

GRAS Notice (GRN) No. 607

<http://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/NoticeInventory/default.htm>

ORIGINAL SUBMISSION



PureCircle™

GRN 000607

Natural Ingredients

October 23, 2015

Food and Drug Administration
Center for Food Safety & Applied Nutrition
Office of Food Additive Safety (HFS-255)
5100 Paint Branch Parkway
College Park, MD 20740-3835



Attention: Dr. Paulette Gaynor

Re: GRAS Notification – Glucosylated Steviol Glycosides

Dear Dr. Gaynor:

PureCircle Limited of Oak Brook, IL has prepared the GRAS notification for FDA review on Glucosylated Steviol Glycosides in concert with GRAS Associates, LLC who convened an Expert Panel to assess the composite safety information of the subject substance with the intended function as a flavoring agent. In addition, PureCircle is providing Form 3667 and the enclosed CD with the GRAS notification for Glucosylated Steviol Glycosides. The attached documentation contains the specific information that addresses the safe human food uses for the subject notified substance as discussed in the GRAS guidance document.

We also wish to advise you that the CD provided for agency review is free of viruses.

If additional information or clarification is needed as you and your colleagues proceed with the review, please feel free to contact PureCircle via telephone or email.

We look forward to your feedback.

Sincerely,



Sidd Purkayastha, Ph.D
V.P. Head of Global Scientific & Regulatory Affairs
PureCircle Limited

Enclosure: GRAS Notification for PureCircle Limited – Glucosylated Steviol Glycosides

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FDA USE ONLY

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration
**GENERALLY RECOGNIZED AS SAFE
(GRAS) NOTICE**

Transmit completed form and attachments electronically via the Electronic Submission Gateway (*see Instructions*); OR Transmit completed form and attachments in paper format or on physical media to: Office of Food Additive Safety (HFS-200), Center for Food Safety and Applied Nutrition, Food and Drug Administration, 5100 Paint Branch Pkwy., College Park, MD 20740-3835.

PART I – INTRODUCTORY INFORMATION ABOUT THE SUBMISSION

1. Type of Submission (*Check one*)

New Amendment to GRN No. _____ Supplement to GRN No. _____

2. All electronic files included in this submission have been checked and found to be virus free. (*Check box to verify*)

3a. For New Submissions Only: Most recent presubmission meeting (*if any*) with FDA on the subject substance (yyyy/mm/dd): 2015-05-20

3b. For Amendments or Supplements: Is your amendment or supplement submitted in response to a communication from FDA? (*Check one*)
 Yes If yes, enter the date of communication (yyyy/mm/dd): _____
 No

PART II – INFORMATION ABOUT THE NOTIFIER

1a. Notifier	Name of Contact Person Sidd Purkayastha, Ph.D.	Position Vice President Global Scientific & Regulatory Affairs
	Company (<i>if applicable</i>) PureCircle Limited	
	Mailing Address (<i>number and street</i>) 915 Harger Road, Suite 250	

City Oak Brook	State or Province Illinois	Zip Code/Postal Code 60523	Country United States of America
Telephone Number 630-361-0374 (ext 98)	Fax Number 630-480-4365	E-Mail Address Sidd.Purkayastha@purecircle.com	

1b. Agent or Attorney (if applicable)	Name of Contact Person Robert S McQuate	Position Chief Regulatory Officer/SVP Business Development
	Company (<i>if applicable</i>) GRAS Associates, LLC	
	Mailing Address (<i>number and street</i>) 27499 Riverview Center Blvd, Suite 212	

City Bonita Springs	State or Province Florida	Zip Code/Postal Code 34134	Country United States of America
Telephone Number 541-678-5522	Fax Number 541-678-5522 call first	E-Mail Address mcquate@gras-associates.com	

PART III – GENERAL ADMINISTRATIVE INFORMATION

1. Name of Substance
Glucosylated Steviol Glycosides

2. Submission Format: (Check appropriate box(es))

- Electronic Submission Gateway Electronic files on physical media with paper signature page
 Paper
If applicable give number and type of physical media _____

3. For paper submissions only:

Number of volumes _____

Total number of pages _____

4. Does this submission incorporate any information in FDA's files by reference? (Check one)

- Yes (Proceed to Item 5) No (Proceed to Item 6)

5. The submission incorporates by reference information from a previous submission to FDA as indicated below (Check all that apply)

- a) GRAS Notice No. GRN _____
 b) GRAS Affirmation Petition No. GRP _____
 c) Food Additive Petition No. FAP _____
 d) Food Master File No. FMF _____
 e) Other or Additional (describe or enter information as above) _____

6. Statutory basis for determination of GRAS status (Check one)

- Scientific Procedures (21 CFR 170.30(b)) Experience based on common use in food (21 CFR 170.30(c))

7. Does the submission (including information that you are incorporating by reference) contain information that you view as trade secret or as confidential commercial or financial information?

- Yes (Proceed to Item 8)
 No (Proceed to Part IV)

8. Have you designated information in your submission that you view as trade secret or as confidential commercial or financial information (Check all that apply)

- Yes, see attached Designation of Confidential Information
 Yes, information is designated at the place where it occurs in the submission
 No

9. Have you attached a redacted copy of some or all of the submission? (Check one)

- Yes, a redacted copy of the complete submission
 Yes, a redacted copy of part(s) of the submission
 No

PART IV – INTENDED USE

1. Describe the intended use of the notified substance including the foods in which the substance will be used, the levels of use in such foods, the purpose for which the substance will be used, and any special population that will consume the substance (e.g., when a substance would be an ingredient in infant formula, identify infants as a special population).

Intend to use as flavoring agent with flavor modifying properties. See Section IV in Volume I.

2. Does the intended use of the notified substance include any use in meat, meat food product, poultry product, or egg product? (Check one)

- Yes No

PART V – IDENTITY

1. Information about the Identity of the Substance

	Name of Substance¹	Registry Used (CAS, EC)	Registry No.²	Biological Source (if applicable)
1	Glucosylated Steviol Glycosides (no less than 80% steviol glycosides content) with Maltodextrin (no more than 20%) - also see item 2 below			
2	Maltodextrin	CAS	9050-36-6	
3				

¹ Include chemical name or common name. Put synonyms (*whether chemical name, other scientific name, or common name*) for each respective item (1 - 3) in Item 3 of Part V (*synonyms*)

² Registry used e.g., CAS (*Chemical Abstracts Service*) and EC (*Refers to Enzyme Commission of the International Union of Biochemistry (IUB), now carried out by the Nomenclature Committee of the International Union of Biochemistry and Molecular Biology (IUBMB)*)

2. Description

Provide additional information to identify the notified substance(s), which may include chemical formula(s), empirical formula(s), structural formula(s), quantitative composition, characteristic properties (*such as molecular weight(s)*), and general composition of the substance. For substances from biological sources, you should include scientific information sufficient to identify the source (*e.g., genus, species, variety, strain, part of a plant source (such as roots or leaves), and organ or tissue of an animal source*), and include any known toxicants that could be in the source.

Glucosylated Steviol Glycosides, produced by extraction of leaves of *Stevia rebaudiana* Bertoni, consist of no less than 80% steviol glycosides with not more than 20% maltodextrin. The distribution of component steviol glycosides is shown in Tables 5 and 6 of Volume I. The purified material meets the detailed specifications provided Tables 2, 3, and 4 in Volume I.

The generic chemical structures appear in Figure 1 with supporting information contained in Table 1 in Volume I.
Molecular Weights and Chemical Formulas: See Section II.C in Volume I.

3. Synonyms

Provide as available or relevant:

1	Alpha-Glucosylated Steviol Glycosides and GSG as found in Section II.A in Volume I; trade name noted as NSF-02 as found in Section II.B in Volume I
2	
3	

Add Continuation Page

PART VI – OTHER ELEMENTS IN YOUR GRAS NOTICE
(check list to help ensure your submission is complete – check all that apply)

- Any additional information about identity not covered in Part V of this form
- Method of Manufacture
- Specifications for food-grade material
- Information about dietary exposure
- Information about any self-limiting levels of use (which may include a statement that the intended use of the notified substance is not-self-limiting)
- Use in food before 1958 (which may include a statement that there is no information about use of the notified substance in food prior to 1958)
- Comprehensive discussion of the basis for the determination of GRAS status
- Bibliography

Other Information

Did you include any other information that you want FDA to consider in evaluating your GRAS notice?

Yes No

Did you include this other information in the list of attachments?

Yes No

PART VII – SIGNATURE

1. The undersigned is informing FDA that PureCircle Limited
(name of notifier)
has concluded that the intended use(s) of Glucosylated Steviol Glycosides
(name of notified substance)
described on this form, as discussed in the attached notice, is (are) exempt from the premarket approval requirements of section 409 of the Federal Food, Drug, and Cosmetic Act because the intended use(s) is (are) generally recognized as safe.

2. PureCircle Limited
(name of notifier) agrees to make the data and information that are the basis for the determination of GRAS status available to FDA if FDA asks to see them.

PureCircle Limited
(name of notifier) agrees to allow FDA to review and copy these data and information during customary business hours at the following location if FDA asks to do so.

915 Harger Road ,Suite 250, Oak Brook, IL, 60523
(address of notifier or other location)

PureCircle Limited
(name of notifier) agrees to send these data and information to FDA if FDA asks to do so.

OR

The complete record that supports the determination of GRAS status is available to FDA in the submitted notice and in GRP No.

(GRAS Affirmation Petition No.)

**3. Signature of Responsible Official,
Agent, or Attorney**

Robert McQuate, Ph.D.
Digitally signed by Robert McQuate, Ph.D.
DN: cn=Robert McQuate, Ph.D., o=GRAS Associates, LLC, ou=Chief
Regulatory Officer, email=rmcquate@gras-associates.com, c=US
Date: 2015.11.16 13:57:10 -0500

Printed Name and Title

Robert S McQuate, Ph.D., Chief Regulatory Officer

Date (mm/dd/yyyy)

10/23/2015

PART VIII – LIST OF ATTACHMENTS

List your attached files or documents containing your submission, forms, amendments or supplements, and other pertinent information. Clearly identify the attachment with appropriate descriptive file names (or titles for paper documents), preferably as suggested in the guidance associated with this form. Number your attachments consecutively. When submitting paper documents, enter the inclusive page numbers of each portion of the document below.

Attachment Number	Attachment Name	Folder Location (select from menu) (Page Number(s) for paper Copy Only)
	Multiple appendices---Appendices A through J---with supporting safety information attached as Volume II.	

OMB Statement: Public reporting burden for this collection of information is estimated to average 150 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to: Department of Health and Human Services, Food and Drug Administration, Office of Chief Information Officer, 1350 Piccard Drive, Room 400, Rockville, MD 20850. (Please do NOT return the form to this address.). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Documentation Supporting the Evaluation of Glucosylated Steviol Glycosides (GSG) as Generally Recognized as Safe (GRAS) for Use as a Flavoring Agent

Volume I

Notifier: PureCircle Limited
915 Harger Road, Suite 250
Oak Brook, IL 60523

Submitted by: (b) (6)
Sidd Purkayastha, Ph.D.
V.P. Head of Global Scientific
Regulatory Affairs

Prepared by: PureCircle Limited
GRAS Associates, LLC

Expert Panel Convened by GRAS Associates, LLC:

Richard Kraska, Ph.D., DABT
Robert S. McQuate, Ph.D.
Robert W. Kapp, Ph.D., Fellow ATS, ERT (UK)

Date: October 23, 2015

Documentation Supporting the Evaluation of Glucosylated Steviol Glycosides (GSG) as Generally Recognized as Safe (GRAS) for Use as a Flavoring Agent

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Documentation Supporting the Evaluation of PureCircle Glucosylated Steviol Glycosides (GSG) as Generally Recognized as Safe (GRAS) for Use as a Flavoring Agent

I. INTRODUCTION

PureCircle Limited (hereafter “PureCircle”) has been manufacturing Glucosylated Steviol Glycosides (GSG) for more than ten years and marketing this product as a sweetener or dietary supplement in several markets. In 2010, PureCircle submitted a petition to FEMA (Flavor and Extract Manufacturers Association) for GRAS status of GSG as a flavoring agent. The FEMA expert panel evaluated the technical and safety information and found the PureCircle GSG to be GRAS.

PureCircle GSG is produced by mixing raw material steviol glycosides, extracted from the *Stevia rebaudiana* Bertoni (*S. rebaudiana*) plant, with liquefied tapioca starch prepared with cyclodextrin glycosyltransferase (CGTase) and α -amylase enzymes. These enzymes facilitate the transfer of glucose units from starch to the steviol glycosides which are produced by means of fermentation using non-GMO bacteria. The process uses solvents and processing aides that are authorized for use in food processing. The enzyme treatment can yield the addition of multiple glucosylation units (1-20 additional glucose moieties) to steviol glycosides.

PureCircle GSG is made from stevia leaf extract, which is obtained by hot-water extraction of dried leaves from the *Stevia rebaudiana* Bertoni (*S. rebaudiana*) plant. The starting stevia leaf extract consists of not less than 95% steviol glycosides containing predominantly rebaudioside A, and/or stevioside. The final product is a blend of glucosylated steviol glycosides, maltodextrin (dextrin), and residual steviol glycosides. Since PureCircle GSG product contains total steviol glycosides less than 95% due to the presence of dextrin (<20%), FDA has requested PureCircle to submit a GRAS dossier for FDA evaluation.

The *S. rebaudiana* plant, also known as honey leaf and sweet herb, is a perennial shrub of the Compositae family, which has been native to Northeastern Paraguay, Brazil, and other South American regions for over 1,500 years (Geuns, 2003; Ferlow, 2005). Steviol glycosides (steviol conjugated with glucose, xylose, and/or rhamnose) are natural constituents of the *S. rebaudiana* plant. To date, more than 35 steviol glycoside molecules have been identified in the leaves of *S. rebaudiana* (Ceunen & Geuns, 2013).

The objective of this dossier is to provide scientific support for the safe use of PureCircle GSG as a flavoring agent with modifying properties.

The PureCircle GSG product is developed to possess significantly reduced sweetness intensity than the starting steviol glycosides, modify flavor profile in-application, and optimize the sweetness intensity profile through synergy with other caloric and non-caloric sweetener and food ingredients

present in the food/beverage matrix. This documentation outlines the identity and production of PureCircle GSG, defines the intended conditions of use of the product in food, presents exposure under the conditions of intended use, and documents the literature regarding its safety. The numerous scientific opinions published by international scientific bodies and regulatory authorities serve as the primary sources of published literature pertinent to the safety of PureCircle GSG. PureCircle supplied information pertaining to the composition and manufacturing process for PureCircle GSG, as well as batch analyses, stability information, and intended uses.

The data and information summarized in this dossier demonstrate that PureCircle GSG, produced using current Good Manufacturing Practices (cGMP) and meeting appropriate food-grade specifications, is Generally Recognized as Safe (GRAS), based on scientific procedures, under the conditions of intended use in foods, as described herein.

II. DESCRIPTION OF PURECIRCLE GLUCOSYLATED STEVIOL GLYCOSIDES

A. Common or Usual Name

GSG, Glucosylated Steviol Glycosides, α -Glucosylated Steviol Glycosides

B. Trade Name

NSF-02

C. Chemical Composition

Molecules	Molecular Formula	Molecular Wt (daltons)
rebaudioside A	$C_{44}H_{70}O_{23}$	967.03
stevioside	$C_{38}H_{60}O_{18}$	804.88
rebaudioside C	$C_{44}H_{70}O_{22}$	951.03
mono-glucosyl stevioside	$C_{44}H_{70}O_{23}$	967.03
mono-glucosyl rebaudioside A	$C_{50}H_{80}O_{28}$	1129.18
di-glucosyl stevioside	$C_{55}H_{80}O_{28}$	1129.18
di-glucosyl rebaudioside A	$C_{60}H_{90}O_{33}$	1291.33
n-glucosyl stevioside	$C_{(38+n*6)}H_{(60+n*10)}O_{(18+n*5)}$	$804.88 + n*162.15$
n-glucosyl rebaudioside A	$C_{(44+n*6)}H_{(70+n*10)}O_{(23+n*5)}$	$967.03 + n*162.15$
Maltodextrins	$C_{6n}H_{(12+10n)}O_{(6+5n)}$	$180.15 + n*162.15$

D. Chemical Abstract Service (CAS) Numbers

Molecules	CAS Registration No
rebaudioside A	58543-16-1
stevioside	57817-89-7
rebaudioside C	63550-99-2
mono-glucosyl stevioside	
mono-glucosyl rebaudioside A	1138458-73-7
di-glucosyl stevioside	-
di-glucosyl rebaudioside A	1138458-77-1
n-glucosyl stevioside	-
n-glucosyl rebaudioside A	-
Maltodextrins	9050-36-6

E. Chemical and Physical Characteristics

All steviol glycosides constituents are glycosylated derivatives of the aglycone, steviol, and as such, all share the same backbone structure (Figure 1), and differ only with respect to the type and number of glycoside units (glucose or rhamnose) at positions R1 and R2. More than 35 different steviol glycosides have been identified in the leaves of *S. rebaudiana*, with rebaudioside A and stevioside typically identified as the principal sweetening constituents. The common names, as well as the chemical (R1 and R2 groups) formulas of different steviol glycosides, are summarized in Table 1 (Ceunen and Geuns, 2013; Chaturvedula, et al, 2011a,b,c; Chaturvedula & Prakash 2011a,b, Ohta et al, 2010).

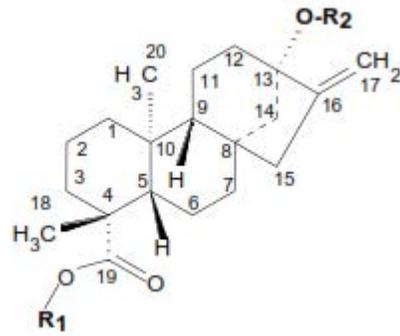
PureCircle GSG is made by enzyme treatment of steviol glycosides (stevia leaf extract), which results in conjugation of additional glucose moieties (glucosylation) to the original steviol glycoside structure via α -(1-4) linkages. The enzyme treatment yields multiple glucosylations (i.e., 1-20 additional glucose units) of steviol glycosides.

PureCircle GSG consists of not less than 80% total steviol glycosides and not more than 20% maltodextrins. Total steviol glycosides contain 70-80% glucosylated steviol glycosides of different molecular weights and less than 10% residual unchanged steviol glycosides from starting stevia leaf extract. PureCircle GSG is a white to off-white powder that has a clean taste with no abnormal odor. The powder is freely soluble in water.

The structures of typical steviol glycoside components in PureCircle GSG have been shown in detail in GRNs 337, 375, 448, and 452 (US FDA, 2015) and they are discussed further in the following section.

Figure 2 depicts a typical HPLC chromatogram of PureCircle GSG, which shows the peaks for major components of steviol glycosides present in the GSG product.

Figure 1. Backbone Structure for Steviol Glycosides



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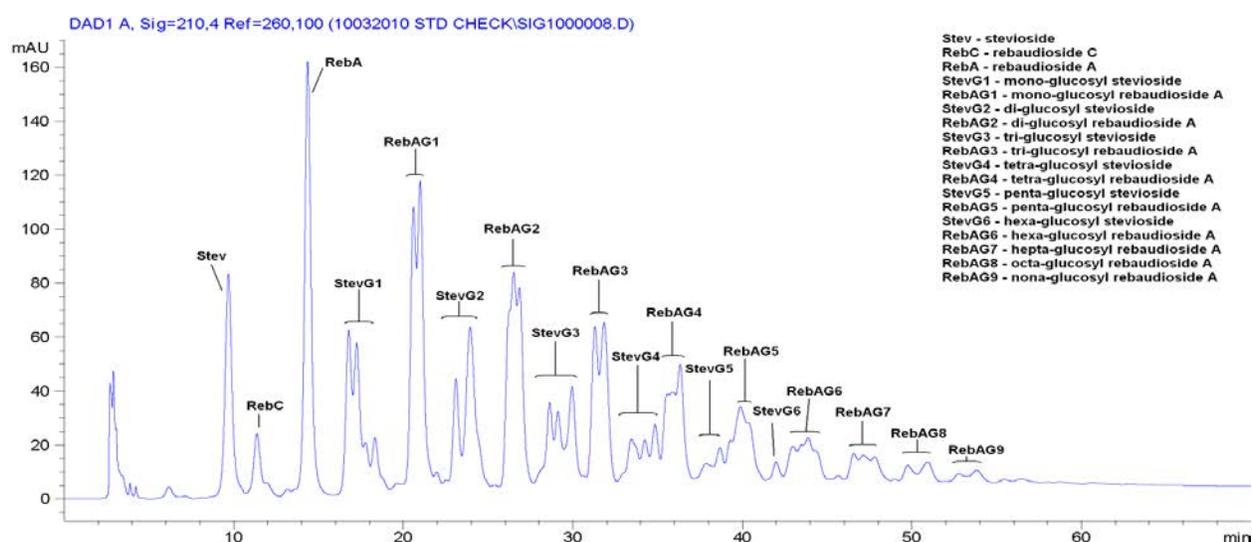
Table 1. Compositions and R-Groups in Backbone Structure (see Figure 1)

#	Common Name	Molecular Composition	R ₁	R ₂
1) Steviol + Glucose (SvGn)				
1.1	Steviolmonoside	SvG1	H	Glcβ1-
1.2	Steviol-19-O-β-D-glucoside	SvG1	Glcβ1-	H
1.3	Rubusoside	SvG2	Glcβ1-	Glcβ1-
1.4	Steviolbioside	SvG2	H	Glcβ(1-2)Glcβ1-
1.5	Stevioside	SvG3	Glcβ1-	Glcβ(1-2)Glcβ1-
1.6	Stevioside A	SvG3	Glcβ(1-2)Glcβ1-	Glcβ1-
1.7	Rebaudioside B	SvG3	H	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
1.8	Rebaudioside G	SvG3	Glcβ1-	Glcβ(1-3)Glcβ1-
1.9	Stevioside B	SvG3	Glcβ(1-3)Glcβ1-	Glcβ1-
1.10	Rebaudioside E	SvG4	Glcβ(1-2)Glcβ1-	Glcβ(1-2)Glcβ1-
1.11	Rebaudioside A	SvG4	Glcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
1.12	Rebaudioside A2	SvG4	Glcβ1-	Glcβ(1-6)Glcβ(1-2)Glcβ1-
1.13	Rebaudioside D	SvG5	Glcβ(1-2)Glcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
1.14	Rebaudioside I	SvG5	Glcβ(1-3)Glcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
1.15	Rebaudioside L	SvG5	Glcβ1-	Glcβ(1-6)Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
1.16	Rebaudioside Q2	SvG5	Glcα(1-2)Glcα(1-4)Glcβ1-	Glcβ(1-2)Glcβ1-
1.17	Rebaudioside Q	SvG5	Glcβ1-	Glcα(1-4)Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
1.18	Rebaudioside I2	SvG5	Glcβ1-	Glcα(1-3)Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
1.19	Rebaudioside Q3	SvG5	Glcβ1-	Glcα(1-4)Glcβ(1-3)[Glcβ(1-2)]Glcβ1-
1.20	Rebaudioside I3	SvG5	Glcβ(1-2)[Glcβ(1-6)]Glcβ1-	Glcβ(1-2)Glcβ1-
1.21	Rebaudioside M	SvG6	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
2) Steviol + Rhamnose + Glucose (SvR1Gn)				
2.1	Dulcoside A	SvR1G2	Glcβ1-	Rhaα(1-2)Glcβ1-
2.2	Dulcoside B	SvR1G2	H	Rhaα(1-2)[Glcβ(1-3)]Glcβ1-
2.3	Rebaudioside C	SvR1G3	Glcβ1-	Rhaα(1-2)[Glcβ(1-3)]Glcβ1-
2.4	Rebaudioside C (isomer)	SvR1G3	Rhaα(1-2)Glcβ1-	Glcβ(1-3)Glcβ1-
2.5	Rebaudioside H	SvR1G4	Glcβ1-	Glcβ(1-3)Rhaα(1-2)[Glcβ(1-3)]Glcβ1-
2.6	Rebaudioside K	SvR1G4	Glcβ(1-2)Glcβ1-	Rhaα(1-2)[Glcβ(1-3)]Glcβ1-
2.7	Rebaudioside J	SvR1G4	Rhaα(1-2)Glcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
2.8	Rebaudioside N	SvR1G5	Rhaα(1-2)[Glcβ(1-3)]Glcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
2.9	Rebaudioside O	SvR1G6	Glcβ(1-3)Rhaα(1-2)[Glcβ(1-3)]Glcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-
3) Steviol + Xylose + Glucose (SvX1Gn)				
3.1	Stevioside F	SvX1G2	Glcβ1-	Xylβ(1-2)Glcβ1-
3.2	Rebaudioside F	SvX1G3	Glcβ1-	Xylβ(1-2)[Glcβ(1-3)]Glcβ1-

3.3	Rebaudioside F2	SvX1G3	Glcβ1-	Glcβ(1-2)[Xylβ(1-3)]Glcβ1-
3.4	Rebaudioside F3	SvX1G3	Xylβ(1-6)Glcβ1-	Glcβ(1-2)Glcβ1-
4) Steviol + Fructose + Glucose (SvF1Gn)				
4.1	Rebaudioside A3	SvF1G3	Glcβ1-	Glcβ(1-2)[Fruβ(1-3)]Glcβ1-
5) Steviol + deoxyGlucose + Glucose (SvdG1Gn)				
5.1	Stevioside D	SvdG1G2	Glcβ1-	6-deoxyGlcβ(1-2)Glcβ1-
5.2	Stevioside E	SvdG1G3	Glcβ1-	6-deoxyGlcβ(1-2)[Glcβ(1-3)]Glcβ1-
5.3	Stevioside E2	SvdG1G3	6-deoxyGlcβ1-	Glcβ(1-2)[Glcβ(1-3)]Glcβ1-

NA = No standardized name at this time; SV = steviol; G= Glucose; R= Rhamnose; X= Xylose; F=Fructose; dG=deoxyGlucose; n=number of units

Figure 2. Major Steviol Glycoside Components of PureCircle GSG by HPLC



III. METHOD OF MANUFACTURE

A. Production Process

A schematic overview of the production process of PureCircle GSG is illustrated below in Figure 3; it can be divided into two stages. The first stage outlines the production of purified RA50 (stevia leaf extract) powder, which is treated with enzyme and tapioca starch in the second stage to make the PureCircle GSG. The production process of RA50 powder is consistent with the methodologies for the manufacture of steviol glycosides as described in the respective Chemical and Technical Assessment (CTA) published by JECFA (2007a). PureCircle's process for GSG uses food grade ethanol, CGTase (EC 2.4.1.19), and α-amylase (EC 3.2.1.1). The CGTase is produced by *Bacillus stearothermophilus*, a non-GM and non-pathogenic strain. The α-amylase (Termamyl® Classic; EC 3.2.1.1) is produced by *Bacillus licheniformis*, a non-GM and non-pathogenic strain. PureCircle GSG is manufactured in a facility certified under Food Safety

System Certification (FSSC) 22000:2010. Solvent, enzyme, and process aids specifications are attached in Appendix A.

Stage 1

Stevia rebaudiana leaves are used as raw material. Stevia leaves are extracted with hot water at 50-60°C for 1-2 h in continuous countercurrent extractors. The filtrate is separated by mesh screens and collected in the holding tank.

The filtrate is treated with flocculant (calcium hydroxide) to remove the mechanical particles, proteins, polysaccharides, and coloring components. The resulting precipitate (floc) is separated by the plate-and-frame filter press. The obtained clear solution is deionized by ion-exchange resins in (H+) and (OH-) form.

The deionized filtrate is fed to a column system packed with macroporous adsorption resin, wherein the steviol glycosides are adsorbed onto resin. The columns are washed with deionized water to remove the impurities that did not adsorb on the resin. Then, steviol glycosides from the column system are desorbed from the resin with aqueous ethanol.

The obtained steviol glycoside solution is treated with activated carbon. The carbon is separated by plate-and-frame filter press. The ethanol is removed from solution by standard evaporator, and the resulting aqueous solution is deionized again by ion-exchange resins in (H+) and (OH-) forms. The refined solution is concentrated using a nanofiltration membrane. The concentrated solution is spray dried to yield stevia extract powder containing >50% Reb A.

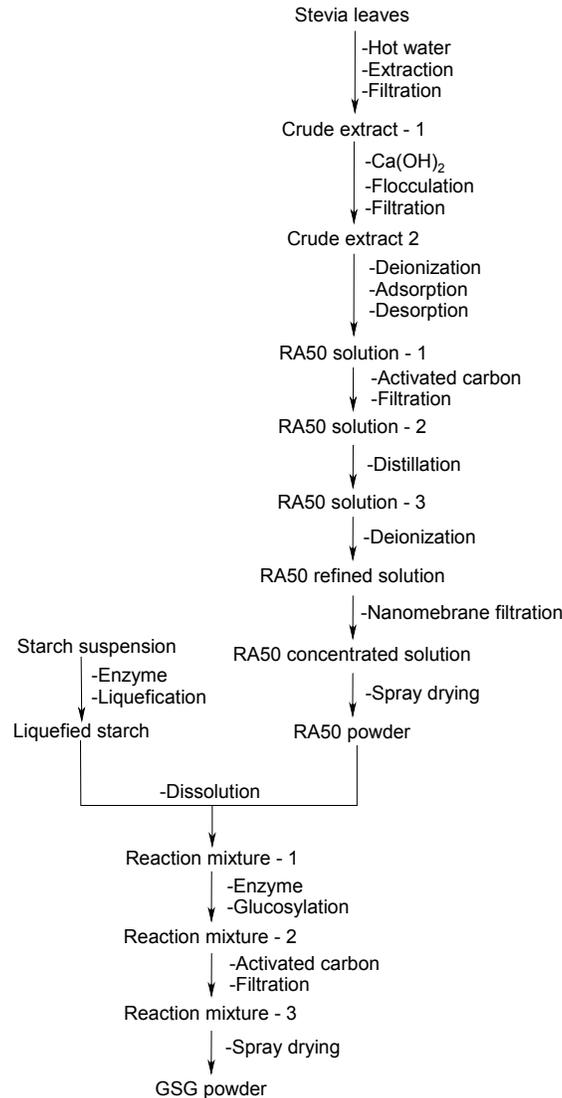
Stage 2

Tapioca starch is dissolved in reverse osmosis (RO) water and liquefied using CGTase and α -amylase enzymes.

The stevia leaf extract powder (containing >50% Reb A) is added to liquefied starch. Another portion of CGTase is added to this mixture, and the reaction media is incubated at 60°C over 48 hrs. The reaction mixture is then heated to 100°C and held for 15 min to inactivate the enzymes.

The obtained mixture is treated with activated carbon to remove the inactivated enzymes. The carbon is separated by candle filter to yield glucosyl steviol glycoside solution, which is dried by means of conventional pressure nozzle spray dryer. The resulting PureCircle GSG is a free flowing powder that contains glucosylated steviol glycosides of different molecular weights and residual unchanged steviol glycosides and maltodextrin,

Figure 3. Schematic Overview of the Manufacturing Process for PureCircle GSG



B. Raw Materials, Processing Aids, and Equipment Specifications

1. *Stevia rebaudiana* Bertoni Leaves

The crushed leaves of the perennial shrub *Stevia rebaudiana* (Bertoni) Bertoni of the Asteraceae (Compositae) family is the starting raw material for the production of PureCircle GSG. The shrub is indigenous to the Paraguayan region of South America. The Asteraceae family of plants also includes other well-known plants such as dandelion, sunflower, marigolds, and chrysanthemums. The dried leaves of the Stevia plant have been used traditionally for at least 100 years to sweeten native drinks (Lewis, 1992; Geuns, 2003).

2. Calcium Hydroxide

High-purity calcium hydroxide [Ca(OH)₂], meeting the current specification listed in the Food Chemicals Codex (FCC, 2012), is used as a flocculant during the production of the intermediate steviol glycoside extract. Calcium hydroxide is permitted for use in food as a direct food additive with no limitations apart from cGMP (21 CFR §184.1205) (U.S. FDA, 2012a). The certificate of analysis can be found in Appendix A-1.

3. Ethanol

Food-grade ethanol, meeting the specifications of the FCC, is used during the production process of PureCircle GSG as a desorption solvent. A certificate of analysis is provided in Appendix A-2. FCC has established a maximum concentration of 0.5% for ethanol residues in steviol glycosides (USP, 2011), and JECFA has specified a maximum level of 5,000 mg/kg for residues of ethanol in steviol glycosides (JECFA, 2010).

4. Activated Carbon

Activated carbon, meeting appropriate food-grade specifications, is used as a decolorizing agent in the production process of the intermediate steviol glycoside extract. A specification sheet and certificate of analysis are provided in Appendix A-3.

5. Ion-Exchange Resin

An ion-exchange resin is used during the production process to remove various impurities, including minerals, from the steviol glycoside extract. The crude steviol glycoside solution is passed through the ion-exchange column during two steps of the production process. The resin was tested for levels of heavy metals (cadmium, lead, mercury, and chromium), as well as polybrominated biphenyls (PBBs) and polybrominated biphenyl ethers (PBBEs) (for the certificate of analysis, see Appendix A-4).

Several varieties of ion-exchange resins are permitted for use by the U.S. Food and Drug Administration (FDA) for the purification of food (21 CFR §173.25) (U.S. FDA, 2012a).

6. Adsorption Resin

An adsorption resin consisting of divinyl benzene is used to purify the steviol glycoside extract by separating the steviol glycosides from other impurities. The resin was submitted for testing to determine levels of lead and volatile organic compounds including benzene, toluene, m-, p-, and o-xylene (see Appendix A-5 for the certificate of analysis).

Divinyl benzene-based resins are permitted for use by FDA for the purification of food (21 CFR §173.25) (U.S. FDA, 2012a).

7. Enzymes

Cyclomaltodextrin glucanotransferase (CGTase) enzyme derived from *Geobacillus stearothermophilus* is used as a processing aid. CGTase (EC 2.4.1.19; 21 CFR §184.1012; CAS No. 9030-09-5) is used in the production of various food additives (e.g., cyclodextrins, trehalose). The enzyme α -Amylase [21 CFR 184.1148 (U.S. FDA, 2010g)] is widely used in the starch industry for liquefaction. The certificates of for five lots of CGTase enzyme are provided in Appendix A-6.

8. Starch

Tapioca starch (CAS No. 9005-25-8), derived from Cassava roots (*Manihot esculenta* Crantz Cassava), acts as a donor of glucose units to make glucosylated steviol glycosides. A certificate of analysis is provided in Appendix A-7.

C. Product Specifications

1. Physical and Chemical Specifications

Table 2. Physical & Chemical Specifications for PureCircle GSG

Specification Parameter	PureCircle GSG	Method of Analysis
Appearance	White to off-white powder	Sensory Evaluation
Total Content of Steviol Glycosides (dry basis)	>80%	Absorption Chromatography
Dextrin (dry basis)	<20%	Absorption Chromatography
Loss on Drying	≤6%	FAO/JECFA, 2006 (Vol 4) ¹ (p. 61)
Total Ash	<1%	FAO/JECFA, 2006 (Vol 4; Method I) (pp. 53-54)
Arsenic	<0.5 mg/kg	AOAC (2005) ² , Method 993.14
Lead	<1 mg/kg	AOAC (2005), Method 993.14
Mercury	<1 mg/kg	AOAC (2005), Method 993.14

¹ FAO/JECFA (2006). *Combined Compendium of Food Additive Specifications [Online Edition]. General Specifications for Enzymes Analytical Methods, Volume 4: Analytical Methods, Test Procedures and Laboratory Solutions Used by and Referenced in the Food Specifications*. 1st to 65th JECFA Meetings, 1956–2005. (FAO JECFA Monographs 1). Rome, Italy: Food and Agriculture Organization of the United Nations (FAO), Joint FAO/WHO Expert Committee on Food Additives (JECFA).

² AOAC (2005). *Official Methods of Analysis of the Association of Official Analytical Chemists: Vols. 1&2, 18th edition*. Association of Official Analytical Chemists (AOAC). Arlington (VA).

2. Microbiological Specifications

PureCircle GSG is produced from a natural source (i.e., leaves of the *S. rebaudiana* Bertoni plant). As such, microbiological specification parameters have been established to ensure the safety of its use in food, similar to those for other food ingredients derived from natural sources. Standard microbial tests appropriate for food ingredients are employed. The microbiological specifications for PureCircle GSG are presented in Table 3, along with the methods of analyses utilized.

Table 3. Microbiological Specifications for PureCircle GSG

Specification Parameter	Specification	Method of Analysis
Total Plate Count (CFU/g)	<1,000	FDA BAM, Chapter 3 ²
Yeast & Mold (CFU/g)	<200	AOAC 997.02 ¹
Total Coliforms (MPN/g)	Not detected	FDA BAM, Chapter 4 ²
<i>Escherichia coli</i> count (MPN/g)	Not detected	AOAC 991.14 ¹
<i>Salmonella</i> sp.	Negative in 25 g	AOAC 2000.07 ¹

¹ AOAC (2005). *Official Methods of Analysis of the Association of Official Analytical Chemists: Vols. 1&2, 18th edition* (Current through Revision 1, 2006). Arlington (VA): Association of Official Analytical Chemists (AOAC).

² U.S. Food and Drug Administration, 2013. *Bacteriological analytical manual (BAM), September 2002; Revised doc, 2013.*

D. Product Analysis

1. Physical and Chemical Analyses of Stevia Leaf Extract (RA50) used for the Production of PureCircle GSG

Analyses of 5 non-consecutive lots of PureCircle RA50 that were used for manufacturing GSG demonstrates that the manufacturing process, as described in Section III.A, produces a consistent product that contains >95% steviol glycosides. Table 4 summarizes the results of the batch analysis for the 5 production lots of RA50 and Table 5 presents the distribution of steviol glycosides in those batches. Certificates of Analysis of the production lots can be found in Appendix B.

Table 4. Summary of the Chemical Product Analyses for 5 Lots of RA 50 (starting stevia leaf extract containing 95% steviol glycosides)

Parameter	Test Method	Specification	Manufacturing Lot				
			C1-002-0115-0011	C1-002-0115-0007	C1-002-0115-0026	C2-002-0514-0021	C2-002-0715-0074
Appearance	Sensory Evaluation	Off-white to white powder	Approved	Approved	Approved	Approved	Approved
Total Steviol Glycosides, % (anhydrous basis)	JECFA 2010 ¹	≥95.0	96.33	96.39	96.32	95.75	95.98

Rebaudioside A, %	JECFA 2010	≥50.0	59.18	57.88	58.71	52.86	59.00
Loss on Drying, %	JECFA Vol.4 ²	≤6.0	4.78	4.59	4.89	3.95	3.88
Ash, %	JECFA Vol.4	<1.0	0.04	0.05	0.02	0.04	0.04
Solubility, %	JECFA Vol.4	Freely soluble	Approved	Approved	Approved	Approved	Approved
pH, 1% in water	JECFA Vol.4	4.5~7.0	6.08	5.76	5.87	6.63	5.46
Residual Ethanol, %	USP<467> ³	<0.50	0.17	0.13	0.12	0.16	0.07
Residual Methanol, %	USP<467>	<0.02	Not Detected				
Lead (as Pb), ppm	AOAC 993.14 ⁴	<1.0	0.008	0.007	<0.005	<0.005	<0.005
Arsenic (as As), ppm	AOAC 993.14	<1.0	0.011	0.015	<0.005	0.034	<0.005
Cadmium (as Cd), ppm	AOAC 993.14	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (as Hg), ppm	AOAC 993.14	<1.0	<0.005	<0.005	<0.005	Not Reported	<0.005
Total Plate Count, CFU/g	Chapter 3, FDA ⁵	<1000	<250	<250	Not Detected	<250	Not Detected
Yeast & Mold, CFU/g	Chapter 18, FDA	<200	Not Detected				
Total Coliform, MPN/g	Chapter 4, FDA	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
<i>E. coli</i> count, MPN/g	Chapter 4, FDA	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
<i>Salmonella sp.</i>	Chapter 5, FDA	Negative/25 g	Not Detected				

¹ JECFA (2010). Steviol glycosides [Prepared at the 73rd JECFA (2010) and published in FAO JECFA Monographs 10 (2010)]. In: Combined Compendium of Food Additive Specifications [Online Edition]. General Specifications for Enzymes Analytical Methods, Volume 4. (FAO JECFA Monographs 10). Rome, Italy: Food and Agriculture Organization of the United Nations (FAO), Joint FAO/WHO Expert Committee on Food Additives (JECFA). Available at: <http://www.fao.org/ag/agn/jecfa-additives/specs/monograph10/additive-442-m10.pdf>.

² FAO/JECFA (2006). *Combined Compendium of Food Additive Specifications [Online Edition]. General Specifications for Enzymes Analytical Methods, Volume 4: Analytical Methods, Test Procedures and Laboratory Solutions Used by and Referenced in the Food Specifications*. 1st to 65th JECFA Meetings, 1956–2005. (FAO JECFA Monographs 1). Rome, Italy: Food and Agriculture Organization of the United Nations (FAO), Joint FAO/WHO Expert Committee on Food Additives (JECFA). Available at: <ftp://ftp.fao.org/docrep/fao/009/a0675e/a0675e00.pdf> [Last updated (Web version): August 2011].

³ USP (2012). United States Pharmacopeia, 35th edition & National Formulary, 30th edition [Online]. Rockville (MD): U.S. Pharmacopeia (USP) Convention Inc. Available at: <http://www.uspnf.com/> [Subscription Only].

⁴ AOAC (2005). *Official Methods of Analysis of the Association of Official Analytical Chemists: Vols. 1&2, 18th edition* (Current through Revision 1, 2006). Arlington (VA): Association of Official Analytical Chemists (AOAC).

⁵ U.S. Food and Drug Administration, 2013. Bacteriological analytical manual (BAM)

Table 5. Summary of the Steviol Glycoside Distribution for 5 Lots of RA 50 (starting stevia leaf extract)

Sample/	C1-002-0115-0007	C1-002-0115-0011	C1-002-0115-0026	C2-002-0715-0074	C2-002-0514-0021
Reb A	57.88	59.18	58.71	59.00	52.86
Stev	25.77	24.80	25.24	24.71	31.17
Reb-C	7.03	7.07	7.04	8.90	8.57
Reb-F	1.41	1.43	1.48	1.67	1.45
Reb D	0.58	0.57	0.57	0.83	0.46
Reb-B	0.53	0.30	0.23	0.32	0.24
Rubu	0.44	0.41	0.43	0.13	0.26
DulA	0.40	0.40	0.41	0.37	0.66
Reb M	0.24	0.25	0.20	0.23	0.16
Reb N	0.21	0.21	0.20	0.24	0.15
Reb O	0.15	0.17	0.17	0.19	0.06
Reb E	0.13	0.12	0.10	0.15	0.11
Steviolbioside	0.03	0.02	0.02	0.05	0.10
Stev (Isomer)	1.25	1.13	1.20	0.83	0.97
Reb C (isomer)	0.34	0.27	0.32	0.28	0.20
TSG (9) JECFA	94.07	94.18	94.13	95.98	95.77
TSG (15)	96.39	96.33	96.32	97.90	97.42

2. Physical and Chemical Analyses of PureCircle GSG

Analyses of 5 non-consecutive lots of PureCircle GSG demonstrate that the manufacturing process, as described in Section III.A, produces a consistent product. Table 6 summarizes the results of the batch analyses for the 5 production lots of PureCircle GSG (Appendix C). The specifications, certificates of analysis, and supporting HPLC chromatograms associated with the specified production lots can be found in Appendix C.

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Table 6. Steviol Glycoside Distribution for 5 Non-Consecutive Lots of PureCircle GSG

Components (dry basis)	Manufacturing Lot				
	GSG0714568	GSG1114612	GSG0415633	GSG0914578	GSG1014587
Stevioside+RebC+RebA (<10%)	7.68	7.68	7.75	7.63	8.26
Mono & di-Glucosyl Steviol Glycosides	35.45	35.33	36.06	36.29	34.79
Tri & tetra-Glucosyl Steviol Glycosides	22.34	23.59	22.34	22.01	23.09
n-Glucosyl Steviol Glycosides n=5-20	18.31	21.39	18.05	19.99	19.66
Total Steviol Glycosides (>80%)	83.78	87.99	84.64	85.92	85.80
Dextrins (<20%)	16.41	12.74	15.6	14.4	15.15

3. Physical & Microbiological Analyses

Analyses of 5 non-consecutive lots of PureCircle GSG demonstrate that the product consistently meets the heavy metal and microbiological specifications outlined in Section III.C. A summary of the microbiological analyses for the 5 lots of PureCircle GSG is presented in Table 7 (see Appendix C for certificates of analysis).

