

Ser Glu  Ile Glu Glu Leu Leu  Tyr Ser Asp Val Glu  Asn Lys Glu
    1010                1015                1020

His Leu  Cys Val Leu Lys Asp  Lys Lys Lys Pro Ile  Leu Phe Thr
    1025                1030                1035

Met Ala  Arg Leu Asp Arg Val  Lys Asn Leu Ser Gly  Leu Val Glu
    1040                1045                1050

Trp Tyr  Gly Lys Asn Thr Arg  Leu Arg Glu Leu Ala  Asn Leu Val
    1055                1060                1065
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Val Val  Gly Gly Asp Arg Arg  Lys Glu Ser Lys Asp  Asn Glu Glu
    1070                 1075                 1080

Lys Ala  Glu Met Lys Lys Met  Tyr Asp Leu Ile Glu  Glu Tyr Lys
    1085                 1090                 1095

Leu Asn  Gly Gln Phe Arg Trp  Ile Ser Ser Gln Met  Asp Arg Val
    1100                 1105                 1110

Arg Asn  Gly Glu Leu Tyr Arg  Tyr Ile Cys Asp Thr  Lys Gly Ala
    1115                 1120                 1125

Phe Val  Gln Pro Ala Leu Tyr  Glu Ala Phe Gly Leu  Thr Val Val
    1130                 1135                 1140

Glu Ala  Met Thr Cys Gly Leu  Pro Thr Phe Ala Thr  Cys Lys Gly
    1145                 1150                 1155

Gly Pro  Ala Glu Ile Ile Val  His Gly Lys Ser Gly  Phe His Ile
    1160                 1165                 1170

Asp Pro  Tyr His Gly Asp Gln  Ala Ala Asp Thr Leu  Ala Asp Phe
    1175                 1180                 1185

Phe Thr  Lys Cys Lys Glu Asp  Pro Ser His Trp Asp  Glu Ile Ser
    1190                 1195                 1200

Lys Gly  Gly Leu Gln Arg Ile  Glu Glu Lys Tyr Thr  Trp Gln Ile
    1205                 1210                 1215

Tyr Ser  Gln Arg Leu Leu Thr  Leu Thr Gly Val Tyr  Gly Phe Trp
    1220                 1225                 1230

Lys His  Val Ser Asn Leu Asp  Arg Leu Glu Ala Arg  Arg Tyr Leu
    1235                 1240                 1245

Glu Met  Phe Tyr Ala Leu Lys  Tyr Arg Pro Leu Ala  Gln Ala Val
    1250                 1255                 1260

Pro Leu  Ala Gln Asp Asp
    1265
```

<210> SEQ ID NO 12
<211> LENGTH: 839
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 12

```
Met Thr Gln Leu Asp Val Glu Ser Leu Ile Gln Glu Leu Thr Leu Asn
1               5                  10                  15

Glu Lys Val Gln Leu Leu Ser Gly Ser Asp Phe Trp His Thr Thr Pro
            20                  25                  30

Val Arg Arg Leu Gly Ile Pro Lys Met Arg Leu Ser Asp Gly Pro Asn
        35                  40                  45

Gly Val Arg Gly Thr Lys Phe Phe Asn Gly Val Pro Thr Ala Cys Phe
    50                  55                  60

Pro Cys Gly Thr Gly Leu Gly Ala Thr Phe Asp Lys Glu Leu Leu Lys
65                  70                  75                  80

Glu Ala Gly Ser Leu Met Ala Asp Glu Ala Lys Ala Lys Ala Ala Ser
                85                  90                  95

Val Val Leu Gly Pro Thr Ala Asn Ile Ala Arg Gly Pro Asn Gly Gly
            100                 105                 110

Arg Gly Phe Glu Ser Phe Gly Glu Asp Pro Val Val Asn Gly Leu Ser
        115                 120                 125
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```
Ser Ala Ala Met Ile Asn Gly Leu Gln Gly Lys Tyr Ile Ala Ala Thr
    130                 135                 140

Met Lys His Tyr Val Cys Asn Asp Leu Glu Met Asp Arg Asn Cys Ile
145                 150                 155                 160

Asp Ala Gln Val Ser His Arg Ala Leu Arg Glu Val Tyr Leu Leu Pro
                165                 170                 175

Phe Gln Ile Ala Val Arg Asp Ala Asn Pro Arg Ala Ile Met Thr Ala
            180                 185                 190

Tyr Asn Lys Ala Asn Gly Glu His Val Ser Gln Ser Lys Phe Leu Leu
        195                 200                 205

Asp Glu Val Leu Arg Lys Glu Trp Gly Trp Asp Gly Leu Leu Met Ser
    210                 215                 220

Asp Trp Phe Gly Val Tyr Asp Ala Lys Ser Ser Ile Thr Asn Gly Leu
225                 230                 235                 240

Asp Leu Glu Met Pro Gly Pro Pro Gln Cys Arg Val His Ser Ala Thr
                245                 250                 255

Asp His Ala Ile Asn Ser Gly Glu Ile His Ile Asn Asp Val Asp Glu
            260                 265                 270

Arg Val Arg Ser Leu Leu Ser Leu Ile Asn Tyr Cys His Gln Ser Gly
        275                 280                 285

Val Thr Glu Glu Asp Pro Glu Thr Ser Asp Asn Asn Thr Pro Glu Thr
    290                 295                 300

Ile Glu Lys Leu Arg Lys Ile Ser Arg Glu Ser Ile Val Leu Leu Lys
305                 310                 315                 320

Asp Asp Asp Arg Asn Arg Ser Ile Leu Pro Leu Lys Lys Ser Asp Lys
                325                 330                 335

