Technology Snapshot: Glucosyl Stevia and Reb E

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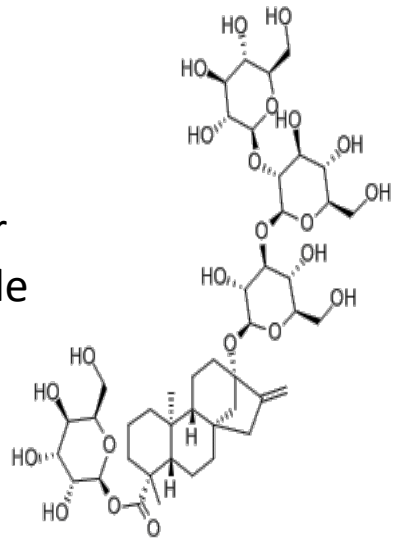
Glycosylation

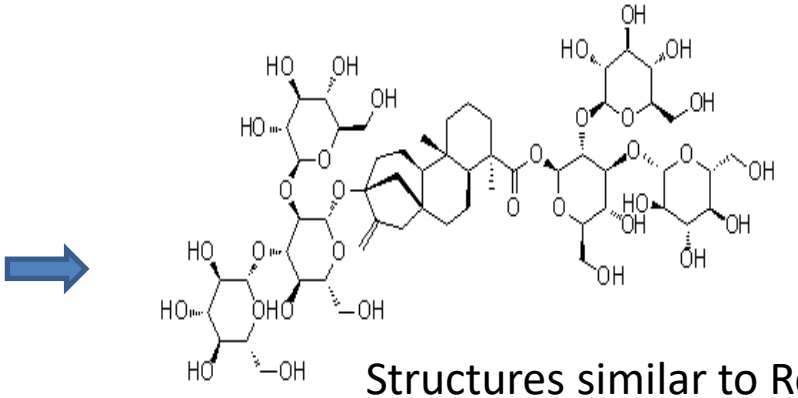
Also known as:

- Glucosylation
- Enzyme-modified

Glycosylation starts with steviol glycosides extracted from the stevia leaf. Glucose units are randomly added by the use of an enzyme, producing steviol glycosides that may or may not be found in the stevia leaf. This process is similar to the bioconversion one in terms of using enzyme but does not produce a targeted steviol glycoside molecule. Enzymes, typically from a natural source, are used to convert the steviol glycosides. The steviol glycosides produced from this process are not directly extracted from the stevia leaf.

Reb A
and / or
Stevioside





Structures similar to Reb D & M,
And other steviol glycosides

Glycosylated/Enzyme Modified

Item	Estimated Sweetness	Potential Directional Sensory	Beverage Max Usage Labeled as Natural Flavor
FEMA 4728	85 - 140	Most common sweetness enhancer	175ppm
FEMA 4845	70 - 140	May add mouthfeel and blocking capabilities	100ppm
FEMA 4876	100 - 160	May add mouthfeel	120ppm
FEMA 4909	150 - 220	Best sweetness enhancer	65ppm
FEMA 4910	90 - 130	May add mouthfeel	135ppm
FEMA 4931	120 - 150	May add mouthfeel	100ppm

- Overall, these are a good value for the great taste quality
- Typically used as sweetness enhancers but also may have some blocking and mouthfeel capabilities
- Higher glycosylated chains may fold over and surround bitter molecules so that the bitter molecules do not get to the receptor
- Sweetness and sensory are just starting guidelines and not fully developed
- For additional information, please see:
  - https://www.femaflavor.org/fema-gras

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Max Use Levels in Application

FEMA Number	4728	4845	4876	4909	4910	4931
Baked Goods	500	100	100	0	135	100
Beverages, Non-Alcoholic	175	100	120	65	135	100
Beverages, Alcoholic	175	100	100	0	135	100
Breakfast Cereals	500	100	100	0	135	100
Cheeses	133	100	100	0	135	100
Chewing Gum	1500	100	100	0	135	100
Condiments and Relishes	200	100	110	0	135	100
Confections and Frostings	100	100	110	0	135	100
Egg Products		0	110	0	0	0
Fats and Oils	189	0	110	0	135	100
Fish Products		0	100	0	0	0
Frozen Dairy	133	100	120	65	135	100
Fruit Ices	133	100	100	0	135	100
Gelatins and Puddings	133	100	110	0	135	100
Granulated Sugar		0	0	0	0	0
Gravies	133	100	100	0	135	100
Hard Candy	133	100	110	0	135	100