Table 7. Summary of the Physical & Microbiological Product Analyses for 5 Lots of PureCircle GSG

Specification Parameter	Limit	Manufacturing Lot				
		GSG0714568	GSG1114612	GSG0415633	GSG0914578	GSG1014587
Appearance	White to off-white powder	Approved	Approved	Approved	Approved	Approved
Loss on drying, %	≤6.0	5.69	4.48	3.95	4.95	3.92
Ash, %	<1.0	0.34	0.25	0.21	0.20	0.38
Arsenic (as As), ppm	<0.5	0.187	0.404	0.099	0.197	0.190
Mercury (as Hg), ppm	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Lead (as Pb), ppm	<1.0	0.010	0.026	<0.005	<0.005	0.014
Total Plate Count, CFU/g	<1000	ND	10	30	10	ND
Yeast and Mold, CFU/g	<200	ND	ND	ND	ND	ND
Total Coliforms, MPN/g	Not permitted	ND	ND	ND	ND	ND
<i>E.coli</i> count, CFU/g	Not permitted	ND	ND	ND	ND	ND
<i>Salmonella sp.</i>	Negative/25g	Negative	Negative	Negative	Negative	Negative

ND, not detected

4. Pesticide Analyses

Pesticide analyses were conducted on the final PureCircle GSG product. Two (2) non-

consecutive lots (Lot Nos. GSG0914578 and GSG1014587) assayed for the chemical and microbiological specification parameters were subjected to a multi-residue pesticide screen that covered a range of commonly applied pesticides. No pesticide residues were detected in the finished product (see Appendix D for the analytical reports).

E. Stability of PureCircle GSG

The stability of steviol glycosides has been previously reviewed by a number of the scientific advisory bodies involved in the evaluation of steviol glycosides safety [JECFA, the European Food Safety Authority (EFSA), and the Food Standards Australia/New Zealand (FSANZ)] and also is discussed in several published studies (Chang and Cook, 1983; Kroyer, 1999).

Specifically, JECFA evaluated the stability of steviol glycosides under conditions mimicking their use in foods at their 68th meeting (JECFA, 2007b). The Committee noted that steviol glycosides do not undergo browning or caramelization when heated, and they are reasonably stable under elevated temperatures used in food processing. Under acidic conditions (pH 2 to 4), steviol glycosides (approximately 90 to 94% purity), are stable for at least 180 days when stored at temperatures up to 24°C. When exposed to elevated temperatures (80°C, in water, 8 hours), however, 4 and 8% decomposition was observed in solutions of steviol glycosides at pH 4.0 and 3.0, respectively, indicating that the stability of steviol glycosides is pH and temperature dependent. When the temperature was increased to 100°C, expectedly higher rates of steviol glycoside decomposition (10 and 40% at pH 4.0 and 3.0, respectively) were observed. Based on the above findings, as well as additional publicly available stability studies, JECFA concluded that steviol glycosides are thermally and hydrolytically stable for use in foods and acidic beverages under normal processing and storage conditions. Although the stability of PureCircle GSG was not specifically addressed during JECFA's evaluation, it is expected that the stability of PureCircle GSG would be similar to other steviol glycosides given the similarities in structure. Additional stability studies of PureCircle GSG in a solution under normal and accelerated conditions, as well as at various pH levels and temperatures, were conducted for confirmation. These studies are summarized in Sections III.E.1 and III.E.2, respectively, and they demonstrate that the stability of PureCircle GSG is similar to other steviol glycosides, as previously concluded by JECFA.

1. Storage Stability of PureCircle GSG

PureCircle GSG (Lot SW0210149) sample was stored in original packaging at 40°C and 75% relative humidity, and tested for total steviol glycosides over a 2 year-time period. At each time point, samples were dissolved to a concentration of 500 mg/L to determine the final product's storage stability. Analyses for steviol glycosides and glucosyl steviol glycosides were conducted in accordance with the method provided in Appendix E. As summarized in Table 8, the storage stability of PureCircle GSG was observed over the course of 144 weeks. Additionally, minimal changes over the study period were observed in all major steviol glycosides detected. PureCircle GSG remained in compliance with the assay parameters described in Table 2 throughout the study (Appendix F).

Table 8. Storage Stability of PureCircle GSG (Lot SW0210149) for up to 144 Weeks when Stored at 40°C and 75% Relative Humidity, on Percent (%) Dry Basis

Time, Weeks	4	6	8	18	24	30	36	40	44	48	60	76	88	96	108	120	132	144
Total SG, %	83.42	86.91	84.22	85.65	86.01	85.06	85.19	85.45	87.45	88.61	88.5	85.25	85.31	86.42	86.55	85.7	85.91	85.22

2. pH Stability of PureCircle GSG

The general stability of PureCircle GSG (Lot No. SW0210149) was assessed in 0.1 M phosphate buffer at temperatures ranging from 5 to 37°C, and at pH values from 2 to 8. PureCircle GSG was added to the solutions at target levels of total steviol glycosides of 500 mg/L, and the stability was analyzed over 34 weeks under the respective conditions. The pH stability study report is provided in Appendix G.

As has been observed with other steviol glycosides compositions, the extent and rate of PureCircle GSG degradation were shown to be dependent on pH, temperature, and time. Consistently, PureCircle GSG at any pH level was most stable when stored at 5°C. Over the course of the study, very minor degradation (<3%) was observed after 26 weeks at pH 2, 3, 5, and 6 when stored at 5°C. Almost 50% degradation was observed at 37°C at pH 2.0, compared to 10% loss at pH 2.0 and 25°C.

Overall, at higher pH values (3 to 8), no significant degradation of PureCircle GSG was observed over 34 weeks, regardless of the storage temperature of the solution, as previously stated. Similar to other steviol glycosides, the stability of PureCircle GSG follows the same degradation pathway and is pH-, temperature-, and time-dependent. Therefore, the conclusions regarding the stability of steviol glycosides made by JECFA and other scientific bodies can be extended to include PureCircle GSG.

IV. INTENDED USE OF PURECIRCLE GLUCOSYLATED STEVIOL GLYCOSIDES IN FOOD

PureCircle GSG was developed to perform as a FMP that modifies the flavor profile in food and beverage matrices. PureCircle GSG has the following attributes: (1) possess significantly reduced sweetness intensity than the starting steviol glycosides; (2) modifies flavor profile in application; and (3) optimizes sweetness intensity profile through synergy with other caloric and non-caloric sweetener and food ingredients present in food/beverage matrix. Since GSG can be used as a sweetener and it also can modify flavor, it is imperative to understand the threshold concentration at which GSG alone can provide recognizable perception of sweetness. The FEMA sensory guidance (Harman et al., 2013) provides a recognition threshold concentration of 1.5% sucrose in water.

A. Sweetness Perception

The sweetness contribution of a bi-functional ingredient (like GSG) is fairly complex. The difficulty arises from the detection and recognition of sweetness in relevant conditions of food composition. The interaction with other sweeteners, flavor, and acid can modulate the perception of sweetness. Other factors influencing the perception of sweetness are aroma, viscosity, mouthfeel, temperature, pH, color and other visual stimuli.

The recognition threshold concentration of sweetness for PureCircle GSG in water is 125 mg/kg. The recognition threshold concentration may vary depending on the food and beverage matrix. The maximum use limit of PureCircle GSG in flavored beverages is 250 mg/kg. Appendix H outlines the test methods used for determining the maximum use levels as well as lists the FEMA approved use levels for different foods and beverages.

If a small amount of PureCircle GSG is used with a sweetened beverage (caloric or non-caloric), the product is perceived to be sweeter. However, the same amount may not contribute any sweetness perception in an unsweetened product. It is postulate that the principle driver for this perception of greater sweetness is the ability of GSG to modulate the overall taste and flavor profile, thus increasing the perception of sweetness.

B. Flavor with Modification Property

Flavorings with modifying properties (FMPs) are widely used by the flavor industry to modify or enhance the flavor profile of a flavoring and the food to which it is added. FMPs may not necessarily have or impart a specific characteristic flavor of their own, but can modify the flavor profile by altering flavor attributes such as intensifying specific flavor characteristics (e.g., perceived fruitiness), reducing specific flavor characteristics, masking of off-notes or bitterness, or changing the time onset and duration of the perception of specific aspects of the flavor profile (Harman et al., 2013).

The sensory report (Appendix I) illustrates the contribution of PureCircle GSG to flavor and sweetness profile modification in several food and beverage applications. These examples also show the synergistic effect of GSG with caloric sweeteners (Sugar, HFCS, and Fructose) on the overall sweetness perception. The key finding from these studies is that a modest increase in sweetness perception and flavor modification occur simultaneously in food systems with GSG, and the minor contribution of sweetness cannot be decoupled from the flavor modification otherwise occurring in the complex product matrix.

Another key observation in GSG applications is that solid food (e.g., chewing gum, snacks, breakfast cereal, etc.) and semi-solid food (e.g., paste, yogurt, fruit preparations) need higher concentrations (ppm) of GSG compared to beverages to deliver flavor modification because of the mastication, residence time in the mouth, and dilution effect during consumption.

C. Current Regulatory Status

Glucosylated steviol glycosides are approved in several Asian countries, including Japan, Korea, and Malaysia. Four GRN notifications (GRN 337, 375, 448, and 452) have been submitted to US FDA (US FDA 2010, 2011, 2012, 2013) on enzyme modified steviol glycosides preparations, and have received "no questions" responses from FDA with respect to the GRAS status of GSG under the intended conditions of use. In addition, there is limited availability of glucosylated modified steviol glycosides as a dietary supplement in the US.

D. Intended Use of PureCircle GSG and Levels of Use in Foods

PureCircle GSG is used as a flavoring with modifying properties and can be used in most of the food categories outlined in 21 CFR 170.3(n). Appendix J shows the nominal and maximum use levels that are approved by FEMA as a FMP for different food and beverage applications including baked goods, juice and carbonated beverages, dairy products, snacks, condiments, confectioners, cereal and snacks and fruit and vegetable preparations, etc.

V. ESTIMATED DIETARY CONSUMPTION OF GLUCOSYLATED STEVIOL GLYCOSIDES BASED UPON INTENDED FOOD USES

A. History of Consumption of Steviol Glycosides

Since it was first discovered in the West in 1887 by Antonio Bertoni (a South American natural scientist), *S. rebaudiana* and its isolated steviol glycosides (most commonly stevioside) have been consumed by humans in various countries as sweeteners in foods and beverages (Geuns, 2003). In Brazil and Paraguay, *S. rebaudiana* has been used by its native people for hundreds of years as both a food ingredient and as a tea (Geuns, 2003; Blumenthal, 1995). Use of *S. rebaudiana* leaves as a sweetener by the native Indians of the Guarani Tribe since pre- Columbian times has been documented (Ferlow, 2005). In the 1980s, *S. rebaudiana* became a popular herbal tea ingredient in the United States (Blumenthal, 1995; Ferlow, 2005). Stevioside has been used as a sweetener in Japan for more than 30 years (Geuns, 2003; Ferlow, 2005). There have been no reports of adverse effects following the use of these natural sweeteners (Lee, 1979; Ferlow, 2005).

B. Estimated Consumption of PureCircle GSG Product in the Proposed Food Uses

The consumption of flavor is generally estimated using one of two methods: the possible average daily intake (PADI) or the maximized survey-derived daily per capita intake (MSDI). The PADI estimates were derived by multiplying the anticipated average use level of a flavouring substance in each of 33 food categories by the average amount of food consumed daily from that food category, and summing the intake over all 33 food categories (Munro & Danielewska-Nikiel, 2006). Reportedly, and as noted below, PADI often provides over-estimates of potential exposure. The MSDI, or daily per capita intake ("eaters only"), is determined from the disappearance of flavor ingredients from the marketplace; that is, the annual total volume of a substance reported to be

sold by the industry for use as a flavor ingredient in food and beverages. It is considered a conservative estimate because it incorporates the assumption that only 10% of the US population (i.e., the "eaters only") consumes the entire annual volume reported by the industry. An added margin of safety is provided by the assumption that only 60% of the actual US volume in use was reported in the annual industry survey (Adams et al., 1996).

FEMA used PADI method, which is approved by the FEMA expert panel, to estimate the total intake of PureCircle GSG as a FMP in a wide range of food and beverage categories. PADI incorporates the assumption that all foods within a category (e.g., baked goods) are flavored with PureCircle GSG. This assumption of use of a flavor in all foods in a category, however, does not apply to most flavor ingredients, which are used in only a few items within a category. For instance, methyl anthranilate is used to impart grape flavor in jelly donuts and pastries, which account for only a small fraction of the baked goods consumed daily (e.g., bread, bagels, chocolate cake, etc.). Therefore, PADI often estimates a gross exaggeration of the potential exposure to individual flavor ingredient (Adams et al., 1996; Smith et al., 2001).

A controlled study was conducted to compare the PADI and the daily per capita intake ("eaters only") estimates from the actual intakes of flavor ingredients consumed by 12,000 volunteers over a 14-day eating period (Oser and Hall, 1977). The mean intakes from total observations (MITO) for 12 flavor ingredients in food were determined based on the consumption patterns of these volunteers. The study showed that the PADI estimates were in the range from 10 to 100,000 times greater than the respective MITO estimates, whereas the per capita intake was 0.2 to 30 times the respective MITO.

Table 9 outlines the mean consumption levels (mg/person/day) of each food category by the US consumer and the anticipated usual and maximum use levels of PureCircle GSG in those categories. The mean consumption and PADI for each category were supplied or estimated by FEMA. Note that the top three categories that contribute significantly (56.5 mg/person/day) to the total PADI (115 mg/p/d) are baked goods, instant tea and coffee, and processed fruits. PureCircle has been marketing this product over the last 4 years; there is no significant use of PureCircle GSG in these categories in any market worldwide. PureCircle GSG is used with caloric and non-caloric sweeteners to impart flavor modification mainly in reduced-sugar beverage and dairy products, and at a very limited amount in other food categories.

The steviol equivalent has been estimated considering the molecular weight, and the concentration of glucosylated steviol glycosides and steviol glycosides present in a typical PureCircle GSG batch (as detailed in Appendix C). The steviol equivalent is approximately 0.20. Even if every product in each category in Table 9 used PureCircle GSG, which is highly improbable, the daily intake is 23 mg/person/day steviol equivalent, or 0.33 mg/kg bw/d (steviol equivalent) for a 70 kg person. Since Oser and Hall (1977) reported that PADI estimates can be at least 10 times higher than actual consumption, the steviol equivalent consumption from GSG as a flavoring agent can be as low as 0.04 mg/kg bw/d.

1. Estimated Consumption of PureCircle GSG Product along with Stevia Sweeteners in the Proposed Food Uses

The PureCircle GSG product can be used alone to modify flavor and sweetness profiles in food applications as discussed in Section IV. A and B. The GSG product is also used with other caloric and non-caloric sweeteners in food and beverage products. When PureCircle GSG is used with other stevia sweeteners in food applications, an analysis is performed to show that overall steviol contribution from the stevia-based sweetener and flavor (GSG) remains significantly below the JECFA ADI for steviol glycosides, which is 4 mg/kg bw/d steviol equivalent.

For the consumption analysis, three PureCircle stevia leaf extracts (sweeteners) were selected; they are SG95 (GRN 323), Reb D (GRN 456), and Reb X or Reb M (GRN 473) Preparation ((U.S. FDA 2010a, 2013a, 2013b). All three sweeteners have total steviol glycosides (TSG) greater than 95%. SG95 is a stevia leaf extract product containing 50-60% rebaudioside A with 8 other steviol glycosides (rebaudiosides B, C, D, F, stevioside, dulcoside A, rubusoside, and steviolbioside) totaling 95% TSG. Reb D is a stevia leaf extract containing around 95% rebaudioside D. Reb X contains mainly rebaudioside M and some Reb D. Table 9 lists the consumption of different stevia sweeteners as steviol equivalents for different population group, and their average and high consumers.

Table 9. Estimated Consumption of Stevia Leaf Extract Sweeteners Using Renwick’s (2008) Methodology of Intense Sweetener Intake Assessment Based on Post-Market Surveillance Intake Data for Currently Used Sweeteners (US FDA 2010a, 2013a,b)

Population Group	Intakes of Intense Sweeteners ³ (expressed as sucrose equivalents) (mg/kg bw/day)		Consumption Estimates for SG95 as steviol equivalents ¹ (mg/kg bw/day)		Consumption Estimates for Reb D as steviol equivalents ² (mg/kg bw/day)		Consumption Estimates for Reb X as steviol equivalents ³ (mg/kg bw/day)	
	Average Consumer	High Consumer	Average Consumer	High Consumer	Average Consumer	High Consumer	Average Consumer	High Consumer
Non-diabetic Adults	255	675	0.38	1.00	0.27	0.70	0.31	0.83
Diabetic Adults	280	897	0.41	1.33	0.29	0.94	0.35	1.11
Non-diabetic Children	425	990	0.63	1.47	0.44	1.03	0.52	1.22
Diabetic Children	672	908	1.00	1.35	0.70	0.94	0.83	1.12

³ Renwick and Tarka (2008)

¹ SG95 consumption was calculated with relative sweetness of 230x sweeter than sugar and steviol equivalent of 0.341

² Reb D consumption was calculated with relative sweetness of 270x sweeter than sugar and steviol equivalent of 0.282

³ Reb X consumption was calculated with relative sweetness of 200x sweeter than sugar and steviol equivalent of 0.247

As seen in Table 9, the maximum consumption of 1.47 mg/kg bw/d was found for high consumer group of non-diabetic children, when the SG95 was used as the chosen sweetener. The lowest consumption was 0.31 mg/kg bw/d for the average consumer group of non-diabetic adults when the selected stevia sweetener is Reb X. When GSG is used as a flavor with any of these

sweeteners in food and beverage applications, GSG will contribute an additional 0.33 mg/kg bw/d (highly exaggerated) of steviol equivalents or 0.04 mg/kg bw/d (more reasonable) of steviol equivalents. Either way, the maximum total steviol consumption for the combined use of stevia sweeteners and GSG as a flavor for any consumer groups may not be higher than 1.80 mg/kg bw/d (1.47+0.33), which is significantly below the JECFA ADI for steviol glycosides, which is 4 mg/kg bw/d steviol equivalent.

Considering the potential gross exaggeration of the exposure estimates by PADI and the use of GSG in selective applications of food categories, the steviol contribution from PureCircle GSG will be minimal when GSG is used as a flavor in reduced sugar or no sugar added food products made with stevia sweetener or any other caloric or non-caloric sweeteners.

VI. INFORMATION TO ESTABLISH THE SAFETY OF GLUCOSYLATED STEVIOL GLYCOSIDES

A. Background

Over the last few decades, the safety of steviol glycosides has been considered by several scientific bodies and regulatory agencies, including FDA, JECFA, the European Commission's Scientific Committee on Food (SCF), EFSA, FSANZ, and Health Canada. Interest in the use of steviol glycosides as sweeteners has encouraged extensive testing of the compounds, and, as such, a large safety database exists. This database includes a thorough examination of the comparative metabolism and pharmacokinetics of steviol glycosides in experimental animals and humans, which extends the overall safety comprehension of the class of similar compounds, acute toxicity studies, short- and long-term toxicity and carcinogenicity studies, reproductive and developmental toxicology studies, in vitro and in vivo mutagenicity/genotoxicity studies, and human studies. GRN 473 (U.S. FDA 2013b), submitted by PureCircle, outlines the safety studies with steviol glycosides in detail.

The scientific literature focusing on safety considerations has been reviewed and updated as of September 16, 2015.

B. Safety Data on Glucosylated Steviol Glycosides

GSG (Glucosylated Steviol Glycosides) consists of higher glycosides of steviol that are formed by adding glucose residues to the steviol glycosides that have been extracted from leaves of the *Stevia rebaudiana* (Bertoni) plant. The CGTase enzyme transfers glucose units from starch to the high purity steviol glycosides starting material. PureCircle GSG contains at least 75% glucosylated steviol glycosides with less than 10% residual steviol glycosides (mainly Reb A, stevioside and Reb C), along with less than 20% maltodextrin.

The primary documentation for GSG safety consists of a combination of several studies on α -glucosylated steviol glycosides and a great deal of evidence supporting the safety of the steviol glycosides starting material in the GSG production process.

In vitro and ex vivo studies have confirmed that steviol glycosides are not hydrolysed by digestive enzymes of the upper gastrointestinal tract and are not absorbed through the upper portion of the gastrointestinal tract (Hutapea et al., 1997; Geuns et al., 2003, 2007; Koyama et al., 2003a). Therefore, steviol glycosides enter the colon intact, where they are subject to microbial degradation by members of the Bacteroidaceae family, resulting in the release of the aglycone steviol (Renwick and Tarka, 2008). Steviol is absorbed but is rapidly converted to glucuronides which are subsequently excreted in the urine or eliminated by the enterohepatic circulation. Several in vitro studies mimicking the anaerobic conditions of the colon have confirmed the ability of the gut microbiota from mice, rats, hamsters, and humans to hydrolyze steviol glycosides completely to steviol (Wingard et al., 1980; Hutapea et al., 1997; Gardana et al., 2003; Koyama et al., 2003b; Nikiforov et al., 2013; Purkayastha et al., 2014, 2015).

Specifically, Koyama et al., (2003b) investigated the degradation of a stevia mixture containing rebaudioside A, stevioside, rebaudioside C, and dulcoside A (purities not reported) in the presence of human fecal homogenates under anaerobic conditions. Similar to studies conducted with individual steviol glycosides (e.g., stevioside or rebaudioside A), the stevia mixture was degraded completely to steviol within 24 hours of incubation. More recently, another related steviol glycoside, rebaudioside D, was observed to be hydrolyzed to stevioside and steviol upon incubation with rat caecal contents over a period of 90 minutes, which was comparable to that observed with rebaudioside A (Nikiforov et al., 2013). In addition, Prakash Chaturvedula and Prakash (2013) observed that incubation of rebaudioside E with crude pectinase (from *Aspergillus niger*) resulted in the generation of steviol; pectinolytic bacteria are known to reside in the human intestine (Jensen and Canale-Parola, 1985), further establishing the intestinal metabolism of steviol glycosides.

More recently, a series of in vitro metabolism studies have been conducted with individual steviol glycosides containing the differing sugar moieties, glucose, rhamnose, and xylose, including rebaudioside A, B, D, E, M, and steviolbioside (Purkayastha et al., 2014, 2015), rebaudioside C (U. S. FDA, 2014), rebaudioside F and Dulcoside A (Purkayastha et al., 2015a). The separate studies used pooled human fecal homogenate samples from 12 healthy volunteers (6/sex) for rebaudiosides A, B, C, D, F, M, steviolbioside, and dulcoside A. Because all steviol glycosides with different degrees of glycosylation are shown to have the same metabolic fate, it is reasonable to expect that glucosylated steviol glycosides (GSG) with increased numbers of glucose units attached by α -covalent bond are similarly not absorbed in the GI tract, but, instead, are also converted to steviol by the normal flora of the lower GI tract.

The safety of α -glucosylated steviol glycosides is supported by both published and unpublished studies on α -glucosylated steviol glycosides and non-enzymatically modified steviol glycosides. Steviol glycosides are not readily absorbed from the upper small intestine as shown in studies by Koyama et al., (2003a) and Gardana et al., (2003).

A number of toxicological studies on a variety of stevia extracts and preparations of steviol glycosides with stevioside and/or Reb A as predominant components have been evaluated by the

JECFA over the course of many years. Recently, several new in vitro investigations have been conducted to assess the hydrolysis of several minor steviol glycosides. The results of these studies provide confirmation that, in the presence of colonic microflora, all steviol glycosides are hydrolyzed to steviol much like rebaudioside A and stevioside (Purkayastha et al., 2015a; Purkayastha et al. 2015; Purkayastha et al., 2014 Nikiforov et al., 2013; Chaturvedula and Prakash, 2013).

Koyama et al., (2003b) published an in vitro study in which α -glucosylated steviol glycosides were degraded by fecal homogenates under anaerobic conditions to steviol glycosides and subsequently hydrolyzed to the aglycon steviol, demonstrating that the metabolic fate of α -glucosylated steviol glycosides follows that of steviol glycosides. Due to the similarities in metabolic fate, the safety of α -glucosylated steviol glycosides can be established based on studies conducted with non-glucosylated steviol glycosides. Furthermore, as individual steviol glycosides show similar pharmacokinetics in the rat and humans, the results of toxicology studies on individual steviol glycosides are applicable to the safety of steviol glycosides in general.

Studies performed on a GSG product in GRN 337 (US FDA, 2010) provides further support for the safety of enzyme modified steviol glycosides by virtue of the findings from the fecal metabolism evaluation that was performed.

Toxicology studies (Hutapea et al., 1997; Geuns et al., 2007) report that human digestive enzymes are not capable of hydrolyzing β -glycosidic bonds, and, thus, steviol glycosides are not digested in the upper gastrointestinal tract. It is believed that the α -glucopyranosyl moiety of α -glucosylated steviol glycosides may be hydrolyzed by digestive enzymes to the non-modified steviol glycosides form due to the presence of an α -(1 \rightarrow 4) glycosidic bond. Therefore, the resulting non-modified steviol glycoside would follow the same metabolic pathway as other steviol glycosides, whereas the cleaved glucose moiety would be absorbed in the intestine and would follow normal carbohydrate metabolism pathways. However, the amount of glucose released during hydrolysis in the upper gastrointestinal tract is negligible (0.2 or 0.7 kcal/day for children and adults, respectively).

In a review publication, Shibasato (1995) reported that the acute oral LD50 of GSG (enzymatically treated stevia) in mice is greater than 60 g/kg bw. A chronic study of 22-24 months in rats was described as negative at 550 mg/kg bw. In addition, Shibasato reported that enzymatically treated stevia is not mutagenic in a bacterial assay, while reporting that enzyme treated stevia is converted to steviol glycosides by treatment with amylase.

Specific unpublished α -glucosylated steviol glycosides data were presented in GRN 375 (US FDA, 2011) on a 13-week dietary study in rats receiving 1.25, 2.5, or 5.0% α -glucosylated steviol glycosides (0, 253, 519, or 1,059 mg steviol equivalents/kg bw/day for males and 0, 289, 601, or 1,153 mg steviol equivalents/kg bw/day for females, respectively) (Hooks et al., 1988). The authors concluded that, under the conditions of the study, the NOAEL of dietary exposure to α -glucosylated steviol glycosides for 13 weeks was 1,059 and 1,153 mg/kg bw/day for males and females, respectively. This finding was consistent with the results of the subchronic toxicity studies

conducted with steviol glycosides. GRN 375 (FDA, 2011) also reports a lack of genotoxic activity in both in vitro and in vivo studies performed by Toyo Sugar.

Studies conducted in both rats and humans show that GSG starting materials of steviol glycosides are metabolized by microflora in the colon to steviol by successive removal of glucose moieties. Steviol is absorbed from the colon, subjected to glucuronidation in the liver, and excreted via bile primarily in the feces of rats as steviol glucuronide or in the urine of humans. The differences in the routes of elimination are due to the lower molecular weight threshold for biliary excretion in rats (325 Da) compared to humans (500 to 600 Da). Although the primary routes of elimination of steviol glucuronide differ between rats and humans, the metabolism of modified and non-modified steviol glycosides and pharmacokinetics are quite similar, which confirms that the rat is an acceptable model for risk assessment in humans (Roberts and Renwick, 2008; Wheeler et al., 2008).

GRN 337 (U.S. FDA, 2010) repeated the Koyama et al., (2003b) studies on an α -glucosylated steviol glycosides product revealing a comparable metabolic fate with no toxicity. Additionally, GRN 375 (U.S. FDA, 2011) conducted toxicology studies on a similar product, also finding no toxicity. Also, GRN 448 (U.S. FDA 2012) and GRN 452 (U.S. FDA 2013) proposed that GSG has the same metabolic degradation in the large intestine, where glucose units are presumably hydrolyzed and consumed by bacteria, and steviol is excreted through urine as steviol-glucuronide in humans. Given these similarities, the results of toxicology studies on stevioside or rebaudioside A can be used to support the safety assessment of glucosylated steviol glycosides in PureCircle GSG.

Most recently, Urban et al., (2015) reviewed the potential allergenicity of steviol glycosides. The authors noted that: "hypersensitivity reactions to stevia in any form are rare," and concluded that current data do not support claims that steviol glycosides are allergenic. In addition, the authors stated that there is "little substantiated scientific evidence" to warrant consumer warning labels for highly purified stevia extracts.

C. Safety of Enzyme Residues in Glucosylated Steviol Glycosides

The primary enzyme used in the manufacturing process for PureCircle GSG is CGTase (EC 2.4.1.19; CAS No. 9030-09-5) derived from *G. stearothermophilus*, which is a QPS microorganism (EFSA, 2013). CGTase performs the glucosylation reaction needed to add glucose moieties to steviol glycosides to form GSG. CGTase is inactivated during the production of GSG (Figure 3). Also, CGTase complies with the JECFA and FCC recommended specifications for food grade enzymes.

- *G. stearothermophilus* has a long history of safe use in the production of enzymes used in the commercial food industry including alpha-amylase (US FDA, 2012a; Health Canada, 2014), 14- α glucan branching enzyme (US FDA, 2012a), and CGTase (US FDA, 2000, 2001, 2004).
- CGTase has been evaluated by JECFA and the U.S. FDA for the safe use of the enzyme in

the production of α -cyclodextrin, β -cyclodextrin, and γ -cyclodextrin. Both organizations concluded that there were no safety concerns for these enzymatically-derived substances (JECFA, 1993, 1995, 1999; US FDA, 2000, 2001, 2004). JECFA also reviewed the use of CGTase in the production of cyclotetraglucose and cyclotetraglucose syrup produced by *G. stearothermopolis* and concluded that there were no safety concerns (JECFA, 2008a).

- In a related review by another regulatory authority, The Food Safety Commission of Japan conducted a safety assessment of CGTase produced by a genetically modified strain of *Bacillus subtilis* and concluded that there were “no safety concerns relevant to human health” (Japan, 2014).
- The U.S. FDA has issued “no objections” agency response letters to GRAS notifications for CGTase enzyme-modified steviol glycosides preparations regarding the safety of the use of CGTase in the production of steviol glycoside preparations (US FDA, 2010, 2011, 2012, 2013).

The alpha-amylase is used for hydrolysis of tapioca starch and widely used in the starch industry.

D. Summary of Safety Considerations

Steviol glycosides pass undigested through the upper portion of the gastrointestinal tract prior to entering the colon intact where they are subject to microbial degradation by members of the *Bacteroidaceae* family. This results in the release of the aglycone steviol.

All steviol glycosides, including rebaudioside A, stevioside, and PureCircle GSG are hydrolyzed to steviol prior to absorption. Studies comparing the metabolic fate of rebaudioside A and stevioside demonstrate that both glycosides undergo similar pharmacokinetics in the rat; they are both metabolized in the gut to steviol prior to absorption followed by glucuronidation in the liver and excretion in the feces *via* the bile. In both rats and humans, steviol was shown to be metabolized to steviol glucuronide following absorption. Overall, the data demonstrate that rebaudioside A and stevioside exhibit similar metabolic and pharmacokinetic fates in the rat. With the exception of having different numbers and types of sugar moieties, steviol glycosides share the same structural backbone, steviol. As such, all steviol glycosides, including PureCircle GSG, are expected to follow the same metabolic pathway as demonstrated for rebaudioside A and stevioside. Therefore, the results of toxicology studies on either stevioside or rebaudioside A are applicable to the safety of all steviol glycosides.

E. Summary of Safety Opinions by Scientific and Regulatory Authorities With Common Knowledge Considerations

Stevia-derived sweeteners are permitted as food additives in South America and in several countries in Asia, including China, Japan, and Korea. In recent years, these sweeteners have received food usage approvals in Mexico, Australia, New Zealand, Switzerland, France, Peru, Uruguay, Colombia, Senegal, Russia, Malaysia, Turkey, Taiwan, Thailand, Israel, Canada, and Hong Kong (EFSA, 2010, Watson, 2010, HealthCanada, 2012a,b). In the US, steviol glycosides have been used as a dietary supplement since 1995 (Geuns, 2003).

Based on available information from FDA's GRAS Notice Inventory website (U.S. FDA, 2015) as of September 29, 2015, the agency has issued 37 "no questions" letters on GRAS notices on rebaudioside A, rebaudioside D, rebaudioside M, or steviol glycosides, including those undergoing enzyme treatment. A summary of these filings is presented in Table 10.

Company	FDA GRAS Identifier	Material Identity	Intended Food Uses
1. Merisant	GRN 252	High-Purity Reb A $\geq 95\%$	Variety of food categories & table top sweetener
2. Cargill Inc.	GRN 253	High-Purity Reb A $\geq 97\%$	General-purpose sweetener, excluding meat & poultry products
3. McNeil Nutritionals LLC	GRN 275	Purified Steviol Glycosides – Reb A Principal Component	Table top sweetener
4. Blue California	GRN 278	High-Purity Reb A $\geq 97\%$	General-purpose & table top sweetener
5. Sweet Green Fields LLC	GRN 282	High-Purity Reb A $\geq 97\%$	General-purpose sweetener, excluding meat & poultry products
6. Wisdom Natural Brands	GRN 287	Purified Steviol Glycosides $>95\%$ - Reb A and Stevioside Principal Component	General-purpose sweetener, excluding meat, poultry products & infant formulas
7. Sunwin USA LLC & WILD Flavors	GRN 303	High-Purity Reb A $\geq 95\%$ / $\geq 98\%$	General-purpose sweetener, excluding meat, poultry products & infant formulas
8. Sunwin USA LLC & WILD Flavors	GRN 304	Purified Steviol Glycosides $>95\%$ - Reb A and Stevioside Principal Component	General-purpose sweetener, excluding meat, poultry products & infant formulas
9. Pyure Brands, LLC	GRN 318	High-Purity Reb A 95%/98%	General-purpose & table top sweetener, excluding meat, poultry products & infant formulas
10. PureCircle USA Inc	GRN 323	Purified Steviol Glycosides – Reb A Principal Component	General-purpose & table top sweetener, excluding meat, poultry products & infant formulas
11. GLG Life Tech Ltd ^c	GRN 329	High-Purity Reb A $\geq 97\%$	General-purpose sweetener, excluding meat & poultry products
12. NOW Foods	GRN 337	Enzyme Modified Steviol Glycosides Preparation (EMSGP)	General-purpose sweetener in foods, excluding meat & poultry products, at levels determined by good manufacturing practices
13. GLG Life Tech Ltd ^c	GRN 348	High-Purity Stevioside $\geq 95\%$	General-purpose & table top sweetener, excluding meat, poultry products & infant formulas
14. GLG Life Tech Ltd ^c	GRN 349	High-Purity Steviol Glycosides $\geq 97\%$	General-purpose & table top sweetener, excluding meat, poultry products & infant formulas
15. Guilin Layn Natural Ingredients, Corp.	GRN 354	High-Purity Reb A $\geq 97\%$	General-purpose & table top sweetener, excluding meat, poultry products & infant formulas
16. BrazTek International Inc.	GRN 365	Purified Reb A	General-purpose sweetener, excluding meat & poultry products
17. Sinochem Qingdao Co. Ltd.	GRN 367	High-Purity Steviol Glycosides $\geq 95\%$	General-purpose & table top sweetener, excluding meat, poultry products & infant formulas
18. Shanghai Freeman Americas LLC	GRN 369	Purified Reb A	General-purpose sweetener, excluding meat & poultry products

19. Toyo Sugar Refining Co., Ltd. & Nippon Paper Chemicals Co., Ltd.	GRN 375	Enzyme Modified Steviol Glycosides	General-purpose sweetener in foods, excluding meat and poultry products, at levels determined by good manufacturing practices
20. GLG Life Tech Ltd ^b	GRN 380	Purified Reb A	General purpose & table top sweetener, excluding meat & poultry products
21. Chengdu Wagott Pharmaceutical	GRN 388	Purified Reb A	General purpose & table top sweetener, excluding meat & poultry products
22. Chengdu Wagott Pharmaceutical	GRN 389	Steviol Glycosides with Stevioside as the Principal Component	General purpose & table top sweetener, excluding meat & poultry products
23. Daepyeong Co., Ltd.	GRN 393	Purified Reb A	General purpose & table top sweetener, excluding meat & poultry products
24. Daepyeong Co., Ltd.	GRN 395	Steviol Glycosides with Reb A and Stevioside as the Principal Components	General purpose & table top sweetener, excluding meat & poultry products
25. MiniStar International, Inc.	GRN 418	Purified Reb A	General-purpose sweetener, excluding meat, poultry products & infant formulas.
26. Daepyeong Co., Ltd.	GRN 448	Enzyme Modified Steviol Glycosides	General-purpose sweetener, excluding meat, poultry products & infant formulas.
27. Daepyeong Co., Ltd.	GRN 452	Enzyme Modified Steviol Glycosides	General-purpose sweetener, excluding meat, poultry products & infant formulas.
28. PureCircle USA, Inc.	GRN 456	High-Purity Reb D \geq 95%	General-purpose sweetener, excluding meat, poultry products & infant formulas.
29. Almendra, Ltd.	GRN 461	High-Purity Reb A \geq 97%	General-purpose sweetener, excluding meat, poultry products & infant formulas.
30. Qufu Xiangzhou Stevia Products Co., Ltd.	GRN 467	High-Purity Reb A \geq 98%	General-purpose sweetener, excluding meat, poultry products & infant formulas.
31. PureCircle USA, Inc.	GRN 473	Purified Steviol Glycosides – Reb M (Reb X) Principal Component	General-purpose sweetener, excluding meat, poultry products & infant formulas.
32. GLG Life Tech Corp.	GRN 493	High purity steviol glycosides \geq 95%	General-purpose sweetener, excluding meat, poultry products.
33. GLG Life Tech Corp.	GRN 512	High purity Reb M \geq 95%	General-purpose sweetener, excluding meat, poultry products & infant formulas.
34. Almendra Limited	GRN 516	Steviol Glycosides with Reb A and Stevioside as the Principal Components	General-purpose sweetener, excluding meat, poultry products & infant formulas.
35. GLG Life Tech Corp.	GRN 536	High purity Reb C and Steviol glycosides with Reb C as the Principal Component	General-purpose sweetener, excluding meat, poultry products & infant formulas.
36. GLG Life Tech Corp.	GRN 548	High purity Reb D	General-purpose sweetener, excluding meat, poultry products & infant formulas.
37. Productora Alysa SpA	GRN 555	Steviol Glycosides with Reb A as the Principal Component	General-purpose sweetener, excluding meat, poultry products & infant formulas.

^aThis table was derived, in part, from (McQuate, 2011). ^bThe name of this company is now GLG Life Tech Corporation.

In addition, the Flavor and Extract Manufacturers Association (FEMA) has included several steviol glycoside preparations on their GRAS lists, as shown in Table 11.

Table 11. FEMA GRAS Status for Steviol Glycosides Preparations

Steviol Glycoside Preparation	FEMA Number	Reference
Rebaudioside A	4601	(Smith et al., 2009)
Rebaudioside C; dulcoside B	4720	(Leffingwell, 2011)
Glucosyl steviol glycosides; enzymatically modified stevia extract	4728	(Leffingwell and Leffingwell, 2014, Marnett et al., 2013)
Stevioside	4763	(Leffingwell and Leffingwell, 2014, Marnett et al., 2013)
Steviol glycoside extract, <i>Stevia rebaudiana</i> , Rebaudioside A 60%	4771	(Marnett et al., 2013)
Steviol glycoside extract, <i>Stevia rebaudiana</i> , Rebaudioside A 80%	4772	(Marnett et al., 2013)
Steviol glycoside extract, <i>Stevia rebaudiana</i> , Rebaudioside C 30%	4796	(Cohen et al., 2015a, Cohen et al., 2015b)
Steviol glycoside extract, <i>Stevia rebaudiana</i> , Rebaudioside A 22%	4805	(Cohen et al., 2015a, Cohen et al., 2015b)
Steviol glycoside extract, <i>Stevia rebaudiana</i> Rebaudioside C 22%	4806	(Cohen et al., 2015a, Cohen et al., 2015b)

The Joint Expert Committee on Food Additives (JECFA) reviewed steviol glycosides at its 51st, 63rd, 68th and 73rd meetings. In 2000, JECFA published the original review on steviol glycosides (WHO, 2000). JECFA established a temporary ADI (acceptable daily intake) of 0-2 mg per kg (on a steviol basis) at its 63rd meeting (WHO, 2006). Additionally, JECFA finalized food grade specifications (FAO, 2007), although they were subsequently updated in 2008 (FAO, 2008) and 2010 (FAO, 2010) (see below). At the 69th meeting, the temporary status of the ADI was removed, and the ADI was raised to 0-4 mg per kg bw per day (on a steviol basis) as a result of the JECFA review of more recently completed clinical studies with steviol glycosides (WHO, 2008). In 2009, JECFA published a final monograph addendum on steviol glycosides (WHO, 2009).

In early 2009, a number of parties, including the government of Australia and the Calorie Control Council, submitted a request to the Codex Committee on Food Additives in which it was proposed that the JECFA specifications for steviol glycosides should be modified to allow inclusion of rebaudioside D and rebaudioside F as specifically named acceptable glycosides that would be considered as part of the minimum 95% steviol glycosides composition (CCFA, 2009). This proposed modification was endorsed by the Codex Alimentarius Committee in July 2009; it was on the agenda for discussion at the JECFA Meeting in June, 2010 (FAO/WHO, 2009), and JECFA subsequently took final action in approving the modified steviol glycosides specifications to include rebaudioside D and rebaudioside F (FAO, 2010).

In 2008, Switzerland's Federal Office for Public Health approved the use of stevia as a sweetener citing the favorable actions of JECFA (Health, 2008). Subsequently, France published its approval for the food uses of rebaudioside A with a purity of 97% (AFSSA, 2009a, AFSSA, 2009b).

Also in 2008, the Food Standards Australia New Zealand (FSANZ) completed its evaluation of an application for use of steviol glycosides in foods. FSANZ recommended that the Australia and New Zealand Food Regulation Ministerial Council (Ministerial Council) amend the Australia New Zealand Food Standards Code to allow the use of steviol glycosides in food (FSANZ, 2008). In December 2010, FSANZ recommended accepting the increased usage levels as requested since no public health and safety issues were identified (FSANZ, 2010). Subsequently, FSANZ approved an increase in the maximum permitted level (MPL) of steviol glycosides (expressed as steviol equivalents) in ice cream, water based beverages, brewed soft drinks, formulated beverages, and flavored soy beverages up to 200 mg per kg, and in plain soy beverages up to 100 mg per kg (FSANZ, 2011). In a recent risk assessment, FSANZ concluded that the use of Reb M does not pose any "public health and safety issues." (FSANZ, 2015b). In addition, FSANZ proposed to add Reb M to the list of permitted steviol glycosides (FSANZ, 2015a).

As of May 2010, the government of Hong Kong amended its food regulations to allow the use of steviol glycosides as a permitted sweetener in foods (Safety, 2010). This action followed in the aftermath of the detailed safety evaluation and favorable findings as reported by JECFA (JECFA, 2009).

On September 18, 2009, based on a review of the international regulation of *Stevia rebaudiana* and the clinical evidence for safety and efficacy, the Natural Health Products Directorate, Health Canada (2009) adopted the following guidelines for the use of *stevia* and steviol glycosides in Natural Health Products (NHPs) (HealthCanada, 2009). The revised recommendation for the maximum limit for steviol glycosides in NHPs is in accordance with the full ADI of 4 mg steviol per kg bw established by JECFA (WHO, 2008).

In light of JECFA's 2008 findings, and in response to a June 2008 request by the European Commission for European Food Safety Authority (EFSA) to deliver a scientific opinion on the safety of steviol glycosides as a sweetener for use in the food categories specified in the dossiers from three petitioners, EFSA reexamined the safety of steviol glycosides (EFSA, 2010). After considering all the data on stability, degradation products, metabolism and toxicology, the EFSA Panel established an ADI for steviol glycosides, expressed as steviol equivalents, of 4 mg per bw per day, which is similar to JECFA's determination. In addition, on May 25, 2011, EFSA published a determination that the daily dietary intake for use of rebaudioside A as a flavoring substance in a variety of foods would be less than the ADI for steviol glycosides (EFSA, 2011). In 2014, EFSA evaluated extending the use of steviol glycosides as ingredients in food categories including coffee, tea, and herbal and fruit infusions (assessed at 10 mg per L steviol glycosides). Exposure estimates were lower than those determined by the Panel in 2011 due to available data, and remained below the ADI of 4 mg per kg bw per day, with the exception of toddlers from one country at the 95th percentile exposure level of 4.3 mg per kg bw per day (EFSA, 2014). More recently, exposure estimates, based on maximum permitted levels (MPLs) and proposed use

levels increased to 29 mg per L steviol glycosides, were found to have a “negligible” impact on dietary intake for all population groups, with the mean exposure estimate below the ADI of 4 mg per kg bw per day, with the exception of toddlers from one country at the 95th percentile exposure level of 4.3 mg per kg bw per day. The EFSA panel concluded that “dietary exposure to steviol glycosides (E 960) is similar to the exposure estimated in 2014 and therefore does not change the outcome of the safety assessment” (EFSA, 2015).