Ile Ala Val Ile Gly Asn Asn Ala Lys Gln Ala Ala Tyr Cys Gly Gly
            340                 345                 350

Gly Ser Ala Ser Val Leu Ser Tyr His Thr Thr Thr Pro Phe Asp Ser
        355                 360                 365

Ile Lys Ser Arg Leu Glu Asp Ser Asn Thr Pro Ala Tyr Thr Ile Gly
    370                 375                 380

Ala Asp Ala Tyr Lys Asn Leu Pro Pro Leu Gly Pro Gln Met Thr Asp
385                 390                 395                 400

Ser Asp Gly Lys Pro Gly Phe Asp Ala Lys Phe Phe Val Gly Ser Pro
                405                 410                 415

Thr Ser Lys Asp Arg Lys Leu Ile Asp His Phe Gln Leu Thr Asn Ser
            420                 425                 430

Gln Val Phe Leu Val Asp Tyr Tyr Asn Glu Gln Ile Pro Glu Asn Lys
        435                 440                 445

Glu Phe Tyr Val Asp Val Glu Gly Gln Phe Ile Pro Glu Glu Asp Gly
    450                 455                 460

Thr Tyr Asn Phe Gly Leu Thr Val Phe Gly Thr Gly Arg Leu Phe Val
465                 470                 475                 480

Asp Asp Lys Leu Val Ser Asp Ser Ser Gln Asn Gln Thr Pro Gly Asp
                485                 490                 495

Ser Phe Phe Gly Leu Ala Ala Gln Glu Val Ile Gly Ser Ile His Leu
            500                 505                 510

Val Lys Gly Lys Ala Tyr Lys Ile Lys Val Leu Tyr Gly Ser Ser Val
        515                 520                 525
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Thr Arg Thr Tyr Glu Ile Ala Ala Ser Val Ala Phe Glu Gly Gly Ala
    530                 535                 540

Phe Thr Phe Gly Ala Ala Lys Gln Arg Asn Glu Asp Glu Glu Ile Ala
545                 550                 555                 560

Arg Ala Val Glu Ile Ala Lys Ala Asn Asp Lys Val Val Leu Cys Ile
                565                 570                 575

Gly Leu Asn Gln Asp Phe Glu Ser Glu Gly Phe Asp Arg Pro Asp Ile
            580                 585                 590

Lys Ile Pro Gly Ala Thr Asn Lys Met Val Ser Ala Val Leu Lys Ala
        595                 600                 605

Asn Pro Asn Thr Val Ile Val Asn Gln Thr Gly Thr Pro Val Glu Met
    610                 615                 620

Pro Trp Ala Ser Asp Ala Pro Val Ile Leu Gln Ala Trp Phe Gly Gly
625                 630                 635                 640

Ser Glu Ala Gly Thr Ala Ile Ala Asp Val Leu Phe Gly Asp Tyr Asn
                645                 650                 655

Pro Ser Gly Lys Leu Thr Val Thr Phe Pro Leu Arg Phe Glu Asp Asn
            660                 665                 670

Pro Ala Tyr Leu Asn Phe Gln Ser Asn Lys Gln Ala Cys Trp Tyr Gly
        675                 680                 685

Glu Asp Val Tyr Val Gly Tyr Arg Tyr Tyr Glu Thr Ile Asp Arg Pro
    690                 695                 700

Val Leu Phe Pro Phe Gly His Gly Leu Ser Phe Thr Glu Phe Asp Phe
705                 710                 715                 720

Thr Asp Met Phe Val Arg Leu Glu Glu Glu Asn Leu Glu Val Glu Val
                725                 730                 735

Val Val Arg Asn Thr Gly Lys Tyr Asp Gly Ala Glu Val Val Gln Leu
            740                 745                 750

Tyr Val Ala Pro Val Ser Pro Ser Leu Lys Arg Pro Ile Lys Glu Leu
        755                 760                 765

Lys Glu Tyr Ala Lys Ile Phe Leu Ala Ser Gly Glu Ala Lys Thr Val
    770                 775                 780

His Leu Ser Val Pro Ile Lys Tyr Ala Thr Ser Phe Phe Asp Glu Tyr
785                 790                 795                 800

Gln Lys Lys Trp Cys Ser Glu Lys Gly Glu Tyr Thr Ile Leu Leu Gly
                805                 810                 815

Ser Ser Ser Ala Asp Ile Lys Val Ser Gln Ser Ile Thr Leu Glu Lys
            820                 825                 830

Thr Thr Phe Trp Lys Gly Leu
        835


<210> SEQ ID NO 13
<211> LENGTH: 346
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 13

Met Lys Ser Gln Leu Ile Phe Met Ala Leu Ala Ser Leu Val Ala Ser
1               5                   10                  15

Ala Pro Leu Glu His Gln Gln Gln His His Lys His Glu Lys Arg Ala
            20                  25                  30
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```
Val Val Thr Gln Thr Val Thr Val Ala Ala Gly Gln Thr Ala Ala Ala
        35                  40                  45

Gly Ser Ala Gln Ala Val Val Thr Ser Ser Ala Ala Pro Ala Ser Val
    50                  55                  60

Ala Ser Ser Ala Ala Ala Ser Ala Ser Ser Ser Ser Ser Ser Tyr Thr
65                  70                  75                  80

Ser Gly Ala Ser Gly Asp Leu Ser Ser Phe Lys Asp Gly Thr Ile Lys
                85                  90                  95

Cys Ser Glu Phe Pro Ser Gly Asp Gly Val Val Ser Val Ser Trp Leu
            100                 105                 110

Gly Phe Gly Gly Trp Ser Ser Ile Met Asn Leu Gln Gly Gly Thr Ser
        115                 120                 125