Max Use Levels in Application

FEMA No.	4728	4845	4876	4909	4910	4931
Instant Coffee and Tea	175	100	100	65	135	100
Jams and Jellies	200	100	110	0	135	100
Meat Products		0	100	0	0	0
Milk Products	225	100	120	65	135	100
Nut Products	175	100	100	0	135	100
Other Grains	133	100	100	0	135	100
Poultry		0	100	0	0	0
Processed Fruits	200	100	110	0	135	100
Processed Vegetables	133	100	100	0	135	100
Reconstituted Vegetables	133	100	100	0	0	100
Seasonings and Flavors	175	100	100	0	135	100
Snack Foods	133	100	100	0	135	100
Soft Candy	133	100	110	0	135	100
Soups	133	50	100	0	135	100
Sugar Substitutes	0	0	0	0	0	0
Sweet Snacks	133	100	110	0	135	100

Compositions of GSG

4728	Glucosyl steviol glycosides	Total steviol glycosides 80-90% inclusive of supraglucosylated steviol glycosides 75-80%; Rebaudioside A 1-6%; stevioside 2-4% and other individual steviol glycosides not further glucosylated each less than 3%. Maltodextrin 3-20%
4845	Glucosylated stevia extract	At least 80% steviol glycosides, not more than 10% Rebaudioside A, not more than 4% Rebaudioside C, not more than 5% stevioside, and no individual steviol glycosides further glucosylated ≤3%.
4876	Enzyme modified stevia, stevioside 20%	90-95% steviol glycosides inclusive of supraglucosylated steviol glycosides 64-70%; rebaudioside A 10-13%; stevioside 20-22%, maltodextrin 1-6%, and other individual steviol glycosides not further glucosylated each less than 1%.
4909	Glucosylated steviol glycosides, 70-80%	Supraglucosylated steviol glycosides 70-80%; Rebaudioside A 14-20%; Steviol glycosides not further glucosylated, each individually, not to exceed 3%; Maltodextrin 3-10%
4910	Glucosylated steviol glycosides, 40%	Supraglucosylated steviol glycosides 30-40%; Rebaudioside A 5-8%; Not more than 4% stevioside; All other individual steviol glycosides not further glucosylated <3%; Maltodextrin 45-60%
4931	Glucosylated steviol glycosides, 90%	Not less than 90% of total steviol glycosides inclusive of supraglucosylated steviol glycosides; Rebaudioside A less than 3%; Stevioside less than 2%; other steviol glycosides not further glucosylated, each individually, less than 2%; Maltodextrin less than 10%

Sweetener GRAS/GRN

- Multiple submissions reviewed for use as a sweetener
  - https://www.accessdata.fda.gov/scripts/fdcc/?set=GRASNotices&sort=GRN_No&order=DESC&startrow=1&type=basic&search=steviol
- GRN 337 reviewed 6/17/11
- GRN 375 reviewed 9/2/11
- GRN 448 reviewed 5/3/13
- GRN 452 reviewed 7/1/13
- GRN 607 reviewed 10/14/16
- GRN 656 reviewed 9/28/16
- GRN 662 reviewed 9/29/16
- GRN 821 reviewed 8/21/19
- GRN 858 reviewed 10/4/19

Teas' Tea Plus Half & Half Green Tea with Peach

View it on GNPD 2123537

Teas' Tea Plus Half & Half Green Tea with Peach is made with natural peach flavor as well as other natural flavors and provides 50 calories with 12g sugar per serving. The tea contains 3% juice, caffeine and antioxidants, which help maintain a healthy heart and neutralize free radicals. The all natural product retails in a 16.9-fl. oz. bottle.

Company: Ito En

Country: USA

Date Published: Jul 2013

Sub-Category: RTD (Iced) Tea

Price: $1.99 / €1.60

Pack Size: 16.900 fl. oz (US) / 499.790 ml

Ingredients:

Purified Water, Cane Sugar, Green Tea, Peach Juice Concentrate, Natural Flavourings, Citric Acid, Vitamin C, **Glucosyl Stevia**

Claims:

All Natural Product, Antioxidant, Functional – Cardiovascular

[Note: Don't recommend calling the product "All Natural" if the use level is above the FEMA guideline and labeling as "Glucosyl Stevia". In 2013, Sweetener GRAS 452 and FEMA GRAS 26 (at that time the max use level for a beverage was <250ppm) both were published.]