The international community continued to exhibit much interest in the food uses of steviol glycosides, with additional advances reported in early July 2011. The Codex Alimentarius Commission has adopted proposed maximum use levels for steviol glycosides in all major food and beverage categories, and this action is expected to favorably influence authorizations of stevia uses in India, Indonesia, Thailand, and the Philippines (FoodNavigator, 2011). An article published online by Food Navigator (2013) states the following: “with approvals now in Vietnam, the Philippines, Malaysia, Singapore and Thailand, Indonesia is the only [Southeast Asian nation] where stevia hasn’t been given the rubber stamp” (Whitehead, 2013). Furthermore, the International Alliance of Dietary/Food Supplement Associations (IADSA) reported that the Codex Alimentarius Commission agreed to adopt the use of steviol glycosides for addition to chewable food supplements as had been requested by IADSA (NewHope360, 2011).

The appropriate European regulatory bodies, including the joint FAO/WHO Expert Committee on Food Additives (JECFA) and the European Food Safety Authority (EFSA), have now agreed that steviol glycosides are safe for all populations to consume and are a suitable sweetening option for diabetics. Effective December 2, 2011, the EU approved their use as food additives (EU, 2011).

On September 10, 2012, the South African Department of Health issued an amendment to labeling regulations indicating: “in the case of the sweetener steviol glycosides, it shall be described as ‘Steviol Glycosides’ or ‘Steviol Extract.’” On the same date, steviol glycosides were added to the List of Permissible Sweeteners (RSADH, 2012b, RSADH, 2012a).

The Food Safety and Standards Authority of India (FSSAI) convened on September 20, 2012, and approved the use of steviol glycosides as a non-nutritive sweetener in a variety of foods. The FSSAI specified that: the steviol glycosides must meet the specifications and purity as established by JECFA; table top sweetener tablets may contain 7 mg of steviol equivalents per 100 mg carrier/filler, as well as established maximum use levels specific to 11 distinct food categories including dairy, beverage, and chewing gum applications (FSSAI, 2012).

On November 30, 2012, Health Canada published its final clearance for use of steviol glycosides as a sweetener in foods (HealthCanada, 2012a,b). In March 2014, Health Canada updated the List of Permitted Sweeteners (Lists of Permitted Food Additives) to include steviol glycosides in applications as a table-top sweetener, and as an ingredient in a variety of foods, beverages, baked goods, meal replacement bars, condiments, and confectionary and gums (HealthCanada, 2014).

Since December 10, 2012, over thirty registrations have been granted by FDA Philippines to

stand-alone steviol glycosides sweeteners or foods containing steviol glycosides as ingredients, including: FR-104390, Steviten Light Brand Steviol Glycosides 95% Sweetener Powder; FR-109427, Del Monte Pineapple Chunks in Extra Light Syrup Reduced Calorie with Steviol Glycosides from Stevia; FR-101120, Diebetamil Zero Calorie Sweetener with Stevia (stick pack); and FR-102127, Sawayaka Stevia Sweetener (1 g sticks) (Philippines, 2014).

Steviol glycosides are also listed under INS number 960 in the Food Additives Permitted Under the Singapore Food Regulations document prepared by the Agri-Food & Veterinary Authority (AVA) of Singapore (AVA, 2014).

The impressive review and acceptance by the broader international scientific community, with access to substantial amounts of published safety information on steviol glycosides in general, demonstrates scientific consensus which convincingly fulfills the common knowledge requirement for favorable GRAS findings.

VII. SUMMARY AND EXPERT PANEL CONCLUSIONS¹

PureCircle has been producing and marketing PureCircle GSG as a flavoring ingredient for several years. All PureCircle GSG products will therefore consist of not less than 80% total steviol glycosides with not more than 20% dextrin. Steviol glycosides contain around 75% glucosylated steviol glycosides and less than 10% steviol glycosides (as residual materials from the starting stevia leaf extract starting material), mainly Reb A, stevioside, and Reb C. Steviol glycosides (steviol conjugated with glucose, xylose, and/or rhamnose) are natural constituents of the *S. rebaudiana* plant. PureCircle GSG is made from stevia leaf extract containing more than 95% steviol glycosides.

PureCircle GSG is produced using a multi-step process, beginning with the hot-water extraction of *S. rebaudiana* leaves, followed by initial purification and concentration steps to produce an intermediate steviol glycoside concentration, and finally by further enzyme treatment of steviol glycoside in presence of starch to obtain PureCircle GSG. This production process is consistent with the methodologies for the general manufacture of steviol glycosides as described by JECFA, and no solvent or processing steps were involved that are not found in the food industry. Thus, the production process will not introduce any safety concerns for GSG.

Physical and chemical specifications, based on those established by JECFA for steviol glycosides, were established for the starting stevia leaf extract (>95% purity of steviol glycosides) to make

¹ The detailed educational and professional credentials for the Expert Panel convened by PureCircle are summarized below with pertinent information for two of the individuals serving on the Expert Panel is available on the GRAS Associates website at www.gras-associates.com. Drs. Kraska and McQuate worked on GRAS and food additive safety issues within FDA's GRAS Review Branch earlier in their careers and subsequently continued working within this area in the private sector. Dr. Kapp's *Curriculum vitae* can be accessed at <http://www.biotox.net>. All three panelists have extensive technical backgrounds in the evaluation of food ingredient safety. Each individual has previously served on multiple GRAS Expert Panels. Dr. Kraska served as Chair of the Panel.

PureCircle GSG. Since the finished ingredient is obtained from a natural source (*S. rebaudiana* leaves) yielding the steviol glycosides “starting material” for the phase 2 manufacturing step that meets acceptable food grade specifications for steviol glycosides, the potential presence of contaminants—including microbiological contaminants—was limited by establishing rigorous microbiological specification parameters. As presented in Section III.C, batch samples of PureCircle GSG are routinely tested to verify compliance with the set chemical and microbiological parameters. Additionally, since PureCircle GSG is obtained from a plant source that may be subjected to various pesticides during cultivation, the final ingredient was subjected to a multi-residue pesticide screen. Results of the analyses showed the absence of any pesticide residues in PureCircle GSG. Although JECFA concluded that steviol glycosides are thermally and hydrolytically stable for use in foods and acidic beverages under normal processing and storage conditions, PureCircle undertook a series of studies to confirm the stability of PureCircle GSG, PureCircle GSG was shown to be stable at pH values above 3.0 and under normal processing and storage conditions.

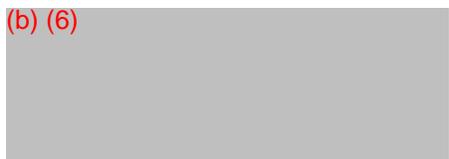
PureCircle GSG is a flavoring with modifying properties (FMP), which can be used in formulations to modify or enhance the flavor profile of a flavoring(s) in the food and beverage applications. FMPs may not necessarily have or impart a specific characteristic flavor of their own but can modify the flavor profile by altering flavor attributes such as intensifying specific flavor characteristics (e.g., perceived fruitiness), reducing specific flavor characteristics, masking of off-notes or bitterness, or changing the time onset and duration of the perception of specific aspects of the flavor profile. The use levels for different food categories have been estimated so that PureCircle GSG provides modification of flavor profile with limited contribution of sweetness in food categories.

Based on its intended uses as a flavoring agent, PureCircle GSG will be added to a variety of food products, as outlined in Table 9. PADI (possible average daily intake) methodology as used by FEMA—that is known to produce highly over-estimated daily intakes—served to estimate the exposure of PureCircle GSG in all food categories. Even if every product in each category in Table 9 used PureCircle GSG, which is highly improbable, the daily intake is 23 mg/person/day or 0.33 mg/kg bw/d (steviol equivalent) for a 70 kg person. Data from three GRAS notifications (GRN 323, 456, 473) of stevia sweeteners were used for estimating the steviol consumption for different population groups when PureCircle GSG is used with various stevia sweeteners in all major food and beverage applications. The maximum steviol consumption was 1.68 mg/kg bw/d. Therefore, the steviol contribution of PureCircle GSG in a stevia sweetened product will be marginal and will remain significantly below the JECFA ADI for steviol glycosides, which is 4 mg/kg bw/d steviol equivalent.

Overall, when viewed in its entirety, the scientific evidence presented above indicates that consumption of PureCircle GSG as a flavoring agent does not present a significant risk to human health and is safe for the intended use. The data provided support the conclusion that PureCircle GSG would not produce any adverse health effects. The total body of published data and information summarized in this report demonstrate that PureCircle GSG meeting appropriate food-grade specifications has met FDA’s food ingredient safety standard of “reasonable certainty of no

harm under the intended conditions of use” and, therefore, is GRAS, based on the scientific procedures.

(b) (6)



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Chair, Expert Panel

(b) (6)



Robert S. McQuate, Ph.D.
Member, Expert Panel

(b) (6)



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Member, Expert Panel

Date: October 23, 2015

VIII. REFERENCES

- Adams, T.B., Hallagan JB., Putnam JL, Gierke TL, Doull J, Munro IC, Newberne P, Portoghese PS, Smith RL, Wagner BM, Weil CS, Woods LA and Ford RA (1996) The FEMA GRAS Assessment of Alicyclic Substances Used as Flavour Ingredients Food and Chemical Toxicology 34: 763-828
- AFSSA (2009a) *Avis de l'Agence française de sécurité sanitaire des aliments sur un projet d'arrêté relatif à l'emploi de rebaudioside A extrait de Stevia rebaudiana en tant qu'additif alimentaire.*: Agence Française de Sécurité Sanitaire Des Aliments. Available at: <http://www.afssa.fr/Documents/AAAT2009sa0119.pdf> (Accessed: June 30, 2014).
- AFSSA (2009b) *France approves high Reb A stevia sweeteners.* FoodNavigator. Available at: <http://www.foodnavigator.com/Legislation/France-approves-high-Reb-A-stevia-sweeteners> (Accessed: June 30, 2014).
- AVA (2014) *Agri-Food & Veterinary Authority of Singapore: Food Additives Permitted Under the Singapore Food Regulations.* Available at: http://www.ava.gov.sg/docs/default-source/tools-and-resources/resources-for-businesses/foodadditivesunderfr_inclnewadditivesunderfdamdtre.
- Blumenthal M (1995). FDA lifts import alert on stevia. Herb can be imported only as dietary supplement; future use as a sweetener is still unclear. HerbalGram (35 - Fall):17-18.
- CCFA (2009) 'Proposals for Additions and Changes to the Priority List of Food Additive Proposed for Evaluation by JECFA (CL 2008/26-FA). Codex Alimentarius Commission E, FAO/WHO/JECFA CX/FA 09/41/11.'
- Chang SS, Cook JM (1983). Stability studies of stevioside and rebaudioside A in carbonated beverages. J Agric Food Chem 31(2):409-412.
- Ceunen S. and Geuns J.M.C. (2013) Steviol Glycosides: Chemical Diversity, Metabolism, and Function. J. Nat. Prod., 76, 1201–1228
- Chaturvedula VSP, Rhea J, Milanowski D, Mocek U, Prakash I. (2011a) Two Minor Diterpene Glycosides from the Leaves of *Stevia rebaudiana*. Natural Product Communications. 6 (2), 175-178
- Chaturvedula VSP, Upreti M, Prakash I. (2011b) Structures of the Novel α -Glucosyl Linked Diterpene Glycosides from *Stevia rebaudiana*. Carbohydrate Research. 346 (13), 2034-2038
- Chaturvedula VSP, Upreti M, Prakash I. (2011c) Diterpene Glycosides from *Stevia rebaudiana*. Molecules. 16 (5), 3552-3562.
- Chaturvedula VSP, Prakash I. (2011a) Additional Minor Diterpene Glycosides from *Stevia rebaudiana*. Natural Product Communications. 6 (6), 1059-1062
- Chaturvedula VSP, Prakash I. (2011b) Structures of the Novel Diterpene Glycosides from *Stevia rebaudiana*. Carbohydrate Research. 346 (8), 1057-1060

Chaturvedula VSP, Prakash I, 2013. Structural characterization and hydrolysis studies of rebaudioside E, a minor sweet component of *Stevia rebaudiana*. *European Chemical Bulletin* 2, 298-302.

Cohen, S. M., Fukushima, S., Gooderham, N. J., Hecht, S. S., Marnett, L. J., Rietjens, I. M. C. M. and Smith, R. L. (2015a) 'GRAS Flavoring Substances 27'.

Cohen, S. M., Fukushima, S., Gooderham, N. J., Hecht, S. S., Marnett, L. J., Rietjens, I. M. C. M., Smith, R. L., Bastaki, M., McGowen, M. M., Harman, C. and Taylor, S. V. (2015b) 'GRAS 27 Flavoring Substances', *Food Technology*.

EFSA (2010). EFSA Panel on Food Additives and Nutrient Sources scientific opinion on safety of steviol glycosides for the proposed uses as a food additive. (Question number: EFSA-Q-2007-071; EFSA-Q-2008-387; EFSA-Q-2008-401, adopted on 10 March 2010 by European Food Safety Authority). *EFSA J* 78(4):1537. [85 pp.]. doi:10.2903/j.efsa.2010.1537. Available at: <http://www.efsa.europa.eu/en/scdocs/scdoc/1537.htm>.

EFSA (2011) 'European Food Safety Authority, Scientific Opinion on Flavouring Group Evaluation 310 (FGE.310): Rebaudioside A from chemical group 30.', *EFSA Journal*, 9(5), pp. 1-37.

EFSA (2013) Scientific Opinion on the maintenance of the list of QPS biological agents intentionally added to food and feed (2013 update); *EFSA J* 2013; 11(11):3449.

EFSA (2014) 'EFSA ANS Panel (EFSA Panel on Food Additives and Nutrient Sources added to Food): Scientific Opinion on the revised exposure assessment of steviol glycosides (E960) for the proposed use as a food additive.', *EFSA Journal*, 12(5), pp. 23.

EFSA (2015) 'EFSA ANS Panel (EFSA Panel on Food Additives and Nutrient Sources added to Food): Scientific Opinion on the extension of use of steviol glycosides (E960) as a food additive', *EFSA Journal*, 13(6), pp. 20.

EU (2011). Commission Regulation (EU) No 1131/2011 of 11 November 2011 amending Annex II to Regulation (EC) No 1333/2008 of the European Parliament and of the Council with regard to steviol glycosides. *Off J Eur Union* 54(L295):205-211. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:295:0205:0211:EN:PDF>.

FAO (2007) 'Steviol Glycosides. FAO JECFA Monographs 4. ', *Food and Agriculture Organization*.

FAO (2008) 'Steviol Glycosides. FAO JECFA Monographs 5', *Food and Agriculture Organization*.

FAO (2010) 'Steviol Glycosides. FAO JECFA Monographs 10', *Food and Agriculture Organization. List of Substances Scheduled for Evaluation and Request for Data. Seventy-third meeting Food additives and Contaminants. Geneva, 8 to 17 June 2010*.

FAO/WHO (2009) 'Food and Agriculture Organization of the United Nations/World Health Organization List of Substances Scheduled for Evaluation and Request for Data. Seventy-third meeting Food additives and Contaminants. Geneva, 8 to 17 June 2010. ', *Joint FAO/WHO Expert Committee on Food Additives*.

FCC (2012). *Food Chemicals Codex, 8th edition*. Rockville (MD): United States Pharmacopeial Convention (USP).

Ferlow K (2005). Stevia - The sweetest substance on Earth. *NutraCos* 4(2, Suppl.):10-11.

FoodNavigator (2011) 'Codex approval will open new stevia markets: PureCircle'.

FSANZ (2008). *Final Assessment Report: Application A540 Steviol Glycosides as Intense Sweeteners*. Canberra, Australia: Food Standards Australia New Zealand (FSANZ). Available at:
http://www.foodstandards.gov.au/srcfiles/FAR_A540_Steviol_glycosides.pdf.

FSANZ (2010) 'Assessment Report. Application A1037. Steviol Glycosides – Increase in Permitted Use Levels.', *Food Standards Australia New Zealand*.

FSANZ (2011) 'Approval report – Application A1037 – Steviol Glycosides – Increase in Permitted Use Levels. (13 May 2011).', *Food Standards Australia New Zealand*.

FSANZ (2015a) 'Call for submissions - Application A1108: Rebaudioside M as a Steviol Glycoside Intense Sweetener'.

FSANZ (2015b) 'Call for submissions on new steviol glycoside'.

FSSAI (2012) 'Food Safety and Standards Authority of India: Minutes of the Tenth Meeting of Food Authority held on 20th September, 2012 at 1100 hrs at FDA Bhavan, New Delhi.'.

Gardana C, Simonetti P, Canzi E, Zanchi R, Pietta P (2003). Metabolism of stevioside and rebaudioside A from *Stevia rebaudiana* extracts by human microflora. *J Agric Food Chem* 51(22):6618-6622.

Geuns JM, Augustijns P, Mols R, Buyse JG, Driessen B (2003). Metabolism of stevioside in pigs and intestinal absorption characteristics of stevioside, rebaudioside A and steviol. *Food Chem Toxicol* 41(11):1599-1607.

Geuns JMC (2003). Stevioside. *Phytochemistry* 64(5):913-921.

Geuns JMC, Buyse J, Vankeirsbilck A, Temme EHM (2007). Metabolism of stevioside by healthy subjects. *Exp Biol Med* 232(1):164-173.

Harman CL, Hallagan JB, and the FEMA Science Committee Sensory Data Task Force (2013) Sensory Testing for Flavorings with Modifying Properties. *Food Technology*, 67(11)

Health, S. F. O. o. P. (2008) Switzerland Federal Office of Public Health. Available at:
<http://www.bag.admin.ch/themen/lebensmittel/04861/04972/index.html?lang=fr>

HealthCanada (2009) Revised Guidelines for the Use of Stevia in Natural Health Products. Available at: <http://www.hc-sc.gc.ca/dhp-mps/prodnatur/legislation/docs/notice-avis-stevia-eng.php>.

- Health Canada (2012a). *Information and Consultation Document on Health Canada's Proposal to Allow the Use of the Food Additive Steviol Glycosides as a Table-Top Sweetener and as a Sweetener in Certain Food Categories*. Ottawa (ON): Health Canada, Bureau of Chemical Safety, Food Directorate. Available at: <http://www.hc-sc.gc.ca/fn-an/consult/steviol/document-consultation-eng.php#a12> [Date Modified: 2012-11-30].
- Health Canada (2012b). *Notice of Modification to the Lists of Permitted Food Additives to Enable the Use of Steviol Glycosides as a Table-Top Sweetener and as a Sweetener in Certain Food Categories*. Ottawa (ON): Health Canada, Bureau of Chemical Safety. Available at: <http://www.hc-sc.gc.ca/fn-an/consult/nom-adm-0002/index-eng.php> [Date Modified: 2012-11-30].
- HealthCanada (2014) List of Permitted Sweeteners (Lists of Permitted Food Additives). Available at: <http://www.hc-sc.gc.ca/fn-an/securit/addit/list/9-sweetener-edulcorant-eng.php>.
- Hooks WN, Hopkins MN, Gibson WA, Offer JM, Gopinath C (1988). a-Glucosyl Steviol Glycoside Toxicity to Rats by Repeated Dietary Administration for 13 Weeks. (SKP 36/871363). Prepared by Cambridgeshire, Engl.: Huntingdon Research Centre Ltd. For Tokyo, Japan: Sanyo Kokusaka Pulp Co. Ltd. I Toyo Seito K.K. [Unpublished].
- Hutapea AM, Toskulkao C, Buddhasukh D, Wilairat P, Glinsukon T (1997). Digestion of stevioside, a natural sweetener, by various digestive enzymes. *J Clin Biochem Nutr* 23(3):177-186.
- Japan Food Safety Commission of Japan, (January 2014). Safety assessment report – CGTase produced by genetically modified strain of *Bacillus subtilis* DTS1451 (pHYT2G).
- JECFA, (1993). FAO/WHO Forty-first report of the Joint FAO/WHO Expert Committee on Food Additives). WHO Technical Report Series, No. 837 - Evaluation of certain food additives and contaminants, beta-cyclodextrin, p23-24; http://whqlibdoc.who.int/trs/WHO_TRS_837.pdf
- JECFA, (1995). Evaluation of certain food additives and contaminants (Forty-fourth report of the Joint FAO/WHO Expert Committee on Food Additives), Geneva, WHO Technical Report Series, No. 859, β cyclodextrin, p 28-29; http://whqlibdoc.who.int/trs/WHO_TRS_859.pdf
- JECFA (1999). Sweetening agent: Stevioside. In: *Safety Evaluation of Certain Food Additives*. 51st Meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), June 9-18, 1998. (WHO Food Additives Series, no 42). Geneva, Switz.: World Health Organization (WHO), pp. 119-143. Available at: <http://www.inchem.org/documents/jecfa/jecmono/v042ie07.htm>.
- JECFA (2006). Steviol glycosides. In: *Safety Evaluation of Certain Food Additives*. Sixty-third Meeting of the Joint FAO/WHO Expert Committee on Food Additives, June 8-17, 2004, Geneva, Switz. (WHO Food Additives Series, no 54). Geneva, Switz.: World Health Organization (WHO), International Programme on Chemical Safety (IPCS), pp. 117-144, 638. Available at: http://whqlibdoc.who.int/publications/2006/9241660546_eng.pdf.

- JECFA (2007a). Steviol glycosides. In: 68th JECFA - Chemical and Technical Assessment (CTA). [Sixty-eighth meeting held June 17-26, 2008]. (Prepared by Harriet Wallin and revised by Paul M. Kuznesof Ph.D). Geneva, Switz.: Joint FAO/WHO Expert Committee on Food Additives (JECFA). Available at: http://www.fao.org/fileadmin/templates/agns/pdf/jecfa/cta/68/Steviol_glycosides.pdf.
- JECFA (2007b). Steviol glycosides. In: *Evaluation of Certain Food Additives and Contaminants*. Sixty-eighth Report of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), June 19-28, 2007, Geneva, Switz. (WHO Technical Report Series no 947). Geneva, Switz.: World Health Organization (WHO), pp. 50-54, 78. Available at: http://whqlibdoc.who.int/publications/2007/9789241209472_eng.pdf.
- JECFA, (2008a). FAO/WHO Expert Committee on Food Additives, Sixty-eighth meeting, Geneva, Cyclotetraglucose and cyclotetraglucose syrup. WHO Food Additives Series: 59 – safety evaluation of certain food additives and contaminants, p 87-110; available at: <http://fao.org/food/food-safetyquality/scientific-advice/jecfa/jecfa-additives/en/>.
- JECFA (2009). Steviol glycosides (addendum). In: *Toxicological Evaluation of Certain Food Additives*. Prepared by the Sixty-ninth meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), June 17-26-29, 2008, Rome, Italy. (WHO Food Additives Series, no 60). Geneva, Switz.: World Health Organization (WHO), pp. 183-220. Available at: http://whqlibdoc.who.int/publications/2009/9789241660600_eng.pdf.
- JECFA (2010). Steviol glycosides [Prepared at the 73rd JECFA (2010) and published in FAO JECFA Monographs 10 (2010)]. In: *Combined Compendium of Food Additive Specifications [Online Edition]. General Specifications for Enzymes Analytical Methods, Volume 4*. (FAO JECFA Monographs 10). Rome, Italy: Food and Agriculture Organization of the United Nations (FAO), Joint FAO/WHO Expert Committee on Food Additives (JECFA). Available at: <http://www.fao.org/ag/agn/jecfa-additives/specs/monograph10/additive-442-m10.pdf>.
- Jensen NS, Canale-Parola E, 1985. Nutritionally limited pectinolytic bacteria from the human intestine. *Applied and Environmental Microbiology* 50, 172-173.
- Koyama E, Sakai N, Ohori Y, Kitazawa K, Izawa O, Kakegawa K et al. (2003a). Absorption and metabolism of glycosidic sweeteners of stevia mixture and their aglycone, steviol, in rats and humans. *Food Chem Toxicol* 41(6):875-883.
- Koyama E, Kitazawa K, Ohori Y, Izawa O, Kakegawa K, Fujino A et al. (2003b). In vitro metabolism of the glycosidic sweeteners, stevia mixture and enzymatically modified stevia in human intestinal microflora. *Food Chem Toxicol* 41(3):359-374.
- Kroyer GT (1999). The low calorie sweetener stevioside: stability and interaction with food ingredients. *Lebensm Wiss Technol* 32(8):509-512.
- Lee CK (1979). Carbohydrate sweeteners: structural requirements for taste. In: Bourne GH, editor. *Some Special Aspects of Nutrition*. (World Review of Nutrition and Dietetics, vol. 33). Basel, Switz.: Karger AG, pp. 142-197 (Stevioside on pp. 184-185).

- Leffingwell, J. (2011) 'Flavor Properties of FEMA GRAS List 25 Flavor Chemicals', *Perfumer & Flavorist*, 36, pp. 24-31.
- Leffingwell, J. and Leffingwell, D. (2014) 'Flavor Properties of FEMA GRAS List 26 Flavor Chemicals', *Perfumer & Flavorist*, 39, pp. 26-37.
- Lewis WH (1992). Early uses of *Stevia rebaudiana* leaves as sweetener in Paraguay. *Econ Bot* 46:336-337.
- Marnett, L. J., Cohen, S. M., Fukushima, S., Gooderham, N. J., Hecht, S. S., Rietjens, I. M. C. M. and Smith, R. L. (2013) 'GRAS Flavoring Substances 26'.
- McQuate, R. S. (2011) 'Ensuring the Safety of Sweeteners from Stevia', *Food Technology*, (no. 4).
- Munro IC1, Danielewska-Nikiel B.(2006). Comparison of estimated daily intakes of flavouring substances with no-observed-effect levels. *Food Chem Toxicol.* 44(6):758-809
- NewHope360 (2011) *IADSA welcomes Codex adoption of Steviol Glycosides*. Available at: <http://newhope360.com/supply-news-amp-analysis/iadsa-welcomes-codex-adoption-steviol-glycosides>.
- Nikiforov AI, Rihner MO, Eapen AK, Thomas JA, 2013. Metabolism and toxicity studies supporting the safety of rebaudioside D. *International Journal of Toxicology* 32, 261- 273.
- Ohta, M., Sasa, S., Inoue, A., Tamai, T., Fujita, I., Morita, K., Matsuura, F., 2010. Characterization of Novel Steviol Glycosides from Leaves of *Stevia rebaudiana* Morita. *Journal of Applied Glycoscience* 57, 199-209
- Oser BL & Hall RL (1977). Criteria employed by the expert panel of fema for the gras evaluation of flavouring substances. *Food and Cosmetics Toxicology* 15(5): 457-456
- Philippines (2014) *Republic of the Philippines Food and Drug Administration*. Available at: <http://www.fda.gov.ph/>.
- Purkayastha S, Pugh G, Lynch B, Roberts A, Kwok D, Tarka SM, 2014. In vitro metabolism of rebaudioside B, D, and M under anaerobic conditions: comparison with rebaudioside A. *Regulatory Toxicology and Pharmacology* 68, 259-268.
- Purkayastha S, Bhusari S, Pugh G, Teng X, Kwok D, Tarka SM, 2015. In vitro metabolism of rebaudioside E under anaerobic conditions: comparison with rebaudioside A. *Regulatory Toxicology and Pharmacology* 72, 646–657
- Purkayastha S, Markosyan A, Prakash I, Bhusari S, Pugh G, Lynch B, Roberts, A (2015a). Steviol glycosides in purified stevia leaf extract sharing the same metabolic fate. Submitted to *Regulatory Toxicology and Pharmacology*.

- Renwick AG (2008). The use of a sweetener substitution method to predict dietary exposures for the intense sweetener rebaudioside A. *Food Chem Toxicol* 46(Suppl. 7):S61-S69.
- Renwick AG, Tarka SM (2008). Microbial hydrolysis of steviol glycosides. *Food Chem Toxicol* 46(Suppl. 7):S70-S74.
- Roberts A, Renwick AG (2008). Comparative toxicokinetics and metabolism of rebaudioside A, stevioside, and steviol in rats. *Food Chem Toxicol* 46(Suppl. 7):S31-S39.
- RSADH (2012a) 'Republic of South Africa Department of Health: Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 52 of 1972): List of Permissible Sweeteners Referred to in Regulation 4 of the Regulations Relating to the Use of Sweeteners in Foodstuffs – (R.733 of 10 September 2012).'
- RSADH (2012b) 'Republic of South Africa Department of Health: No. R. 733 Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972): Regulations Relating to the Use of Sweeteners in Foodstuffs, 10 September 2012.'
- Safety, H. K. C. f. F. (2010) *Hong Kong Centre for Food Safety Legislative council brief. Sweeteners in food (amendment) regulation*. Available at: http://www.cfs.gov.hk/english/programme/programme_rafs/files/2010_amendment_to_sweeteners_in_food_regulation_Legco_brief.pdf.
- Shibasato, Michio. (1995) Current status of stevia sweeteners and its applications. *Japan Food Science* No. 12, 51–58, Toyo Sugar Co. Ltd.
- Smith RL, J. Doull, V.J. Feron, J.I. Goodman, I.C. Munro, P.M. Newberne, P.S. Portoghese, W.J. Waddell, B.M. Wagner, T.B. Adams, and M.M. McGowen (2001) GRAS Flavoring Substances 20. *Food Technology* VOL. 55, NO. 12
- Smith, R. L., Waddell, W. J., Cohen, S. M., Feron, V. J., Marnett, L. J., Portoghese, P. S., Rietjens, I. M. C. M., Adams, T. B., Gavin, C. L., McGowen, M. M., Taylor, S. V. and Williams, M. C. (2009) 'GRAS Flavoring Substances 24', *Food Technology*, pp. 46-105.
- Urban, JD, Carakostas, MC, Taylor, SL (2015) Steviol glycoside safety: are highly purified steviol glycoside sweeteners food allergens? *Food Chem Toxicol*, 75:71-8.
- U.S. FDA (2000). GRAS Notice No.46 Gamma Cyclodextrin. Available at: <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm153769.htm>
- U.S. FDA (2001) GRAS Notice No. 74. Beta-Cyclodextrin. Available at: http://www.accessdata.fda.gov/scripts/fdcc/?set=GRASNotices&id=74&sort=GRN_No&order=DESC&startrow=1&type=basic&search=ucm154182.htm
- U.S. FDA (2004) GRAS Notice No.155 Alpha Cyclodextrin Available at: <http://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/NoticeInventory/ucm1543>

[85.htm](#)

- U.S. FDA (2008a). GRAS Notice No.252 Rebaudioside A purified from *Stevia rebaudiana* (Bertoni) Bertoni. Available at:
<http://www.fda.gov/Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/GRASListings/ucm154988.htm>.
- U.S. FDA (2008b). GRAS Notice No. 253 Rebaudioside A purified from *Stevia rebaudiana* (Bertoni) Bertoni]. Available at:
<http://www.fda.gov/Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/GRASListings/ucm154989.htm>.
- U.S. FDA (2009a). GRAS Notice No. 275 Purified Steviol Glycosides With Rebaudioside A as the Principal Component Available at:
<http://www.fda.gov/Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/GRASListings/ucm171539.htm>.
- U.S. FDA (2010). GRAS Notice No. 337, Glycosylated enzyme treated stevia (GETS), Available online:
http://www.accessdata.fda.gov/scripts/fcn/gras_notices/GRN000337.pdf.
- U.S. FDA (2010a). GRAS Notice No. 323 Purified steviol glycosides with rebaudioside A and stevioside as the principal components. Available online:
http://www.accessdata.fda.gov/scripts/fcn/gras_notices/GRN000323.pdf
- U.S. FDA (2010b). GRAS Notice No. 304 Purified steviol glycosides with rebaudioside A and stevioside as the principal components. Available at:
<http://www.fda.gov/Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/GRASListings/ucm207983.htm>
- U.S FDA (2011). GRAS Notice No. 375, GRAS exemption claim for α -glucosylated steviol glycosides. Available online:
http://www.accessdata.fda.gov/scripts/fcn/gras_notices/GRN375.pdf.
- U.S. FDA (2012). GRAS Notice No. 448, Glycosylated Steviol Glycosides, November 5, 2012. Available online:
http://www.accessdata.fda.gov/scripts/fcn/gras_notices/GRN000448.pdf.
- U.S. FDA (2012a). *U.S. Code of Federal Regulations (CFR). Title 21—Food and Drugs (Food and Drug Administration)*. Washington (DC): U.S. Government Printing Office (GPO). Available at: <http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR>.
- U.S. FDA (2013). GRAS Notice No. 452, GRAS Assessment of Glycosylated Rebaudioside A, Available online:
http://www.accessdata.fda.gov/scripts/fcn/gras_notices/GRN000452.pdf.
- U.S. FDA (2013a). GRAS Notice No.456 Rebaudioside D purified from the leaves of *Stevia rebaudiana* (Bertoni) Bertoni (rebaudioside D)]. Available online:

http://www.accessdata.fda.gov/scripts/fcn/gras_notices/GRN000456.pdf.

U.S. FDA (2013b). GRAS Notice No. 473 Purified steviol glycosides with rebaudioside X as the principal component. Available online:

<http://www.accessdata.fda.gov/scripts/fdcc/grasnotices/GRN000473.pdf>.

U.S. FDA (2014). GRAS Notice No. 536 High purity rebaudioside C. Available online:

http://www.accessdata.fda.gov/scripts/fcn/gras_notices/GRN000536.pdf.

U.S. FDA (2015) 'GRAS Notices'. Available at:

<http://www.accessdata.fda.gov/scripts/fdcc/?set=GRASNotices> (Accessed September 29, 2015).

USP (2011). Steviol glycosides In: *United States Pharmacopeia Forum*. (December 2011). Rockville (MD): United States Pharmacopeia. Available at:

<http://forum.foodchemicalscodex.org/forum/pub/index.html> [Registration required].

Watson, E., EFSA opinion paves way for EU approval of stevia-based sweeteners. *NutraIngredients* April 14, 2010, 2010.

Wheeler A, Boileau AC, Winkler PC, Compton JC, Prakash I, Jiang X et al. (2008). Pharmacokinetics of rebaudioside A and stevioside after single oral doses in healthy men. *Food Chem Toxicol* 46(Suppl. 7):S54-S60.

Whitehead, R. J. (2013) 'Thailand's stevia approval poses challenge for Indonesian regulators', *FoodNavigator*.

WHO (2000) 'WHO Food Additive Series; 42. Safety evaluation of certain food additives. Stevioside.', *Joint FAO/WHO Expert Committee on Food Additives*.

WHO (2006) 'WHO Food Additive Series; 54. Safety evaluation of certain food additives, Steviol Glycosides', *Joint FAO/WHO Expert Committee on Food Additives*. , pp. 117-144.

WHO (2008) 'Sixty-ninth meeting: Summary and Conclusions, Steviol Glycosides', *Joint FAO/WHO Expert Committee on Food Additives*.

WHO (2009) 'WHO Food Additive Series: 60. Safety evaluation of certain food additives. Steviol Glycosides (addendum).'

Wingard RE Jr, Brown JP, Enderlin FE, Dale JA, Hale RL, Seitz CT (1980). Intestinal degradation and absorption of the glycosidic sweeteners stevioside and rebaudioside A. *Experientia* 36(5):519-520.

Documentation Supporting the Evaluation of Glucosylated Steviol Glycosides (GSG) as Generally Recognized as Safe (GRAS) for Use as a Flavoring Agent

Volume II

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Date: October 23, 2015

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Appendix A Specification Sheets/Certificates of Analysis for the Raw Materials and Processing Aids Used in the Production of GSG

- A-1 Calcium Hydroxide
- A-2 Ethanol Certificate of Analysis
- A-3 Activated Carbon Specification and Certificate of Analysis
- A-4 Ion Exchange Resin Certificate of Analysis
- A-5 Adsorption Resin Certificate of Analysis
- A-6 CGTase and α -Amylase Enzymes Certificates of Analysis
- A-7 Starch Certificate of Analysis

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A-1 Calcium Hydroxide

COA of Food Grade Ca(OH)₂

Document No. QR 8.2.4-03-A/0

Serial No. 284836 Page: 1/5

Name of Material:	CALCIUM HYDROXIDE	Sampling quantity:	0.2kg
Weight:	25kg/ bag	Sample received date:	7 th Nov, 2012
Sample sender:	Dai Li	Report date:	8 th Nov, 2012
Manufacturer:		Quantity of product:	11MT
Batch No.	1211060001	Manufacture date:	6 th Nov, 2012

Item No.	Test Parameter	Specific	Test result	Conclusion for each item
1	Sensory test	White, powder	White powder	Pass
2	Net weight	25	25.02	Pass
3	Content of Ca(OH) ₂ , %	95.0~100.5	96.1	Pass
4	Loss of drying, %	≤1.0	0.07	Pass
5	Sieving residual (0.045mm), %	≤0.4	0.01	Pass
6	Substance can't dissolve in acid, %	≤0.1	0.07	Pass
7	Carbonate	Pass test	Pass test	Pass
8	Fluoride (as F), mg/kg	≤50	37	Pass
9	Magnesium and Alkalis,	≤2.0	1.9	Pass
10	Arsenic (As), mg/kg	≤2	0.7	Pass
11	Lead (Pb), mg/kg	≤2	0.5	Pass
12	Heavy metal (as Pb), mg/kg	≤10	<10	Pass
Test standard: Chinese National Standard GB25572-2010				
Shelf life: from Nov 6 th 2012 to Nov 5 th 2014				
Test conclusion: (√)Pass ()Fail				
Action to be taken for failed product: () Reject, () Discard, () Rework, () Concession				

Prepared by: Tian Honghua

Reviewed by: Zhou Chao

Note:

- 1) Dim the product of each shift as a batch. Each batch of product must be sampling and test according Chinese National Standard, only the product past test can release. The sample should be taken from 10 bags of each batch of product, and the sampling quantity is 400g (2 bags, 200g/bag). One bag for testing and one bag for retention sample.
- 2) Test frequency for item 1 to 8 is every batch, and for 9 to 12 is once per 10 batches.

AS-008-1211-0012

上海江沪钛白化工制品有限公司奉贤分公司

食品添加剂氢氧化钙分析报告书

表码: QRS.2.4-03-A/0
 编号: 284836 页次: 15

品名: <u>氢氧化钙</u>	抽样数量: <u>0.2kg</u>
规格: <u>25kg袋</u>	样品收到日期: <u>2012.11.07</u>
送检人: <u>戴丽</u>	报告日期: <u>2012.11.08</u>
生产厂家: <u>本公司</u>	生产数量: <u>11T</u>
生产批号: <u>121106001</u>	生产日期: <u>2012.11.06</u>

序号	检验项目	检验指标	检验结果	单项判定
1	感官检查	白色、粉末状	<u>白色粉末状</u>	<u>合格</u>
2	净含量 (kg)	25	<u>25.02</u>	<u>合格</u>
3	氢氧化钙 [Ca(OH) ₂], w/%	95.0-100.5	<u>96.1</u>	<u>合格</u>
4	干燥减量 w/%	≤ 1.0	<u>0.07</u>	<u>合格</u>
5	筛余物 (0.045mm), w/%	≤ 0.4	<u>0.01</u>	<u>合格</u>
6	酸不溶物, w/%	≤ 0.1	<u>0.07</u>	<u>合格</u>
7	碳酸盐	通过试验	<u>通过试验</u>	<u>合格</u>
8	氟化物 (以 F 计) / (mg/kg) ≤	50	<u>37</u>	<u>合格</u>
9	镁及碱金属, w/% ≤	2.0	<u>1.9</u>	<u>合格</u>
10	砷 (As) / (mg/kg)	2	<u>0.7</u>	<u>合格</u>
11	铅 (Pb) / (mg/kg)		<u>0.5</u>	<u>合格</u>
12	重金属 (以 Pb 计) / (mg/kg) ≤		<u><10</u>	<u>合格</u>



检验依据: 国标 GB25572-2010

产品保质期: 2012 年 11 月 06 日至 2012 年 11 月 05 日

检验结论: 合格 不合格

不合格品的处置: 退货 报废 返工 让步接收

填报人: 田红霞 审核人: 田红霞

注: 1、每班生产的产品为一批, 每批产品质量按国标抽样检验合格并附合格证方可出厂。每批产品抽 10 件; 其中抽样两小包 (每包 200 克), 用作理化指标出厂检验, 其余留样备用。

2、检验项目: 第 1、2、3、4、5、6、7、8 项, 每次抽样都化验, 第 9、10、11、12 项, 每隔 10 批抽样化验。

A-2 Ethanol Specification and Certificate of Analysis

Guangdongzhongneng Co.,ltd STATEMENT

Our company Guangdongzhongneng Co.,ltd statement which mentioned our Ethanol complies with FCC specifications.



2018.01.22 15:17 P4
Jan. 22 2018 16:01 P4

FAX NO. 1
FAX NO. 1

FROM :
FROM :

广东中能酒精有限公司
Guangdongzhongneng Co., Ltd

质检报告

certificate of analysis

检验货物名称: 食用酒精		
Name of material: Ethyl Alcohol (Ethanol)		
检验项目 Parameter	检验标准 Acceptance criteria	批号 Batch No. 20091230
含量 Assay, %	>94.9	>95.2
含水量 Water Content, %	<5.1	<4.8
酸性 (乙酸) Acidity (as acetic acid), %	<0.003	<0.002
碱性 Alkalinity (as NH ₃), ppm	<3	<2
杂醇油 Fusel Oil	passes test	合格
酮, 异丙醇 Ketones, Isopropyl Alcohol	passes test	合格
铅 Lead, ppm	<0.5	合格
甲醇 Methanol	passes test	合格
不挥发物 Non-volatile Residue, %	<0.003	<0.002
可溶性 (在水中溶解度) Solubility in water	passes test	合格
硫酸实验 Substance Darkened by H ₂ SO ₄	passes test	合格
高锰酸盐物质 Substance Reducing Permanganate	passes test	合格
甲苯 Toluene, ppb	<10	<10
检验结论 Test conclusion	该样品所检验项目均符合GB10343-2008, 判定合格	

检验员:
Authorized by

审核:
Check by:

批准:
Approved by:



广东中能酒精有限公司
Guangdongzhongneng Co., Ltd
质检报告
certificate of analysis

检验货物名称: 食用酒精		
Name of material: Ethyl Alcohol (Ethanol)		
检验项目	检验标准	批号
Parameter	Acceptance criteria	Batch No. 20100110
含量		
Assay, %	>94.9	>95.3
含水量		
Water Content, %	<5.1	<4.7
酸性 (乙酸)		
Acidity (as acetic acid), %	<0.003	<0.002
碱性		
Alkalinity (as NH ₃), ppm	<3	<2
杂醇油		合格
Fusel Oil	passes test	
酮, 异丙醇		合格
Ketones, Isopropyl Alcohol	passes test	
铅		合格
Lead, ppm	<0.5	
甲醇		合格
Methanol	passes test	
不挥发物		
Non-volatile Residue, %	<0.003	<0.002
可溶性 (在水中溶解度)		合格
Solubility in water	passes test	
硫酸实验		合格
Substance Darkened by H ₂ SO ₄	passes test	
高锰酸盐物质		合格
Substance Reducing Permanganate	passes test	
甲苯		
Toluene, ppb	<10	<9
检验结论	该样品所检验项目符合GB10343-2008, 判定合格	
Test conclusion		

检验员:
Authorized by

审核:
Check by

批准:
Approved by:



广东中能酒精有限公司
Guangdongzhongneng Co., Ltd

质检报告

certificate of analysis

检验货物名称: 食用酒精		
Name of material: Ethyl Alcohol (Ethanol)		
检验项目 Parameter	检验标准 Acceptance criteria	批号 Batch No. 20091220
含量 Assay, %	>94.9	>95.1
含水量 Water Content, %	<5.1	<4.9
酸性 (乙酸) Acidity (as acetic acid), %	<0.003	<0.002
碱性 Alkalinity (as NH ₃), ppm	<3	<2
杂醇油 Fusel Oil	passes test	合格
酮, 异丙醇 Ketones, Isopropyl Alcohol	passes test	合格
铅 Lead, ppm	<0.5	合格
甲醇 Methanol	passes test	合格
不挥发物 Non-volatile Residue, %	<0.003	<0.002
可溶性 (在水中溶解度) Solubility in water	passes test	合格
硫酸实验 Substance Darkened by H ₂ SO ₄	passes test	合格
高锰酸盐物质 Substance Reducing Permanganate	passes test	合格
甲苯 Toluene, ppb	<10	<10
检验结论 Test conclusion	该样品所检验项目结果符合GB10343-2008, 判定合格	



检验员:
Authorized by:

审核:
Check by:

批准:
Approved by:

广东中能酒精有限公司
Guangdongzhongneng Co., Ltd
原材料明细表

Raw Material Specification

检验货物名称: 食用酒精 Name of material: Ethyl Alcohol (Ethanol)		
检验项目 Parameter	检验标准 Acceptance criteria	检验方法 Test Method
含量 Assay, %	>94.9	FCCV
含水量 Water Content, %	<5.1	Karl Fischer Titration
酸性 (乙酸) Acidity (as acetic acid), %	<0.003	FCCV
碱性 Alkalinity (as NH ₃), ppm	<3	FCCV
杂醇油 Fusel Oil	passes test	FCCV
酮, 异丙醇 Ketones, Isopropyl Alcohol	passes test	FCCV
铅 Lead, ppm	<0.5	FCCV
甲醇 Methanol	passes test	FCCV
不挥发物 Non-volatile Residue, %	<0.003	FCCV
可溶性 (在水中溶解度) Solubility in water	passes test	FCCV
硫酸实验 Substance Darkened by H ₂ SO ₄	passes test	FCCV
高锰酸盐物质 Substance Reducing Permanganate	passes test	FCCV
甲苯 Toluene, ppb	<10	US EPA 82603

*Note : Food Chemicals Codex-5th ed. (2004), pp. 157-158

Prepared by:
Date:

Reviewed by:
Date:



2018.01.22 15:18 P2
Jan. 22 2018 16:01 P3

FRX NO. :
FRX NO. :

FROM :
FROM :



(2012)粤质认字029号
有效期至2015年11月12日



检 验 报 告

INSPECTION REPORT

No.: HWT00301-15

样 品 名 称: 食用酒精
 Product description _____
 型 号 规 格: ---
 Model/Specification _____
 委 托 单 位: 广东三联实业有限公司
 Client _____
 检 验 类 别: 一般委检
 Inspection/Test Category _____



广东省湛江市质量计量监督检测所
 Zhanjiang Institute of Supervision & Test on Quality & Measure, Guangdong
 2015年02月03日



说 明

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In case of any disagreement, applicant shall make a request for explanation or retest to our institute within 15 days after the report issue date, otherwise no requests will be accepted.