Glu Ser Cys Glu Asn Gly Tyr Tyr Cys Ser Tyr Ala Cys Glu Ala Gly
    130                 135                 140

Tyr Ser Lys Thr Gln Trp Pro Ser Asn Gln Pro Ser Asp Gly Arg Ser
145                 150                 155                 160

Val Gly Gly Leu Leu Cys Lys Asp Gly Leu Leu Tyr Arg Ser Asn Thr
                165                 170                 175

Ala Phe Asp Thr Leu Cys Val Pro Gly Lys Gly Thr Ala Ser Val Glu
            180                 185                 190

Asn Asn Val Ser Lys Gly Ile Ser Ile Cys Arg Thr Asp Tyr Pro Gly
        195                 200                 205

Ser Glu Asn Met Cys Val Pro Thr Trp Val Asp Ala Gly Asn Ser Asn
    210                 215                 220

Thr Leu Thr Val Val Asp Glu Asp Asn Tyr Tyr Glu Trp Gln Gly Leu
225                 230                 235                 240

Lys Thr Ser Ala Gln Tyr Tyr Val Asn Asn Ala Gly Val Ser Val Glu
                245                 250                 255

Asp Gly Cys Ile Trp Gly Asp Glu Ser Ser Gly Val Gly Asn Trp Ala
            260                 265                 270

Pro Leu Val Leu Gly Ala Gly Ser Thr Gly Gly Leu Thr Tyr Leu Ser
        275                 280                 285

Leu Ile Pro Asn Pro Asn Asn Lys Lys Ala Pro Asn Phe Asn Val Lys
    290                 295                 300

Ile Val Ala Thr Asp Gly Ser Ser Ile Asn Gly Asp Cys Lys Tyr Glu
305                 310                 315                 320

Asn Gly Ile Phe Val Gly Ser Ser Thr Asp Gly Cys Thr Val Thr Val
                325                 330                 335

Thr Ser Gly Ser Ala Lys Leu Val Phe Tyr
            340                 345


<210> SEQ ID NO 14
<211> LENGTH: 348
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 14

Met Gln Val Lys Ser Ile Val Asn Leu Leu Leu Ala Cys Ser Leu Ala
1               5                   10                  15