Rebaudioside E

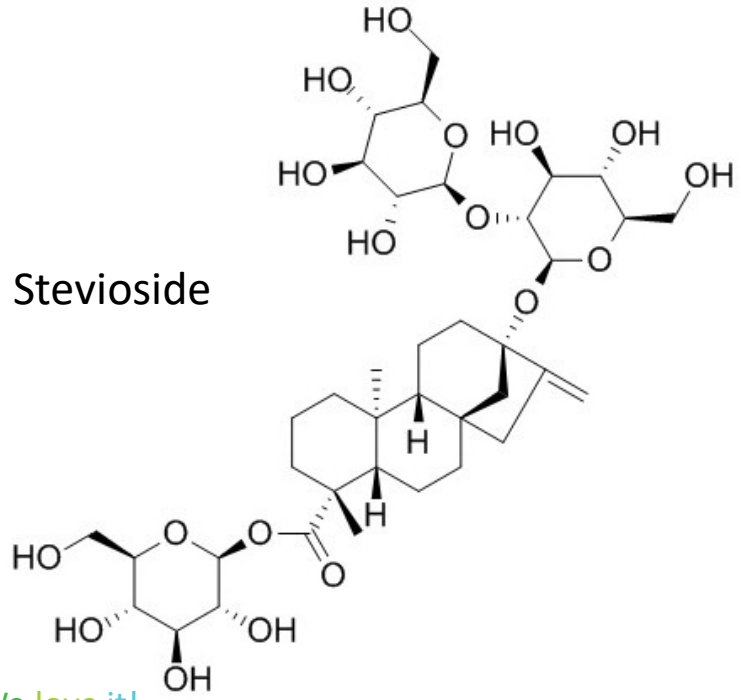
- 85% purity is the most common
  - Could be leaf extracted or produced by bio-conversion
- Less sweet than Reb A but less off-notes at higher use levels
  - At equivalent sweetness though, Reb E doesn't seem to provide much benefit
- Closest to Reb B with higher solubility
- GRAS/GRN 823
  - https://www.fda.gov/media/134209/download
- FEMA 4936 allows Reb E 85 a use level <45ppm in most applications to be labeled as a natural flavor

	Sweetness Potency
Reb A	200 - 300
Reb B	150 - 250
Reb E	120 - 175

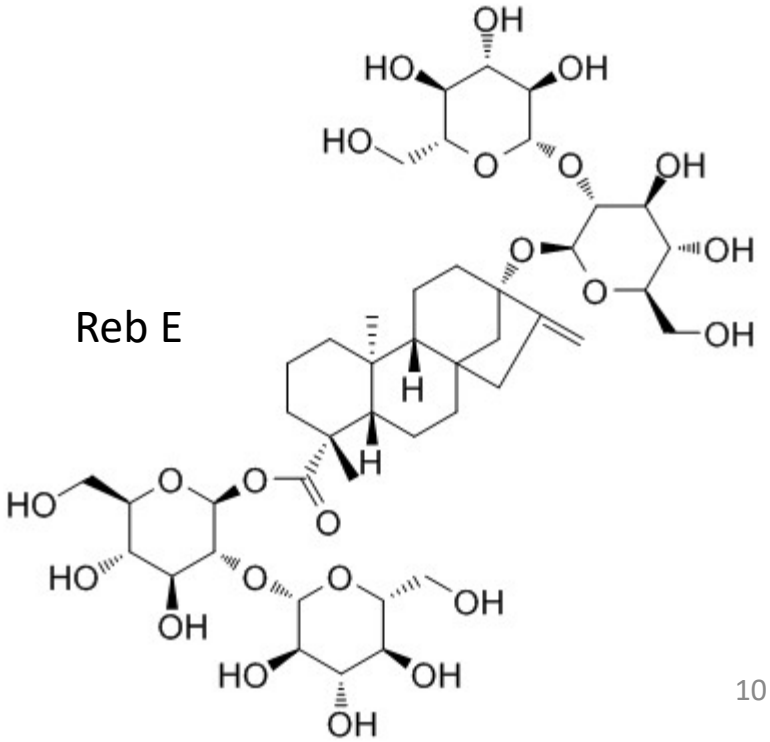
Bio-Conversion

Bioconversion starts with steviol glycosides extracted from the stevia leaf that are then converted to different targeted steviol glycosides, such as Reb M and Reb E, by adding one or more glucose moieties with the use of enzymes obtained from genetically modified organisms and a glucose source. Enzymes that aid the process are used to mirror the maturation process which occurs naturally in the leaf, when Reb A or Stevioside gradually becomes Reb M or Reb E (or other unique glycosides). The steviol glycosides produced from this process are identical to those steviol glycosides found in the stevia leaves but are not directly extracted from the stevia leaf.

Stevioside



Reb E



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Tasting / Q & A

- Reb E 85 at 500ppm
- Reb A 99 at 265ppm
  - RA99 is sweeter than the typical RA95
- GSG in 5% sugar at 65ppm
  - Plain 5% sugar
  - 4728
  - 4845
  - 4909

- Questions or would like samples of FEMA 4728, 4845 or other commercially available stevia extracts? Visit us at https://www.sopurestevia.com/