单位地址：广东省湛江市麻章区瑞云南路8号

英文地址:No.8 SOUTH RUIYUN ROAD, MAZHANG ZHANJIANG GUANGDONG CHINA.

邮政编码(ZIP):524096 电话(TEL.):0759-3582678 电传(FAX):0759-3582670

投诉电话(Complaint TEL.):0759-3582661 电子邮箱(Email):qm_zjb@21cn.net



广东省湛江市质量计量监督检测所

Zhanjiang Institute of Supervision & Test on Quality & Measure, Guangdong

检验报告 正本
INSPECTION REPORT 正 本
No.: HWT00301-15
共 2 页第 1 页
pages of

样 本	样品名称 Product Description	食用酒精	商标 Trade Mark	
	规格、型号 Model/Specification	_____	生产日期 Production Date	_____
	标称生产单位 Manufacturer	广东徐闻三和发展有限公司	样品数量 Sample Quantity	2000ml
	编号、批号 Sample Nos.	_____	抽样基数 Cardinal Number	0
	到样日期 Delivered Date	2015年01月20日	抽样日期 Sampling date	_____
	抽样单位 Sampling unit	_____	来样方式 To sample	送样
	送样人 Delivered by	陈嘉琪	样品状态 Sample Status	玻璃瓶装完好
	任务来源文号 Task source textion	_____		
委托 单位	名称 Client	广东三联实业有限公司	邮编 Zip	_____
	地址 Address	遂溪县遂城镇景山小区白银路3号	电话 TEL.	_____
受检 单位	名称 Inspection Enterprise	_____	邮编 Zip	_____
	地址 Address	_____	电话 TEL.	_____
检验起止日期 Test Date		起始日期: 2015年01月20日 完检日期: 2015年02月03日	检验类别 Test Category	一般委检
检验依据 Reference Documents for the Test		GB10343-2008 食用酒精 GB/T21911-2008 食品中邻苯二甲酸酯的测定		
检验结论 Test Conclusion		该样品所检项目符合GB10343-2008 (普通级) 的标准要求。 (报告专用章) (Special stamp of Test Report) 签发日期: 2015-02-03 Issue Date: 2015-02-03		
备注 Remark		检验项目中DEHP、DBP、DMP、DEP、DIBP、DMEP、BMPP、DEEP、DPP、DHXP、BBP、DBEP、DCHP、DNOP、DNP、邻苯二甲酸二苯酯不做判定。		

批准: (b) (6)
Approved By
日期 (Date) 2015-02-03

审核: (b) (6)
Verified By
日期 (Date) 2015-02-03

主检: (b) (6)
Tested By
日期 (Date) 2015-02-03



广东省湛江市质量计量监督检测所

Zhanjiang Institute of Supervision &

Test on Quality & Measure, Guangdong

检验报告

INSPECTION REPORT

No.: HWT00301-15
共 2 页第 2 页
pages of

No	检验项目	标准要求			检验结果	单项判定
		特级	优级	普通级		
1	外观	无色透明			符合	合格
2	气味	具有乙醇固有的香味,无异味		无异臭	普通级	合格
3	口味	纯净,微甜	纯正,微甜	较纯正	普通级	合格
4	色度 号	≤10	≤10	≤10	<10	合格
5	乙醇(体积分数) %	≥96.0	≥95.5	≥95.0	95.3	合格
6	硫酸试验 号	≤5	≤10	≤60	<10	合格
7	氧化时间 min	≥40	≥30	≥20	40	合格
8	醛(以乙醛计) mg/L	≤1	≤3	≤30	5	合格
9	酸(以乙酸计) mg/L	≤7	≤10	≤20	16	合格
10	酯(以乙酸乙酯计) mg/L	≤10	≤18	≤25	17	合格
11	不挥发物 mg/L	≤10	≤20	≤25	3	合格
12	甲醇 mg/L	≤2	≤50	≤150	11	合格
13	正丙醇 mg/L	≤2	≤35	≤100	23	合格
14	异丁醇+异戊醇 mg/L	≤1	≤2	≤30	未检出(检出限 2.0)	合格
15	重金属(以 Pb 计) mg/L	≤1			<1	合格
16	DEHP mg/L	—			未检出(检出限 0.05)	—
17	DBP mg/L	—			未检出(检出限 0.05)	—
18	DMP mg/L	—			未检出(检出限 0.05)	—
19	DEP mg/L	—			未检出(检出限 0.05)	—
20	DIBP mg/L	—			未检出(检出限 0.05)	—
21	DMEP mg/L	—			未检出(检出限 0.05)	—
22	BMPP mg/L	—			未检出(检出限 0.05)	—
23	DEEP mg/L	—			未检出(检出限 0.05)	—
24	DPP mg/L	—			未检出(检出限 0.05)	—
25	DHXP mg/L	—			未检出(检出限 0.05)	—
26	BBP mg/L	—			未检出(检出限 0.05)	—
27	DBEP mg/L	—			未检出(检出限 0.05)	—
28	DCHP mg/L	—			未检出(检出限 0.05)	—
29	DNOP mg/L	—			未检出(检出限 0.05)	—
30	DNP mg/L	—			未检出(检出限 0.05)	—
31	邻苯二甲酸二苯酯 mg/L	—			未检出(检出限 0.05)	—

审核:
Verified By

(b) (6)

主检:
Tested By

(b) (6)



C3012(粤)质监认字029号
有效期至2015年11月12日



检 验 报 告

INSPECTION REPORT

No.: HWT00301-15

样 品 名 称: 食用酒精
 Product description: _____

型 号 规 格: _____
 Model/Specification: _____

委 托 单 位: 广东三联实业有限公司
 Client: _____

检 验 类 别: 一般委检
 Inspection/Test Category: _____



广东省湛江市质量计量监督检测所

Zhanjiang Institute of Supervision & Test on Quality & Measure, Guangdong

2015年02月03日



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英文地址:No.8 SOUTH RUIYUN ROAD, MAZHANG ZHANJIANG GUANGDONG CHINA.

邮政编码(ZIP):524096 电话(TEL.):0759-3582678 电传(FAX):0759-3582670

投诉电话(Complaint TEL.):0759-3582661 电子邮箱(Email):qm_zjb@21cn.net



广东省湛江市质量计量监督检测所

Zhanjiang Institute of Supervision &

Test of Quality & Measure, Guangdong

检验报告

INSPECTION REPORT 正本

No.: HWT00301-15

共 2 页第 1 页
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样 本	样品名称 Product Description	食用酒精	商标 Trade Mark	
	规格、型号 Model/Specification		生产日期 Production Date	
	标称生产单位 Manufacturer	广东徐闻三和发展有限公司	样品数量 Sample Quantity	2000ml
	编号、批号 Sample Nos.		抽样基数 Cardinal Number	0
	到样日期 Delivered Date	2015年01月20日	抽样日期 Sampling date	
	抽样单位 Sampling unit		来样方式 To sample	送样
	送样人 Delivered by	陈嘉琪	样品状态 Sample Status	玻璃瓶装完好
	任务来源文号 Task source textion			
委托 单位	名称 Client	广东三联实业有限公司	邮编 Zip	
	地址 Address	遂溪县遂城镇景山小区白银路3号	电话 TEL.	
受检 单位	名称 Inspection Enterprise		邮编 Zip	
	地址 Address		电话 TEL.	
检验起止日期 Test Date		起始日期: 2015年01月20日 完检日期: 2015年02月03日	检验类别 Test Category	一般委检
检验依据 Reference Documents for the Test		GB10343-2008 食用酒精 GB/T21911-2008 食品中邻苯二甲酸酯的测定		
检验结论 Test Conclusion		该样品所检项目符合GB10343-2008 (普通级) 的标准要求。  (Report for Special group test Report) 签发日期: 2015-02-03 Issue Date: 2015-02-03		
备注 Remark		检验项目中DEHP、DBP、DMP、DEP、DIBP、DMEP、BMPP、DEEP、DPP、DNXP、BEP、DBEP、DCHP、DNOP、DMP、邻苯二甲酸二甲酯不做判定。		

批准: Approved By

审核: Verified By

主检: Tested By

日期 (Date) 2015-02-03

日期 (Date) 2015-02-03

日期 (Date) 2015-02-03



广东省湛江市质量计量监督检测所

Zhanjiang Institute of Supervision &

Test on Quality & Measure ,Guangdong

检验报告

正本

No.: HWT00301-15

共 2 页第 2 页
pages of

INSPECTION REPORT

no	item	Specification			result	Conclusion
		special grade	Ample grade	general		
1	Appearance	Passes test			passes	Approved
2	Odor	No odor		Passes test	general	Approved
3	Taste	Purity and sweet	Clear and sweet	clear	general	Approved
4	Color	≤10	≤10	≤10	< 10	Approved
5	C ₂ H ₅ OH content,%	≥96.0	≥95.5	≥95.0	95.3	Approved
6	Substance Darkened by H ₂ SO ₄	≤5	≤10	≤60	< 10	Approved
7	Oxidize time,min	≥40	≥30	≥20	40	Approved
8	Aldehyde, mg/L	≤1	≤3	≤30	5	Approved
9	acid(as acetic acid),mg/L	≤7	≤10	≤20	16	Approved
10	Ester(as ethyl ester),mg/L	≤10	≤18	≤25	17	Approved
11	Non-volatile residue,mg/L	≤10	≤20	≤25	3	Approved
12	Methanol,mg/L	≤2	≤50	≤150	11	Approved
13	N-propyl alcohol,mg/L	≤2	≤35	≤100	23	Approved
14	Isobutanol +Isoamyol,mg/L	≤1	≤2	≤30	ND(test limit 2.0)	Approved
15	Heavy metal(as Pb),mg/L	≤1			< 1	Approved
16	DEHP,mg/L	-			ND(Test limit 0.05)	-
17	DBP,mg/L	-				-
18	DMP,mg/L	-				-
19	DEP,mg/L	-				-
20	DIBP,mg/L	-				--
21	DMEP,mg/L	-				-
22	BMPP,mg/L	-				-
23	DEEP,mg/L	-				-
24	DPP,mg/L	-				--
25	DHXP,mg/L	-				-

26	BBP,mg/L	-		-
27	DBEP,mg/L	-		-
28	DCHP,mg/L	-		-
29	DNOP,mg/L	-		-
30	DNP,mg/L	-		-
31	PAEs,mg/L	-		-

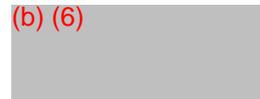
审核：
Verified By

(b) (6)



主检：
Tested By

(b) (6)



A-3 Activated Carbon Specification and Certificate of Analysis



NORIT ACTIVATED CARBON

16 January 2012

Food/ A51

DARCO[®] A-51

WHY CABOT

Cabot Norit Activated Carbon is a premier activated carbon manufacturer respected for experienced people, diverse products and strong customer relationships. Cabot's history of innovation, product performance, technical expertise and customer focus ensure that you receive the right products and solutions for your specific purification needs.



DARCO A-51 is very suitable for purification of many food products, in particular starch based sweeteners and liquid sucrose solutions. DARCO A-51 is a steam activated carbon with a high adsorptive capacity, a high purity and good filtration characteristics.

DARCO A-51 meets the requirements of the latest version of the U.S. Food Chemicals Codex.

SPECIFICATIONS

Molasses decolorizing efficiency (RE)	min. 95	-
Particle size, laser, volume D ₅₀	min. 3.3	µm
pH	min. 4.3	-
pH	max. 7.5	-
Moisture (as packed)	max. 10	mass-%

GENERAL CHARACTERISTICS

Molasses number (EUR)	325	-
Methylene blue adsorption	12	g/100 g
Total surface area (B.E.T.)	650	m ² /g
Apparent density (tamped)	470	kg/m ³
Particle size D ₅₀	40	µm
Water soluble Ash	1	mass-%
Filtration time	13	min



NORIT ACTIVATED CARBON

DARCO[®] A-51

NOTES

- 1 All analyses based on Norit Standard Test Methods (NSTM)
- 2 Specifications are guaranteed values based on lot to lot quality control, as covered by Norit's ISO 9001 certification.
- 3 General characteristics reflect average values of product quality.

PACKAGING

DARCO[®] A-51 is available in:

- Multiply paper bags of 20 kg, 50 bags per pallet, shrink wrapped (1000 kg net weight per pallet)
- Bulk bags of 408.2 kg net weight on a pallet, shrink wrapped

Product availabilities depend on the type of packaging.



NORTH AMERICA

Cabot Corporation Business
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Billerica, MA 01821-7001 USA
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F2012130019
有效期限至:2015年10月23日



检 验 报 告

TEST REPORT

No: (2014) SJHSJ-151

样品名称: 食品添加剂 植物活性炭(木质活性炭)

委托单位: 江西能欣生物科技有限公司

受检单位: 江西能欣生物科技有限公司

报告日期: 2014.06.11

三 明 市 产 品 质 量 检 验 所

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- 4、报告涂改无效。
- 5、对报告若有异议，应于收到之日（以邮戳为准）起十五日内向本检验机构提出。
- 6、对客户送样的委托检验仅对来样负责。
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电话：(0598) 8242197 传真：(0598)8966010

邮政编码：365000 电子信箱：fjsmzjs@163.com

网址：<http://www.sqii.net>

三明市产品质量检验所

检 验 报 告



编 号: (2014)SJHSJ-151

第 1 页 共 2 页

任务来源:江西能欣生物科技有限公司

检验性质:委托检验

<input checked="" type="checkbox"/> 委 托 检 单 位	名称	江西能欣生物科技有限公司			样品名称	食品添加剂 植物活性炭(木质活性炭)	
	地址	江西省宜春市上高县芦洲工业小区			商 标	/	
	电话	13907052208	邮 编	336400	型 号	/	
	传真	/	电 子 信 箱	/	规 格	20kg/袋	
					等 级	/	
					出 厂 编 号	/	
					生 产 日 期	2014.05.20	
生产单位		江西能欣生物科技有限公司					
抽 样 概 况	日期	2014.05.24		抽样单位	江西省食品药品监督管理局		
	地点	/		抽样基数	5000kg		
	方法	《江西省食品药品监督管理局抽样》		抽样数量	400g		
样 品 概 况	数量	抽样数量: 200g; 各样数量: 200g		接收日期	2014.05.28		
	说明	样品符合试验要求					
检 验	GB29215-2012《食品安全国家标准 食品添加剂 植物活性炭(木质活性炭)》						
依 据							
检 结 果	(详见续页)						
检 验 结 论	该批产品经检验符合GB29215-2012《食品安全国家标准 食品添加剂 植物活性炭(木质活性炭)》标准,判定为合格。						
说 明	/						
检验日期		2014.06.01-2014.06.06					

批准: (b) (6) 审定: (b) (6) 校核: (b) (6) 编制: (b) (6)

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检 验 报 告

编 号：(2014)SJHSJ-151

三明市产品质量检验所

续 页：第 2 页 共 2 页

检验结果：

检验项目		标准要求	检验结果	单项判定
感 官	色泽	黑色	黑色	符合
	状态	粉末或颗粒	粉末	符合
碘吸附值(以干基计), mg/g		≥ 400	1106	符合
硫酸盐灰分(以干基计), w/%		≤ 7.0	5.0	符合
氰化物		通过试验	通过试验	符合
高级芳香烃		通过试验	通过试验	符合
水溶物(以干基计), w/%		≤ 4.0	0.6	符合
砷 (As) (以干基计), mg/kg		≤ 3	< 3	符合
铅 (Pb) (以干基计), mg/kg		≤ 5	0.5	符合

以下空白

Test Report

No:(2014)SJHSJ-151

Sample Name: Food Additive Active Carbon (Woodiness Active Carbon)

Application Co.: Jiangxi nengxin Biological Technology CO.,LTD

Sample from: Jiangxi nengxin Biological Technology CO.,LTD

Report Date: 2014.06.11

Sanming City product quality inspection institute

Sanming City product quality inspection institute

Test report

No:(2014)SJHSJ-151

Sample from: Jiangxi nengxin Biological Technology CO.,LTD

Inspection category: customer required

Application Co.	Name	Jiangxi nengxin Biological Technology CO.,LTD			Sample name	Food Additive Active Carbon (Woodiness Active Carbon)
	Address	Luzhou Industry Zone, Shanggao County, Yichun City, Jiangxi Province			Trade Type	-
	Tel	13907052208	Zip code	336400	Model	20 kg/bag
	Fax	-	Email	-	Grade	-
Manufacture	Jiangxi nengxin Biological Technology CO.,LTD					
	Batch No					
Sampling	Date	2014.05.24		Sampling by	Jiangxi Food And Drug Administration	
	Place	-		Sampling from	5000kg	
	Method	Jiangxi Food And Drug Administration Required		Sample Quantity	400g	
Sample condition	Quantity	Test 200g Prepare 200g		Received Date	2014.05.28	
	explain	regular				
Analysis Request		According to the GB 29215-2012 Food Additive Active Carbon (Woodiness Active Carbon)				
Test result		See next page				
Conclusion		Approved				
Mark		-				
Test Date		2014.06.01-2014.06.06				

Approved: Verify: Check: Prepare:

TEST REPORT

No:(2014)SJHSJ-151

Sanming City product quality inspection institute

Test result:

Item		Specification	Result	Conclusion
Appearance	Color	Black	Black	Approved
	Status	Powder or Granulated	Powder	Approved
iodine sorption value(as anhydrous basis),mg/g		≥ 400	1106	Approved
Sulfate Ash(as anhydrous basis),w/%		≤ 7.0	5.0	Approved
Prussiate		Passes test	Passes test	Approved
Advanced aromatic hydrocarbon		Passes test	Passes test	Approved
Hydrotrope (as anhydrous basis),w/%		≤ 4.0	0.6	Approved
As(as As) (as anhydrous basis),mg/kg		≤ 3	< 3	Approved
Pb(as Pb) (as anhydrous basis),mg/kg		≤ 5	0.5	Approved

A-4 Ion Exchange Resin Certificate of Analysis



Test Report

No. TJ505961/CHEM

Date: 11.30.2005

Page 1 of 3

ZIBO DONGDA CHEMICAL CO.,LTD.
NO. 21 XINCUN EAST ROAD ZHANGDIAN DISTRICT,ZIBO CITY,SHANDONG PROVINCE,CHINA

The following sample(s) was/were submitted and identified on behalf of the applicant as:

Sample Name : ION EXCHANGE RESIN
SGS Ref No. : TJECO051102708
SGS Order No. : BJFDO051100358FD
Main substance : ION EXCHANGE RESIN

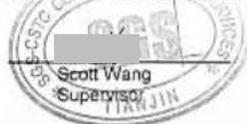
Sample Receiving Date : November 23, 2005
Testing Period : November 23 to November 29, 2005

Test Requested : 1) To determine the Cadmium content of the submitted sample.
2) To determine the Lead content of the submitted sample.
3) To determine Mercury content of the submitted sample.
4) To determine Hexavalent Chromium content of the submitted sample.
5) To determine the PBBs(Polybrominated biphenyls) PBDEs(PBDES)
(Polybrominated biphenyl ethers) content of the submitted sample.

Test method : 1) With reference to BS EN 1122:2001, Method B or other acid digestion.
Analysis was performed by Inductively Coupled Argon Plasma – Atomic Emission Spectrometry (ICP-AES) or Atomic Absorption Spectrometry.
2) With reference to US EPA Method 3050B or other acid digestion.
Analysis was performed by Inductively Coupled Argon Plasma – Atomic Emission Spectrometry (ICP-AES) or Atomic Absorption Spectrometry.
3) With reference to US EPA 3052 or other acid digestion.
Analysis was performed by Inductively Coupled Argon Plasma – Atomic Emission Spectrometry (ICP-AES) or US EPA7473 Analysis was performed by Hg Analyzer.
4) With reference to US EPA3060A and US EPA7196A
Analysis was performed by UV-VIS Spectrometric method.
5) With reference to USEPA 8081A/8270C/3540C/3550B
Analysis was performed by GC/MS.

Test Results : Please refer to next page

Signed for and on behalf of
SGS-CSTC Chemical Laboratory



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Tianjin Branch Chemical Laboratory | 中国 - 天津 - 经济技术开发区第五大街41号1层C区3-8号 邮编: 300457 | 1-86 22 28293899 ext.135 | 1-86 22 28293261 | www.sgs.com

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Test Report

No. TJ505961/CHEM

Date: 11.30.2005

Page 2 of 3

Test Results

No.	Item	Unit	MDL	A
1	Cadmium (Cd)	ppm	2	N.D.
2	Lead (Pb)	ppm	2	2
3	Mercury(Hg)	ppm	2	N.D.
4	Hexavalent Chromium(Cr VI)	ppm	2	N.D.
5	PBBs(Polybrominated biphenyls)	---	---	---
	PBBs(Bromobiphenyl)	ppm	5	N.D.
	PBBs(Dibromobiphenyl)	ppm	5	N.D.
	PBBs(Tribromobiphenyl)	ppm	5	N.D.
	PBBs(Tetrabromobiphenyl)	ppm	5	N.D.
	PBBs(Pentabromobiphenyl)	ppm	5	N.D.
	PBBs(Hexabromobiphenyl)	ppm	5	N.D.
	PBBs(Heptabromobiphenyl)	ppm	5	N.D.
	PBBs(Octabromobiphenyl)	ppm	5	N.D.
	PBBs(Nonabromobiphenyl)	ppm	5	N.D.
	PBBs(Decabromobiphenyl)	ppm	5	N.D.
	PBBEs(PBDEs)(Polybrominated biphenyl ethers)	---	---	---
	PBBEs(PBDEs)(Monobromobiphenyl ethers)	ppm	5	N.D.
	PBBEs(PBDEs)(Dibromobiphenyl ethers)	ppm	5	N.D.
	PBBEs(PBDEs)(Tribromobiphenyl ethers)	ppm	5	N.D.
	PBBEs(PBDEs)(Tetrabromobiphenyl ethers)	ppm	5	N.D.
	PBBEs(PBDEs)(Pentabromobiphenyl ethers)	ppm	5	N.D.
	PBBEs(PBDEs)(Hexabromobiphenyl ethers)	ppm	5	N.D.
	PBBEs(PBDEs)(Heptabromobiphenyl ethers)	ppm	5	N.D.
	PBBEs(PBDEs)(Octabromobiphenyl ethers)	ppm	5	N.D.
PBBEs(PBDEs)(Nonabromobiphenyl ethers)	ppm	5	N.D.	
PBBEs(PBDEs)(Decabromobiphenyl ethers)	ppm	5	N.D.	

Sample Description:

A. yellow grains

Note : ppm=mg/kg

MDL= Method Detection Limit

N.D. = Not detected. (<MDL)

Photo appendix is as follow

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Tianjin Branch Chemical Laboratory | 中国·天津·经济技术开发区第五大街41号1层C1.8-9号 邮编: 300457 | 86-22-25208899 ext.131 86-22-25201252 | www.sgs.com



20122701910号
有效期至2015年11月04日

检 验 报 告

报告批号： 2013GC199

产品名称： SEPLITE牌离子交换吸附树脂

委托单位： 陕西省卫生监督所

生产单位： 西安蓝晓科技新材料股份有限公司

检验类别： 委托检验

陕西省饮用水产品质量监督检验站

**陕西省饮用水产品质量监督检验站
检 验 报 告**

报告批号： 2013GC199

第 1 页共 2 页

产品名称	SEPLITE牌离子交换吸附树脂	型号规格	50KG/袋
委托单位	陕西省卫生监督所	检验类别	委托检验
生产单位	西安蓝晓科技新材料股份有限公司	委托人	杨小刚
采样地点	——	数 量	250g
批 号	20130506	到样时间	2013-5-14
送样编号	——	检测编号	2013GC199
检验依据	《生活饮用水输配水设备及防护材料卫生安全评价规范》； GB/T 5750—2006	检测日期	2013-5-14—2013-5-21
检验项目	砷、汞等共十五项。		
检 验 结 论	<p>依据《生活饮用水输配水设备及防护材料卫生安全评价规范》判定：</p> <p>该样品浸泡试验所检项目均符合《生活饮用水输配水设备及防护材料卫生安全评价规范》的要求。</p> <p style="text-align: right;">签发日期：二〇一三年五月二十一日</p>		
备 注	<p>所检样品采样工作由委托方完成，采样信息由委托方提供，本站未参与本批次样品的采样工作，该样品的检测结果仅对来样负责。</p>		

批准： (b) (6)

审核： (b) (6)

主检： (b) (6)



陕西省饮用水产品质量监督检验站 检 验 报 告

委托单位：陕西省卫生监督所

报告批号：2013GC199 第 2 页共 2 页

送样编号		—			检测编号	2013GC199	
序号	检验项目	单位	检测结果1	检测结果2	对照液数据	标准卫生要求	单项判定
1	色度	度	<5	<5	<5	增加量≤5度	符合
2	浊度	NTU	0.26	0.26	0.11	增加量≤0.2NTU	符合
3	臭和味	无量纲	无异臭、异味	无异臭、异味	无异臭、异味	浸泡后水无异臭、异味	符合
4	肉眼可见物	无量纲	浸泡后水未产生任何肉眼可见的碎片杂物	浸泡后水未产生任何肉眼可见的碎片杂物	无任何肉眼可见的碎片杂物	浸泡后水不产生任何肉眼可见的碎片杂物	符合
5	pH值	无量纲	8.03	8.05	8.00	改变量≤0.5	符合
6	溶解性总固体	mg/L	180	182	174	增加量≤10mg/L	符合
7	耗氧量	mg/L	0.64	0.64	0.56	增加量≤1(以O ₂ mg/L)	符合
8	砷	mg/L	<0.0004	<0.0004	<0.0004	增加量≤0.005mg/L	符合
9	汞	mg/L	<0.00004	<0.00004	<0.00004	增加量≤0.0002mg/L	符合
10	镉	mg/L	<0.0002	<0.0002	<0.0002	增加量≤0.0005mg/L	符合
11	铬	mg/L	0.0027	0.0028	0.0028	增加量≤0.005mg/L	符合
12	铅	mg/L	<0.002	<0.002	<0.002	增加量≤0.001mg/L	符合
13	铝	mg/L	<0.002	<0.002	<0.002	增加量≤0.02mg/L	符合
14	挥发酚	mg/L	<0.002	<0.002	<0.002	增加量≤0.002mg/L	符合
14	三氯甲烷	μg/L	<0.0002	<0.0002	<0.0002	增加量≤6μg/L	符合



Test Report

Report Number: 2013GC199

Product Name: SEPLITE Ion Exchange & Adsorption Resin

Testing Institutions: Health Supervision of Shanxi Province

Production Company: Sunrein New Materials Co. Ltd., Xi'an

Report Number: 2013GC199

Sample Description:

Sample Name: SEPLITE Ion Exchange & Adsorption Resin

Sample Batch No.: 20130506

Date of Sample Received: 14 May 2013

Testing Period: 14 May 2013- 21 May 2013

Test Method(s): water transport equipment and protective materials' hygiene safety evaluation standard for domestic and drinking water.

GB/T 5750-2006

Test Result(s):

Test Item(s)	Unit	Test Result(s)-1	Test Result(s)-2	Test Result(s)-3	Specification	Item conclusion
Color	-	<5	<5	<5	Increment ≤ 5	Pass
Turbidity	NT	0.26	0.26	0.11	Increment ≤ 0.2	Pass
Odor & Taste	-	No odor & taste	No odor & taste	No odor & taste	No odor & taste -	Pass
Visible substance	-	None	None	None	None	Pass
pH	-	8.03	8.05	8.00	Variable quantity ≤ 0.5	Pass
Total soluble solids	mg/L	180	182	174	Increment ≤ 10 mg/L	Pass
Oxygen Consumption(as O ₂)	mg/L	0.64	0.64	0.56	Increment ≤ 1 (as O ₂ mg/L)	Pass
Arsenic (As)	mg/L	<0.0004	<0.0004	<0.0004	Increment ≤ 0.005	Pass
Mercury (Hg)	mg/L	<0.00004	<0.00004	<0.00004	Increment ≤ 0.0002	Pass
Cadmium (Cd)	mg/L	<0.0002	<0.0002	<0.0002	Increment ≤ 0.0005	Pass
Chromium (VI)	mg/L	0.0027	0.0028	0.0028	Increment ≤ 0.005	Pass
Lead (Pb)	mg/L	<0.002	<0.002	<0.002	Increment ≤ 0.001	Pass
Aluminum (Al)	mg/L	<0.002	<0.002	<0.002	Increment ≤ 0.02	Pass
Volatile Phenolic	mg/L	<0.002	<0.002	<0.002	Increment ≤ 0.002	Pass
Chloroform	μ g/L	<0.0002	<0.0002	<0.0002	Increment ≤ 6 μ g/L	Pass

Approver: Zhang Cang

Auditor: Hu Jianping

Tester: Li Xiaoqing

A-5 Adsorption Resin Certificate of Analysis



Test Report

No. TSNIND1500905001

Date: 16 Jul 2015

Page 1 of 3

CANGZHOU YUANWEI CHEMICAL ENGINEERING CO.,LTD
NO.18 GUOZHUANG INDUSTRIAL AREA XIANXIAN HEBEI 062254 P.R CHINA

The following sample(s) was/were submitted and identified on behalf of the clients as : MACROPOROUS ADSORPTIO RESINN

SGS Job No. : TJIN1507007102PS - TJ
Specification : 03F
Date of Sample Received : 06 Jul 2015
Testing Period : 06 Jul 2015 - 16 Jul 2015
Test Requested : Selected test(s) as requested by client.
Test Method : Please refer to next page(s).
Test Results : Please refer to next page(s).

Signed for and on behalf of
SGS-CSTC Standards Technical Services (Tianjin) Co., Ltd.



Reabeca Zhou
Approved Signatory



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Test Report

No. TSNIND1500905001

Date: 16 Jul 2015

Page 2 of 3

Test Results :

Test Part Description :

Specimen No.	SGS Sample ID	Description
SN1	TSN15-009050.001	white grains

Remarks :

- (1) 1 mg/kg = 0.0001%
- (2) MDL = Method Detection Limit
- (3) ND = Not Detected (< MDL)
- (4) "-" = Not Regulated

Element(s)

Test Method : With reference to US EPA Method 3052:1996, analysis was performed by ICP-OES.

<u>Test Item(s)</u>	<u>Unit</u>	<u>MDL</u>	<u>001</u>
Lead (Pb)	mg/kg	2	ND

Solvents (inhalation)

Test Method : Sample preparation with reference to EN71-10:2005 followed by analysis with reference to EN71-11:2005.

<u>Test Item(s)</u>	<u>CAS NO.</u>	<u>Unit</u>	<u>MDL</u>	<u>001</u>
Benzene	71-43-2	µg/g	5	ND
Toluene	108-88-3	µg/g	5	ND
Xylene (all isomers)	Various	µg/g	15	ND

This test was subcontracted to SGS Shanghai chemical lab.



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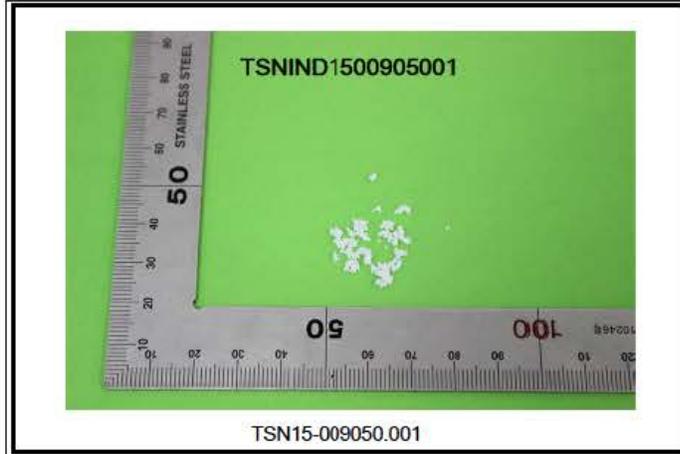
Test Report

No. TSNIND1500905001

Date: 16 Jul 2015

Page 3 of 3

Sample photo:



SGS authenticate the photo on original report only

*** End of Report ***



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Test Report

No. TJTC 0961936/CHEM

Date: December 1, 2009

Page 1 of 2

CANGZHOU YUANWEI CHEMICAL ENGINEERING CO., LTD
NO.18 GUOZHUANG INDUSTRIAL AREA, XIANXIAN, HEBEI 062254 P.R.CHINA

The following sample(s) was/were submitted and identified by/on behalf of the client as: MACROPOROUS ADSORPTION RESIN

SGS Ref No : 1002788
Composition : DIVINYL BENZENE
Model No. : 03F
Supplier : CANGZHOU YUANWEI CHEMICAL ENGINEERING CO., LTD

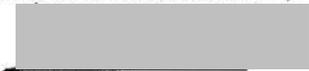
Sample Receiving Date : November 18, 2009
Testing Period : November 18 to December 01, 2009

Test Requested : 1. To determine the Lead content in the submitted sample.
2. *As per client's request, to determine Volatile Organic Compounds (VOC)- Benzene, Toluene, m- & p-Xylene, o-Xylene in the submitted sample.

Test method : 1. With reference to IEC 62321 Ed.1: 2008 for Lead content. Analysis was performed by ICP-AES.
2. *In-house method. Analysis was performed by Headspace Gas Chromatograph / Mass Spectrometer (HS-GC-MS).

Test Results : Please refer to next pages

Signed for and on behalf of
SGS-CSTC Chemical Laboratory



Lucid Qi
Lab Manager

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FORM 238023

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Test Report

No. T.JTC 0961936/CHEM

Date: December 1, 2009

Page 2 of 2

Test results by chemical method (Unit: mg/kg)

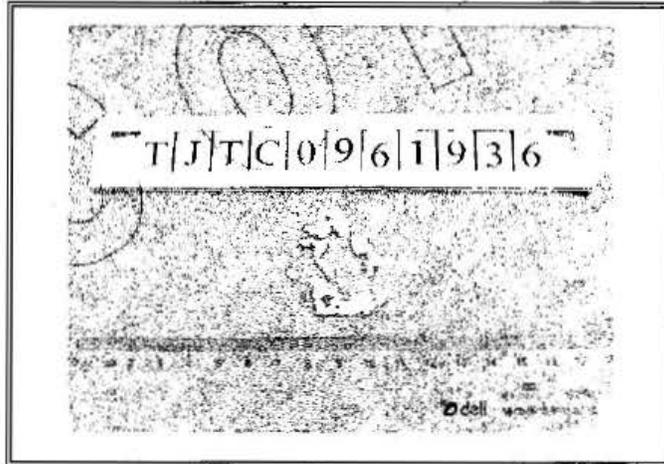
Test Item(s)	Method (refer to)	A	MDL
Lead (Pb)	(1)	n.d.	2
Benzene*	(2)	n.d.	5
Toluene*		11	5
m- & p-Xylene*		n.d.	10
o-Xylene*		n.d.	5

Test Part Description:

A. white grains

- Note : (1) mg/kg = ppm
 (2) n.d. = Not Detected
 (3) MDL = Method Detection Limit
 (4)* This test was subcontracted to SGS Shanghai chemical lab.
 (5)* Results reported on the submitted sample as received.

Sample photo:



SGS authenticate the photo on original report only

*** End of Report ***

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 中国·天津·经济技术开发区第五大街41号5层C区A-9号 邮编: 300457 | (86-22) 25293999 | (86-22) 25295252 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)

A-6 CGTase and α -Amylase Enzymes Certificates of Analysis



PURECIRCLE SDN BHD (578803-K)

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Tel: +606-798 7300 • Fax: +606-791 3333
E-mail: office@purecircle.com

CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: CGTase (CAS 9030-09-5)
BATCH #: CG06151058
MANUFACTURING DATE: 10 June, 2015
EXPIRY DATE: 17 June, 2015
STORAGE CONDITIONS: DRY AND VENTILATED AREA

PARAMETER	METHODS	SPECIFICATION	TEST RESULTS
Appearance	Visual inspection	Clear brown liquid	Approved
CGTase Activity (Units/ml)	Hale, Rawlins*	1.5-2.5 U/ml	2.2 U/ml
pH	JECFA vol.4	5.0-7.0	6.8
Brix	Refractometer	1.5-3.0	2.6
Standard Plate Count, CFU/ml	AOAC 990.12	$10^3 - 10^4$	10^3

* Hale W.S., Rawlins L.C. Amylase of *Bacillus macerans*. Cereal Chem., 28, 49-58, 1951.

Prepared by: 
Mariam Adamyan
Production Scientific Manager
Date: 10 June 2015

Reviewed by: 
Suzanne Wong Soo Sian
Quality Assurance Department
Date: 10 June 2015



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CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: CGTase (CAS 9030-09-5)
BATCH #: CG05151037
MANUFACTURING DATE: 22 May, 2015
EXPIRY DATE: 29 May, 2015
STORAGE CONDITIONS: DRY AND VENTILATED AREA

PARAMETER	METHODS	SPECIFICATION	TEST RESULTS
Appearance	Visual inspection	Clear brown liquid	Approved
CGTase Activity (Units/ml)	Hale, Rawlins*	1.5-2.5 U/ml	2.3 U/ml
pH	JECFA vol.4	5.0-7.0	6.9
Brix	Refractometer	1.5-3.0	2.5
Standard Plate Count, CFU/ml	AOAC 990.12	$10^3 - 10^4$	10^4

* Hale W.S., Rawlins L.C. Amylase of *Bacillus macerans*. Cereal Chem., 28, 49-58, 1951.

Prepared by: 
Mariam Adamyam
Production Scientific Manager
Date: 22 May 2015

Reviewed by: 
Suzanne Wong Soo Sian
Quality Assurance Department
Date: 22 May 2015



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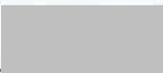
CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: CGTase (CAS 9030-09-5)
BATCH #: CG1114922
MANUFACTURING DATE: 23 November, 2014
EXPIRY DATE: 30 November, 2014
STORAGE CONDITIONS: DRY AND VENTILATED AREA

PARAMETER	METHODS	SPECIFICATION	TEST RESULTS
Appearance	Visual inspection	Clear brown liquid	Approved
CGTase Activity (Units/ml)	Hale, Rawlins ¹	1.5-2.5 U/ml	2.4 U/ml
pH	JECFA vol.4	5.0-7.0	6.75
Brix	Refractometer	1.5-3.0	2.4
Standard Plate Count, CFU/ml	AOAC 990.12	10 ³ - 10 ⁴	10 ²

¹ Hale W.S., Rawlins L.C. Amylase of *Bacillus macerans*. Cereal Chem., 28, 49-58, 1951.

Prepared by: 
Mariam Adamyani
Production Scientific Manager
Date: 23 November 2014

Reviewed by: 
Suzanne Wong Soo Sian
Quality Assurance Department
Date: 23 November 2014



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CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: CGTase (CAS 9030-09-5)
BATCH #: CG0415999
MANUFACTURING DATE: 14 April, 2015
EXPIRY DATE: 21 April, 2015
STORAGE CONDITIONS: DRY AND VENTILATED AREA

PARAMETER	METHODS	SPECIFICATION	TEST RESULTS
Appearance	Visual inspection	Clear brown liquid	Approved
CGTase Activity (Units/ml)	Hale, Rawlins ¹	1.5-2.5 U/ml	2.2 U/ml
pH	JECFA vol.4	5.0-7.0	6.7
Brix	Refractometer	1.5-3.0	2.8
Standard Plate Count, CFU/ml	AOAC 990.12	10 ³ – 10 ⁴	10 ²

¹ Hale W.S., Rawlins L.C. Amylase of *Bacillus macerans*. Cereal Chem., 28, 49-58, 1951.

Prepared by: 
Mariam Adamyan
Production Scientific Manager
Date: 14 April 2015

Reviewed by: 
Suzanne Wong Soo Siân
Quality Assurance Department
Date: 14 April 2015



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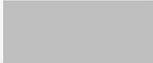
CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: CGTase (CAS 9030-09-5)
BATCH #: CG0115961
MANUFACTURING DATE: 27 January, 2015
EXPIRY DATE: 03 February, 2015
STORAGE CONDITIONS: DRY AND VENTILATED AREA

PARAMETER	METHODS	SPECIFICATION	TEST RESULTS
Appearance	Visual inspection	Clear brown liquid	Approved
CGTase Activity (Units/ml)	Hale, Rawlins*	1.5-2.5 U/ml	2.3 U/ml
pH	JECFA vol.4	5.0-7.0	7.0
Brix	Refractometer	1.5-3.0	2.8
Standard Plate Count, CFU/ml	AOAC 990.12	$10^3 - 10^4$	10^3

*Hale W.S., Rawlins L.C. Amylase of *Bacillus macerans*. Cereal Chem., 28, 49-58, 1951.