Val Ala Arg Pro Leu Glu His Ala His His Gln His Asp Lys Arg Gly
            20                  25                  30
```

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```
Val Val Val Val Thr Lys Thr Ile Val Val Asp Gly Ser Thr Val Glu
        35                  40                  45

Ala Thr Ala Ala Ala Gln Val Gln Glu His Ala Glu Thr Phe Ala Glu
    50                  55                  60

Ser Thr Pro Ser Ala Val Val Ser Ser Ser Ser Ala Pro Ser Ser Ala
65                  70                  75                  80

Ser Ser Ala Ser Ala Pro Ala Ser Ser Gly Ser Phe Ser Ala Gly Thr
                85                  90                  95

Lys Gly Val Thr Tyr Ser Pro Tyr Gln Ala Gly Gly Gly Cys Lys Thr
            100                 105                 110

Ala Glu Glu Val Ala Ser Asp Leu Ser Gln Leu Thr Gly Tyr Glu Ile
        115                 120                 125

Ile Arg Leu Tyr Gly Val Asp Cys Asn Gln Val Glu Asn Val Phe Lys
    130                 135                 140

Ala Lys Ala Pro Gly Gln Lys Leu Phe Leu Gly Ile Phe Phe Val Asp
145                 150                 155                 160

Ala Ile Glu Ser Gly Val Ser Ala Ile Ala Ser Ala Val Lys Ser Tyr
                165                 170                 175

Gly Ser Trp Asp Asp Val His Thr Val Ser Val Gly Asn Glu Leu Val
            180                 185                 190

Asn Asn Gly Glu Ala Thr Val Ser Gln Ile Gly Gln Tyr Val Ser Thr
        195                 200                 205

Ala Lys Ser Ala Leu Arg Ser Ala Gly Phe Thr Gly Pro Val Leu Ser
    210                 215                 220

Val Asp Thr Phe Ile Ala Val Ile Asn Asn Pro Gly Leu Cys Asp Phe
225                 230                 235                 240

Ala Asp Glu Tyr Val Ala Val Asn Ala His Ala Phe Phe Asp Gly Gly
                245                 250                 255

Ile Ala Ala Ser Gly Ala Gly Asp Trp Ala Ala Glu Gln Ile Gln Arg
            260                 265                 270

Val Ser Ser Ala Cys Gly Gly Lys Asp Val Leu Ile Val Glu Ser Gly
        275                 280                 285

Trp Pro Ser Lys Gly Asp Thr Asn Gly Ala Ala Val Pro Ser Lys Ser
    290                 295                 300

Asn Gln Gln Ala Ala Val Gln Ser Leu Gly Gln Lys Ile Gly Ser Ser
305                 310                 315                 320

Cys Ile Ala Phe Asn Ala Phe Asn Asp Tyr Trp Lys Ala Asp Gly Pro
                325                 330                 335

Phe Asn Ala Glu Lys Tyr Trp Gly Ile Leu Asp Ser
            340                 345


<210> SEQ ID NO 15
<211> LENGTH: 464
<212> TYPE: PRT
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 15

Met Leu Ser Thr Ile Leu Asn Ile Phe Ile Leu Leu Leu Phe Ile Gln
1               5                   10                  15

Ala Ser Leu Gln Ala Pro Ile Pro Val Val Thr Lys Tyr Val Thr Glu
            20                  25                  30
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```
Gly Ile Ala Val Val Thr Glu Thr Asn Val Arg Val Val Thr Lys Thr
        35                  40                  45

Ile Pro Ile Val Gln Val Leu Ile Ser Asp Gly Ala Thr Tyr Thr His
    50                  55                  60

Thr Leu Thr Thr Val Ser Thr Ala Glu Glu Asn Gly Asn Phe Gln Pro
65                  70                  75                  80

Ile Thr Thr Thr Ser Ile Val Asn Lys Glu Val Val Val Pro Thr Ser
                85                  90                  95

Val Thr Pro Asn Thr Gln Gln Thr Arg Pro Thr Gln Val Asp Thr Thr
            100                 105                 110

Gln Asn Asn Ala Asp Thr Pro Ala Ala Pro Thr Pro Ser Pro Thr Thr
        115                 120                 125

Ser Ser Asn Asn Gly Val Phe Thr Thr Tyr Ser Thr Thr Arg Ser Val
    130                 135                 140

Val Thr Ser Val Val Val Val Gly Pro Asp Gly Ser Pro Ile Glu Asn
145                 150                 155                 160

Thr Gly Gln Thr Ala Asn Pro Thr Thr Thr Ala Pro Thr Thr Ser Thr
                165                 170                 175

Thr Ala Ala Arg Thr Thr Ser Ser Thr Ser Thr Thr Pro Thr Ala Ser
            180                 185                 190

Ser Thr Pro Gly Gly Asn His Pro Arg Ser Ile Val Tyr Ser Pro Tyr
        195                 200                 205

Ser Asp Ser Ser Gln Cys Lys Asp Ala Thr Thr Ile Glu Thr Asp Leu
    210                 215                 220

Glu Phe Ile Ala Ser Lys Gly Ile Ser Ala Val Arg Ile Tyr Gly Asn
225                 230                 235                 240

Asp Cys Asn Tyr Leu Thr Val Val Leu Pro Lys Cys Ala Ser Leu Gly
                245                 250                 255

Leu Lys Val Asn Gln Gly Phe Trp Ile Gly Pro Ser Gly Val Asp Ser
            260                 265                 270

Ile Asp Asp Ala Val Gln Glu Phe Ile Gln Ala Val Asn Gly Asn Asn
        275                 280                 285

Gly Phe Asn Trp Asp Leu Phe Glu Leu Ile Thr Val Gly Asn Glu Ala
    290                 295                 300

Ile Ser Ala Gly Tyr Val Ser Ala Ser Ser Leu Ile Ser Lys Ile Lys
305                 310                 315                 320

Glu Val Ser Ser Ile Leu Ser Ser Ala Gly Tyr Thr Gly Pro Ile Thr
                325                 330                 335

Thr Ala Glu Pro Pro Asn Val Tyr Glu Asp Tyr Gly Asp Leu Cys Ser
            340                 345                 350

Thr Asp Val Met Ser Ile Val Gly Val Asn Ala His Ser Tyr Phe Asn
        355                 360                 365

Thr Leu Phe Ala Ala Ser Asp Ser Gly Ser Phe Val Lys Ser Gln Ile
    370                 375                 380

Glu Val Val Gln Lys Ala Cys Ser Arg Ser Asp Ile Thr Ile Ile Glu
385                 390                 395                 400

Thr Gly Tyr Pro Ser Gln Gly Ala Thr Asn Gly Lys Asn Val Pro Ser
                405                 410                 415

Lys Glu Asn Gln Lys Thr Ala Ile Phe Ser Ile Phe Glu Val Val Gly
            420                 425                 430

Thr Asp Val Thr Ile Leu Ser Thr Tyr Asp Asp Leu Trp Lys Asp Pro
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        435                 440                 445

Gly Pro Tyr Gly Ile Glu Gln Phe Phe Gly Ala Ile Asp Leu Phe Ser
    450                 455                 460
```

<210> SEQ ID NO 16
<211> LENGTH: 1377
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 16

```
atggagaata agacagaaac aaccgtaaga cggaggcgga ggattatctt gttccctgta     60

ccatttcagg gccatattaa tccgatcctc caattagcaa acgtcctcta ctccaaggga    120

ttttcaataa caatcttcca tactaacttt aacaagccta aaacgagtaa ttatcctcac    180

tttacattca ggttcattct agacaacgac cctcaggatg agcgtatctc aaatttacct    240

acgcatggcc ccttggcagg tatgcgaata ccaataatca atgagcatgg agccgatgaa    300

ctccgtcgcg agttagagct tctcatgctc gcaagtgagg aagacgagga agtttcgtgc    360

ctaataactg atgcgctttg gtacttcgcc caatcagtcg cagactcact gaatctacgc    420

cgtttggtcc ttatgacaag ttcattattc aactttcacg cacatgtatc actgccgcaa    480

tttgacgagt tgggttacct ggacccggat gacaaaacgc gattggagga acaagcgtcg    540

ggcttcccca tgctgaaagt caaagatatt aagagcgctt atagtaattg gcaaattctg    600

aaagaaattc tcggaaaaat gataaagcaa accaaagcgt cctctggagt aatctggaac    660

tccttcaagg agttagagga atctgaactt gaaacggtca tcagagaaat ccccgctccc    720

tcgttcttaa ttccactacc caagcacctt actgcaagta gcagttccct cctagatcat    780

gaccgaaccg tgtttcagtg gctggatcag caacccccgt cgtcagttct atatgtaagc    840

tttgggagta cttcggaagt ggatgaaaag gacttcttag agattgcgcg agggctcgtg    900

gatagcaaac agagcttcct gtgggtagtg agaccgggat tcgttaaggg ctcgacgtgg    960

gtcgagccgt tgccagatgg ttttctaggg gagagaggga gaatcgtgaa atgggttcca   1020

cagcaagagg ttttggctca cggagctata ggggcctttt ggacccactc tggttggaat   1080

tctactcttg aaagtgtctg tgaaggcgtt ccaatgatat tttctgattt tgggcttgac   1140

cagcctctaa acgctcgcta tatgtctgat gtgttgaagg ttggcgtgta cctggagaat   1200

ggttgggaaa ggggggaaat tgccaacgcc atacgccggg taatggtgga cgaggaaggt   1260

gagtacatac gtcagaacgc tcgggtttta aaacaaaaag cggacgtcag ccttatgaag   1320

ggaggtagct cctatgaatc cctagaatcc ttggtaagct atatatcttc gttataa      1377
```