Prepared by: 
Mariam Adamyani
Production Scientific Manager
Date: 27 January 2015

Reviewed by: 
Suzanne Wong Soo Sian
Quality Assurance Department
Date: 27 January 2015



บริษัท อีเอ็มพีเอ็น อุตสาหกรรม แป้ง จำกัด
EIAMHENG TAPIOCA STARCH INDUSTRY CO.,LTD.
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 15 หมู่ 12, Kutkai, Songphang, Nakhon Ratchasima 30130, Thailand. Tel: +66(0) 4445-7060-44 Fax: +66(0) 4444-7067

Certificate of Analysis

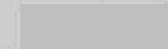
Product Name: NATIVE TAPIOCA STARCH Date: January 21, 2014
 Customer Name: PureCircle Sdn Bhd SO No: 1230000084
 Remarks: Page 1/2 DO No: 1310001663

Batch No.	MFC Date	BBL Date	Parameters						Qty (MT)
			Appearance (1)	Moisture content (2)	Ash content (3)	pH value (4)	SD ₅ (5)	Starch content (6)	
1112M2005	21/12/13	21/12/13	White powder	11.51	0.07	5.54	ND	86.91	18.500
Standard Value			White powder	18.00 Max	0.20 Max	3.00-4.00	ND 0 Max	83.00 Min	
Total									18.500

Method Applied for above parameters:

- (1) Visual test
- (2) Sp / 130 °C (moisture weight) (%)
- (3) Determined at 551 °C (%)
- (4) 20g marsh / 60ml H₂O
- (5) Modified Mowser-Williams method (ppm)
- (6) AOAC (%)

Remark: ND for Not Detected

Approved By: 

(6)



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 15 หมู่ 12, Kutkai, Songphang, Nakhon Ratchasima 30130, Thailand. Tel: +66(0) 4445-7060-44 Fax: +66(0) 4444-7067

Certificate of Analysis

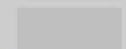
Product Name: NATIVE TAPIOCA STARCH Date: January 21, 2014
 Customer Name: PureCircle Sdn Bhd SO No: 1230000084
 Remarks: Page 2/2 DO No: 1310001663

Batch No.	MFC Date	BBL Date	Parameters						Qty (MT)
			For analysis (1)	Protein content (2)	Load (3)	Total Paster Count (4)	Total (5)	Moist (6)	
1112M2005	21/12/13	21/12/13	0.04	0.04	0.612	21	<10	<10	18.500
Standard Value			0.12 Max	0.20 Max	1.000 Max	10,000 Bcfes	100 Max	100 Max	
Total									18.500

Method Applied for above parameters:

- (1) FCC 9th Monograph Feed starch, Unmodified, pp. 111-115)
- (2) Protein content (%)
- (3) AOAC (2007) 999.11 (ppm)
- (4) FDA-BAM vol. 2001 (Chapter 1) (CTU/g)
- (5) FDA-BAM vol. 2001 (Chapter 11) (CTU/g)
- (6) FDA-BAM vol. 2001 (Chapter 11) (CTU/g)

Remark: ND for Not Detected

Approved By: 

Appendix B Certificates of Analysis for PureCircle RA50

B-1 Certificate of Analysis Lot C1-002-0015-0007

B-2 Certificate of Analysis Lot C1-002-0015-0011

B-3 Certificate of Analysis Lot C1-002-0115-0026

B-4 Certificate of Analysis Lot C1-002-0514-0021

B-5 Certificate of Analysis Lot C1-002-0715-0074

B-1 Certificate of Analysis Lot C1-002-0015-0007



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CERTIFICATE OF ANALYSIS

(Report No.: SG90F2015-0007/2)

PRODUCT NAME: Steviol Glycosides (SG95)	BATCH NO. : C1-002-0115-0007
MANUFACTURE DATE: Jan 06, 2015	EXPIRY DATE: 2 years from manufacturing date
STORAGE CONDITION: Keep in dry & ventilated place	

PARAMETER	TEST METHOD	SPECIFICATION	TEST RESULT
Appearance	Sensory Evaluation	Off-white to white powder	Approved
Total Steviol Glycosides*, % (anhydrous basis)	JECFA 2010	≥95.0	96.39
—Rebaudioside A, %	JECFA 2010	≥50.0	57.88
Loss on Drying, %	JECFA Vol.4	≤6.0	4.59
Ash,%	JECFA Vol.4	<1.0	0.05
Solubility, %	JECFA Vol.4	Freely soluble	Approved
pH,1% in water	JECFA Vol.4	4.5-7.0	5.76
Residual Ethanol, %	USP<467>	<0.50	0.13
Residual Methanol, %	USP<467>	<0.02	Not Detected
Lead (as Pb)**, ppm	AOAC 993.14	<1.0	0.007
Arsenic (as As)**, ppm	AOAC 993.14	<1.0	0.015
Cadmium (as Cd)**, ppm	AOAC 993.14	<1.0	<0.005
Mercury (as Hg) **, ppm	AOAC 993.14	<1.0	<0.005
Total Plate Count***, CFU/g	Chapter 3, FDA	<1000	<250
Yeast & Mold***, CFU/g	Chapter 18, FDA	<200	Not Detected
Total Coliform***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
E. coli count***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
Salmonella sp.***	Chapter 5, FDA	Negative/25 g	Not Detected

Note:

*15 Glycosides defined in "Steviol Glycosides"

**Analyzed by ALS HK

***Analyzed by SGS Xiamen, China.

Prepared by: _____

QC Department

Report Date: Aug 26, 2015



Reviewed by: _____

B-2 Certificate of Analysis Lot C1-002-0015-0011



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CERTIFICATE OF ANALYSIS

(Report No.: SG90F2015-0011/2)

PRODUCT NAME: Steviol Glycosides (SG95)	BATCH NO.: C1-002-0115-0011
MANUFACTURE DATE: Jan 07, 2015	EXPIRY DATE: 2 years from manufacturing date
STORAGE CONDITION: Keep in dry & ventilated place	

PARAMETER	TEST METHOD	SPECIFICATION	TEST RESULT
Appearance	Sensory Evaluation	Off-white to white powder	Approved
Total Steviol Glycosides*, % (anhydrous basis)	JECFA 2010	≥95.0	96.33
—Rebaudioside A, %	JECFA 2010	≥50.0	59.18
Loss on Drying, %	JECFA Vol.4	≤6.0	4.78
Ash,%	JECFA Vol.4	<1.0	0.04
Solubility, %	JECFA Vol.4	Freely soluble	Approved
pH,1% in water	JECFA Vol.4	4.5-7.0	6.08
Residual Ethanol, %	USP<467>	<0.50	0.17
Residual Methanol, %	USP<467>	<0.02	Not Detected
Lead (as Pb)**, ppm	AOAC 993.14	<1.0	0.008
Arsenic (as As)**, ppm	AOAC 993.14	<1.0	0.011
Cadmium (as Cd)**, ppm	AOAC 993.14	<1.0	<0.005
Mercury (as Hg) **, ppm	AOAC 993.14	<1.0	<0.005
Total Plate Count***, CFU/g	Chapter 3, FDA	<1000	<250
Yeast & Mold***, CFU/g	Chapter 18, FDA	<200	Not Detected
Total Coliform***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
E. coli count***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
Salmonella sp.***	Chapter 5, FDA	Negative/25 g	Not Detected

Note:

*15 Glycosides defined in "Steviol Glycosides"

**Analyzed by ALS HK

***Analyzed by SGS Xiamen, China.

Prepared by: _____

QC Department

Report Date: Aug 26, 2015



Reviewed by: _____

B-3 Certificate of Analysis Lot C1-002-0115-0026



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CERTIFICATE OF ANALYSIS

(Report No.: SG90F2015-0026/2)

PRODUCT NAME: Steviol Glycosides (SG95)	BATCH NO.: C1-002-0115-0026
MANUFACTURE DATE: Jan 21, 2015	EXPIRY DATE: 2 years from manufacturing date
STORAGE CONDITION: Keep in dry & ventilated place	

PARAMETER	TEST METHOD	SPECIFICATION	TEST RESULT
Appearance	Sensory Evaluation	Off-white to white powder	Approved
Total Steviol Glycosides*, % (anhydrous basis)	JECFA 2010	≥95.0	96.32
—Rebaudioside A, %	JECFA 2010	≥50.0	58.71
Loss on Drying %	JECFA Vol.4	≤6.0	4.89
Ash,%	JECFA Vol.4	<1.0	0.02
Solubility, %	JECFA Vol.4	Freely soluble	Approved
pH,1% in water	JECFA Vol.4	4.5-7.0	5.87
Residual Ethanol, %	USP<467>	<0.50	0.12
Residual Methanol, %	USP<467>	<0.02	Not Detected
Lead (as Pb)**, ppm	AOAC 993.14	<1.0	<0.005
Arsenic (as As)**, ppm	AOAC 993.14	<1.0	<0.005
Cadmium (as Cd)**, ppm	AOAC 993.14	<1.0	<0.005
Mercury (as Hg) **, ppm	AOAC 993.14	<1.0	<0.005
Total Plate Count***, CFU/g	Chapter 3, FDA	<1000	Not Detected
Yeast & Mold***, CFU/g	Chapter 18, FDA	<200	Not Detected
Total Coliform***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
E. coli count***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
Salmonella sp.***	Chapter 5, FDA	Negative/25 g	Not Detected

Note:
 *15 Glycosides defined in "Steviol Glycosides"
 **Analyzed by ALS HK
 ***Analyzed by SGS Xiamen, China.

Prepared by: XXXXXXXXXX

QC Department

Report Date: Aug 26, 2015



Reviewed by: XXXXXXXXXX

B-4 Certificate of Analysis Lot C1-002-0514-0021



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CERTIFICATE OF ANALYSIS

(Report No.: SG95F2014-0021)

PRODUCT NAME: Steviol Glycosides (SG95)	BATCH NO.: C2-002-0514-0021
MANUFACTURE DATE: May 26, 2014	EXPIRY DATE: 2 years from manufacturing date
STORAGE CONDITION: Keep in dry & ventilated place	

PARAMETER	TEST METHOD	SPECIFICATION	TEST RESULT
Appearance	Sensory Evaluation	Off-white to white powder	Approved
Total Steviol Glycosides*, % (anhydrous basis)	JECFA 2010	≥95.0	95.75
—Rebaudioside A, %	JECFA 2010	≥50.0	52.86
Loss on Drying, %	JECFA Vol.4	≤6.0	3.95
Ash,%	JECFA Vol.4	<1.0	0.04
Solubility, %	JECFA Vol.4	Freely soluble	Approved
pH,1% in water	JECFA Vol.4	4.5–7.0	6.63
Residual Ethanol, %	USP<467>	<0.50	0.16
Residual Methanol, %	USP<467>	<0.02	Not Detected
Lead (as Pb)**, ppm	AOAC 993.14	<1.0	<0.005
Arsenic (as As)**, ppm	AOAC 993.14	<1.0	0.034
Cadmium (as Cd)**, ppm	AOAC 993.14	<1.0	<0.005
Aluminum (as Al)**,ppm	AOAC 993.14	<10.0	<1.0
Total Plate Count***, CFU/g	Chapter 3, FDA	<1000	<250
Yeast & Mold***, CFU/g	Chapter 18, FDA	<200	Not Detected
Total Coliform***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
<i>E. coli</i> count***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
<i>Salmonella</i> sp.***	Chapter 5, FDA	Negative/25 g	Not Detected

Note:

*9 Glycosides defined in "Steviol Glycosides" specification of FAO JECFA Monographs 10[2010].

**Analyzed by ALS HK

***Analyzed by SGS Xiamen, China.

Prepared by: _____

QC Department



Reviewed by: _____



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Report Date: Jun. 16, 2014

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B-5 Certificate of Analysis Lot C1-002-0715-0074



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http: //www.purecircle.com.cn	E-mail: qcjx@purecircle.com

CERTIFICATE OF ANALYSIS

(Report No.: SG95F2015-0074)

PRODUCT NAME: Steviol Glycosides (SG95)	BATCH NO. : C2-002-0715-0074
MANUFACTURE DATE: JUL 07, 2015	EXPIRY DATE: 3 years from manufacturing date
STORAGE CONDITION: Keep in dry & ventilated place	

PARAMETER	TEST METHOD	SPECIFICATION	TEST RESULT
Appearance	Sensory Evaluation	Off-white to white powder	Approved
Total Steviol Glycosides*, % (anhydrous basis)	JECFA 2010	≥95.0	95.98
—Rebaudioside A, %	JECFA 2010	≥50.0	59.00
Loss on Drying, %	JECFA Vol.4	≤6.0	3.88
Ash,%	JECFA Vol.4	<1.0	0.04
Solubility, %	JECFA Vol.4	Freely soluble	Approved
pH,1% in water	JECFA Vol.4	4.5-7.0	5.46
Residual Ethanol, %	USP<467>	<0.50	0.07
Residual Methanol, %	USP<467>	<0.02	ND
Lead (as Pb)**, ppm	AOAC 993.14	<1.0	<0.005
Arsenic (as As)**, ppm	AOAC 993.14	<1.0	<0.005
Cadmium (as Cd)**, ppm	AOAC 993.14	<1.0	<0.005
Mercury (as Hg) **, ppm	AOAC 993.14	<1.0	<0.005
Aluminum (as Al)**,ppm	AOAC 993.14	<10.0	<1.0
Total Plate Count***, CFU/g	Chapter 3, FDA	<1000	Not Detected
Yeast & Mold***, CFU/g	Chapter 18, FDA	<200	Not Detected
Total Coliform***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
E. coli count***, MPN/g	Chapter 4, FDA	Not Detected	Not Detected
Salmonella sp.***	Chapter 5, FDA	Negative/25 g	Not Detected

Note:

*9 Glycosides defined in "Steviol Glycosides" specification of FAO JECFA Monographs 10[2010].

**Analyzed by ALS HK

***Analyzed by SGS Xiamen, China.

Prepared by: _____

Reviewed by: _____

QC Department





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Report Date: JUL 24, 2015

Appendix C Specification, Certificates of Analysis, and HPLC Chromatograms for PureCircle GSG

C-1 Specifications for GSG, Trade Name NSF-02

C-2 Certificate of Analysis Lot GSG0415633

C-3 Certificate of Analysis Lot GSG0714568

C-4 Certificate of Analysis Lot GSG0914578

C-5 Certificate of Analysis Lot GSG1014587

C-6 Certificate of Analysis Lot GSG1114612

C-7 HPLC Chromatograms

C-1 Specifications for GSG, Trade Name NSF-02

PURECIRCLE SDN BHD (578803-K)
 PT23419 Lengkok Teknologi, techpark@enstek,
 71760 Bandar ENSTEK, Negeri Sembilan, Malaysia
 E-mail: office@purecircle.com www.purecircle.com
 Tel: +606-798 7300 Fax: +606-791 3333



PCSB-LAB-039.5
 Issue Date: 19/11/10
 Revision: 04

SPECIFICATION OF PRODUCT

NAME OF PRODUCT: NSF-02
SHELF LIFE: 3 Years from Manufacturing Date*
STORAGE CONDITIONS: Store in cool, dry and ventilated area

PARAMETER	SPECIFICATION	METHODS
Appearance	White or yellowish powder	Organoleptic Evaluation
Total content of Steviol Glycosides, %	≥80.0	Adsorption Chromatography
Dextrins, %	≤20.0	Adsorption Chromatography
Loss on drying, %	≤6.0	JECFA vol.4
Ash, %	<1.0	AOAC 945.46
Arsenic (as As), ppm	<0.5	AOAC 993.14
Mercury (as Hg), ppm	<0.05	AOAC 993.14
Lead (as Pb), ppm	<1.0	AOAC 993.14
Total Plate Count, CFU/g	<1000	Chapter 3, FDA
Yeast and Mold, CFU/g	<200	AOAC 997.02
Total Coliforms, MPN/g	Not permitted	Chapter 4, FDA
<i>E. coli</i> count, CFU/g	Not permitted	AOAC 991.14
<i>Salmonella</i> sp.	Negative/25g	Tecra Unique/AOAC 2000.07

*-Under PureCircle recommended storage conditions

C-2 Certificate of Analysis Lot GSG0415633



PURECIRCLE SDN BHD (578803-K)

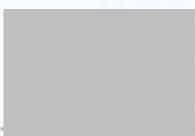
PT 23419, Lengkok Teknologi, techpark@enstek,
71760 Bandar ENSTEK
Negeri Sembilan, Malaysia
Tel: +606-798 7300 • Fax: +606-791 3333
E-mail: office@purecircle.com

CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: NSF-02
BATCH #: GSG0415633
MANUFACTURING DATE: 10th April 2015
EXPIRY DATE: 3 Years from Manufacturing Date*
STORAGE CONDITIONS: Store in cool, dry and ventilated area.

PARAMETER	SPECIFICATION	METHODS	RESULT
Appearance	White or yellowish powder	Organoleptic Evaluation	Approved
Total content of Steviol Glycosides, %	≥80.0	Adsorption Chromatography	84.64
Dextrins, %	≤20.0	Adsorption Chromatography	15.60
Loss on drying, %	≤6.0	JECFA vol.4	3.95
Ash, %	<1.0	AOAC 945.46	0.21
Arsenic (as As), ppm	<0.5	AOAC 993.14	0.099
Mercury (as Hg), ppm	<0.05	AOAC 993.14	<0.005
Lead (as Pb), ppm	<1.0	AOAC 993.14	<0.005
Total Plate Count, CFU/g	<1000	AOAC 990.12	30
Yeast and Mold, CFU/g	<200	AOAC 997.02	Not Detected
Total Coliforms, MPN/g	Not permitted	Chapter 4, FDA	Not Detected
<i>E.coli</i> count, CFU/g	Not permitted	AOAC 991.14	Not Detected
<i>Salmonella</i> sp	Negative/25g	Teera Unique / AOAC 2000.07	Negative

*-Under PureCircle recommended storage conditions

Prepared by: 
 Sharifah Hidayah Syed Nazri
 Quality Assurance Department
 Date: 28th April 2015

Reviewed by: 
 Suzanne Wong Soo Sian
 Quality Assurance Department
 Date: 28th April 2015

C-3 Certificate of Analysis Lot GSG0714568



PURECIRCLE SDN BHD (578803-K)

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71760 Bandar ENSTEK
Negeri Sembilan, Malaysia
Tel: +606-798 7300 • Fax: +606-791 3333
E-mail: office@purecircle.com

CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: NSF-02
BATCH #: GSG0714568
MANUFACTURING DATE: 7th July 2014
EXPIRY DATE: 3 Years from Manufacturing Date*
STORAGE CONDITIONS: Store in cool, dry and ventilated area.

PARAMETER	SPECIFICATION	METHODS	RESULT
Appearance	White or yellowish powder	Organoleptic Evaluation	Approved
Total content of Steviol Glycosides, %	≥80.0	Adsorption Chromatography	83.78
Dextrins, %	≤20.0	Adsorption Chromatography	16.41
Loss on drying, %	≤6.0	JECFA vol.4	5.69
Ash, %	<1.0	AOAC 945.46	0.34
Arsenic (as As), ppm	<0.5	AOAC 993.14	0.187
Mercury (as Hg), ppm	<0.05	AOAC 993.14	<0.005
Lead (as Pb), ppm	<1.0	AOAC 993.14	0.010
Total Plate Count, CFU/g	<1000	AOAC 990.12	Not Detected
Yeast and Mold, CFU/g	<200	AOAC 997.02	Not Detected
Total Coliforms, MPN/g	Not permitted	Chapter 4, FDA	Not Detected
<i>E.coli</i> count, CFU/g	Not permitted	AOAC 991.14	Not Detected
<i>Salmonella</i> sp	Negative/25g	Tecra Unique / AOAC 2000.07	Negative

*-Under PureCircle recommended storage conditions

Prepared by: 
Noorwaeda Musian
Quality Assurance Department
Date: 23rd July 2014

Reviewed by: 
Suzanne Wong Soo Sian
Quality Assurance Department
Date: 23rd July 2014

C-4 Certificate of Analysis Lot GSG0914578



PURECIRCLE SDN BHD (578803-K)

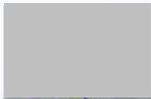
PT 23419, Lengkok Teknologi, techpark@enstek,
71760 Bandar ENSTEK
Negeri Sembilan, Malaysia
Tel: +606-798 7300 • Fax: +606-791 3333
E-mail: office@purecircle.com

CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: NSF-02
BATCH #: GSG0914578
MANUFACTURING DATE: 4th September 2014
EXPIRY DATE: 3 Years from Manufacturing Date*
STORAGE CONDITIONS: Store in cool, dry and ventilated area.

PARAMETER	SPECIFICATION	METHODS	RESULT
Appearance	White or yellowish powder	Organoleptic Evaluation	Approved
Total content of Steviol Glycosides, %	≥80.0	Adsorption Chromatography	85.92
Dextrins, %	≤20.0	Adsorption Chromatography	14.40
Loss on drying, %	≤6.0	JECFA vol.4	4.95
Ash, %	<1.0	AOAC 945.46	0.20
Arsenic (as As), ppm	<0.5	AOAC 993.14	0.197
Mercury (as Hg), ppm	<0.05	AOAC 993.14	<0.005
Lead (as Pb), ppm	<1.0	AOAC 993.14	<0.005
Total Plate Count, CFU/g	<1000	AOAC 990.12	10
Yeast and Mold, CFU/g	<200	AOAC 997.02	Not Detected
Total Coliforms, MPN/g	Not permitted	Chapter 4, FDA	Not Detected
<i>E. coli</i> count, CFU/g	Not permitted	AOAC 991.14	Not Detected
<i>Salmonella</i> sp	Negative/25g	Tecra Unique / AOAC 2000.07	Negative

*-Under PureCircle recommended storage conditions

Prepared by: 
 Noorwaeda Muslan
 Quality Assurance Department
 Date: 18th September 2014

Reviewed by: 
 Alina Dmitrieva
 Quality Assurance Department
 Date: 18th September 2014

C-5 Certificate of Analysis Lot GSG1014587



PURECIRCLE SDN BHD (578803-K)

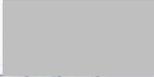
PT 23419, Lengkok Teknologi, techpark@cnstek,
71760 Bandar ENSTEK
Negeri Sembilan, Malaysia
Tel: +606-798 7300 • Fax: +606-791 3333
E-mail: office@purecircle.com

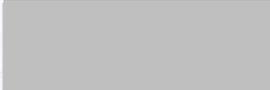
CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: NSF-02
BATCH #: GSG1014587
MANUFACTURING DATE: 13th October 2014
EXPIRY DATE: 3 Years from Manufacturing Date*
STORAGE CONDITIONS: Store in cool, dry and ventilated area.

PARAMETER	SPECIFICATION	METHODS	RESULT
Appearance	White or yellowish powder	Organoleptic Evaluation	Approved
Total content of Steviol Glycosides, %	≥80.0	Adsorption Chromatography	85.80
Dextrins, %	≤20.0	Adsorption Chromatography	15.15
Loss on drying, %	≤6.0	JECFA vol.4	3.92
Ash, %	<1.0	AOAC 945.46	0.38
Arsenic (as As), ppm	<0.5	AOAC 993.14	0.190
Mercury (as Hg), ppm	<0.05	AOAC 993.14	<0.005
Lead (as Pb), ppm	<1.0	AOAC 993.14	0.014
Total Plate Count, CFU/g	<1000	AOAC 990.12	Not Detected
Yeast and Mold, CFU/g	<200	AOAC 997.02	Not Detected
Total Coliforms, MPN/g	Not permitted	Chapter 4, FDA	Not Detected
<i>E. coli</i> count, CFU/g	Not permitted	AOAC 991.14	Not Detected
<i>Salmonella</i> sp	Negative/25g	Tecra Unique / AOAC 2000.07	Negative

*Under PureCircle recommended storage conditions

Prepared by: 
 Suzanne Wong Soo Sian
 Quality Assurance Department
 Date: 28th October 2014

Reviewed by: 
 Alina Dmitrieva
 Quality Assurance Department
 Date: 28th October 2014

C-6 Certificate of Analysis Lot GSG1114612



PURECIRCLE SDN BHD (578803-K)

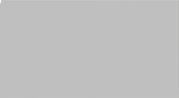
PT 23419, Lengkuk Teknologi, techpark@enstek,
71760 Bandar ENSTEK
Negeri Sembilan, Malaysia
Tel: +606-798 7300 • Fax: +606-791 3333
E-mail: office@purecircle.com

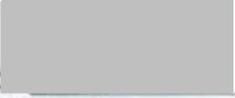
CERTIFICATE OF ANALYSIS

NAME OF PRODUCT: NSF-02
BATCH #: GSG1114612
MANUFACTURING DATE: 28th November 2014
EXPIRY DATE: 3 Years from Manufacturing Date*
STORAGE CONDITIONS: Store in cool, dry and ventilated area.

PARAMETER	SPECIFICATION	METHODS	RESULT
Appearance	White or yellowish powder	Organoleptic Evaluation	Approved
Total content of Steviol Glycosides, %	≥80.0	Adsorption Chromatography	87.99
Dextrins, %	≤20.0	Adsorption Chromatography	12.74
Loss on drying, %	≤6.0	JECFA vol.4	4.48
Ash, %	<1.0	AOAC 945.46	0.25
Arsenic (as As), ppm	<0.5	AOAC 993.14	0.404
Mercury (as Hg), ppm	<0.05	AOAC 993.14	<0.005
Lead (as Pb), ppm	<1.0	AOAC 993.14	0.026
Total Plate Count, CFU/g	<1000	AOAC 990.12	10
Yeast and Mold, CFU/g	<200	AOAC 997.02	Not Detected
Total Coliforms, MPN/g	Not permitted	Chapter 4, FDA	Not Detected
<i>E. coli</i> count, CFU/g	Not permitted	AOAC 991.14	Not Detected
<i>Salmonella</i> sp	Negative/25g	Tecra Unique / AOAC 2000.07	Negative

*Under PureCircle recommended storage conditions

Prepared by: 
Noorwaeda Muslan
Quality Assurance Department
Date: 16th December 2014

Reviewed by: 
Alina Dmitrieva
Quality Assurance Department
Date: 16th December 2014

C-7 GSG HPLC Chromatograms

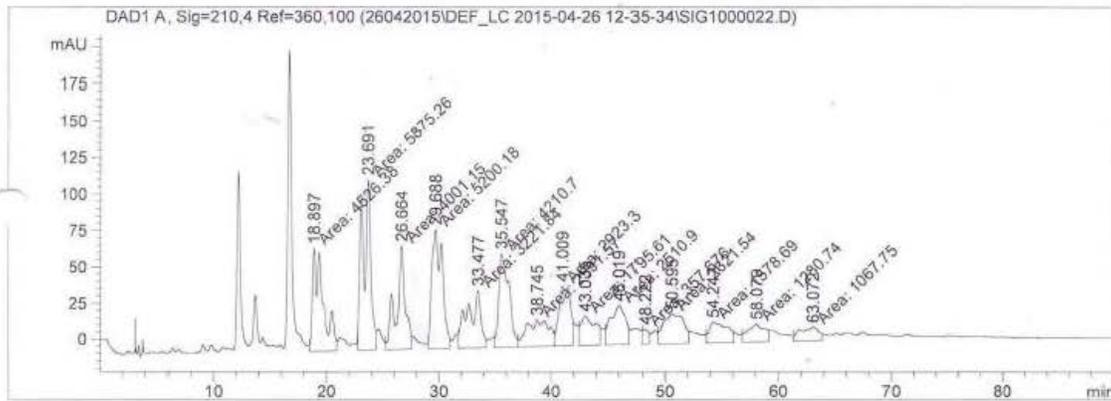
Data File C:\CHEM32\1\DATA\26042015\DEF_LC 2015-04-26 12-35-34\SIG1000022.D
 Sample Name: PCS

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Acq. Instrument : Instrument 1                   Location  : Vial 3
Injection Date  : 4/27/2015 9:36:52 PM        Inj       : 1
                                                    Inj Volume: 12 µl

Acq. Method    : C:\Chem32\1\DATA\26042015\DEF_LC 2015-04-26 12-35-34\SWETAGRAD.M
Last changed   : 4/26/2015 9:25:36 AM
Analysis Method: C:\CHEM32\1\METHODS\SWETAGRAD.M
Last changed   : 8/26/2015 10:59:17 PM
Method Info    : Gradient Method for SWETA

Sample Info    : GSG 633
  
```



Area Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 3/10/2015 3:00:33 PM
Multiplier    : 1.0000
Dilution      : 1.0000
Use Multiplier & Dilution Factor with ISTDs
  
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Signal 1: DAD1 A, Sig=210,4 Ref=360,100

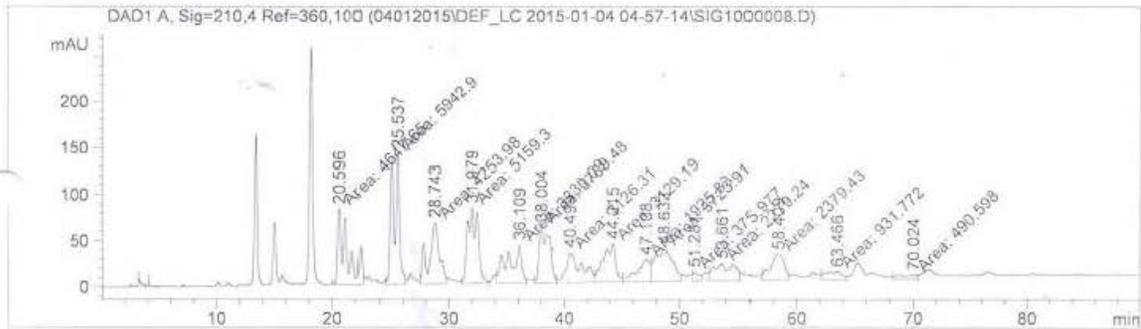
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Area %	Name
1	18.897	MF	1.0604	4526.37744	10.3429	mono-Glucosyl Stevioside (Stv-G1)
2	23.691	MF	0.8351	5875.26074	13.4251	mono-Glucosyl RebA (RebA-G1)
3	26.664	MF	0.9333	4001.15381	9.1427	di-Glucosyl Stevioside (Stev G-2)
4	29.688	MF	1.0552	5200.17676	11.8825	di-Glucosyl RebA (RebA G-2)
5	33.477	MF	1.3516	3221.84399	7.3620	tri-Glucosyl Stevioside (Stev G3)
6	35.547	MF	1.0853	4210.69531	9.6215	tri-Glucosyl RebA (RebA G3)
7	38.745	MF	2.3394	2591.56934	5.9218	tetra-Glucosyl Stevioside (Stev G4)
8	41.009	MF	1.1745	2923.30420	6.6798	tetra-Glucosyl RebA (RebA G4)
9	43.035	MF	1.4549	1795.60706	4.1030	penta-Glucosyl Stevioside (Stev G5)
10	46.019	MF	1.5399	2510.90234	5.7375	penta-Glucosyl RebA (RebA G5)
11	48.222	MF	0.5756	357.67560	0.8173	hexa-Glucosyl Stevioside (Stev G6)
12	50.595	MF	2.0926	2621.54077	5.9903	hexa-Glucosyl RebA (RebA G6)
13	54.247	MF	1.8362	1578.69287	3.6073	hepta-Glucosyl RebA (RebA G7)
14	58.079	MF	1.7472	1280.73779	2.9265	octa-Glucosyl RebA (RebA G8)
15	63.072	MF	1.9240	1067.74927	2.4398	nona-Glucosyl RebA (RebA G9)

```

=====
Acq. Operator   :                               Seq. Line :    8
Acq. Instrument : Instrument 1                   Location  : Vial 5
Injection Date  : 1/4/2015 4:16:54 PM          Inj       :    1
                                                Inj Volume: 12 µl

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Last changed    : 1/4/2015 4:57:13 AM
Analysis Method : C:\CHEM32\1\METHODS\REBASEQ.M
Last changed    : 1/28/2015 6:21:07 AM
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Method Info     : Gradient Method for SWETA

Sample Info     : GSG 612
  
```



Area Percent Report

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Sorted By      : Signal
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
  
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Signal 1: DAD1 A, Sig=210,4 Ref=360,100

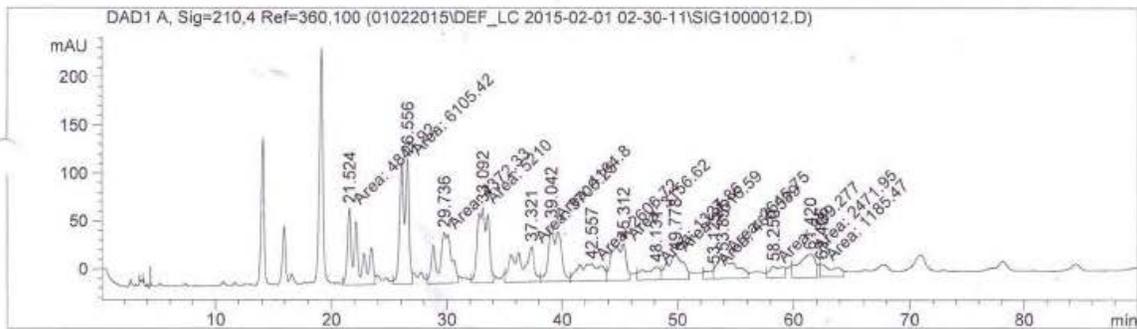
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %	Compound
1	20.596	MF	0.9334	4647.64990	82.98412	10.2223	mono-Glucosyl Stevioside (Stv-G1)
2	25.537	MF	0.7003	5942.90332	141.43909	13.0712	mono-Glucosyl RebA (RebA-G1)
3	28.743	MF	1.0616	4253.97900	66.78529	9.3565	di-Glucosyl Stevioside (Stev G-2)
4	31.979	MF	1.0450	5159.29980	82.28238	11.3477	di-Glucosyl RebA (RebA G-2)
5	36.109	MF	1.3354	3330.08521	41.56237	7.3244	tri-Glucosyl Stevioside (Stev G3)
6	38.004	MF	1.0299	3769.47681	61.00037	8.2908	tri-Glucosyl RebA (RebA G3)
7	40.499	MF	1.5903	3126.31250	32.76498	6.8762	tetra-Glucosyl Stevioside (Stev G4)
8	44.215	MF	1.2626	3129.18750	41.30594	6.8825	tetra-Glucosyl RebA (RebA G4)
9	47.108	MF	1.3300	1925.82678	24.13256	4.2358	penta-Glucosyl Stevioside (Stev G5)
10	48.633	MF	1.7636	3723.90918	35.19297	8.1906	penta-Glucosyl RebA (RebA G5)
11	51.281	FM	0.6352	375.97711	9.86526	0.8269	hexa-Glucosyl Stevioside (Stev G6)
12	53.661	MF	2.0347	2279.23950	18.66978	5.0131	hexa-Glucosyl RebA (RebA G6)
13	58.409	MF	1.4079	2379.43140	28.16814	5.2335	hepta-Glucosyl RebA (RebA G7)
14	63.466	MF	1.7323	931.77161	8.96443	2.0494	octa-Glucosyl RebA (RebA G8)
15	70.024	MF	1.8527	490.59769	4.41345	1.0791	nona-Glucosyl RebA (RebA G9)
Totals :				4.54656e4	679.53113		

```

=====
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Acq. Instrument : Instrument 1                   Location  : Vial 6
Injection Date  : 2/1/2015 7:31:44 PM          Inj       :    1
                                                    Inj Volume: 12 µl

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Analysis Method : C:\CHEM32\1\METHODS\REBASEQ1.M
Last changed    : 2/9/2015 5:24:25 PM
                  (modified after loading)
Method Info     : Gradient Method for SWETA

Sample Info     : GSG 587;
  
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Area Percent Report

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Sorted By      : Signal
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
  
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Signal 1: DAD1 A, Sig=210,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %	
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2	26.556	MF	0.7761	6105.41748	131.10803	13.3421	mono-Glucosyl RebA (RebA-G1)
3	29.736	MF	1.3690	4372.32715	53.23042	9.5548	di-Glucosyl Stevioside (Stev G-2)
4	33.092	MF	1.1014	5210.00391	78.83846	11.3854	di-Glucosyl RebA (RebA G-2)
5	37.321	MF	1.6429	3700.25293	37.53679	8.0861	tri-Glucosyl Stevioside (Stev G3)
6	39.042	MF	1.1349	4164.80420	61.16076	9.1013	tri-Glucosyl RebA (RebA G3)
7	42.557	MF	2.3965	2606.72168	18.12871	5.6964	tetra-Glucosyl Stevioside (Stev G4)
8	45.312	MF	1.3690	3156.62354	38.43089	6.8981	tetra-Glucosyl RebA (RebA G4)
9	48.131	MF	1.6185	1327.85986	13.67404	2.9018	penta-Glucosyl Stevioside (Stev G5)
10	49.778	MF	1.6224	2516.58691	25.85243	5.4995	penta-Glucosyl RebA (RebA G5)
11	53.125	MF	0.7401	465.58945	10.48470	1.0174	hexa-Glucosyl Stevioside (Stev G6)
12	53.855	MF	1.8429	2645.74976	23.92778	5.7817	hexa-Glucosyl RebA (RebA G6)
13	58.250	MF	1.3371	989.27747	12.33104	2.1619	hepta-Glucosyl RebA (RebA G7)
14	61.420	MM	1.6581	2471.94897	24.84685	5.4019	octa-Glucosyl RebA (RebA G8)
15	62.406	MM	1.4614	1185.46704	13.51978	2.5906	nona-Glucosyl RebA (RebA G9)

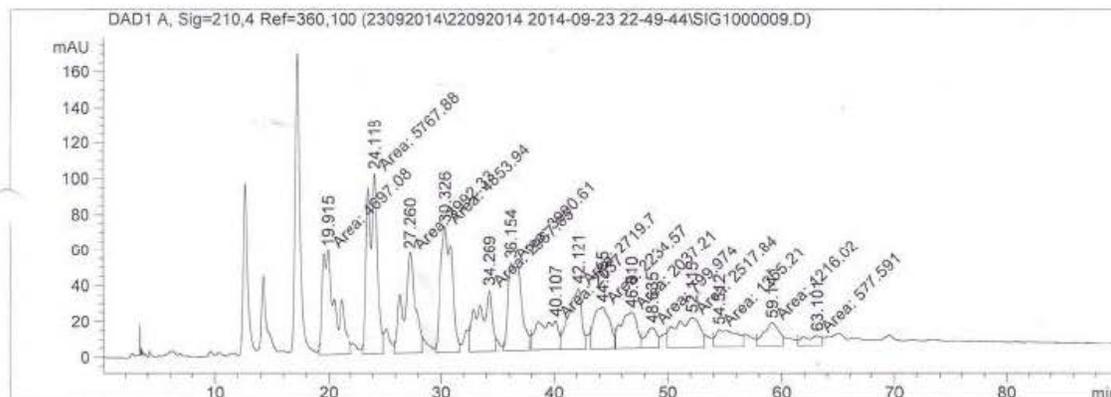
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Acq. Instrument : Instrument 1                   Location  : Vial 3
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                                                    Inj Volume: 12 µl

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Last changed   : 9/23/2014 10:49:43 PM
Analysis Method : C:\CHEM32\1\METHODS\SWETAGRAD.M
Last changed   : 8/21/2015 10:58:57 AM
Method Info    : Gradient Method for SWETA

Sample Info    : GSG 578
  
```



=====
 Area Percent Report
 =====

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Sorted By      : Signal
Calib. Data Modified : 3/10/2015 3:00:33 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
  
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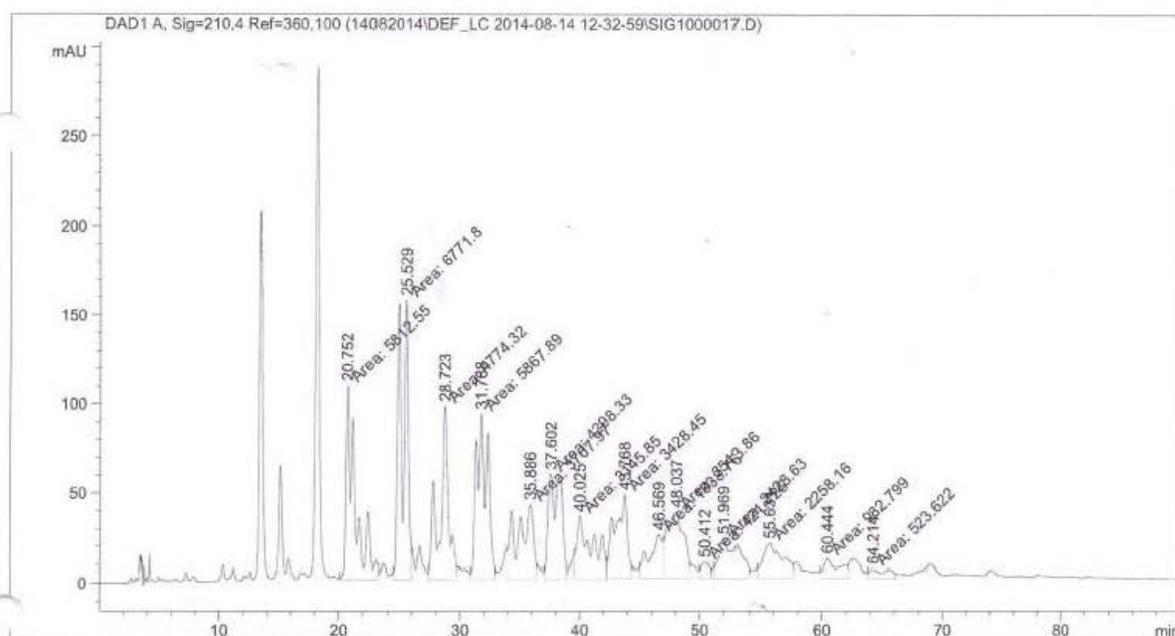
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Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Area %	Name
1	19.187		0.0000	0.00000	0.0000	
2	19.915	MF	1.3479	4697.08398	11.2735	mono-Glucosyl Stevioside (Stv-G1)
3	24.118	MF	0.9563	5767.88135	13.8435	mono-Glucosyl RebA (RebA-G1)
4	27.260	MF	1.1902	3992.33374	9.5820	di-Glucosyl Stevioside (Stev G-2)
5	30.326	MF	1.1527	4853.93945	11.6500	di-Glucosyl RebA (RebA G-2)
6	34.269	MF	1.4495	2967.84570	7.1231	tri-Glucosyl Stevioside (Stev G3)
7	36.154	MF	1.3694	3990.61353	9.5779	tri-Glucosyl RebA (RebA G3)
8	40.107	MF	2.1202	2036.99634	4.8890	tetra-Glucosyl Stevioside (Stev G4)
9	42.121	MF	1.3328	2719.69653	6.5276	tetra-Glucosyl RebA (RebA G4)
10	44.255	MF	1.5882	2234.56689	5.3632	penta-Glucosyl Stevioside (Stev G5)
11	46.810	MF	1.6765	2037.20581	4.8895	penta-Glucosyl RebA (RebA G5)
12	48.635	MF	1.1645	799.97400	1.9200	hexa-Glucosyl Stevioside (Stev G6)
13	52.115	FM	2.5002	2517.83813	6.0431	hexa-Glucosyl RebA (RebA G6)
14	54.512	MF	2.1264	1255.20850	3.0126	hepta-Glucosyl RebA (RebA G7)
15	59.141	MF	1.5543	1216.02026	2.9186	octa-Glucosyl RebA (RebA G8)
16	63.101	MF	1.7878	577.59113	1.3863	nona-Glucosyl RebA (RebA G9)

Data File C:\CHEM32\1\DATA\14082014\DEF_LC 2014-08-14 12-32-59\SIG1000017.D
 Sample Name: GSG

```

=====
Acq. Operator   :                               Seq. Line :   17
Acq. Instrument : Instrument 1                 Location  : Vial 11
Injection Date  : 8/15/2014 2:26:18 PM       Inj       :    1
                                                Inj Volume: 12 µl
Acq. Method     : C:\Chem32\1\DATA\14082014\DEF_LC 2014-08-14 12-32-59\SWETAGRAD.M
Last changed    : 8/14/2014 9:40:36 AM
Analysis Method : C:\CHEM32\1\METHODS\SWETAGRAD.M
Last changed    : 8/16/2014 12:30:41 AM
                : (modified after loading)
Method Info     : Gradient Method for SWETA
Sample Info     : GSG 568;
  
```



=====
 Area Percent Report
 =====

```

Sorted By      :      Signal
Multiplier     :      1.0000
Dilution       :      1.0000
Use Multiplier & Dilution Factor with ISTDs
  
```

Signal 1: DAD1 A, Sig=210,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %	
1	20.752	MF	0.8918	5812.55322	108.63142	11.6566	mono-Glucosyl Stevioside (Stv-G1)
2	25.529	MF	0.7220	6771.79932	156.32436	13.5803	mono-Glucosyl RebA (RebA-G1)
3	28.723	MF	0.8216	4774.32129	96.84922	9.5745	di-Glucosyl Stevioside (Stev G-2)

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %	
4	31.788	MF	1.0596	5867.89258	92.29915	11.7676	di-Glucosyl RebA (RebA G-2)
5	35.886	MF	1.5204	3767.97412	41.30482	7.5564	tri-Glucosyl Stevioside (Stev G3)
6	37.602	MM	1.2303	4298.32812	58.23037	8.6200	tri-Glucosyl RebA (RebA G3)
7	40.025	MM	1.5139	3145.84961	34.63289	6.3088	tetra-Glucosyl Stevioside (Stev G4)
8	43.768	MF	1.2199	3428.44946	46.84030	6.8755	tetra-Glucosyl RebA (RebA G4)
9	46.569	MF	1.2512	1838.76099	24.49403	3.6875	penta-Glucosyl Stevioside (Stev G5)
10	48.037	MF	1.5903	3543.85522	37.14088	7.1069	penta-Glucosyl RebA (RebA G5)
11	50.412	MF	0.7820	421.72455	8.98771	0.8457	hexa-Glucosyl Stevioside (Stev G6)
12	51.969	MF	1.8486	2428.63208	21.89672	4.8704	hexa-Glucosyl RebA (RebA G6)
13	55.631	MF	1.9477	2258.15845	19.32311	4.5286	hepta-Glucosyl RebA (RebA G7)
14	60.444	MF	1.4824	982.79895	11.05000	1.9709	octa-Glucosyl RebA (RebA G8)
15	64.214	MF	1.7572	523.62213	4.96639	1.0501	nona-Glucosyl RebA (RebA G9)

Totals : 4.98647e4 762.97139

=====
 *** End of Report ***

Appendix D Pesticide Analysis Reports for PureCircle GSG

D-1 Pesticide Analysis Report for Lot GSG0714587

D-2 Pesticide Analysis Report for Lot GSG0914578

D-1 Pesticide Analysis Report for Lot GSG0714587

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Analytical Report

November 12, 2014

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Phone: + 606-791-2222
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Email: PureCircle Group

Project No:

PO No:

Client Sample ID: GSG0714587
 NSF-02
 30th October 14

EMA Sample No: 14110321-03

Date Received: 11/3/2014

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-OC1

Extraction Method: FDA 302

Date Extracted: 11/4/2014

Date Completed: 11/6/2014

Analyte	Amount	RL ppm	Tolerance ppm
Acinathrin	ND	0.010	
Aldrin	ND	0.010	
alpha-BHC	ND	0.010	
Atrazine	ND	0.010	
Benfluralin	ND	0.010	
beta-Chlordane	ND	0.010	
Bifenthrin	ND	0.010	
Boscalid	ND	0.010	
Bromopropylate	ND	0.010	
Captaf	ND	0.010	
Chlorodimethom	ND	0.010	
Chlorobenzilate	ND	0.010	
Chloroneb	ND	0.010	
Chlorthal Dimethyl	ND	0.010	
Chlorothalonil	ND	0.010	
CIPC	ND	0.010	
cis-Chlordane	ND	0.010	
cis-Nonachlor	ND	0.010	
cis-Permethrin	ND	0.010	
Cis-metazone	ND	0.010	
Cyanazine	ND	0.010	
Cypermethrin	ND	0.010	
Cyproconazole	ND	0.010	
Deltamethrin	ND	0.010	
delta-BHC	ND	0.010	
Diallate-1	ND	0.010	
Diallate-2	ND	0.010	
3,4-Dichloroaniline	ND	0.010	
Dichlobenil	ND	0.010	
Dichlofluanid	ND	0.010	
Dichloran	ND	0.010	
Dieldrin	ND	0.010	
Difenoconazole 1, 2	ND	0.010	
Dimethachlor	ND	0.010	
Dimethomorph 1, 2	ND	0.010	
Diniframine	ND	0.010	
Dursban	ND	0.010	
Endosulfan Sulfate	ND	0.010	
Endosulfan-I	ND	0.010	
Endosulfan-II	ND	0.010	
Endrin	ND	0.010	
Epoxiconazole	ND	0.010	
Etaconazole-1	ND	0.010	
Etaconazole-2	ND	0.010	
Ethafuralin	ND	0.010	
Etridiazole	ND	0.010	
Fenarimol	ND	0.010	
Fenbuconazole	ND	0.010	
Fenhexamid	ND	0.010	
Fenvalerate-1	ND	0.010	
Fenvalerate-2	ND	0.010	
Fipronil	ND	0.010	
Fluchloralin	ND	0.010	
Flucythrinate	ND	0.010	
Fludioxanil	ND	0.010	
Fluquinconazole	ND	0.010	
Flutolanil	ND	0.010	
Fluvalinate	ND	0.010	
Folpet	ND	0.010	
gamma-BHC/Lindane	ND	0.010	
gamma-Chlordane	ND	0.010	
Heptachlor	ND	0.010	
Heptachlor Epoxide	ND	0.010	
Hexachlorobenzene	ND	0.010	

Comments:

ND = None Detected at the Reporting Limit (RL)
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(b) (6)

Date: 11/12/14 Reviewed by: _____ Don Peterson, Laboratory Director

Analytical Report

November 12, 2014

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Phone: + 606-791-2222
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Project No:

PO No:

Client Sample ID: GSG0714587
 NSF-02
 30th October 14

EMA Sample No: 14110321-03

Date Received: 11/3/2014

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-OC2

Extraction Method: FDA 302

Date Extracted: 11/4/2014

Date Completed: 11/6/2014

Comments:

Analyte	Amount	RL ppm	Tolerance ppm
Hexaconazole	ND	0.010	
Imazalil	ND	0.010	
Iprodione	ND	0.010	
lambda-Cyhalothrin	ND	0.010	
Linuron	ND	0.010	
Metolachlor	ND	0.010	
Mirex	ND	0.010	
Monolinuron	ND	0.010	
Myclobutanil	ND	0.010	
Notrofen	ND	0.010	
Nuarimol	ND	0.010	
o,p'-DDT	ND	0.010	
o,p'-Methoxychlor	ND	0.010	
p,p'-DDE	ND	0.010	
p,p'-DDT	ND	0.010	
p,p'-Methoxychlor	ND	0.010	
Penconazole	ND	0.010	
Pentachloroaniline	ND	0.010	
Pentachlorobenzene	ND	0.010	
Pentachlorobenzonitrile	ND	0.010	
Pentachlorothioanisole	ND	0.010	
Polychlorinatedbiphenyl - Cogeners	ND	0.010	
Prochloraz	ND	0.010	
Procymidone	ND	0.010	
Profluralin	ND	0.010	
Pronamide	ND	0.010	
Propachlor	ND	0.010	
Propanil	ND	0.010	
Propiconazole/Tilt-1	ND	0.010	
Propiconazole/Tilt-2	ND	0.010	
Pyraclostrobin	ND	0.010	
Pyridaben	ND	0.010	
Pyrifenox-1	ND	0.010	
Pyrifenox-2	ND	0.010	
Quinoxifen	ND	0.010	
Quintozene	ND	0.010	
Simazine	ND	0.010	
Tebuconazole	ND	0.010	
Tebufenpyrad	ND	0.010	
Tecnezene	ND	0.010	
Tefluthrin	ND	0.010	
Terbutylazine	ND	0.010	
Tetradifon	ND	0.010	
Tolyfluanid	ND	0.010	
trans-Chlordane	ND	0.010	
trans-Nonachlor	ND	0.010	
trans-Permethrin	ND	0.010	
Triadimefon	ND	0.010	
Triadimenol	ND	0.010	
Triallate	ND	0.010	
Trifloxystrobin	ND	0.010	
Triflumizole	ND	0.010	
Trifluralin	ND	0.010	
Triconazole	ND	0.010	
Vinlozolin	ND	0.010	

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Project No:

PO No:

Client Sample ID: GSG0714587
 NSF-02
 30th October 14

EMA Sample No: 14110321-03

Date Received: 11/3/2014

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-NSO-1

Extraction Method: FDA 302

Date Extracted: 11/4/2014

Date Completed: 11/6/2014

Analyte	Amount	RL ppm	Tolerance ppm
Allethrin	ND	0.010	
Acetamiprid	ND	0.010	
alpha-Spiroxamine	ND	0.010	
Ametryn	ND	0.010	
Aminocarb	ND	0.010	
Amtraz	ND	0.010	
Aniten/Flurecol Butyl E.	ND	0.010	
Azoxystrobin	ND	0.010	
Benzalxyl	ND	0.010	
Bendiocarb	ND	0.010	
beta-Spiroxamine	ND	0.010	
Biphenyl	ND	0.010	
Biteranol-1	ND	0.010	
Biteranol-2	ND	0.010	
Bufenocarb-1	ND	0.010	
Bufenocarb-2	ND	0.010	
Supinate	ND	0.010	
Buprofezin	ND	0.010	
Butralin	ND	0.010	
Butylate	ND	0.010	
3-OH Carbofuran	ND	0.010	
Carbaryl	ND	0.010	
Carbofuran	ND	0.010	
Carbosulfan	ND	0.010	
Carboxin	ND	0.010	
Cycloate/Ro Neet	ND	0.010	
Cycluron	ND	0.010	
Cymazole	ND	0.010	
Cyprodinil	ND	0.010	
Desmedpham	ND	0.010	
Desmethyl Diphenamid	ND	0.010	
Deametryn	ND	0.010	
Diethofenocarb	ND	0.010	
Difenconazole	ND	0.010	
Dioxcarb	ND	0.010	
Diphenamid	ND	0.010	
Diphenylamine	ND	0.010	
d-Phenothrin #	ND	0.010	
EPTC/Eptam	ND	0.010	
Ethiofencarb	ND	0.010	
Ethiolate	ND	0.010	
Ethofumesate	ND	0.010	
Ethoxyquin	ND	0.010	
Etofenprox	ND	0.010	
Famoxadone	ND	0.010	
Fenazaquin	ND	0.010	
Fenfuram	ND	0.010	
Fenobucarb	ND	0.010	
Fenoxycarb	ND	0.010	
Fenpropathrin	ND	0.010	
Fenpropimorph	ND	0.010	
Flusilazole	ND	0.010	
Fuberiazole	ND	0.010	
Furalaxyl	ND	0.010	
Hexazinone	ND	0.010	
Isocarbamid	ND	0.010	

Comments:

ND = None Detected at the Reporting Limit (RL)
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Date: 11/12/14 Reviewed by: (b) (6) Don Peterson, Laboratory Director Page: 17 of 42

Analytical Report

November 12, 2014

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PO No:

Client Sample ID: GSG0714587
 NSF-02
 30th October 14

EMA Sample No: 14110321-03

Date Received: 11/3/2014

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-NSO-2

Extraction Method: FDA 302

Date Extracted: 11/4/2014

Date Completed: 11/6/2014

Analyte	Amount	RL ppm	Tolerance ppm
Isoprocarb	ND	0.010	
Isopropalin	ND	0.010	
Isoprothiolane	ND	0.010	
Lenacil	ND	0.010	
MBTZ	ND	0.010	
Mepronil	ND	0.010	
Metaxyl	ND	0.010	
Metaldhyde	ND	0.010	
Methiuroxan	ND	0.010	
Methiocarb	ND	0.010	
Methoprotryne	ND	0.010	
Metolacarb	ND	0.010	
Methibuzin	ND	0.010	
Mexacarbate	ND	0.010	
MKG-264	ND	0.010	
Molinala	ND	0.010	
Naphthalene Acetamide	ND	0.010	
Naprosanalid	ND	0.010	
Naprogamide	ND	0.010	
Nitralin	ND	0.010	
Nitrothal Isopropyl	ND	0.010	
Norea	ND	0.010	
Octhilinone	ND	0.010	
o-Phenylphenol	ND	0.010	
Pebulate	ND	0.010	
Pendimethalin	ND	0.010	
Phenmedipham	ND	0.010	
Piperonyl Butoxide	ND	0.010	
Pirimacarb	ND	0.010	
Promecarb	ND	0.010	
Prometon	ND	0.010	
Prometryn	ND	0.010	
Propargite	ND	0.010	
Propham	ND	0.010	
Propoxur	ND	0.010	
Pyracarbolid	ND	0.010	
Pyrethrin-1	ND	0.010	
Pyrethrin-2	ND	0.010	
Pyrimethanil	ND	0.010	
Pyriproxifen	ND	0.010	
Resmethrin	ND	0.010	
Secbumeton	ND	0.010	
Sethoxydim	ND	0.010	
Simetryn	ND	0.010	
Tebutam	ND	0.010	
Tebuthiuron	ND	0.010	
Terbumeton	ND	0.010	
Terbutryn	ND	0.010	
Tetraconazole	ND	0.010	
Tetramethrin-1	ND	0.010	
Tetramethrin-2	ND	0.010	
Thiabendazole	ND	0.010	
THPI	ND	0.010	
Tralkoxydim	ND	0.010	
Tricyclazole	ND	0.010	
2,3,5-Trimethacarb	ND	0.010	
3,4,5-Trimethacarb	ND	0.010	
Vernolate	ND	0.010	

Comments:

ND = None Detected at the Reporting Limit (RL)
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Date: 11/12/14 Reviewed by: (b) (6) Don Peterson, Laboratory Director Page: 18 of 42

Analytical Report

November 12, 2014

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Project No:

PO No:

Client Sample ID: GSG0714587
 NSF-02
 30th October 14

EMA Sample No: 14110321-03

Date Received: 11/3/2014

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-PHOS-1

Extraction Method: FDA 302

Date Extracted: 11/4/2014

Date Completed: 11/6/2014

Analyte	Amount	RL ppm	Tolerance ppm
Acephate	ND	0.010	
Azinphos-methyl	ND	0.010	
beta-Chlorfenvinphos	ND	0.010	
Cadusafos	ND	0.010	
Carbophenothion	ND	0.010	
Chlorpyrifos	ND	0.010	
Chlorpyrifos OA	ND	0.010	
Chlorpyrifos-methyl	ND	0.010	
Chlorthiophos	ND	0.010	
Coumaphos	ND	0.010	
Cyanofenphos	ND	0.010	
Cyanophos	ND	0.010	
DEF	ND	0.010	
Demeton S Sulfone	ND	0.010	
Diazinon	ND	0.010	
Dichlorvos	ND	0.010	
Diclorfophos	ND	0.010	
Dimethoate	ND	0.010	
Dioxathion	ND	0.010	
Disulfoton	ND	0.010	
Edifenphos	ND	0.010	
EPN	ND	0.010	
Ethion	ND	0.010	
Ethioprop	ND	0.010	
2-Ethylhexyldiphenyl phos.	ND	0.010	
Fenamiphos	ND	0.010	
Fenamiphos Sulfone	ND	0.010	
Fenitrothion	ND	0.010	
Fenthion	ND	0.010	
Fonophos	ND	0.010	
Heptenophos	ND	0.010	
Isolenphos	ND	0.010	
Leptophos	ND	0.010	
Malathion	ND	0.010	
Malathion OA	ND	0.010	

Comments:

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Date: 11/12/14 Reviewed by: (b) (6) Don Peterson, Laboratory Director Page: 19 of 42

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Analytical Report

November 12, 2014

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Project No:

PO No:

Client Sample ID: GSG0714587
 NSF-02
 30th October 14

EMA Sample No: 14110321-03

Date Received: 11/3/2014

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-PHOS-2

Extraction Method: FDA 302

Date Extracted: 11/4/2014

Date Completed: 11/6/2014

Analyte	Amount	RL ppm	Tolerance ppm
Mercarbam	ND	0.010	
Methamidophos	ND	0.010	
Methidathion	ND	0.010	
Methyl Parathion	ND	0.010	
Methyl Parathion OA	ND	0.010	
Mevinphos	ND	0.010	
Monocrotophos	ND	0.010	
Omethoate	ND	0.010	
Parathion	ND	0.010	
Parathion OA	ND	0.010	
Phorate	ND	0.010	
Phorate Sulfone	ND	0.010	
Phorate Sulfoxide	ND	0.010	
Phosalone	ND	0.010	
Phosmet	ND	0.010	
Pirimiphos-methyl	ND	0.010	
Profenophos	ND	0.010	
Prothiophos	ND	0.010	
Pyrazophos	ND	0.010	
Pyndaphenthion	ND	0.010	
Quinalphos	ND	0.010	
Sulfotep	ND	0.010	
Sulprofos	ND	0.010	
Terbufos	ND	0.010	
Tetrachlorvinphos	ND	0.010	
Tolclophos Methyl	ND	0.010	
Trizaphos	ND	0.010	
Trichlorfon	ND	0.010	
Tris (Chloropropyl) Phosphate-1	ND	0.010	
Tris (Chloropropyl) Phosphate-2	ND	0.010	
Tris 2-Butoxyethyl Phosphate	ND	0.010	

Comments:

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Date: 11/12/14

Reviewed by:

(b) (6)

Don Peterson, Laboratory Director

Page: 20 of 42

Analytical Report

November 12, 2014

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Email: PureCircle Group

<u>Analyte</u>	<u>Amount</u>	<u>RL</u> <u>ppm</u>	<u>Tolerance</u> <u>ppm</u>
Ferbam	ND	0.030	
Maneb (Dithane M-22)	ND	0.030	
Mancozeb	ND	0.030	
Metiram	ND	0.030	
Nabam	ND	0.030	
Thiram	ND	0.030	
Zineb	ND	0.030	
Ziram	ND	0.030	

Project No:

PO No:

Client Sample ID: GSG0714587
NSF-02
30th October 14

EMA Sample No: 14110321-03

Date Received: 11/3/2014

Sample Matrix: Stevia Powder

Analytical Method: EBDC Screen

Extraction Method: CDFA

Date Extracted: 11/4/2014

Date Completed: 11/4/2014

Comments:

ND = None Detected at the Reporting Limit (RL)
Tolerance data taken from 40 CFR § 180 and/or MRLdatabase.com. Environmental Micro Analysis, Inc. makes no claims as to the accuracy of tolerance numbers.
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Date: 11/12/14

Reviewed by:

(b) (6)

Don Peterson, Laboratory Director

Page: 21 of 42

D-2 Pesticide Analysis Report for Lot GSG0914578

Environmental Micro Analysis, Inc. ISO 17025 accreditation
 460 N East Street ELAP Certificate #2819
 Woodland, CA 95776

Phone: (530) 666-6890 Fax: (530) 666-2987
 e-mail: emalab@emalab.com website: www.emalab.com

Analytical Report

Revised

March 12, 2015

Client: Ieda Musjan
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 PT 23419 Bandar Enek
 Negeri Sembilan, 71760

Phone: + 606-791-2222
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Email: PureCircle Group

Project No:

PO No:

Client Sample ID: GSG0914578
 NSF-02
 24th February 2015

EMA Sample No: 15022516-04

Date Received: 2/25/2015

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-OC1

Extraction Method: FDA 302

Date Extracted: 3/3/2015

Date Completed: 3/3/2015

Comments:

ND = None Detected at the Reporting Limit (RL)
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Analysis	Amount	RL ppm	Tolerance ppm
Acrinathrin	ND	0.010	
Aldrin	ND	0.010	
alpha-BHC	ND	0.010	
Atrazine	ND	0.010	
Benfluralin	ND	0.010	
beta-Chlordane	ND	0.010	
Bifenthrin	ND	0.010	
Boscalid	ND	0.010	
Bromopropylate	ND	0.010	
Captan	ND	0.010	
Chlorodimelform	ND	0.010	
Chlorobenzilate	ND	0.010	
Chloroneb	ND	0.010	
Chlorthal Dimethyl	ND	0.010	
Chlorothalonil	ND	0.010	
CIPC	ND	0.010	
cis-Chlordane	ND	0.010	
cis-Nonachlor	ND	0.010	
cis-Permethrin	ND	0.010	
Clomazone	ND	0.010	
Cyanazine	ND	0.010	
Cypermethrin	ND	0.010	
Cyproconazole	ND	0.010	
Deltamethrin	ND	0.010	
delta-BHC	ND	0.010	
Dialate-1	ND	0.010	
Dialate-2	ND	0.010	
3,4-Dichloroaniline	ND	0.010	
Dichlobenil	ND	0.010	
Dichlofluanid	ND	0.010	
Dichloran	ND	0.010	
Dieldrin	ND	0.010	
Difenoconazole 1, 2	ND	0.010	
Dimethachlor	ND	0.010	
Dimethmorph 1, 2	ND	0.010	
Dirtramine	ND	0.010	
Dursban	ND	0.010	
Endosulfan Sulfate	ND	0.010	
Endosulfan-I	ND	0.010	
Endosulfan-II	ND	0.010	
Endrin	ND	0.010	
Epoxiconazole	ND	0.010	
Etaconazole-1	ND	0.010	
Etaconazole-2	ND	0.010	
Ethalfuralin	ND	0.010	
Etridiazole	ND	0.010	
Fenarimol	ND	0.010	
Fenbuconazole	ND	0.010	
Fenhexamid	ND	0.010	
Fenvalerate-1	ND	0.010	
Fenvalerate-2	ND	0.010	
Flpronil	ND	0.010	
Flchloralin	ND	0.010	
Flucythrinate	ND	0.010	
Fludioxanil	ND	0.010	
Fluquinconazole	ND	0.010	
Flutolanil	ND	0.010	
Fluralinate	ND	0.010	
Folpet	ND	0.010	
gamma-BHC/Lindane	ND	0.010	
gamma-Chlordane	ND	0.010	
Heptachlor	ND	0.010	
Heptachlor Epoxide	ND	0.010	
Hexachlorobenzene	ND	0.010	

Date: 03/12/15 Reviewed by: (b) (6) Don Peterson, Laboratory Director

Analytical Report Revised

March 12, 2015
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 Email: PureCircle Group

Project No:

PO No:

Client Sample ID: GSG0914578
 NSF-02
 24th February 2015

EMA Sample No: 15022516-04

Date Received: 2/25/2015

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-OC2

Extraction Method: FDA 302

Date Extracted: 3/3/2015

Date Completed: 3/3/2015

Comments:

Analyte	Amount	RL ppm	Tolerance ppm
Hexaconazole	ND	0,010	
Imazail	ND	0,010	
Iprodione	ND	0,010	
lambda-Cyhalothrin	ND	0,010	
Linuron	ND	0,010	
Metolachlor	ND	0,010	
Mirex	ND	0,010	
Monolinuron	ND	0,010	
Myclobutanil	ND	0,010	
Notrofen	ND	0,010	
Nuarimol	ND	0,010	
o,p'-DDT	ND	0,010	
0,p'-Methoxychlor	ND	0,010	
p,p'-DDE	ND	0,010	
p,p'-DDT	ND	0,010	
p,p'-Methoxychlor	ND	0,010	
Pencconazole	ND	0,010	
Pentachloroaniline	ND	0,010	
Pentachlorobenzene	ND	0,010	
Pentachlorobenzonitrile	ND	0,010	
Pentachlorothioanisole	ND	0,010	
Polychlorinatedbiphenyl - Cogeners	ND	0,010	
Prochloraz	ND	0,010	
Procyimidone	ND	0,010	
Profluralin	ND	0,010	
Pronamide	ND	0,010	
Propachlor	ND	0,010	
Propanil	ND	0,010	
Propiconazole/Tilt-1	ND	0,010	
Propiconazole/Tilt-2	ND	0,010	
Pyradostrobin	ND	0,010	
Pyridaben	ND	0,010	
Pyriproxyfen-1	ND	0,010	
Pyriproxyfen-2	ND	0,010	
Quinoxifen	ND	0,010	
Quintozene	ND	0,010	
Simazine	ND	0,010	
Tebuconazole	ND	0,010	
Tebuconazole	ND	0,010	
Tecnezene	ND	0,010	
Tefluthrin	ND	0,010	
Terbutrylazine	ND	0,010	
Tetradifon	ND	0,010	
Tolyfluanid	ND	0,010	
trans-Chlordane	ND	0,010	
trans-Nonachlor	ND	0,010	
trans-Permethrin	ND	0,010	
Triadimefon	ND	0,010	
Triadimenol	ND	0,010	
Triallate	ND	0,010	
Trifloxystrobin	ND	0,010	
Triflumizole	ND	0,010	
Trifluralin	ND	0,010	
Triflucanazole	ND	0,010	
Vinclozolin	ND	0,010	

ND = None Detected at the Reporting Limit (RL)
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(b) (6)

Date: 03/12/15 Reviewed by: Don Peterson, Laboratory Director

Page: 23 of 35

Analytical Report Revised

March 12, 2015

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Project No:

PO No:

Client Sample ID: GSG0914578
 NSF-02
 24th February 2015

EMA Sample No: 15022516-04

Date Received: 2/25/2015

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-NSO-1

Extraction Method: FDA 302

Date Extracted: 3/3/2015

Date Completed: 3/4/2015

<u>Analysis</u>	<u>Amount</u>	<u>RL</u> <u>ppm</u>	<u>Tolerance</u> <u>ppm</u>
Alcethrin	ND	0.010	
Acetamiprid	ND	0.010	
alpha-Spiroxamine	ND	0.010	
Ametryn	ND	0.010	
Aminocarb	ND	0.010	
Amitraz	ND	0.010	
Aniten/Flurecol Butyl E.	ND	0.010	
Azoxystrobin	ND	0.010	
Benalaxyl	ND	0.010	
Bendiocarb	ND	0.010	
beta-Spiroxamine	ND	0.010	
Biphenyl	ND	0.010	
Biteranol-1	ND	0.010	
Biteranol-2	ND	0.010	
Bufenocarb-1	ND	0.010	
Bufenocarb-2	ND	0.010	
Bupirimate	ND	0.010	
Buprofezin	ND	0.010	
Butralin	ND	0.010	
Butylate	ND	0.010	
3-OH Carboturan	ND	0.010	
Carbaryl	ND	0.010	
Carboturan	ND	0.010	
Carbosulfan	ND	0.010	
Carboxin	ND	0.010	
Cycloate/Rio Neet	ND	0.010	
Cycluron	ND	0.010	
Cymiazole	ND	0.010	
Cyprodinil	ND	0.010	
Desmedipham	ND	0.010	
Desmethyl Diphenamid	ND	0.010	
Desmetryn	ND	0.010	
Diethofenocarb	ND	0.010	
Difenoconazole	ND	0.010	
Dioxacarb	ND	0.010	
Diphenamid	ND	0.010	
Diphenylamine	ND	0.010	
d-Phenothrin #	ND	0.010	
EPTC/Eptam	ND	0.010	
Ethiofencarb	ND	0.010	
Ethiolate	ND	0.010	
Ethofumesate	ND	0.010	
Ethoxyquin	ND	0.010	
Etofenprox	ND	0.010	
Fenoxadone	ND	0.010	
Fenazaquin	ND	0.010	
Fenfuram	ND	0.010	
Fenobucarb	ND	0.010	
Fenoxycarb	ND	0.010	
Fenpropathrin	ND	0.010	
Fenpropimorph	ND	0.010	
Flusilazole	ND	0.010	
Fuberidazole	ND	0.010	
Furalaxyl	ND	0.010	
Hexazinone	ND	0.010	
Isocarbamid	ND	0.010	

Comments:

ND = None Detected at the Reporting Limit (RL)
 Tolerance data taken from 40 CFR § 180 and/or MRLdatabase.com. Environmental Micro Analysis, Inc. makes no claims as to the accuracy of tolerance numbers.
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(b) (6)

Date: 03/12/15

Reviewed by:

Don Peterson, Laboratory Director

Page: 24 of 35

Analytical Report Revised

March 12, 2015

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Project No:

PO No:

Client Sample ID: GSG0914578
 NSF-02
 24th February 2015

EMA Sample No: 15022516-04

Date Received: 2/25/2015

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-NSO-2

Extraction Method: FDA 302

Date Extracted: 3/3/2015

Date Completed: 3/4/2015

<u>Analyte</u>	<u>Amount</u>	<u>RL</u> <u>ppm</u>	<u>Tolerance</u> <u>ppm</u>
Isoprocarb	ND	0,010	
Isopropalin	ND	0,010	
Isoprothiolane	ND	0,010	
Lencol	ND	0,010	
MBTZ	ND	0,010	
Mepronil	ND	0,010	
Metalaaxyl	ND	0,010	
Metalddehyde	ND	0,010	
Methfuroxan	ND	0,010	
Methiocarb	ND	0,010	
Methoprotyme	ND	0,010	
Metolacarb	ND	0,010	
Metribuzin	ND	0,010	
Mexacarbate	ND	0,010	
MGK-264	ND	0,010	
Molinate	ND	0,010	
Naphthalene Acetamide	ND	0,010	
Naproanalid	ND	0,010	
Napropamide	ND	0,010	
Nitralin	ND	0,010	
Nitrothal Isopropyl	ND	0,010	
Norea	ND	0,010	
Octilinone	ND	0,010	
o-Phenylphenol	ND	0,010	
Pebujate	ND	0,010	
Pendimethalin	ND	0,010	
Phenmedipharm	ND	0,010	
Pipernonyl Butoxide	ND	0,010	
Pirimacarb	ND	0,010	
Promecarb	ND	0,010	
Prometon	ND	0,010	
Prometryn	ND	0,010	
Propargite	ND	0,010	
Propham	ND	0,010	
Propoxur	ND	0,010	
Pyracarbolid	ND	0,010	
Pyrethrin-1	ND	0,010	
Pyrethrin-2	ND	0,010	
Pyrimethanil	ND	0,010	
Pyriproctfen	ND	0,010	
Resmethrin	ND	0,010	
Secbumeton	ND	0,010	
Sethoxydim	ND	0,010	
Simetryn	ND	0,010	
Tebutam	ND	0,010	
Tebuthiuron	ND	0,010	
Terbumeton	ND	0,010	
Terbutryn	ND	0,010	
Tetraconazole	ND	0,010	
Tetramethrin-1	ND	0,010	
Tetramethrin-2	ND	0,010	
Thiabendazole	ND	0,010	
THPI	ND	0,010	
Tralcoxydim	ND	0,010	
Tricyclazole	ND	0,010	
2,3,5-Trimethacarb	ND	0,010	
3,4,5-Trimethacarb	ND	0,010	
Vernolate	ND	0,010	

Comments:

ND = None Detected at the Reporting Limit (RL)
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Analytical Report Revised

March 12, 2015

Client: Ieda Muslan
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Email: PureCircle Group

Project No:

PO No:

Client Sample ID: GSG0914578
 NSF-02
 24th February 2015

EMA Sample No: 15022516-04

Date Received: 2/25/2015

Sample Matrix: Stevia Powder

Analytical Method: FDA IMP-PHOS-2

Extraction Method: FDA 302

Date Extracted: 3/3/2015

Date Completed: 3/4/2015

Analyte	Amount	RL ppm	Tolerance ppm
Mercarbam	ND	0.010	
Methamidophos	ND	0.010	
Methidathion	ND	0.010	
Methyl Parathion	ND	0.010	
Methyl Parathion OA	ND	0.010	
Mevinphos	ND	0.010	
Monocrotophos	ND	0.010	
Omethoate	ND	0.010	
Parathion	ND	0.010	
Parathion OA	ND	0.010	
Phorate	ND	0.010	
Phorate Sulfone	ND	0.010	
Phorate Sulfoxide	ND	0.010	
Phosalone	ND	0.010	
Phosmet	ND	0.010	
Pirimiphos-methyl	ND	0.010	
Profenophos	ND	0.010	
Prothiophos	ND	0.010	
Pyrazophos	ND	0.010	
Pyridaphenthion	ND	0.010	
Quinalphos	ND	0.010	
Sulfotep	ND	0.010	
Sulprofos	ND	0.010	
Terbufos	ND	0.010	
Tetrachlorvinphos	ND	0.010	
Tolclophos Methyl	ND	0.010	
Trizaphos	ND	0.010	
Trichlorfon	ND	0.010	
Tris (Chloropropyl) Phosphate-1	ND	0.010	
Tris (Chloropropyl) Phosphate-2	ND	0.010	
Tris 2-Butoxyethyl Phosphate	ND	0.010	

Comments:

ND = None Detected at the Reporting Limit (RL)
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Date: 03/12/15 Reviewed by: (b) (6) Don Peterson, Laboratory Director

Analytical Report Revised

March 12, 2015

Client: Jeda Musjan
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Email: PureCircle Group

<u>Analysis</u>	<u>Amount</u>	<u>RL</u> <u>ppm</u>	<u>Tolerance</u> <u>ppm</u>
Ferbam	ND	0,030	
Maneb (Dithane M-22)	ND	0,030	
Mancozeb	ND	0,030	
Moltram	ND	0,030	
Nabam	ND	0,030	
Thiram	ND	0,030	
Zineb	ND	0,030	
Ziram	ND	0,030	

Project No:

PO No:

Client Sample ID: GSG0914578
NSF-02
24th February 2015

EMA Sample No: 15022516-04

Date Received: 2/25/2015

Sample Matrix: Stevia Powder

Analytical Method: EBDC Screen

Extraction Method: CDFA

Date Extracted: 2/26/2015

Date Completed: 2/26/2015

Comments:

ND = None Detected at the Reporting Limit (RL)
Tolerance data taken from 40 CFR § 180 and/or MRLdatabase.com, Environmental Micro Analysis, Inc. makes no claims as to the accuracy of tolerance numbers.
Excess sample and extracts are stored for a minimum of 30 days from the date of analytical report. Special storage arrangements possible.
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Date: 03/12/15 Reviewed by: (b) (6) Don Peterson, Laboratory Director

Page: 28 of 35

Appendix E Analytical Method for Analysis of Glucosyl Steviol Glycosides

PureCircle Sdn Bhd (578803-K)
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PCSB-LAB-079
Issue Date: 11/01/09
Revision: 03

Protocol for QC Analysis of Glucosyl Steviol Glycosides (Adsorption Chromatography)

Prepared by: _____ 13/02/2014
Sharifah Hidayah Syed Nazri, QC Executive Date

Approved by: _____ 13/02/2014
Alina Dmitrieva, QA&QC Manager Date

1. Principle

This assay is capable of determining the concentration of *total steviol glycosides (TSG)* and *residual dextrans (RD)* by using adsorption chromatography

2. Scope

This assay encompasses final products containing mixtures of *α -1,4-glucosyl steviol glycosides (GSG)*. The assay is applicable for solid samples which have *total steviol glycosides* concentrations in the range of 60-102% on dry basis.

3. Equipment and reagents

- 3.1. Analytical balance, Mettler Toledo XS205, or equivalent;
- 3.2. Vacuum Evaporating Device, Heidolph Laborota Rotavap 4001, or equivalent;
- 3.3. Vacuum oven, Memmert VO-400, or equivalent;
- 3.4. Class A volumetric flasks and pipettes;
- 3.5. Glass column (25mm ID) packed with 200mL YWD03F adsorbent (China);
- 3.6. Water, HPLC grade, JT Baker, or equivalent;
- 3.7. Ethanol, reagent grade, System, or equivalent;

4. Safety notes

- 4.1. Always follow the Chemical Hygiene Plan and established safety procedures for handling materials, cleaning up spills and disposing of wastes.
- 4.2. Read and observe all precautionary measures and hazards noted in the Material Safety Data Sheets for all chemicals used in this procedure.
- 4.3. Steviol glycoside materials are typically powders that can become airborne if shaken, dropped or otherwise agitated. Once airborne they can be tasted and smelled by the analyst. Utilize caution to prevent material from becoming airborne.

5. Procedure

5.1. *Total content of steviol glycosides (TSG)*

- **Test Solution** Weigh accurately about 5 g of GSG, and dissolve it in 250 mL of water. Load the solution into a glass column (25 mm ID) packed with 200 mL of Amberlite XAD 7HP resin at a rate of less than 15 mL/min, then wash the resin with 1000 mL of water. Elute adsorbed steviol glycosides with 1000 mL of 70% (vol)* ethanol at a rate of 15 mL/min or less. Evaporate the collected ethanol eluate and water fractions to dryness, and then dry them in vacuum oven at 105°C for 2 hours. Weigh and record the dry weight of each fraction. Calculate the content (%) of total steviol glycosides (TSG) and residual dextrins (RD) by formula.

$$\text{TSG (\%)} = [\text{Amount of dried Ethanol fraction (g)} / \text{Dry weight of initial sample (g)}] \times 100\%$$

$$\text{RD (\%)} = [\text{Amount of dried water fraction (g)} / \text{Dry weight of initial sample (g)}] \times 100\%$$

$$\text{Dry weight of initial sample (g)} = \text{Wet weight of initial sample (g)} \times [100 - \text{Moisture (\%)}] \times 10^{-2}$$

*-for SW/GSG use 70% ethanol solution; for NSF-03/NSF-04 use 100% ethanol solution

6. Result reporting

TSG and RD concentrations should be reported on a %wt dry basis. Report average of 3 sample duplicate results in a form PCSB-LAB-029.

7. Revision history

Rev 01 – changed from STV to PCSB letter head

Rev 02- added NSF-02

Rev 03 - (13/02/2014) – added NSF-03/NSF-04 solution

Appendix F Shelf Life Stability Report

 PureCircle Sdn Bhd	Report#: ZMA_SW0210149	Issue date: 02/07/15
	Shelf Life Study of SW0210149	Revision date: -----
		Revision No: 00

CONFIDENTIAL

Shelf Life Study of SW0210149

Prepared by : (b) (6) 02/07/15
Zunnisa' Bt Md Ashraf
QC Chemist
Date

Approved by : (b) (6) 2/7/15
Suzanne Wong Soo Sian
Quality Manager
Date

 PureCircle Sdn Bhd Shelf Life Study of SW0210149	Report#: ZMA_SW0210149	Issue date: 02/07/15
		Revision date: -----
		Revision No: 00

CONFIDENTIAL

Objective

Objective of this study is to determine the shelf life of SW0210149 produced by PureCircle.

1.0 Apparatus

- 1) *Mettler Toledo*[®] AB 265-S analytical balance;
- 2) *Mettler Toledo*[®] HB 43-S moisture analyzer;
- 3) *Becton Dickinson*[®] sterile syringes; 5 mL;
- 4) *Whatman*[®] nylon syringe filters; 0.45µm;
- 5) *Heidolph*[®] rotary evaporator;
- 6) *Memmert*[®] oven;
- 7) Laboratory glassware.

2.0 Reagents and Chemicals

- 1) Sweta, SW0210149 (PureCircle Sdn Bhd);
- 2) DIAION[®] HP20 adsorbent resin (Mitsubishi Chemicals);
- 3) Ethyl alcohol 99.8% (System[®]);
- 4) HPLC grade water (JT Baker[®]).

3.0 Sample Storage

Samples labeled as SW0210149 were kept in sealed aluminum foil bags at 40°C.

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		Revision date: -----
Shelf Life Study of SW0210149	Revision No: 00	

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4.0 Method

Sweta SW0210149 with concentration 5% was prepared by dissolving 5g of Sweta in 100ml of water. The solution was passed through one column of HP20 adsorbent resins (100ml) to remove non-steviol glycosides compounds. Then, the column was washed with 5 times the volumes of water. Steviol glycosides were eluted from resins using 70% EtOH solution. The eluted product was evaporated and labeled as EtOH fraction. The fraction was dried overnight at 105°C.

The dried product was weighed and the figure was recorded. The content of total steviol glycosides (TSG) was calculated using formula;

$$\text{TSG (\%)} = \left[\frac{\text{Amount of dried Ethanol fraction (g)}}{\text{Dry weight of initial sample (g)}} \right] \times 100\%$$

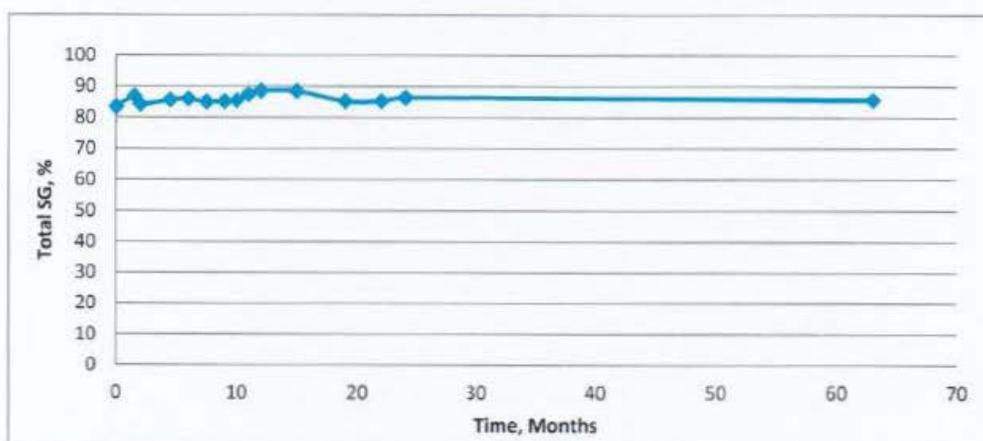
$$\text{Dry weight of initial sample (g)} = \frac{\text{Wet weight of initial sample (g)} \times [100 - \text{Moisture (\%)}]}{100}$$

 PureCircle Sdn Bhd Shelf Life Study of SW0210149	Report#: ZMA_SW0210149	Issue date: 02/07/15
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5.0 Results

Time, Months	0	1.5	2	4.5	6	7.5	9	10	11	12	15	19	22	24	63
Total SG, %	83.42	86.91	84.22	85.65	86.01	85.06	85.19	85.45	87.45	88.61	88.50	85.25	85.31	86.42	85.71



6.0 Conclusion

It can be concluded that there is no significance drop of TSG throughout 63 months of study. Therefore the TSG of SW0210149 can be considered as stable.

Appendix G pH Stability Report

Instruction steps of how to prepare of difference pH solution

1. Preparation of 0.1 M solution :

A) 0.1M NaH₂PO₄ solution: take 13.8 g of NaH₂PO₄ tablet dissolved in 1 liter of water.

B) 0.1 M Na₂HPO₄ solution: take 14.2 g of Na₂HPO₄ tablet dissolved in 1 liter of water.

C) 0.1 M H₃PO₄ solution: take 6.68 ml of H₃PO₄ dissolved in 1 liter of water.

* Above taken amount of 6.68 ml of H₃PO₄ is calculated based on a purity of 85 % H₃PO₄.

2. Preparation of differences pH solution of 0.1 M buffer:

Follow with below table proportion of each solution, mixing to become a 500 ml total volume of pH solution.

	0.1M NaH ₂ PO ₄	0.1 M Na ₂ HPO ₄	0.1 M H ₃ PO ₄	0.1 M NaH ₂ PO ₄
pH2			326	174
pH3			52.6	447.4
pH4			4.9	495.1
pH5	493.2	6.8		
pH6	431.2	68.8		
pH7	167.3	332.7		
pH8	21.8	478.2		

*If after mixing still can achieve the target pH, can adjusted with Phosphoric acid or NaOH

3. Preparation of a solution resulted in with 5000 mg/L of SG95 powder:

Testing SG95 sample powder's water content by KF caulometer. Then weighting around 2.5 gram of SG95 sample powder and completely dissolved it in each differences pH solution above. After dissolved, transfer each 500 ml of difference pH solution into vials and close with cap tightly. If the pH stability experiment is assuming will be carrying out by 6 month, the number of vials should has around to as below calculation:

12 times (every two weeks testing) X 4 group of difference temp (5°C, 26°C, 37°C, 56°C) X 7 pH level
= 336 vials needed

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		Revision date: -----
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Objective

To determine pH stability of NSF 02 produced by PureCircle.

Sample

One sample representing commercial lot of NSF 02 labeled as “SW0510158”.

Standards

1. Rebaudioside A standard (USP Rockville, MD USA, Lot#FOI077), or equivalent;
2. Stevioside standard (USP Rockville, MD USA, Lot#FOI080), or equivalent;

Solvents and Reagents

- Acetonitrile, HPLC grade (JT Baker®, USA);
- Water, HPLC grade (JT Baker®, USA);
- Sodium dihydrogen phosphate monohydrate, NaH₂PO₄·H₂O Merck®, Germany
- (*ortho*-Phosphoric Acid 85%, H₃PO₄. System ®, ChemPur)

Apparatus

1. Agilent 1100 HPLC system equipped with Quaternary pump (G 1311 A), auto sampler (GI 3 1 3A), thermostatted column compartment (GI 3 1 6A) and MWD detector (GI 365B), (Agilent Technologies, USA);

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2. *Agilent Zorbax NH₂TM 5 μm*, Analytical Column 4. 6x 250mm (PN 880953-708)
3. Analytical balance, XS205, (Mettler Toledo, USA);
4. Karl Fischer coulometer, Mettler Toledo DL-39, (Mettler Toledo, USA);
5. Volumetric (class *A*) and Laboratory glassware

Sample Solution

Sample solution was prepared at approx 50000 mg/L in 500 mL of diluent 0.1M phosphate and 0.1M phosphorous acid

Sample solution storage

Each pH level was stored at 4 different temperatures conditions as 5°C, 25°C, 37°C and 56°C in amber glass bottles.

Analysis

Analysis and calculations were performed as per SWETA gradient method (APPENDIX B)

The assay results are summarized in Table 1-4.

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Table 1

NSF 02 assay at 5°C

	Total Steviol Glycosides, mg/mL						
	pH 2.0	pH 3.0	pH 4.0	pH 5.0	pH 6.0	pH 7.0	pH 8.0
t=0	25.49	25.49	25.49	25.49	25.49	25.49	25.49
2	26.13	25.72	24.80	26.52	25.21	25.65	25.86
4	27.49	27.10	27.01	26.88	26.54	26.32	25.91
6	27.40	27.83	27.96	27.07	28.17	28.07	28.30
8	26.72	26.75	27.19	26.44	27.15	26.88	26.60
10	25.83	26.57	26.51	26.78	26.73	26.39	26.93
14	26.10	25.36	26.30	27.26	27.01	25.84	25.80
18	26.19	26.13	27.73	26.49	25.82	26.82	27.24
20	24.11	25.84	25.61	26.55	26.60	26.88	26.34
24	26.76	25.91	27.43	24.81	25.32	24.98	24.70
26	25.36	25.85	25.72	24.91	25.66	25.97	24.02
30	24.51	23.11	24.92	24.83	25.19	25.05	24.96
34	24.43	23.68	24.25	23.88	24.07	25.16	24.57

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		Revision date: -----
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Table 2

NSF 02 assay at 25°C

	Total Steviol Glycosides, mg/mL						
	pH 2.0	pH 3.0	pH 4.0	pH 5.0	pH 6.0	pH 7.0	pH 8.0
t=0	25.49	25.49	25.49	25.49	25.49	25.49	25.49
2	23.48	25.10	25.37	25.56	25.19	24.71	24.74
4	24.87	25.47	26.35	27.50	26.11	25.79	26.37
6	26.65	26.34	27.32	26.93	27.62	27.75	28.29
8	24.76	25.55	25.70	26.01	26.68	26.85	26.62
10	25.46	25.62	25.88	26.32	26.20	26.28	26.03
14	24.63	22.77	24.02	26.29	26.76	26.43	25.66
18	24.18	23.83	25.46	27.17	26.19	27.41	27.15
20	23.50	24.89	25.17	25.99	26.16	26.38	26.64
24	23.23	23.70	23.94	24.58	23.89	22.90	23.23
26	22.98	22.89	23.83	25.25	25.71	23.02	24.32
30	22.07	22.43	24.55	25.39	24.80	24.94	23.91
34	22.16	21.84	23.63	24.74	24.55	24.88	23.97

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		Revision date: -----
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Table 3

NSF 02 assay at 37°C

t=0	Total Steviol Glycosides, mg/mL						
	pH 2.0	pH 3.0	pH 4.0	pH 5.0	pH 6.0	pH 7.0	pH 8.0
0	25.49	25.49	25.49	25.49	25.49	25.49	25.49
2	23.23	24.23	24.07	25.19	24.77	25.63	25.60
4	22.98	23.84	25.64	26.54	26.21	25.39	26.21
6	24.36	24.56	26.06	27.46	27.83	27.78	28.35
8	23.18	22.81	24.58	25.62	26.55	26.62	26.70
10	22.20	23.49	25.40	25.86	26.78	26.56	26.32
14	19.69	20.88	22.34	26.05	26.63	26.43	26.87
18	19.48	18.62	21.43	24.81	26.71	27.82	25.90
20	20.44	19.14	21.14	24.79	25.53	27.23	26.53
24	16.70	15.70	18.44	21.19	23.42	25.41	24.79
26	16.75	16.42	17.96	22.54	26.09	23.44	22.82
30	16.48	15.77	19.64	22.57	25.22	24.90	23.37
34	12.78	14.97	18.12	21.23	24.74	24.91	23.70

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
		Revision No: 00

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Table 4

NSF 02 assay at 56°C

t=0	Total Steviol Glycosides, mg/mL						
	pH 2.0	pH 3.0	pH 4.0	pH 5.0	pH 6.0	pH 7.0	pH 8.0
0	25.49	25.49	25.49	25.49	25.49	25.49	25.49
2	17.44	18.26	20.05	24.78	25.60	26.72	25.61
4	10.42	13.54	21.00	24.31	26.64	25.62	25.70
6	7.78	11.61	17.43	25.42	27.90	27.95	24.81
8	4.40	9.87	16.07	21.60	25.98	26.55	25.94
10	3.28	12.69	17.71	21.28	26.64	26.21	24.37
14	1.65	10.87	18.66	20.90	27.59	26.72	28.42
18	1.05	7.98	12.70	14.81	26.38	27.22	23.11
20	1.68	9.62	12.68	18.17	28.01	29.33	25.64
24	0.81	6.37	10.58	14.38	25.29	23.49	20.88
26	1.62	4.00	10.50	12.47	24.57	27.21	17.26
30	1.14	5.44	10.87	11.61	24.37	25.27	18.86
34	1.19	3.54	8.60	8.43	24.65	25.11	17.82

Reference

1. Standard Operating Procedure (SOP) for “Determination of Steviol Glycosides by HPLC assay” PCSB-LAB-106, Rev 04

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		Revision date: -----
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APPENDIX A

Sample chromatograms

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\PH011210\GSG PH2, 5C_D
Sample Name: GSG pH2, 5C

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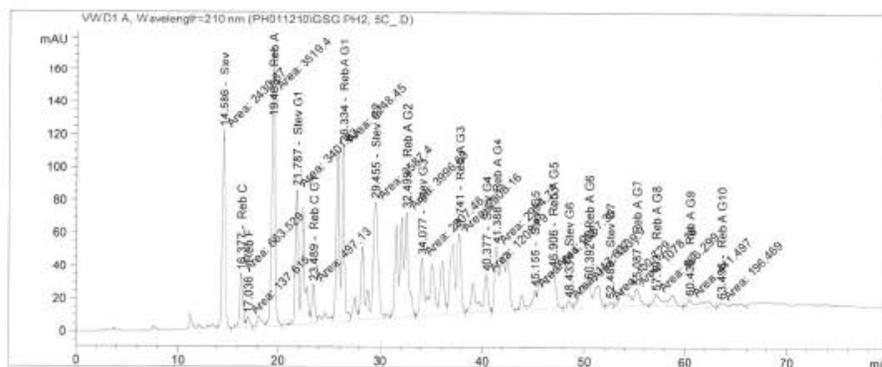
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Acq. Instrument : HPLC 10                       Location  : Vial 12
Injection Date  : 12/2/2010 5:50:17 AM          Inj       :    1
                                                Inj Volume: 10.000 µl

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Last changed   : 12/1/2010 6:07:04 PM
Analysis Method: C:\CHEM32\1\METHODS\GRADSW1.M
Last changed   : 12/6/2010 11:21:48 AM
                (modified after loading)

Method Info    : Stevia

Sample Info    : GSG (SW0510158), pH2, 5C, week 2, 47019.3203mg/L
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External Standard Report

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Calib. Data Modified : 12/6/2010 11:21:51 AM
Multiplier:    : 1.0000
Dilution:      : 1.0000
Use Multiplier & Dilution Factor with ISTDs

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Signal 1: VWD1 A, Wavelength=210 nm

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [ng/L]	Grp	Name
14.586	MM	2430.67334	4.06051e-1	986.97628		Stev
16.377	MF	663.52875	4.08931e-1	320.17826		Reb C
17.036	FM	137.61488	4.08931e-1	65.27900		Reb F
19.463	MF	3519.40381	4.80337e-1	1690.50130		Reb A
21.787	MF	3401.82764	4.08931e-1	1669.33555		Stev G1
23.489	MF	497.12967	4.08931e-1	280.54263		Reb C G1
26.334	MF	4248.44580	4.08931e-1	2432.24999		Reb A G1
29.455	MF	3587.39868	4.08931e-1	2053.79621		Stev G2

HPLC 10 12/6/2010 11:22:08 AM

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\PH011210\GSG PH2, 5C_.D
Sample Name: GSG pH2, 5C

RetTime [min]	Type	Area [mAU*s]	Ant/Area	Amount [mg/L]	Grp	Name
32.499	MF	3996.68628	4.08931e-1	2614.99061	Reb A	G2
34.077	MF	2907.46265	4.08931e-1	1890.43331	Stev	G3
37.741	FM	2808.15771	4.08931e-1	2055.53378	Reb A	G3
40.377	MF	1208.79004	4.08931e-1	884.81810	Stev	G4
41.388	FM	2994.75439	4.08931e-1	2437.04966	Reb A	G4
45.155	MF	614.10211	4.08931e-1	499.73959	Stev	G5
46.906	FM	2067.35596	4.08931e-1	1851.43925	Reb A	G5
48.433	MF	117.63654	4.08931e-1	105.35047	Stev	G6
50.392	MF	1539.30188	4.08931e-1	1504.42933	Reb A	G6
52.485	MF	100.72890	4.08931e-1	98.03500	Stev	G7
55.087	FM	1078.18359	4.08931e-1	1137.52910	Reb A	G7
57.193	MF	666.29919	4.08931e-1	757.46780	Reb A	G8
60.430	FM	441.49692	4.08931e-1	538.01456	Reb A	G9
63.496	MM	196.46902	4.08931e-1	259.50558	Reb A	G10

Totals : 2.61332e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
		Revision No: 00

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Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH2, 5C_W34.D
Sample Name: GSG pH2, 5C

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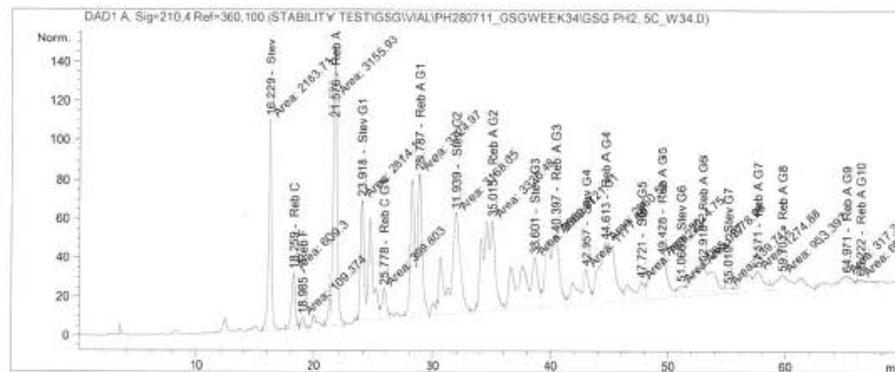
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                                                    Inj Volume: 10 µl

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Analysis Method: C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 10/4/2011 1:58:13 PM by R&D
                (modified after loading)

Sample Info    : GSG (SW0510158), pH2, 5C, week 34, 47019.3203mg/L
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External Standard Report

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Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs

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Signal 1: DAD1 A, Sig=210,4 Ref=360,100

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
16.229	PM +	2183.70972	3.99780e-1	873.00348	Stev	
18.259	MF	609.29993	3.99780e-1	287.43136	Reb C	
18.985	MF	109.37360	3.99780e-1	50.72144	Reb F	
21.576	MF	3155.93213	4.58394e-1	1446.66181	Reb A	
23.918	MF	2814.10474	3.99780e-1	1350.02722	Stev G1	
25.778	MF	399.80273	3.99780e-1	220.56971	Reb C G1	
28.787	MF	3724.97046	3.99780e-1	2084.83596	Reb A G1	
31.939	MF	3168.05298	3.99780e-1	1773.13374	Stev G2	
35.015	MF	3326.47827	3.99780e-1	2127.77497	Reb A G2	

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH2, 5C_W34.D
Sample Name: GSG pH2, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
38.601	MF	2662.91309	3.99780e-1	1692.68107		Stev 03
40.397	MF	2721.31030	3.99780e-1	1947.38634		Reb A 33
42.957	MF	1177.04639	3.99780e-1	842.30161		Stev 04
44.613	MF	2850.52051	3.99780e-1	2267.76615		Reb A 34
47.721	MF	753.22272	3.99780e-1	599.23546		Stev 05
48.428	MF	2024.74780	3.99780e-1	1772.70338		Reb A 35
51.066	MF	265.02728	3.99780e-1	232.03619		Stev 06
52.918	MF	1978.28149	3.99780e-1	1890.19674		Reb A 36
55.019	MF	139.71213	3.99780e-1	132.93278		Stev 07
57.571	MF	1274.88318	3.99780e-1	1314.95569		Reb A 37
59.701	FM	953.39691	3.99780e-1	1059.59417		Reb A 38
64.971	MM	317.29987	3.99780e-1	378.01338		Reb A 39
66.222	MM	65.04379	3.99780e-1	83.99034		Reb A 010

Totals : 2.44280e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15 Revision date: ——
	Revision No: 00	

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Data File C:\CHEM32\1\DATA\PH011210\GSG PH3, 5C_D
Sample Name: GSG pH3, 5C

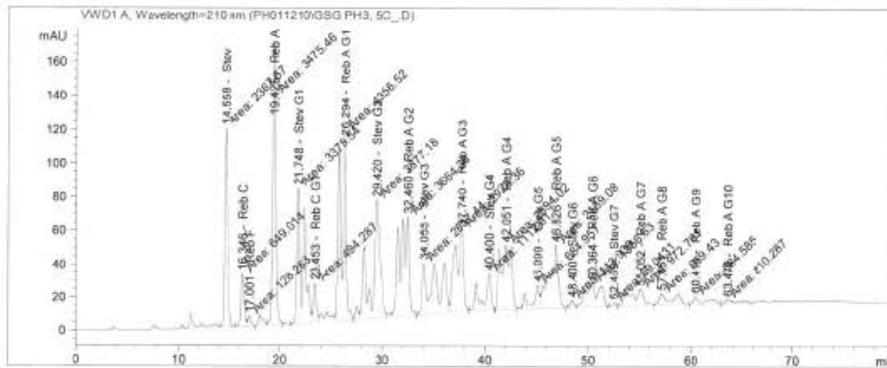
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                                           Inj Volume: 10.000 µl

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Analysis Method: C:\CHEM32\1\METHODS\GRADSW1.M
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Method Info    : Stevia

Sample Info    : GSG (SW0510158), pH3, 5C, week 2, 47115.9687mg/L
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External Standard Report

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Dilution:      :      1.0000
Use Multiplier & Dilution Factor with ISTDs
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Signal 1: VWD1 A, Wavelength=210 nm

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14.558	MM	2367.67310	4.05974e-1	961.21358		Stev
16.346	MF	649.01440	4.08931e-1	313.17453		Reb C
17.001	FM	128.26347	4.08931e-1	60.84306		Reb F
19.425	MF	3475.46021	4.80335e-1	1669.38612		Reb A
21.748	MF	3375.53540	4.08931e-1	1656.43350		Stev G1
23.453	MF	494.28662	4.08931e-1	278.93823		Reb C G1
26.294	MF	4356.52197	4.08931e-1	2494.12197		Reb A G1
29.420	MF	3877.18311	4.08931e-1	2219.70080		Stev G2

HPLC 10 12/6/2010 11:46:28 AM

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File c:\CHEM32\1\DATA\PH011210\GSG PH3, 5C_D
 Sample Name: GSG pH3, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
32.460	PM	3664.27686	4.08931e-1	2397.49856	Reb A	G2
34.055	MF	2857.44263	4.08931e-1	1857.91027	Stev	G3
37.740	FM	2928.35718	4.08931e-1	2143.51818	Reb A	G3
40.400	MM	1112.00793	4.08931e-1	813.97489	Stev	G4
42.051	MF	2894.01538	4.08931e-1	2355.07099	Reb A	G4
45.099	MF	684.95685	4.08931e-1	557.39925	Stev	G5
46.826	FM	2189.08374	4.08931e-1	1960.45366	Reb A	G5
48.400	MF	113.93887	4.08931e-1	102.03898	Stev	G6
50.364	FM	1356.62634	4.08931e-1	1325.89227	Reb A	G6
52.455	MM	59.04314	4.08931e-1	57.46408	Stev	G7
55.052	MF	972.76086	4.08931e-1	1026.30368	Reb A	G7
57.151	MF	639.43030	4.08931e-1	726.92248	Reb A	G8
60.414	FM	384.58548	4.08931e-1	468.66146	Reb A	G9
63.472	MM	210.28685	4.08931e-1	277.75682	Reb A	G10

Totals : 2.57247e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
		Revision No: 00

CONFIDENTIAL

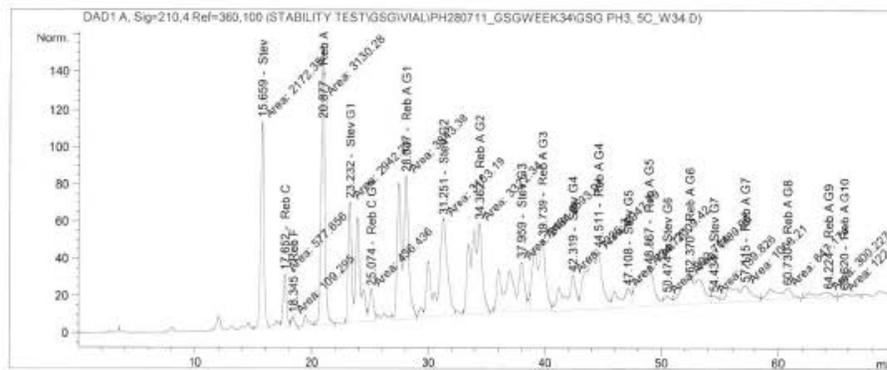
Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH3, 5C_W34.D
Sample Name: GSG pH3, 5C