<210> SEQ ID NO 17
<211> LENGTH: 1377
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 17

```
atggagaata agacagaaac aaccgtaaga cggaggcgga ggattatctt gttccctgta     60

ccatttcagg gccatattaa tccgatcctc caattagcaa acgtcctcta ctccaaggga    120

ttttcaataa caatcttcca tactaacttt aacaagccta aaacgagtaa ttatcctcac    180
```

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tttacattca ggttcattct agacaacgac cctcaggatg agcgtatctc aaatttacct 240

acgcatggcc ccttggcagg tatgcgaata ccaataatca atgagcatgg agccgatgaa 300

ctccgtcgcg agttagagct tctcatgctc gcaagtgagg aagacgagga agtttcgtgc 360

ctaataactg atgcgctttg gtacttcgcc caatcagtcg cagactcact gaatctacgc 420

cgtttggtcc ttatgacaag ttcattattc aactttcacg cacatgtatc actgccgcaa 480

tttgacgagt tgggttacct ggacccggat gacaaaacgc gattggagga acaagcgtcg 540

ggcttcccca tgctgaaagt caaagatatt aagagcgctt atagtaattg gcaaattgcg 600

aaagaaattc tcggaaaaat gataaagcaa accaaagcgt cctctggagt aatctggaac 660

tccttcaagg agttagagga atctgaactt gaaacggtca tcagagaaat ccccgctccc 720

tcgttcttaa ttccactacc caagcacctt actgcaagta gcagttccct cctagatcat 780

gaccgaaccg tgtttcagtg gctggatcag caacccccgt cgtcagttct atatgtaagc 840

tttgggagta cttcggaagt ggatgaaaag gacttcttag agattgcgcg agggctcgtg 900

gatagcaaac agagcttcct gtgggtagtg agaccgggat tcgttaaggg ctcgacgtgg 960

gtcgagccgt tgccagatgg ttttctaggg gagagaggga gaatcgtgaa atgggttcca 1020

cagcaagagg ttttggctca cggagctata ggggcctttt ggacccactc tggttggaat 1080

tctactcttg aaagtgtctg tgaaggcgtt ccaatgatat tttctgattt tgggcttgac 1140

cagcctctaa acgctcgcta tatgtctgat gtgttgaagg ttggcgtgta cctggagaat 1200

ggttgggaaa ggggggaaat tgccaacgcc atacgccggg taatggtgga cgaggaaggt 1260

gagtacatac gtcagaacgc tcgggtttta aaacaaaaag cggacgtcag ccttatgaag 1320

ggaggtagct cctatgaatc cctagaatcc ttggtaagct atatatcttc gttataa 1377

<210> SEQ ID NO 18
<211> LENGTH: 1377
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 18

atgaactggc aaatcctgaa agaaatcctg ggtaaaatga tcaaacaaac caaagcgtcg 60

tcgggcgtta tctggaactc cttcaaagaa ctggaagaat cagaactgga aaccgttatt 120

cgcgaaatcc cggctccgtc gttcctgatt ccgctgccga aacatctgac cgcgagcagc 180

agcagcctgc tggatcacga ccgtacggtc tttcagtggc tggatcagca accgccgtca 240

tcggtgctgt atgtttcatt cggtagcacc tctgaagtcg atgaaaaaga ctttctggaa 300

atcgctcgcg gcctggtgga tagtaaacag tccttcctgt gggtggttcg tccgggtttt 360

gtgaaaggca gcacgtgggt tgaaccgctg ccggatggct tcctgggtga acgcggccgt 420

attgtcaaat gggtgccgca gcaagaagtg ctggcacatg gtgctatcgg cgcgttttgg 480

acccactctg gttggaacag tacgctggaa tccgtttgcg aaggtgtccc gatgattttc 540

agcgattttg gcctggacca gccgctgaat gcccgctata tgtctgatgt tctgaaagtc 600

ggtgtgtacc tggaaaacgg ttgggaacgt ggcgaaattg cgaatgccat ccgtcgcgtt 660

atggtcgatg aagaaggcga atacattcgc cagaacgctc gtgtcctgaa acaaaaagcg 720

gacgtgagcc tgatgaaagg cggtagctct tatgaatcac tggaatcgct ggttagctac 780

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atcagttccc tggaaaataa aaccgaaacc acggtgcgtc gccgtcgccg tattatcctg 840

ttcccggttc cgtttcaggg tcatattaac ccgatcctgc aactggcgaa tgttctgtat 900

tcaaaaggct tttcgatcac catcttccat acgaacttca acaaaccgaa aaccagtaac 960

tacccgcact ttacgttccg ctttattctg gataacgacc cgcaggatga acgtatctcc 1020

aatctgccga cccacggccc gctggccggt atgcgcattc cgattatcaa tgaacacggt 1080

gcagatgaac tgcgccgtga actggaactg ctgatgctgg ccagtgaaga agatgaagaa 1140

gtgtcctgtc tgatcaccga cgcactgtgg tatttcgccc agagcgttgc agattctctg 1200

aacctgcgcc gtctggtcct gatgacgtca tcgctgttca attttcatgc gcacgtttct 1260

ctgccgcaat ttgatgaact gggctacctg gacccggatg acaaaacccg tctggaagaa 1320

caagccagtg gttttccgat gctgaaagtc aaagacatta aatccgccta ttcgtaa 1377

<210> SEQ ID NO 19
<211> LENGTH: 1428
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 19