```

=====
Acq. Operator   : R&D                               Seq. Line : 17
Acq. Instrument : HPLC B                             Location  : Vial 13
Injection Date  : 7/29/2011 10:03:11 AM              Inj       : 1
                                                    Inj Volume: 10 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 7/29/2011 3:17:06 AM by R&D
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 10/4/2011 2:05:33 PM by R&D
                (modified after loading)
Sample Info    : GSG (8W0510158), pH3, 5C, week 34, 47115.9687mg/L
=====

```



External Standard Report

```

Sorted By      : Signal
Calib. Data Modified : 10/4/2011 2:05:32 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs

```

Signal 1: DAD1 A, Sig=210,4 Ref=360,100

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
15.659	MF	2172.34912	3.99780e-1	868.46174	Stev	
17.652	MF	577.65649	3.99780e-1	272.50388	Reb C	
18.345	MF	109.29453	3.99780e-1	50.68477	Reb F	
20.877	FM	3130.28174	4.58394e-1	1434.90381	Reb A	
23.232	MF	2942.22900	3.99780e-1	1411.49304	Stev G1	
25.074	MF	436.43631	3.99780e-1	240.78032	Reb C G1	
28.047	MF	3843.37671	3.99780e-1	2151.10699	Reb A G1	
31.251	MM	3163.19312	3.99780e-1	1770.41371	Stev G2	
34.362	MM	3322.33789	3.99780e-1	2125.12658	Reb A G2	

HPLC 8 10/4/2011 2:05:56 PM R&D

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH3, 5C_W34.D
 Sample Name: GSG pH3, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
37.959	MM	2481.60278	3.99780e-1	1577.43115		Stev G3
39.739	MM	2593.91138	3.99780e-1	1856.21888		Reb A G3
42.319	MF	1226.30090	3.99780e-1	877.54844		Stev G4
44.511	MF	2947.78687	3.99780e-1	2345.14758		Reb A G4
47.108	MF	734.77051	3.99780e-1	584.55558		Stev G5
48.867	MF	2009.41992	3.99780e-1	1759.28354		Reb A G5
50.474	MF	202.70383	3.99780e-1	177.47087		Stev G6
52.370	MF	1789.05554	3.99780e-1	1709.39625		Reb A G6
54.434	MF	139.82643	3.99780e-1	133.04154		Stev G7
57.115	MF	1068.20850	3.99780e-1	1101.78475		Reb A G7
60.730	MM	647.17383	3.99780e-1	719.26142		Reb A G8
64.224	MF	300.22696	3.99780e-1	357.67367		Reb A G9
65.620	FM	122.77853	3.99780e-1	158.54259		Reb A G10

Totals : 2.36828e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

 *** End of Report ***

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: ——
	pH stability of NSF 02	Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\PH011210\GSG PH4, 5C_D
Sample Name: GSG pH4, 5C

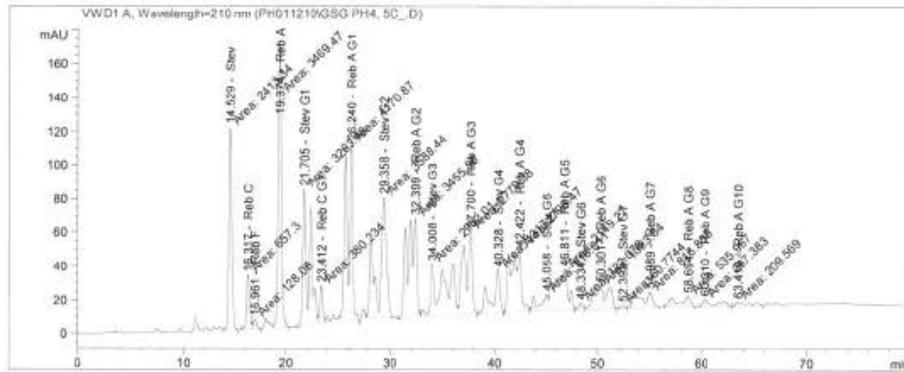
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=====
Acq. Operator   :                               Seq. Line : 15
Acq. Instrument : HPLC 10                       Location  : Vial 14
Injection Date  : 12/2/2010 9:01:47 AM          Inj       : 1
                                                Inj Volume: 10.000 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 12/1/2010 6:07:04 PM
Analysis Method: C:\CHEM32\1\METHODS\GRADSW1.M
Last changed   : 12/3/2010 11:19:29 AM
                (modified after loading)
Method Info    : Stevia

Sample Info    : GSG (SW0510158), pH4, 5C, week 2, 46926.6130mg/L
=====

```



External Standard Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/3/2010 11:19:32 AM
Multiplier:    : 1.0000
Dilution:      : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: VWD1 A, Wavelength=210 nm

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [ng/L]	Grp	Name
14.529	MM	2413.33960	4.06030e-1	979.88799		Stev
16.317	MF	657.30011	4.08931e-1	317.17270		Reb C
16.961	FM	128.08040	4.08931e-1	60.75622		Reb F
19.374	MM	3469.46826	4.80335e-1	1666.50695		Reb A
21.705	MF	3263.48291	4.08931e-1	1601.44741		Stev G1
23.412	FM	380.23386	4.08931e-1	214.57542		Reb C G1
26.240	MM	4170.86768	4.08931e-1	2387.83624		Reb A G1
29.358	MM	3588.44434	4.08931e-1	2054.39686		Stev G2

HPLC 10 12/3/2010 11:19:37 AM

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\PH011210\GSG PH4, 5C.D
 Sample Name: GSG pH4, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
32.399	MM	3455.57983	4.08931e-1	2260.95025	Reb A	G2
34.008	MF	2902.01123	4.08931e-1	1886.88879	Stev	G3
37.700	FM	2779.37866	4.08931e-1	2034.46790	Reb A	G3
40.328	MM	1317.21277	4.08931e-1	964.18208	Stev	G4
42.422	MM	2796.46509	4.08931e-1	2275.68722	Reb A	G4
45.058	MF	516.81091	4.08931e-1	420.56666	Stev	G5
46.811	FM	2149.26758	4.08931e-1	1924.79594	Reb A	G5
48.334	MF	122.07822	4.08931e-1	109.32825	Stev	G6
50.301	FM	1393.84277	4.08931e-1	1362.26557	Reb A	G6
52.392	MM	60.77435	4.08931e-1	59.14900	Stev	G7
54.989	MM	816.83619	4.08931e-1	861.79658	Reb A	G7
58.694	MM	535.95660	4.08931e-1	609.29065	Reb A	G8
60.310	MM	387.38348	4.08931e-1	472.07115	Reb A	G9
63.419	MM	209.56880	4.08931e-1	276.80839	Reb A	G10
Totals :				2.48008e4		

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

 *** End of Report ***

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: _____
		Revision No: 00

CONFIDENTIAL

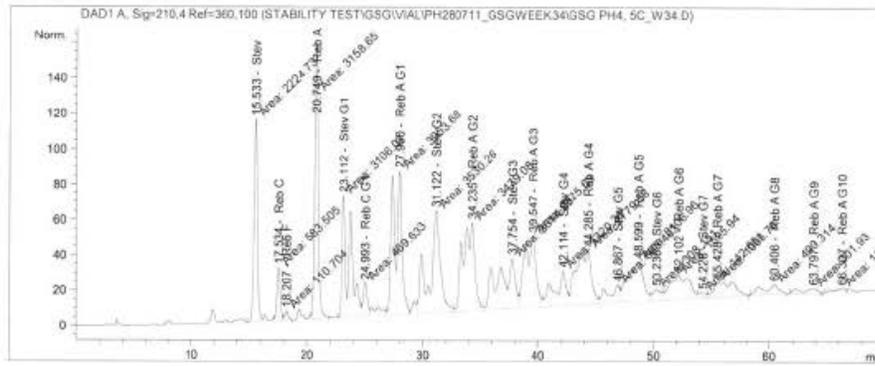
Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH4, 5C_W34.D
Sample Name: GSG pH4, 5C

```

=====
Acq. Operator   : R&D                               Seq. Line : 21
Acq. Instrument : HPLC 8                             Location  : Vial 14
Injection Date  : 7/29/2011 3:27:53 PM              Inj       : 1
                                                    Inj Volume: 10 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 7/29/2011 3:17:06 AM by R&D
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 10/4/2011 2:21:14 PM by R&D
                (modified after loading)
Sample Info    : GSG (S0510158), pH4, 5C, week 34, 46926.6130mg/L
=====

```



External Standard Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 10/4/2011 2:21:13 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: DAD1 A, Sig=210,4 Ref=360,100

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
15.533	MF +	2224.73169	3.99780e-1	889.40324		Stev
17.534	MF	583.50494	3.99780e-1	275.26283		Reb C
18.207	MF	110.70414	3.99780e-1	51.33846		Reb F
20.749	FM	3158.64697	4.58394e-1	1447.90628		Reb A
23.112	MF	3106.07129	3.99780e-1	1490.09407		Stev G1
24.993	MF	469.63336	3.99780e-1	259.09501		Reb C G1
27.960	MF	3953.68433	3.99780e-1	2212.84527		Reb A G1
31.122	MF	3530.26147	3.99780e-1	1975.85891		Stev G2
34.235	MF	3479.08032	3.99780e-1	2225.38655		Reb A G2

HPLC 8 10/4/2011 2:21:38 PM R&D

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH200711_GSGWEEK34\GSG PH4, 5C_W34.D
Sample Name: GSG pH4, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
37.754	MF	2814.03003	3.99780e-1	1788.73858		Stev G3
39.547	MF	2825.63086	3.99780e-1	2022.03877		Reb A G3
42.114	MF	1320.31091	3.99780e-1	944.82258		Stev G4
44.285	MF	2779.57642	3.99780e-1	2211.32571		Reb A G4
46.867	MF	663.40289	3.99780e-1	527.77021		Stev G5
48.599	MF	2106.95996	3.99780e-1	1844.68161		Reb A G5
50.236	MF	308.15149	3.99780e-1	269.79221		Stev G6
52.102	MF	1595.93738	3.99780e-1	1524.87684		Reb A G6
54.226	MF	142.65063	3.99780e-1	135.72870		Stev G7
55.428	FM	1066.75916	3.99780e-1	1100.28985		Reb A G7
60.406	MM	490.31381	3.99780e-1	544.92903		Reb A G8
63.797	MM	301.92960	3.99780e-1	359.70210		Reb A G9
66.307	MM	114.13910	3.99780e-1	147.38659		Reb A G10
Totals :				2.42493e4		

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\PH011210\GSG PH5, 5C_D
Sample Name: GSG pH5, 5C

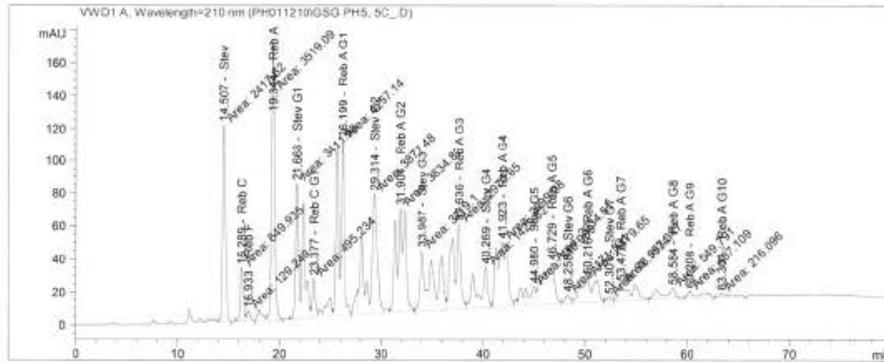
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=====
Acq. Operator   :                               Seq. Line : 16
Acq. Instrument : HPLC 10                       Location  : Vial 15
Injection Date  : 12/2/2010 10:37:31 AM         Inj       : 1
                                                    Inj Volume: 10.000 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 12/1/2010 6:07:04 PM
Analysis Method: C:\CHEM32\1\METHODS\GRADSW1.M
Last changed   : 12/6/2010 12:33:04 PM
                (modified after loading)
Method Info    : Stevia

Sample Info    : GSG (8W0510158), pH5, 5C, week 2, 47874.7988mg/L
=====

```



External Standard Report

```

Sorted By      : Signal
Calib. Data Modified : 12/6/2010 12:33:07 PM
Multiplier:    : 1.0000
Dilution:      : 1.0000
Use Multiplier & Dilution Factor with ISTDs

```

Signal 1: VKD1 A, Wavelength=210 nm

RetTime (min)	Type	Area [MAU*s]	Amt/Area	Amount [ng/L]	Grp	Name
14.507	MM +	2417.62451	4.06035e-1	981.64022		Stev
16.289	MF	649.93457	4.08931e-1	313.61855		Reb C
16.933	FM	129.24930	4.08931e-1	61.31070		Reb F
19.344	MF	3519.09082	4.80337e-1	1690.35091		Reb A
21.668	MF	3411.98145	4.08931e-1	1674.31820		Stev G1
23.377	MF	495.23434	4.08931e-1	279.47305		Reb C G1
26.199	MF	4257.14160	4.08931e-1	2437.22836		Reb A G1
29.314	FM	3877.48022	4.08931e-1	2219.87091		Stev G2

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\PH011210\GSG PH5, 5C.D
Sample Name: GSG pH5, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
31.504	FM	3834.82031	4.08931e-1	2509.08338	Reb A	G2
33.587	MF	3219.09619	4.08931e-1	2093.05755	Stev	G3
37.636	MF	2970.64722	4.08931e-1	2174.47392	Reb A	G3
40.269	MF	1429.81824	4.08931e-1	1046.60777	Stev	G4
41.923	MF	2999.08276	4.08931e-1	2440.57197	Reb A	G4
44.980	MF	840.98895	4.08931e-1	684.37393	Stev	G5
46.729	FM	2034.51282	4.08931e-1	1822.02628	Reb A	G5
48.258	MF	171.53133	4.08931e-1	153.61642	Stev	G6
50.216	FM	1479.64636	4.08931e-1	1446.12530	Reb A	G6
52.301	MF	78.59343	4.08931e-1	76.49152	Stev	G7
53.472	FM	957.34705	4.08931e-1	1010.04146	Reb A	G7
58.584	MM	549.79114	4.08931e-1	625.01814	Reb A	G8
60.208	MM	407.10901	4.08931e-1	496.10896	Reb A	G9
63.301	MM	216.09596	4.08931e-1	285.42977	Reb A	G10
Totals :				2.65208e4		

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\STABILITY TEST\CSC\VIAL\PH280711_GSGWEEK34\GSG PH5, 5C_W34.D
 Sample Name: GSG pH5, 5C

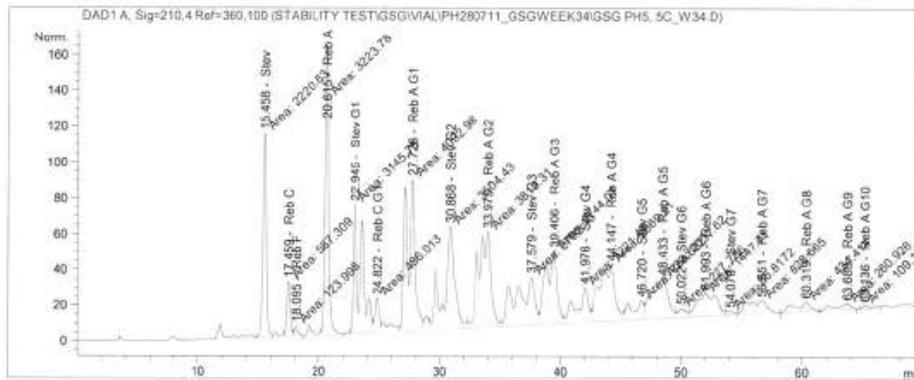
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=====
Acq. Operator   : R&D                               Seq. Line : 26
Acq. Instrument : HPLC 8                             Location  : Vial 15
Injection Date  : 7/29/2011 10:13:49 PM             Inj       : 1
                                                    Inj Volume: 10 µl

Acq. Method     : C:\CHEM32\1\METHODS\GRADSW.M
Last changed    : 7/29/2011 3:17:06 AM by R&D
                (modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\GRADSW.M
Last changed    : 10/4/2011 2:30:08 PM by R&D
                (modified after loading)

Sample Info     : GSG (SW0510156), pH5, 5C, week 34, 47874.7988mg/L
=====
  
```



External Standard Report

```

Sorted By      : Signal
Calib. Data Modified : 10/4/2011 2:30:07 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
  
```

Signal 1: DAD1 A, Sig=210,4 Ref=360,100

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
15.458	MF +	2220.83008	3.99780e-1	887.84346		Stev
17.459	MF	587.30865	3.99780e-1	277.05719		Reb C
18.095	MF	123.99762	3.99780e-1	57.50325		Reb F
20.615	FM	3223.78076	4.58394e-1	1477.76325		Reb A
22.945	MF	3145.78003	3.99780e-1	1509.14378		Stev G1
24.822	MF	486.01263	3.99780e-1	268.13139		Reb C G1
27.726	MF	4092.97778	3.99780e-1	2290.80670		Reb A G1
30.868	MF	3504.43140	3.99780e-1	1961.40203		Stev G2
33.975	MF	3819.31494	3.99780e-1	2443.01693		Reb A G2

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH200711_GSGWEEK34\GSG PH5_ 5C_W34.D
Sample Name: GSG pH5, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
37.579	MF	2792.12793	3.99780e-1	1774.81650		Stev G3
39.406	MF	2744.07324	3.99780e-1	1963.67563		Reb A G3
41.976	MF	1221.47339	3.99780e-1	874.09385		Stev G4
44.147	MF	2869.21362	3.99780e-1	2282.63768		Reb A G4
46.720	MF	723.62152	3.99780e-1	575.68587		Stev G5
48.433	MF	2037.62256	3.99780e-1	1783.97546		Reb A G5
50.022	MF	227.78618	3.99780e-1	199.43093		Stev G6
51.993	MF	1447.71313	3.99780e-1	1383.25241		Reb A G6
54.070	MF	85.81721	3.99780e-1	81.65305		Stev G7
56.651	MF	828.66467	3.99780e-1	854.71151		Reb A G7
60.319	MF	434.41379	3.99780e-1	482.80240		Reb A G8
63.689	FM	260.92581	3.99780e-1	310.85247		Reb A G9
65.136	MM	109.14535	3.99780e-1	140.93822		Reb A G10

Totals : 2.38812e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\PH011210\GSG PH6, 5C_D
Sample Name: GSG pH6, 5C

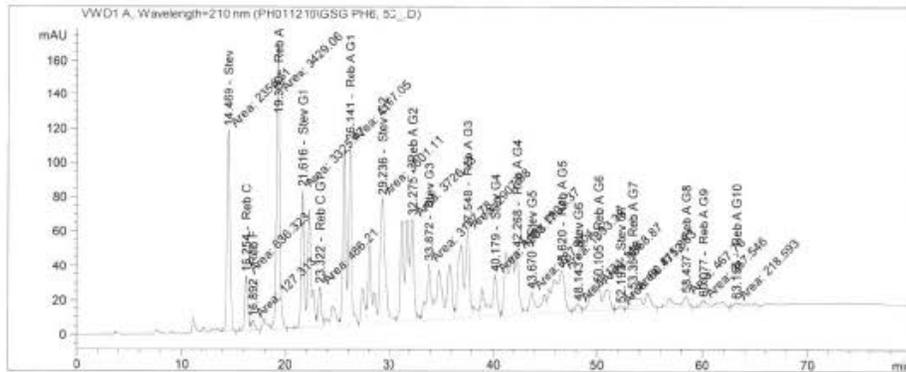
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=====
Acq. Operator   :                               Seq. Line : 17
Acq. Instrument : HPLC 10                       Location  : Vial 16
Injection Date  : 12/2/2010 12:13:19 PM         Inj       : 1
                                                Inj Volume: 10.000 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 12/1/2010 6:07:04 PM
Analysis Method: C:\CHEM32\1\METHODS\GRADSW1.M
Last changed   : 12/6/2010 12:50:29 PM
                (modified after loading)
Method Info    : Stevia

Sample Info    : GSG (SW0510158), pH6, 5C, week 2, 47094.1993mg/L
=====

```



External Standard Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/6/2010 13:50:41 PM
Multiplier:    : 1.0000
Dilution:      : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: VWD1 A, Wavelength=210 nm

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [ng/L]	Grp	Name
14.469	MM *	2356.31299	4.05960e-1	956.56809		Stev
16.254	MF	636.32312	4.08931e-1	307.05050		Reb C
16.892	FM	127.31285	4.08931e-1	60.39213		Reb F
19.300	MF	3429.05884	4.80333e-1	1647.08996		Reb A
21.616	MF	3325.46777	4.08931e-1	1631.86445		Stev G1
23.322	MF	486.21039	4.08931e-1	274.38061		Reb C G1
26.141	MF	4167.05029	4.08931e-1	2385.65078		Reb A G1
29.236	MF	3601.10693	4.08931e-1	2061.64624		Stev G2

HPLC 10 12/6/2010 12:50:45 PM

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\PH011210\GSG PH6_ 5C_.D
 Sample Name: GSG pH6_ 5C

RetTime [min]	Type	Area (mAU*s)	Amt/Area	Amount [mg/L]	Grp	Name
32.275	MF	3726.12915	4.08931e-1	2437.96787	Reb A	G2
33.872	MF	3177.77686	4.08931e-1	2066.19171	Stev	G3
37.548	MF	2907.98120	4.08931e-1	2128.60323	Reb A	G3
40.179	MF	1203.17175	4.08931e-1	880.70559	Stev	G4
42.268	MF	2903.36963	4.08931e-1	2362.68323	Reb A	G4
43.670	MF	787.80377	4.08931e-1	641.09328	Stev	G5
46.620	FM	1893.37500	4.08931e-1	1695.62904	Reb A	G5
48.143	MF	131.14792	4.08931e-1	117.45070	Stev	G6
50.105	FM	1368.87170	4.08931e-1	1337.86022	Reb A	G6
52.193	MM	60.47124	4.08931e-1	58.85400	Stev	G7
53.364	MM	815.86334	4.08931e-1	860.77019	Reb A	G7
58.437	MM	467.75961	4.08931e-1	531.76238	Reb A	G8
60.077	MM	387.54614	4.08931e-1	472.26936	Reb A	G9
63.155	MM	218.59290	4.08931e-1	288.72784	Reb A	G10

Totals : 2.52052e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15 Revision date: -----
		Revision No: 00

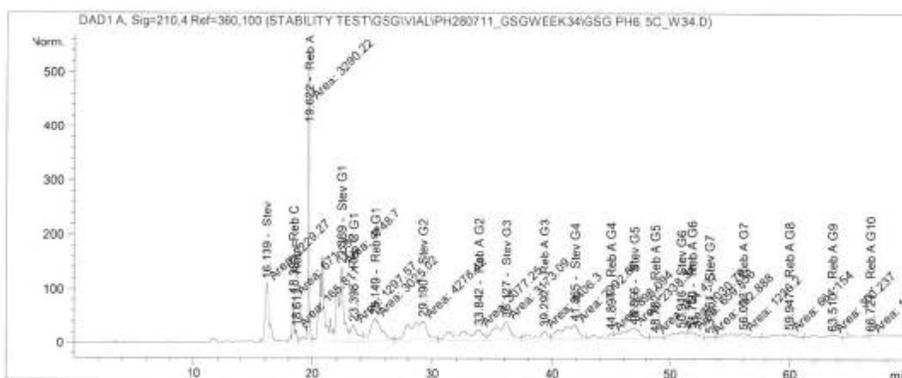
CONFIDENTIAL

Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH6, 5C_W34.D
 Sample Name: GSG pH6, 5C

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Acq. Instrument : HPLC 8                               Location    : Vial 16
Injection Date  : 7/30/2011 3:38:34 AM                Inj         : 1
                                                    Inj Volume  : 10 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 7/29/2011 3:17:06 AM by R&D
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 10/4/2011 3:31:39 PM by R&D
                (modified after loading)
Sample Info    : GSG (SW0510158), pH6, 5C, week 34, 47094.1993mg/L
  
```



External Standard Report

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Sorted By      : Signal
Calib. Data Modified : 10/4/2011 3:31:38 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
  
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Signal 1: DAD1 A, Sig=210,4 Ref=360,100

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [ng/L]	Grp	Name
16.139	MF +	2229.27002	3.99780e-1	891.21758		Stev
18.391	MF	671.53931	3.99780e-1	316.79219		Reb C
18.611	MF	165.81067	3.99780e-1	76.89383		Reb F
19.622	MF	3290.21729	4.58394e-1	1508.21738		Reb A
22.369	MF	4748.69629	3.99780e-1	2278.12034		Stev G1
23.398	MF	1297.57458	3.99780e-1	715.86716		Reb C G1
25.149	MF	3025.02271	3.99780e-1	1693.08084		Reb A G1
29.190	MF	4278.41748	3.99780e-1	2394.59580		Stev G2
33.842	MF	3077.25464	3.99780e-1	1968.35958		Reb A G2

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
		Revision No: 00

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Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\FW280711_GSGWEEK34\GSG pH6, 5C_W34.D
Sample Name: GSG pH6, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
36.127	MF	3173.09277	3.99780e-1	2016.97686	Stev	G3
39.292	MF	1406.30005	3.99780e-1	1006.35694	Reb A	G3
41.865	MF	2992.86035	3.99780e-1	2141.70921	Stev	G4
44.894	MF	898.09381	3.99780e-1	714.48942	Reb A	G4
46.866	MF	2338.34155	3.99780e-1	1860.29597	Stev	G5
48.702	MF	304.43704	3.99780e-1	266.54015	Reb A	G5
50.916	MF	1030.78906	3.99780e-1	902.47450	Stev	G6
51.750	FM	659.85620	3.99780e-1	630.47551	Reb A	G6
53.261	MF	182.88821	3.99780e-1	174.01380	Stev	G7
56.031	FM	1236.19666	3.99780e-1	1275.05316	Reb A	G7
59.947	FM	664.15411	3.99780e-1	738.13311	Reb A	G8
63.510	MM	300.23749	3.99780e-1	357.68621	Reb A	G9
66.727	MM	113.97934	3.99780e-1	147.18030	Reb A	G10

Totals : 2.40745e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15 Revision date: -----
		Revision No: 00

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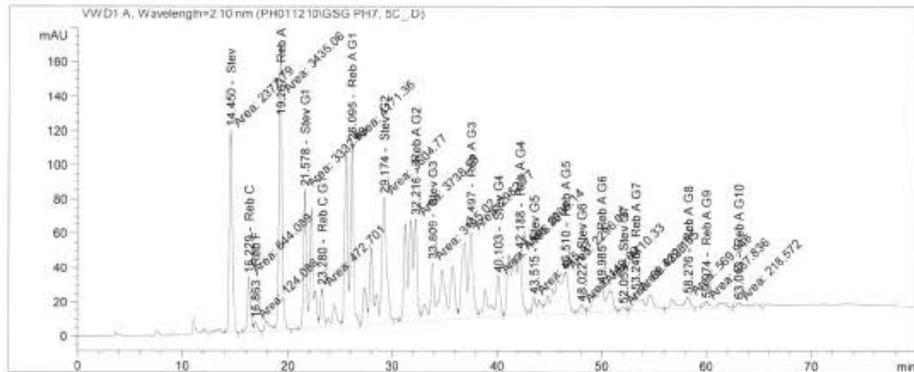
Data File C:\CHEM32\1\DATA\PH011210\GSG PH7, 5C_D
 Sample Name: GSG pH7, 5C

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Acq. Operator   :                               Seq. Line : 18
Acq. Instrument : HPLC 10                       Location  : Vial 17
Injection Date  : 12/2/2010 1:49:03 PM         Inj       : 1
                                                Inj Volume: 10.000 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 12/1/2010 6:07:04 PM
Analysis Method: C:\CHEM32\1\METHODS\GRADSW1.M
Last changed   : 12/6/2010 1:42:55 PM
                (modified after loading)
Method Info    : Stevia

Sample Info    : GSG (SW0510158), pH7, 5C, week 2, 47033.1138mg/L
=====
  
```



External Standard Report