atgaactggc aaatcctgaa agaaatcctg ggtaaaatga tcaaacaaac caaagcgtcg 60

tcgggcgtta tctggaactc cttcaaagaa ctggaagaat cagaactgga aaccgttatt 120

cgcgaaatcc cggctccgtc gttcctgatt ccgctgccga aacatctgac cgcgagcagc 180

agcagcctgc tggatcacga ccgtacggtc tttcagtggc tggatcagca accgccgtca 240

tcggtgctgt atgtttcatt cggtagcacc tctgaagtcg atgaaaaaga ctttctggaa 300

atcgctcgcg gcctggtgga tagtaaacag tccttcctgt gggtggttcg tccgggtttt 360

gtgaaaggca gcacgtgggt tgaaccgctg ccggatggct tcctgggtga acgcggccgt 420

attgtcaaat gggtgccgca gcaagaagtg ctggcacatg gtgctatcgg cgcgttttgg 480

acccactctg gttggaacag tacgctggaa tccgtttgcg aaggtgtccc gatgattttc 540

agcgattttg gcctggacca gccgctgaat gcccgctata tgtctgatgt tctgaaagtc 600

ggtgtgtacc tggaaaacgg ttgggaacgt ggcgaaattg cgaatgccat ccgtcgcgtt 660

atggtcgatg aagaaggcga atacattcgc cagaacgctc gtgtcctgaa acaaaaagcg 720

gacgtgagcc tgatgaaagg cggtagctct tatgaatcac tggaatcgct ggttagctac 780

atcagttccc tgtacaaaga tgacagcggt tatagcagca gctatgcggc ggcggcgggt 840

atggaaaata aaaccgaaac cacggtgcgt cgccgtcgcc gtattatcct gttcccggtt 900

ccgtttcagg gtcatattaa cccgatcctg caactggcga atgttctgta ttcaaaaggc 960

ttttcgatca ccatcttcca tacgaacttc aacaaaccga aaaccagtaa ctacccgcac 1020

tttacgttcc gctttattct ggataacgac ccgcaggatg aacgtatctc caatctgccg 1080

acccacggcc cgctggccgg tatgcgcatt ccgattatca atgaacacgg tgcagatgaa 1140

ctgcgccgtg aactggaact gctgatgctg gccagtgaag aagatgaaga agtgtcctgt 1200

ctgatcaccg acgcactgtg gtatttcgcc cagagcgttg cagattctct gaacctgcgc 1260

cgtctggtcc tgatgacgtc atcgctgttc aattttcatg cgcacgtttc tctgccgcaa 1320

tttgatgaac tgggctacct ggacccggat gacaaaaccc gtctggaaga acaagccagt 1380

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ggttttccga tgctgaaagt caaagacatt aaatccgcct attcgtaa 1428

<210> SEQ ID NO 20
<211> LENGTH: 1389
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 20

atggattcgg gttactcttc ctcctatgcg gcggctgcgg gtatgcacgt tgttatctgt 60

ccgtggctgg cttttggtca cctgctgccg tgcctggatc tggcacagcg tctggcttca 120

cgcggccatc gtgtcagctt cgtgtctacc ccgcgcaata tttcgcgtct gccgccggtt 180

cgtccggcac tggctccgct ggttgcattt gtcgctctgc cgctgccgcg cgtggaaggt 240

ctgccggatg gtgcggaaag taccaacgac gtgccgcatg atcgcccgga catggttgaa 300

ctgcaccgtc gtgcattcga tggtctggca gcaccgtttt ccgaatttct gggtacggcg 360

tgcgccgatt gggtgatcgt tgacgtcttt catcactggg cggcggcggc ggcgctggaa 420

cataaagttc cgtgtgcaat gatgctgctg ggctcagctc acatgattgc gtcgatcgca 480

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gatcagggtc cgaacgcacg tctgattgaa gcgaaaaatg ccggcctgca agttgcgcgc 1200

aacgatggcg acggttcttt cgaccgtgag ggtgtggctg cggccattcg cgcagtggct 1260

gttgaagaag aatcatcgaa agtttttcag gcgaaagcca aaaaactgca agaaatcgtc 1320

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aaagactaa 1389

<210> SEQ ID NO 21
<211> LENGTH: 1389
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 21

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ctgcgcggca aaccgattac cttcctgggt ctgatgccgc cgctgcatga aggccgtcgc 180

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tatgtcgcac tgggcagcga agtgccgctg ggtgtcgaaa aagtgcacga actggccctg 300

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gatgctgacc tgctgccggc gggtttcgaa gaacgcaccc gcggccgtgg tgtcgtggcc 420

acccgttggg tgccgcaaat gtccattctg gctcatgcgg ccgttggcgc atttctgacc 480

cactgcggtt ggaacagcac gatcgaaggc ctgatgtttg gtcatccgct gattatgctg 540

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caagttgcgc gtaacgatgg cgacggtagc tttgaccgcg aaggtgtcgc agctgcgatt 660

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ccggacatgg tcgaactgca tcgtcgcgcc tttgatggcc tggccgcacc gtttagcgaa 1140

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ggccagggtc gtccggcggc ggcaccgacc tttgaagtgg cacgtatgaa actgattcgc 1380

acgaaataa 1389

<210> SEQ ID NO 22
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<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 22

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gcagaacgct atttcctgac gctgatgcgt agcgatctgg ttgccatccg ctcttgcgca 660

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atcgaaggcc tgctgttcgg tcatccgctg attatgctgc cgatcagctc tgatcagggt 1140

ccgaatgcgc gcctgatgga aggccgtaaa gtcggtatgc aagtgccgcg tgatgaatca 1200

gacggctcgt ttcgtcgcga agatgttgcc gcaaccgtcc gcgccgtggc agttgaagaa 1260

gacggtcgtc gcgtcttcac ggctaacgcg aaaaagatgc aagaaattgt ggccgatggc 1320

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<210> SEQ ID NO 23
<211> LENGTH: 2427
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 23

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aaaggtattc tgcagcaaaa ccagattatc gcggaatttg aagccctgcc ggaacaaacc 180

cgcaaaaagc tggaaggcgg tccgtttttc gatctgctga aatctacgca ggaagcgatc 240

gttctgccgc cgtgggtcgc actggcagtg cgtccgcgtc cgggcgtttg ggaatatctg 300

cgtgtcaacc tgcatgcact ggtggttgaa gaactgcagc cggctgaatt tctgcacttc 360

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ccgttcaatg ccagtatccc gcgtccgacg ctgcataaat atattggcaa cggtgtggac 480

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cagaacctga ataccctgca acacacgctg cgcaaggcgg aagaatacct ggccgaactg 660

aaaagtgaaa ccctgtacga agaattcgaa gcaaagttcg aagaaattgg cctggaacgt 720

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tactgtgata ttctgcgtgt cccgtttcgc accgaaaagg gtattgtgcg taaatggatc 1140

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<211> LENGTH: 3807
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 24

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acgcatggcc ccttggcagg tatgcgaata ccaataatca atgagcatgg agccgatgaa 300

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<210> SEQ ID NO 25
<211> LENGTH: 3819
<212> TYPE: DNA
<213> ORGANISM: Artificial Sequence
<220> FEATURE:
<223> OTHER INFORMATION: Synthetic

<400> SEQUENCE: 25

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What is claimed is:

1. A steviol glycoside formulation consisting essentially of 40-60wt. % rebaudioside A (Reb A), 15-30 wt. % rebaudioside E (Reb E), 10-17 wt. % rebaudioside D (Reb D), and 5-10 wt. % rebaudioside M (Reb M).

2. A steviol glycoside formulation consisting essentially of 40-60 wt. % rebaudioside A (Reb A), 15-30 wt. % rebaudioside E (Reb E), 10-17 wt. % rebaudioside D (Reb D), 5-10 wt. % rebaudioside M (Reb M), and 2-8 wt. % rebaudioside I (Reb I).

3. The steviol glycoside formulation of claim **1**, wherein Reb A is present in a concentration of 300-600 ppm, Reb E is present in a concentration of 50-200 ppm, Reb D is present in a concentration of 50-200 ppm, Reb M is present in a concentration of 200-500 ppm.

4. The steviol glycoside formulation of claim **2**, wherein Reb A is present in a concentration of 200-500 ppm, Reb E is present in a concentration of 50-300 ppm, Reb D is present in a concentration of 50-300 ppm, Reb M is present in a concentration of 5-100 ppm, and Reb I is present in a concentration of 5-50 ppm.

5. A steviol glycoside formulation consisting essentially of rebaudioside A (Reb A), rebaudioside E (Reb E), rebaudioside D (Reb D), and rebaudioside M (Reb M), wherein Reb A is present in an amount of 300-600 ppm; Reb E is present in an amount of from 50-250 ppm; Reb D is present in an amount of 10-200 ppm; and/or Reb M is present in an amount of 10-150 ppm.

6. The steviol glycoside formulation of claim **5**, further comprising rebaudioside I (Reb I) in an amount of 1-50 ppm.

7. A steviol glycoside formulation consisting essentially of 500 ppm Reb A, 350 ppm Reb M, 100 ppm Reb D, and 100 ppm Reb E.

8. A steviol glycoside formulation consisting essentially of 373 ppm Reb A, 48 ppm Reb M, 100 ppm Reb D, 131 ppm Reb E, and 30 ppm Reb I.

9. The steviol glycoside formulation of any one of claims **1-8**, wherein at least one rebaudioside is made by a genetically modified microbe.

10. An orally consumable product comprising the steviol glycoside formulation of any one of claims **1-9**, or the sweetener of any one of claims **43-54**.

11. The orally consumable product of claim **10**, wherein the orally consumable product is selected from the group consisting of a food composition, a beverage product, a dietary supplement, a nutraceutical, an edible gel mix, an edible gel composition, a pharmaceutical composition, a dental and oral hygiene composition, and an animal feed.

12. The orally consumable product of claim **11**, wherein the orally consumable product is a dental and oral hygiene composition.

13. The orally consumable product of claim **12**, wherein the dental and oral hygiene composition is a toothpaste.

14. The orally consumable product of claim **12** or claim **13**, wherein the steviol glycoside formulation is present in a concentration of 50-800 ppm.

15. The orally consumable product of any one of claims **12-14**, wherein the steviol glycoside formulation is present in the range of 0.0003% to 1.0% by weight of the total weight of the orally consumable product.

16. The orally consumable product of claim **11**, wherein the orally consumable product is a pharmaceutical composition.

17. The orally consumable product of claim **16**, wherein the steviol glycoside formulation is present in a concentration of 50-800 ppm.

18. The orally consumable product claim **16** or claim **17**, wherein the steviol glycoside formulation is present in the range of 0.0004% to 1.25% by weight of the total weight of the orally consumable product.

19. The orally consumable product of claim **11**, wherein the orally consumable product is a beverage.

20. The orally consumable product of claim **19**, wherein the beverage is a carbonated or non-carbonated beverage.

21. The orally consumable product of claim **20**, wherein the beverage is selected from the group consisting of a soft drink, a fountain beverage, a frozen and ready-to-drink beverage, coffee, tea, a dairy beverage, a powdered soft drink, a liquid concentrate, flavored water, enhanced water, fruit juice, a fruit juice flavored drink, a sport drink, and an energy drink.

22. The orally consumable product of any one of claims **19-21**, wherein the steviol glycoside formulation is present in a concentration of 65-800 ppm.

23. The orally consumable product of any one of claims **19-22**, wherein the steviol glycoside formulation is present in the range of 0.0005% to 1.0% by weight of the total weight of the orally consumable product.

24. The orally consumable product of claim **11**, wherein the orally consumable product is a food composition.

25. The orally consumable product of claim **24**, wherein the food composition is selected from the group consisting of spreads, margarines, sports products, nutrition bars, infant formulas, mayonnaise, confectionary composition, a condiment, a chewing gum, a cereal composition, a baked good, a dairy product, and a tabletop sweetener composition.

26. The orally consumable product of claim **25**, wherein the food composition is a yogurt.

27. The orally consumable product of claim **24** or claim **25**, wherein the food composition is frozen.

28. The orally consumable product of claim **27**, wherein the food composition is ice cream.

29. The orally consumable product of any one of claims **24-28**, wherein the steviol glycoside formulation is present in a concentration of 50-700 ppm.

30. The orally consumable product of any one of claims **24-29**, wherein the steviol glycoside formulation is present in the range of 0.0005% to 1.0% by weight of the total weight of the orally consumable product.

31. The orally consumable product of any one of claims **24-30**, further comprising a component selected from the group consisting of sucrose, aroma compounds, flavoring compounds and mixtures thereof.

32. The orally consumable product of claim **31**, further comprising tocopherols in an amount of at least 5 ppm.

33. The orally consumable product of any one of claims **24-32**, wherein further comprising at least one stabilizing agent selected from the group consisting of citric acid, sodium benzoate, t-butyl hydroquinone, ascorbyl palmitate, propyl gallate, and combinations thereof.

34. The orally consumable product of any one of claims **24-33**, further comprising a moisture containing ingredient.

35. The orally consumable product of claim **34**, wherein the moisture ingredient is an emulsion.

36. The orally consumable product of any one of claims **24-35**, further comprising a chelating agent.

37. The orally consumable product of claim **11**, wherein the orally consumable product is an animal feed product for livestock, companion animals and/or aquaculture.

38. The orally consumable product of claim **37**, wherein the livestock is cattle, swine and/or poultry.

39. The orally consumable product of claim **37** or claim **38**, wherein the steviol glycoside formulation is present in a concentration of 50-800 ppm.

40. The orally consumable product of any one of claims **37-39**, further comprising a hydrocolloid or erythritol.

41. A composition in any one of the figures.

42. A method for creating or enhancing a sweetening effect in an orally consumable product comprising adding an amount of the steviol glycoside formulation of any one of claims **1-9** or the sweetener of any one of claims **43-54** sufficient to produce the desired degree of sweetness to the orally consumable product.

43. A sweetener comprising rebaudioside I (Reb I) produced by a reaction mixture comprising a steviol glycoside; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine diposphoglycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of any one of SEQ ID NOs: 1-4.

44. The sweetener of claim **43**, wherein the reaction mixture further comprises a sucrose synthase comprising the amino acid sequence of SEQ ID NO: 8.

45. The sweetener of claim **43** or claim **44**, wherein the steviol glycoside is rebaudioside A.

46. The sweetener of any one of claims **43-45**, further comprising one or more steviol glycoside selected from the group consisting of: rebaudioside E (Reb E), rebaudioside A (Reb A), rebaudioside M (Reb M), and rebaudioside D (Reb D).

47. The sweetener of claim **46**, further comprising Reb E, Reb A, Reb M, and Reb D.

48. The sweetener of claim **46** or claim **47**, wherein the Reb E is produced by a reaction mixture comprising stevioside, rebaudioside KA, or rubusoside; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine diposphoglycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of any one of SEQ ID NOs: 1, 5, and 7.

49. The sweetener of any one of claims **46-48**, wherein the Reb A is produced by a reaction mixture comprising stevioside or rebaudioside D; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine diposphoglycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of SEQ ID NO: 1.

50. The sweetener of any one of claims **46-49**, wherein the Reb M is produced by a reaction mixture comprising stevioside or rebaudioside D; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine diposphoglycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of SEQ ID NO: 1 or SEQ ID NO: 7.

51. The sweetener of any one of claims **46-50** wherein the Reb D is produced by a reaction mixture comprising rebaudioside A or rebaudioside E; a substrate selected from the group consisting of sucrose, uridine diphosphate (UDP), and uridine diphosphate-glucose (UDP-glucose); and an uridine diposphoglycosyltransferases (UDP-glycosyltransferase) comprising the amino acid sequence of any one of SEQ ID NOs: 1, 5, and 7.

52. The sweetener of any one of claims **48-51**, wherein the reaction mixture further comprises a sucrose synthase comprising the amino acid sequence of SEQ ID NO: 8.

53. The sweetener of any one of claims **47-52**, comprising 40-60 wt. % Reb A, 15-30 wt. % Reb E, 10-17 wt. % Reb D, 5-10 wt. % Reb M, and 2-8 wt. % Reb I.

54. The sweetener of any one of claims **47-53**, wherein Reb A is present in a concentration of 200-500 ppm, Reb E is present in a concentration of 50-300 ppm, Reb D is present in a concentration of 50-300 ppm, Reb M is present in a concentration of 5-100 ppm, and Reb I is present in a concentration of 5-50 ppm.

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