```

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Sorted By      : Signal
Calib. Data Modified : 12/6/2010 1:42:59 PM
Multiplier:    : 1.0000
Dilution:      : 1.0000
Use Multiplier & Dilution Factor with ISTDs
  
```

Signal 1: WWD1 A, Wavelength=210 nm

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
14.450	MM	2377.79077	4.05987e-1	965.35101		Stev
16.229	MF	644.08875	4.08931e-1	310.79771		Reb C
16.863	FM	124.08641	4.08931e-1	58.86163		Reb F
19.267	MF	3435.06445	4.80333e-1	1649.97569		Reb A
21.578	MF	3332.89380	4.08931e-1	1635.50853		Stev G1
23.280	MF	472.70074	4.08931e-1	266.75678		Reb C G1
26.095	MF	4171.36230	4.08931e-1	2388.11942		Reb A G1
29.174	MF	3604.76685	4.08931e-1	2063.74155		Stev G2

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\PH011210\GSG PH7, 5C_D
Sample Name: GSG pH7, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
32.216	MF	3738.58276	4.08931e-1	2446.11615	Reb A	G2
33.809	MF	3165.02417	4.08931e-1	2057.89991	Stev	G3
37.497	MF	2982.77222	4.08931e-1	2183.34925	Reb A	G3
40.103	MF	1195.85852	4.08931e-1	875.35240	Stev	G4
42.188	MF	2906.14331	4.08931e-1	2364.94037	Reb A	G4
43.515	MF	445.47000	4.08931e-1	362.51137	Stev	G5
46.510	MF	2296.04517	4.08931e-1	2056.24393	Reb A	G5
48.022	MF	149.69034	4.08931e-1	134.05653	Stev	G6
49.985	MF	1410.32776	4.08931e-1	1378.37709	Reb A	G6
52.059	MF	69.43980	4.08931e-1	67.58269	Stev	G7
53.240	FM	922.10541	4.08931e-1	972.86004	Reb A	G7
58.276	MF	569.94580	4.08931e-1	647.93053	Reb A	G8
59.974	FM	387.83624	4.08931e-1	472.62289	Reb A	G9
63.013	MM	218.57216	4.08931e-1	288.70045	Reb A	G10

Totals : 2.56477e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***



PureCircle Sdn Bhd

Report# NSF02_pH_W34

Issue date: 01/09/15

Revision date: ---

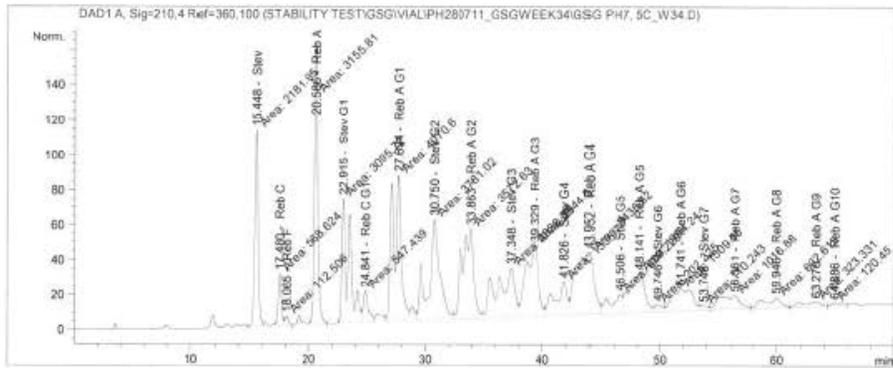
pH stability of NSF 02

Revision No: 00

CONFIDENTIAL

Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH7, 5C_W34.D
Sample Name: GSG pH7, 5C

Acq. Operator : R&D
Acq. Instrument : HPLC 8
Injection Date : 7/30/2011 9:03:21 AM
Acq. Method : C:\CHEM32\1\METHODS\GRADSW.M
Last changed : 7/29/2011 3:17:06 AM by R&D
Analysis Method : C:\CHEM32\1\METHODS\GRADSW.M
Last changed : 10/4/2011 2:41:14 PM by R&D
Sample Info : GSG (SW0510158), pH7, 5C, week 34, 47033.1138mg/L



External Standard Report

Sorted By : Signal
Calib. Data Modified : 10/4/2011 2:41:13 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 A, Sig=210,4 Ref=360,100

Table with 6 columns: RetTime [min], Type, Area [mAU*s], Amt/Area, Amount [mg/L], Grp, Name. Contains 10 rows of peak data.

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
		Revision No: 00

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Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH7, 5C_W34.D
 Sample Name: GSG pH7, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
37.348	MF	2938.33496	3.99780e-1	1867.75302		Stev G3
39.329	MF	2944.50488	3.99780e-1	2107.10575		Reb A G3
41.826	MF	1335.69995	3.99780e-1	955.82507		Stev G4
43.952	MF	3438.52148	3.99780e-1	2735.55745		Reb A G4
46.506	MF	829.22913	3.99780e-1	659.70328		Stev G5
48.141	MF	1994.24036	3.99780e-1	1745.99356		Reb A G5
49.746	MF	202.32486	3.99780e-1	177.13908		Stev G6
51.741	MF	1509.55078	3.99780e-1	1442.33668		Reb A G6
53.748	MF	110.24310	3.99780e-1	104.89370		Stev G7
56.361	MF	1016.88019	3.99780e-1	1048.84307		Reb A G7
59.946	MF	602.61481	3.99780e-1	669.73904		Reb A G8
63.276	FM	323.33105	3.99780e-1	385.19860		Reb A G9
64.886	MM	120.45026	3.99780e-1	185.53612		Reb A G10

Totals : 2.51618e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\PH011210\GSG PH8, 5C_D
Sample Name: GSG pH8, 5C

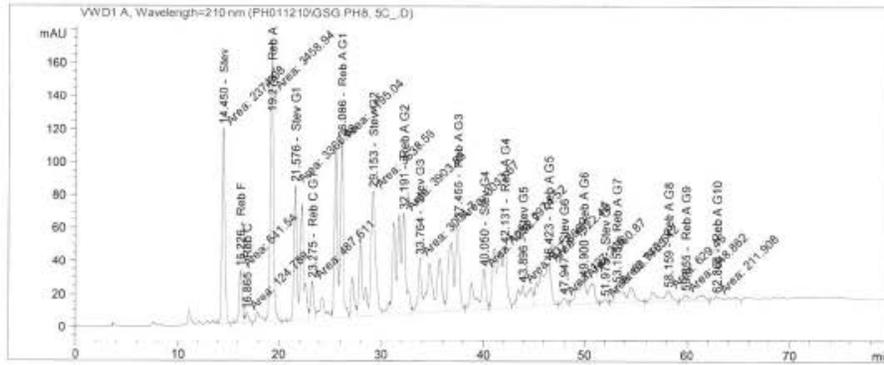
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=====
Acq. Operator   :                               Seq. Line : 19
Acq. Instrument : HPLC 10                       Location  : Vial 18
Injection Date  : 12/2/2010 3:24:50 PM          Inj       : 1
                                                Inj Volume: 10.000 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 12/1/2010 6:07:04 PM
Analysis Method: C:\CHEM32\1\METHODS\GRADSW1.M
Last changed   : 12/6/2010 2:26:11 PM
                (modified after loading)
Method Info    : Stevia

Sample Info    : GSG (SW0510158), pH8, 5C, week 2, 47145.3385mg/L

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External Standard Report

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Sorted By      : Signal
Calib. Data Modified : 12/6/2010 2:26:10 PM
Multiplier:    : 1.0000
Dilution:      : 1.0000
Use Multiplier & Dilution Factor with ISTDs

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Signal 1: VWD1 A, Wavelength=210 nm

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [ng/L]	Grp	Name
14.450	MM	2374.07837	4.05982e-1	963.83289		Stev
16.226	MF	641.53986	4.08931e-1	304.32086		Reb F
16.865	FM	124.78881	4.08931e-1	60.21542		Reb C
19.278	MF	3458.93945	4.80334e-1	1661.44779		Reb A
21.576	MF	3366.07764	4.08931e-1	1651.79241		Stev G1
23.275	MF	487.61081	4.08931e-1	275.17090		Reb C G1
26.086	MF	4195.03906	4.08931e-1	2401.67444		Reb A G1
29.153	MF	3638.59277	4.08931e-1	2083.10701		Stev G2

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\PH011210\GSG PH8, 5C_D
Sample Name: GSG pH8, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
32.191	MF	3903.83081	4.08931e-1	2554.23624	Reb	A G2
33.764	MF	3004.69995	4.08931e-1	1953.65704	Stev	G3
37.455	MF	3033.57471	4.08931e-1	2220.53600	Reb	A G3
40.050	MF	1232.89600	4.08931e-1	902.46333	Stev	G4
42.131	MF	2974.52197	4.08931e-1	2420.58507	Reb	A G4
43.896	MF	937.86639	4.08931e-1	763.21016	Stev	G5
46.423	FM	1922.48462	4.08931e-1	1721.69842	Reb	A G5
47.947	MF	127.21572	4.08931e-1	113.92919	Stev	G6
49.900	MF	1360.86719	4.08931e-1	1330.03704	Reb	A G6
51.975	MF	63.77650	4.08931e-1	62.07085	Stev	G7
53.153	FM	940.54205	4.08931e-1	992.31148	Reb	A G7
58.159	MM	629.44983	4.08931e-1	715.57640	Reb	A G8
59.855	MM	348.86185	4.08931e-1	425.12812	Reb	A G9
62.868	MM	211.90810	4.08931e-1	279.89824	Reb	A G10

Totals : 2.58569e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\PH280711_GSGWEEK34\GSG PH8, 5C_W34.D
Sample Name: GSG pH8, 5C

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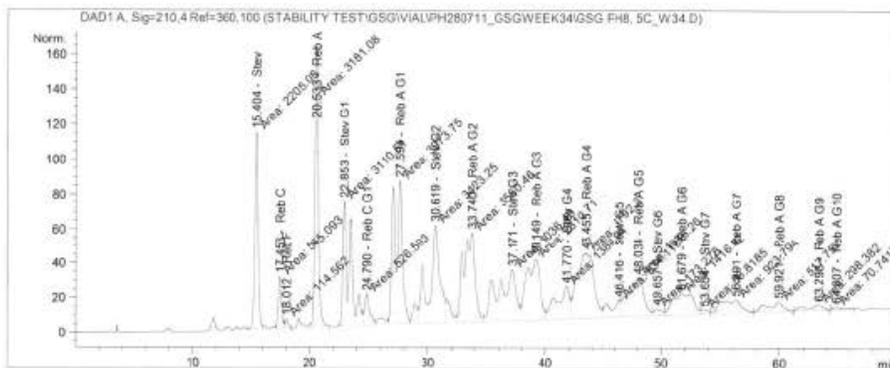
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Acq. Instrument : HPLC 8                             Location  : Vial 18
Injection Date  : 7/30/2011 2:28:08 PM              Inj       : 1
                                                    Inj Volume: 10 µl

Acq. Method    : C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 7/29/2011 3:17:06 AM by R&D
                (modified after loading)

Analysis Method: C:\CHEM32\1\METHODS\GRADSW.M
Last changed   : 10/4/2011 2:55:20 PM by R&D
                (modified after loading)

Sample Info    : GSG (SW0510158), pH8, 5C, week 34, 47145.3385mg/L
=====

```



External Standard Report

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Sorted By      : Signal
Calib. Data Modified : 10/4/2011 2:55:19 PM
Multiplier    : 1.0000
Dilution      : 1.0000
Use Multiplier & Dilution Factor with ISTDs

```

Signal 1: DAD1 A, Sig=210,4 Ref=360,100

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
15.404	MF +	2205.07520	3.99780e-1	881.54497		Stev
17.453	MF	565.09338	3.99780e-1	266.57735		Reb C
18.012	MF	114.56186	3.99780e-1	53.12746		Reb F
20.533	FM	3181.07861	4.58394e-1	1458.18882		Reb A
22.853	MF	1110.51416	3.99780e-1	1492.22548		Stev G1
24.790	MF	526.50250	3.99780e-1	290.46951		Reb C G1
27.594	MF	3973.75366	3.99780e-1	2224.07792		Reb A G1
30.619	MF	3423.24854	3.99780e-1	1915.96463		Stev G2
33.740	MF	3560.46143	3.99780e-1	2277.44181		Reb A G2

HPIC 8 10/4/2011 2:57:22 PM R&D

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 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

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Data File C:\CHEM32\1\DATA\STABILITY TEST\GSG\VIAL\FH280711_GSGWEEK34\GSG PH8, 5C_W34.D
Sample Name: GSG pH8, 5C

RetTime [min]	Type	Area [mAU*s]	Amt/Area	Amount [mg/L]	Grp	Name
37.171	MF	3036.48804	3.99780e-1	1930.14404	Stev	G3
39.149	MF	2810.70654	3.99780e-1	2011.35883	Reb A	G3
41.770	MF	1386.94031	3.99780e-1	992.50299	Stev	G4
43.455	MF	3792.29688	3.99780e-1	3017.00775	Reb A	G4
46.416	MF	634.11847	3.99780e-1	504.48064	Stev	G5
48.034	MF	1936.25684	3.99780e-1	1695.22793	Reb A	G5
49.657	MF	173.27763	3.99780e-1	151.70771	Stev	G6
51.679	MF	1416.91882	3.99780e-1	1353.82925	Reb A	G6
53.654	MF	86.81852	3.99780e-1	82.60576	Stev	G7
56.291	MF	923.79388	3.99780e-1	952.83085	Reb A	G7
59.921	MF	517.75659	3.99780e-1	575.42861	Reb A	G8
63.298	FM	298.38162	3.99780e-1	355.47524	Reb A	G9
64.807	MM	70.74147	3.99780e-1	91.34770	Reb A	G10

Totals : 2.45736e4

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

*** End of Report ***

 PureCircle Sdn Bhd	Report# NSF02_pH_W34	Issue date: 01/09/15
		Revision date: -----
pH stability of NSF 02		Revision No: 00

CONFIDENTIAL

APPENDIX B

**Standard Operating Procedure (SOP) for
 Determination of
 Steviol Glycosides by HPLC assay**

(b) (6)

Prepared by: _____ 05/11/14
 Sharhan Muayan Syed Nazri, S. Quality Executive Date

Approved by: _____ 05/11/14
 Alina Dmitrieva, S. Quality Manager Date

 PureCircle Sdn Bhd pH stability of NSF 02	Report# NSF02_pH_W34	Issue date: 01/09/15 Revision date: -----
		Revision No: 00

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1 Materials and Methods

1.1 Apparatus

- 1.1.1 *Agilent*[®] 1100 HPLC system equipped with isocratic pump (G1310A), auto sampler (G1313A), VWD UV Detector (G1314A) and ChemStation (Rev.A.10.02) software;
- 1.1.2 *Zorbax*[®] *NH₂* analytical column; 4.6x250mm, 5µm (PN 883952-708);
- 1.1.3 *Mettler Toledo*[®] *AB 204-S* analytical balance;
- 1.1.4 *Mettler Toledo*[®] *DL-39* Karl Fischer coulometer;
- 1.1.5 *Mettler Toledo*[®] *HB-43* moisture analyzer;
- 1.1.6 *Becton Dickinson*[®] sterile syringes; 5 mL;
- 1.1.7 *Whatman*[®] syringe filters; 25mm; 0.45µm;
- 1.1.8 Volumetric and Laboratory glassware.

1.2 Reagents and Chemicals

- 1.2.1 Rebaudioside A standard (Chromadex, PN# ASB-00018226), or equivalent
- 1.2.2 Stevioside standard (Chromadex, PN# ASB-00019353), or equivalent
- 1.2.3 Rebaudioside B standard (Chromadex, PN# ASB-00018227), or equivalent
- 1.2.4 Rebaudioside C standard (Chromadex, PN# ASB-00018228), or equivalent
- 1.2.5 Rebaudioside D standard (Chromadex, PN# ASB-00018229), or equivalent
- 1.2.6 Rebaudioside F standard (Chromadex, PN# ASB-00018305), or equivalent
- 1.2.7 Rebaudioside F standard (Chromadex, PN# ASB-00018305), or equivalent

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- 1.2.8 Steviolbioside standard (Chromadex, PN# ASB-00019349), or equivalent
- 1.2.9 Dulcoside A standard (Chromadex, PN# ASB-00014949), or equivalent
- 1.2.10 Rubusoside standard (Chromadex, PN# ASB-00018226), or equivalent
- 1.2.11 Acetonitrile (ACN), HPLC grade (JT Baker[®]);
- 1.2.12 HPLC grade water (JT Baker[®]);
- 1.2.13 Ethanol AR grade (System[®])

2 Assay (High Performance Liquid Chromatography)

2.1 Mobile Phase Preparation

2.1.2 Mobile Phase (acetonitrile : water – 80:20)

Mobile phase is prepared by mixing 8 volumes of acetonitrile with 2 volumes of water.

2.1.3 Diluent Solution (Ethanol : water - 50:50)

The diluent solution is prepared by mixing 1 volume of Ethanol with 1 volume of water.

2.1.4 Preliminary conditioning of testing material

The samples and standards should be conditioned at least 12 hrs in room conditions, by placing them in Petri dishes (not more than 5mm layer of material) or in other suitable container and mixing the mixture every 3 hrs.

Important!

- a) **Ensure that conditioned material is sufficient for water/moisture determination, and sample preparation.**
- b) **Due to high value of material the limit of Rebaudioside A standard usage must not exceed 200mg for each assay.**

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c) **If the moisture analyzer was used for determination of moisture content in sample, do not use the dried material for sample preparation.**

2.2 Rebaudioside A Standard Preparation

Record the water content of Rebaudioside A standard obtained by KF titration and residual solvent content from CoA.

Place 50.0 ± 0.5 mg, recorded to the nearest 0.1 mg, of the Rebaudioside A standard in a 10 mL volumetric flask, add diluent solution, stir the solution if necessary until dissolved and dilute to volume with the diluent solution. **(Important! If heating was used for dissolution – adjust the volume only after the solution was cooled to room temperature).** This will make approximately 5000 mg/L solution and should be injected at 8.0, 10.0, and 12.0 μ L.

2.2.1 Rebaudioside A Standard Check

Record the water content of Rebaudioside A standard obtained by KF titration and residual solvent content from CoA.

Place 52.5 ± 0.5 mg, recorded to the nearest 0.1 mg, of the Rebaudioside A standard in a 10 mL volumetric flask, add diluent solution, stir the solution if necessary until dissolved and dilute to volume with the diluent solution. **(Important! If heating was used for dissolution – adjust the volume only after the solution was cooled to room temperature).** This will make approximately 5250 mg/L solution and should be injected at 12.0 μ L.

2.2.2 Separation check (Standard Preparation , M6)

Approx. 100 mg/L (each) of *rubusoside, dulcoside A, stevioside, rebaudioside C, rebaudioside F, and rebaudioside A*, solution prepared in diluents.

2.3 Sample Preparation

Record the water /moisture content of sample obtained by KF titration/ moisture analyzer. Place 2500 ± 5 mg, recorded to the nearest 1.0 mg, of sample in a 50 mL

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volumetric flask, add diluent solution, stir the solution if necessary until dissolved and dilute to volume with the diluent solution (approx. 50000 mg/L). **(Important! If heating was used for dissolution – adjust the volume only after the solution was cooled to room temperature).**

2.4 Instrumental Conditions

Column:	Zorbax NH ₂ , 250 x 4.6 mm, 5 µm
Temperature:	30°C
Gradient Mobile Phase:	A – Acetonitrile; B – water 0 min A:B – 80:20 0 to 2 min A:B – 80:20 2 to 70 min A:B – 50:50
Flow Rate:	1.0 mL/min
Injection:	10 µL
Detection:	UV at 210 nm (4 nm bw), Reference: 260 nm (100 nm bw)
Run Time:	70 min
Autosampler Temperature:	Ambient

2.5 System Suitability

2.5.1 Separation check

Inject the separation check sample (see 2.2.2) and record the retention time for each glycoside. To proceed with the rest of analysis each Steviol glycoside peak should be clearly separated. The assay should be discontinued immediately after detection of any merged peaks of any main Steviol glycoside (Dulcoside A, Stevioside, Rebaudioside A and Rebaudioside C).

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2.5.2 Area Count and Retention Time Reproducibility

Make five injections of separation check sample (see 2.2.2). The RSD of the peak area counts (mAU*s) and retention time (min) for Rebaudioside A and Stevioside should be less than 2.00%.

2.5.3 Baseline Stability

Flush the column with the mobile phase until baseline is stable in -5.0 to 10.0 mAU scale during 10 min.

2.6 Assay Sequence

Inject Rebaudioside A standard solution at 8.0, 10.0, and 12.0 μ L followed by Rebaudioside A standard check and samples duplicate injections at 12 μ L. Bracket the samples with standard and standard check re-injection after every 10 samples. Record the area of each Steviol glycoside (Dulcoside A, Stevioside, Rebaudioside A and Rebaudioside C) in sample injection, and Rebaudioside A for standard and standard check injection determined by data acquisition software.

Enter the areas and sample parameters (weight and water/moisture) into *Excel*[®] datasheet and record the content of Steviol glycoside in sample.

2.7 Validity parameters

The assay is considered failed and the results are not valid if any of following parameters is out of required limits:

- The recovery for standard check sample should be within the limits of 98.0 – 102.0%.
- The %RSD for Rebaudioside A and Stevioside content in duplicate samples should be less than 2.00%.

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- The correlation coefficient for standard curve should be greater than 0.99900.
- In case of water/moisture determination by KF titration/moisture analyzer the %RSD of triplicate should be less than 2.00% and the mean result should be used for calculations.

3.0 Data interpretation

3.1 Analysis Procedure

3.1.1 Integration parameters

The integration is done using the software tools. Example chromatogram is provided in the *Appendices* section (5.1).

3.1.2 Separation of steviol glycosides

There should be clear separation between *stevioside* and *rebaudioside C*, *rebaudioside A* peaks in M6 solution. Record retention time for each steviol glycoside the *Appendices* section (5.2).

3.2 Calculations

- Identify each unreacted steviol glycoside by matching elution profile with example chromatogram (5.1, 5.2).
- Integrate all unreacted glycosides peaks (*stevioside* and *rebaudioside C*, *rebaudioside A*). Determine the (% area) ratio of unreacted steviol glycoside using data acquisition software tools (5.3)
- Record percentage of all unreacted steviol glycoside.

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3.3 Reporting results

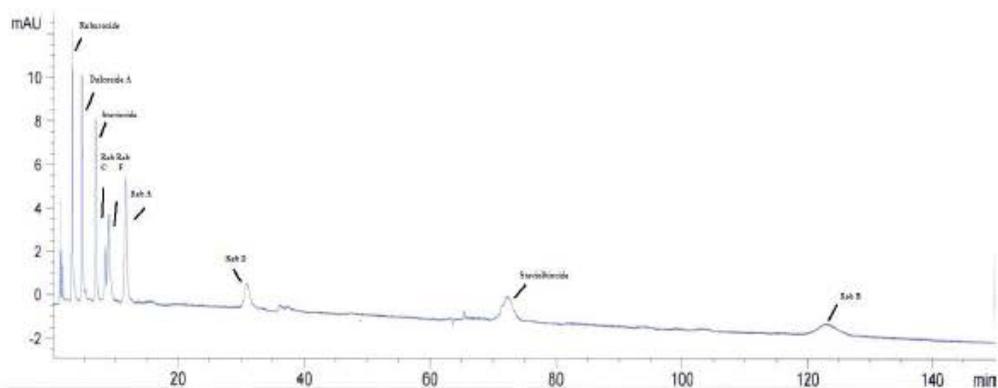
Unreacted glycosides' should be reported on a %wt dry basis. Attach the average of 2 sample duplicate excel sheet, provided in the *Appendices* section (5.3)

4.0 Revision history

- 01 -2010 – put on PCSB letterhead
- 02 -23/09/2011 – changed from STV to PCSB
- 03 -25/04/2012 - revised concentration of the sample solution
- 04 -29/10/2014 – revised the standards

Appendices

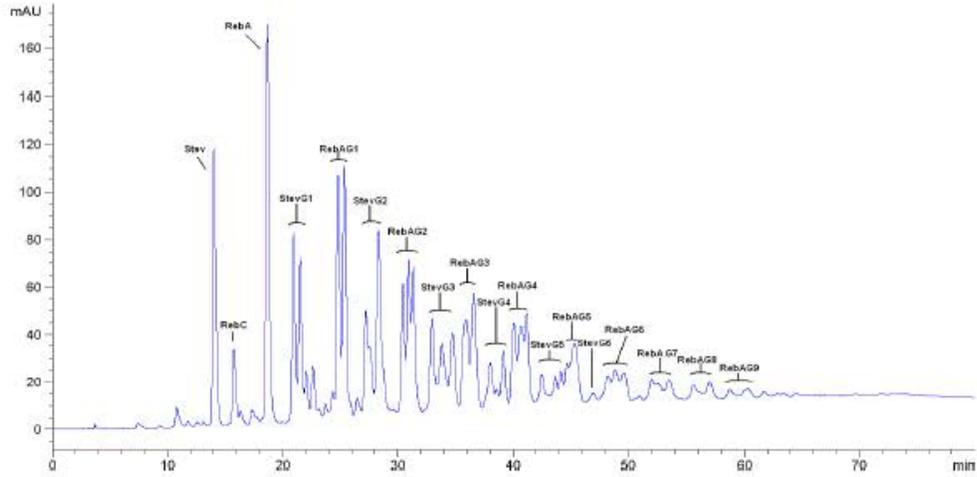
5.1 HPLC Chromatogram of M9 sample (gradient)



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5.2 Integration example chromatogram for sample gradient analysis



5.3 Data acquisition software tools

Area of Reba 8.0 µL injection 1st bracket	7672.71	Concentration of Reba 8.0 µL injection, mg/L	3011.87
Area of Reba 8.0 µL injection 2nd bracket	7651.62	Amt/Area for Reba 8.0 µL Injection	0.39203
Area of Reba 10.0 µL injection 1st bracket	9557.88	Concentration of Reba 10.0 µL injection, mg/L	3764.83
Area of Reba 10.0 µL injection 2nd bracket	9535.19	Amt/Area for Reba 10.0 µL Injection	0.39437
Area of Reba 12.0 µL injection 1st bracket	11420.26	Concentration of Reba 12.0 µL injection, mg/L	4517.80
Area of Reba 12.0 µL injection 2nd bracket	11412.30	Amt/Area for Reba 12.0 µL Injection	0.39588
Average Amt/Area for Reba, all levels	0.39426	Average Area of Reba 8.0 µL	7667.16
Area of Reba std check injection	11922.10	Average Area of Reba, 10.0 µL	9546.53
Net Concentration (Cm) of Reba std check, mg/L	4743.89	Average Area of Reba 12.0 µL	11420.25
Recovery of Reba std check %	99.05		
Sample		Correlation	1.000000
Sample Volumetric Flask Capacity, mL	50.00		
Weight of Sample 1st duplicate, mg	2500.30		
Weight of Sample 2nd duplicate, mg	2500.30		
Concentration of Sample 1st Duplicate, mg/L	50006.00		
Concentration of Sample 2nd Duplicate, mg/L	50006.00		
Water/Moisture Content in Sample, %	10.50		
Dry matter in sample, 1st duplicate, mg/L	44756.37		
Dry matter in sample, 2nd duplicate, mg/L	44755.37		
Rebaudioside A		Stevioside	
Multiplier	1.00	Multiplier	0.83
Area of RebaA in sample 1st duplicate	2529.88	Area of Stev in sample 1st duplicate	5656.76
Area of RebaA in sample 2nd duplicate	2563.99	Area of Stev in sample 2nd duplicate	5852.18
Content of RebaA in Sample 1st Duplicate, % DB	2.24	Content of Stev in Sample 1st Duplicate, % DB	4.14
Content of RebaA in Sample 2nd Duplicate, % DB	2.26	Content of Stev in Sample 2nd Duplicate, % DB	4.15
Mean Content of RebaA in Sample, % DB	2.25	Mean Content of Stev in Sample, % DB	4.14
%RSD of RebaA content in Sample	0.70	%RSD of Stev content in Sample	0.33
Rebaudioside C		Dulcoside A	
Multiplier	0.98	Multiplier	0.82
Area of RebC in sample 1st duplicate	1044.26	Area of DulA in sample 1st duplicate	0.00
Area of RebC in sample 2nd duplicate	1057.95	Area of DulA in sample 2nd duplicate	0.00
Content of RebC in Sample 1st Duplicate, % DB	0.96	Content of DulA in Sample 1st Duplicate, % DB	0.00
Content of RebC in Sample 2nd Duplicate, % DB	0.91	Content of DulA in Sample 2nd Duplicate, % DB	0.00
Mean Content of RebC in Sample, % DB	0.91	Mean Content of DulA in Sample, % DB	0.00
%RSD of RebC content in Sample	0.86	%RSD of DulA content in Sample	#DIV/0!
Rebaudioside D		Rebaudioside B	
Multiplier	1.17	Multiplier	0.83
Area of RebD in sample 1st duplicate	0.00	Area of RebB in sample 1st duplicate	0.00
Area of RebD in sample 2nd duplicate	0.00	Area of RebB in sample 2nd duplicate	0.00
Content of RebD in Sample 1st Duplicate, % DB	0.00	Content of RebB in Sample 1st Duplicate, % DB	0.00
Content of RebD in Sample 2nd Duplicate, % DB	0.00	Content of RebB in Sample 2nd Duplicate, % DB	0.00
Mean Content of RebD in Sample, % DB	0.00	Mean Content of RebB in Sample, % DB	0.00
%RSD of RebD content in Sample	#DIV/0!	%RSD of RebB content in Sample	#DIV/0!
Total Content of Steviol Glycosides, % DB	7.30		

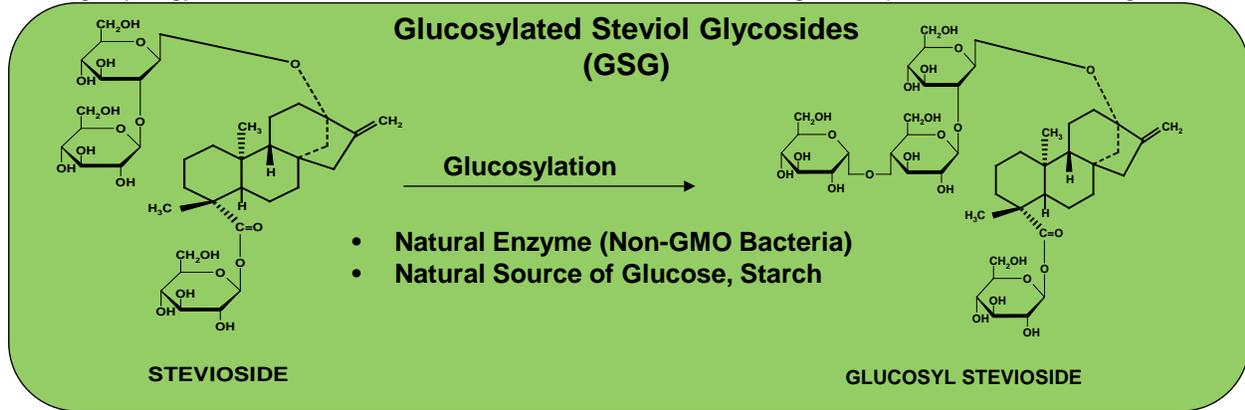
Appendix H Test Methods for Maximum Usage Levels

PureCircle GSG- A Flavor with Modifying Properties (FMP)

Introduction

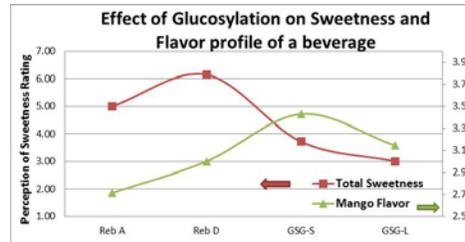
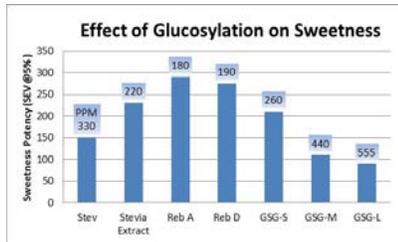
PureCircle GSG (Glucosylated Steviol Glycosides) is produced by treating the raw materials, steviol glycosides, extracted from the Stevia plant, and starch, extracted from tapioca, with a natural enzyme. The enzyme transfers glucose units from starch to the steviol glycosides. The enzyme is produced by means of fermentation using non-GMO bacteria. The process does not use any solvents or processing aides not approved for use in food processing. The enzyme treatment can yield multiple glucosylation (1-20 additional glucose units) of steviol glycosides. GSG is made from stevia extract containing predominantly Rebaudioside A, and/or Stevioside (see below).

PureCircle GSG is developed to have the following attributes: (1) possess significantly reduced sweetness intensity than the starting steviol glycosides, (2) modify flavour profile in application, and (3) optimize sweetness intensity profile through synergy with other caloric and non-caloric sweetener and food ingredient present in food/beverage matrix.



Glucosylation to Reduce Sweetness and Modify Flavour

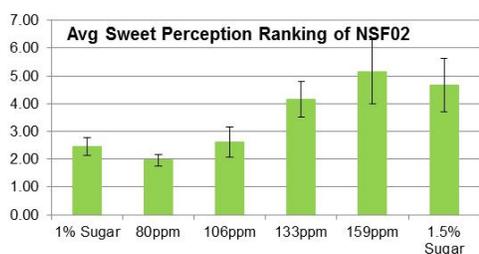
GSG can be made from stevia extract (combination of steviol glycosides) or from refined steviol glycoside, as example stevioside or Reb A. With an increase in the number of glucose units in steviol glycoside molecules, the sweetness intensity increases and taste/flavour profile improves. However, the relative sweetness decreases significantly with increase of glucose units beyond a certain level. To evaluate the sweetness potency of steviol glycosides (with different number of glucose unit attached to steviol molecule), a test was conducted to estimate the sweetness perception (at 5% sugar equivalent sweetness) with stevioside (with 3 Glucose units or SvG3), mixture of steviol glycosides (Stevia extract, mainly SVG3 and SvG4), Reb A (SvG4), Reb D (SvG5), GSG-S (SvG5 & SvG6), GSG-M (Mixture of SvGn, where n=5-13) and GSG-L (Mixture of SvGn, where n=5-20). Also, performed a test to estimate the effect on perception of sweetness and flavour profile in a beverage application with a selected stevia-derived products as shown below.



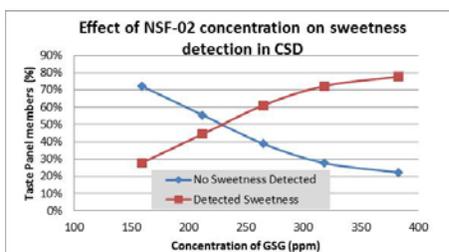
Sweetness Detection of PureCircle GSG

To use GSG as a flavoring ingredient, it is imperative to understand the threshold concentration of the ingredient at which there is insignificant sweetness contribution, but perform as a flavor with modifying property in food and beverage application. Since the main objective is to determine the sweetness perception and detection the threshold level at which there is no significant sweetness, consumer panels (rather trained panel) were used in the following tests. It is generally accepted in industry that such flavor with modifying property should contribute less sweetness than that of 1.5% sugar solution in water.

- **Sweetness Detection in Aqueous Solution:** Thirty-three consumer panel members evaluated a series of aqueous solutions of sucrose and GSG at room temperature; the sucrose solutions of 1.0% & 1.5% concentration and GSG solutions with concentrations ranging between 80 and 160 ppm were prepared with filter water. Sweetness detection is derived in water at room temperature. The panel members were asked to rank solutions containing GSG or sugar from the least (1) to highest (6). The sweetness detection of GSG in water was at a concentration higher than 106 ppm and below 133 ppm. The detection limit is considered at 125 ppm. The methodology and details of the test is covered in Appendix of this report.
- **Sweetness detection in a Sparkling Beverage:** Eighteen consumer panel members participated in a sensory test to detect sweetness in five lemon-lime Carbonated Soft Drink (CSD) samples sweetened with different amount of GSG ranging between 150 and 400 ppm. The percentage of panel members who detected the sweetness for each sample was calculated and plotted (as shown below). More than 50% panel members could detect sweetness in samples containing greater than 250 ppm of GSG. The methodology and details of the test is covered in Appendix of the report.



Detection limit in water is 125 ppm



Detection limit in CSD (2.9 pH) is 250 ppm

- **Sweetness detection in a Sparkling Beverage:** The potency ranges between 60 and 125 times sweeter than sugar in the test range. The details of the test and results are summarized in the Appendix

•

A group of scientists under the auspices of the Flavor & Extract Manufacturing Association (FEMA) investigated the perception of sweetness threshold of different flavoring compounds and developed a sensory methodology, which defined the sweetness perception threshold of a bi-functional flavoring ingredient that should be less than 1.5% sugar-equivalent sweetness. The methodology was published in Food Technology (Harman et al, 2013).

Sweetness Perception Threshold Of PureCircle GSG

Application: Neutral Water
Client: Internal/Design Team

The sweetness perception of 1.5% sugar solution and different solutions of GSG were tested with a consumer panel and found that **125 ppm of GSG solution in water** provided sweetness perception significantly lower than that of 1.5% sugar solution

METHODOLOGY

• Nature of Participants:	Company employees
• Number of Sessions	1
• Number of Participants:	30
• Test Design:	2- AFC, Balanced, randomized within pair. Blind
• Sensory Test Method:	Intensity ratings
• Environmental Condition	Standard booth lighting
• Attributes and Scales:	Which sample is sweeter?
• Statistical Analysis:	Paired comparison Test
• Sample Size	~1.5 oz. in a clear capped plastic cup
• Serving Temperature	Room temperature (~70°F)
• Serving/Panelists Instruction:	Samples served simultaneously. Panelists instructed to read ingredient statement, evaluate each sample.

This is a re-evaluation of the recognition threshold concentration to follow methodology outlined in section 1.4.2 of the “Guidance for the Sensory Testing of Flavorings with Modifying Properties within the FEMA GRAS™ Program”.

DATA: n=30					
Two-Tailed Analysis Table Report for Result				Binomial Distribution Probability	
	1.5% Sugar	115 ppm of GSG	Percent Frequency Sample 1	P-value	Sig
PC	23	7	76.7%	0.0052	***
% Frequency	76.7%	23.3%			
Analysis: The panel found that 1.5% sugar solution had significantly higher sweetness perception compared to the 115 ppm solution of PureCircle GSG					

DATA: n=30					
Two-Tailed Analysis Table Report for Result				Binomial Distribution Probability	
	1.5% Sugar	125 ppm of GSG	Percent Frequency Sample 1	P-value	Sig
PC	21	9	70.0%	0.0428	***
% Frequency	70.0%	30.0%			
Analysis: The panel found that 1.5% sugar solution had significantly higher sweetness perception compared to the 125 ppm solution of PureCircle GSG					

DATA: n=30					
Two-Tailed Analysis Table Report for Result				Binomial Distribution Probability	
	1.5% Sugar	135 ppm of GSG	Percent Frequency Sample 1	P-value	Sig
PC	19	11	63.3%	0.2005	
% Frequency	63.3%	36.7%			
Analysis: The panel found that 1.5% sugar solution had higher sweetness perception compared to the 135 ppm solution of PureCircle GSG. But the difference of sweetness perception was not statistically significant					

*The following table has been approved by FEMA as the guidance for the use levels for different applications.

Food Category	Anticipated Usual Use Level (ppm)	Maximum Use Level (ppm)
Baked Goods	150	400
Beverages Type I, Non-alcoholic	125	250
Beverages Type II, Alcoholic	125	250
Breakfast cereals	200	500
Cheese	100	200
Chewing Gum	500	1000
Condiments & Relishes	125	250
Confectionery & Frostings	50	100
Fats & oils	125	250
Frozen Dairy	125	250
Fruit Ices	125	250
Gelatins & Puddings	125	250
Gravies	125	250
Hard Candy	100	300
Imitation Dairy Products	125	250
Instant Coffee & Tea	125	250
Jams & Jellies	150	300
Milk products	150	300
Nut Products	200	400
Other grains	100	200
Processed Fruits	150	400
Processed Vegetables	100	200
Reconstituted Vegetables	150	300
Seasonings & Flavors	200	400
Snack Foods	150	300
Soft Candy	100	300
Soups	150	300
Sugar Substitutes	300	800
Sweet Sauce	200	400

Sweetness Detection in Aqueous Solution

Summary

Thirty-three consumer panel members evaluated a series of aqueous solutions of sucrose and GSG at room temperature; the sucrose solutions of 1.0% & 1.5% concentration and GSG solutions with concentrations ranging between 80 and 160 ppm were prepared with filter water. The objective of the test was to determine the sweetness detection limit of GSG.

- The sweetness detection of GSG in water was at a concentration higher than 106 ppm and below 133 ppm
- The detection limit is considered at 125 ppm

Methodology

The samples were coded and presented in random order to panel members to taste and rank them from “least sweet” (rank 1) to the “most sweet” (rank 6). Panelists were asked to focus only on sweet attribute of those samples and to use cracker and water in order to cleanse the palate between samples.

• Nature of Participants:	Company employees
• Number of Sessions	2
• Number of Participants:	33
• Test Design:	Randomized samples. Blind
• Sensory Test Method:	Perception of sweetness rating
• Environmental	Standard room lighting
• Attributes and Scales:	
• Forced ranking samples according to perception of sweetness where 1 = Least sweet perception 6 = Most sweet perception	
• Statistical Analysis:	ANOVA (by Block)
• Sample Size	~2.0 oz. in a clear capped 3.5 oz. plastic drinking cup
• Serving Temperature	Room temperature (~20°C)
• Serving/Panelists Instruction:	Samples served simultaneously. Panelists were instructed to taste and rank them from least to most sweet perception.

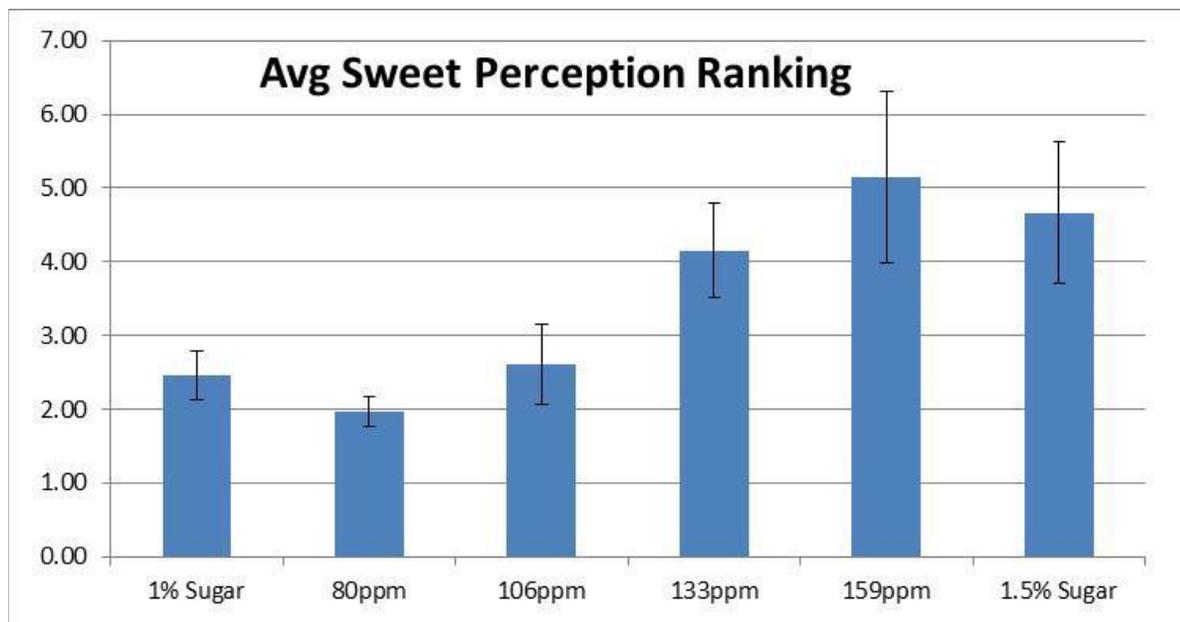
Result & Analysis:

The ranking of all samples by 33 consumer panel members is presented in Table 2. The average and standard deviation of the numerical ranking of each sample containing either sucrose or GSG are graphically presented in Fig. 3. The overall sweetness of those samples was barely detectable. The ranking shows that 80 ppm GSG solution was the least sweet sample and the sample with 159 ppm GSG ranked as the sweetest samples.

Table 2: Ranking of samples by panel members

Samples	Least sweet					Most sweet
	Ranked 1st (n)	Ranked 2nd (n)	Ranked 3rd (n)	Ranked 4th (n)	Ranked 5th (n)	Ranked 6th (n)
1.0% Sugar	6	16	4	4	3	0
80 ppm GSG	15	9	5	3	1	0
106 ppm GSG	9	2	16	5	1	0
133 ppm GSG	0	3	5	12	10	3
159 ppm GSG	1	0	1	5	10	16
1.5% Sugar	2	3	2	4	8	14

Fig. 3: Average sweet perception ranking of aqueous samples with sucrose and GSG



Sweetness Detection PureCircle GSG in a Typical Beverage Formulation

Summary

Eighteen consumer panel members participated in a sensory test to detect sweetness in five lemon-lime Carbonated Soft Drink (CSD) samples sweetened with different amount of GSG ranging between 150 and 400 ppm. The percentage of panel members who detected the sweetness for each sample was calculated and plotted as shown in Figure 3. More than 50% panel members could detect sweetness in samples containing more than 250 ppm of GSG.

Sample Preparation

The CSD samples were made with 50g syrup (Table 3), GSG solution and required amount of carbonated water to make 300 ml beverage for different level of GSG concentration. The GSG concentration in the five test samples were 159, 212, 265, 318 and 383 ppm.

Table 3: Syrup formulation for CSD

Water	246.3014
Citric Acid	2.25
Lemon Lime Flavor-RC	1.67
Sodium Benzoate	0.4
Potassium Citrate	0.4
Xanthan Gum	0.17
Total (wt.)	251.1914

Methodology

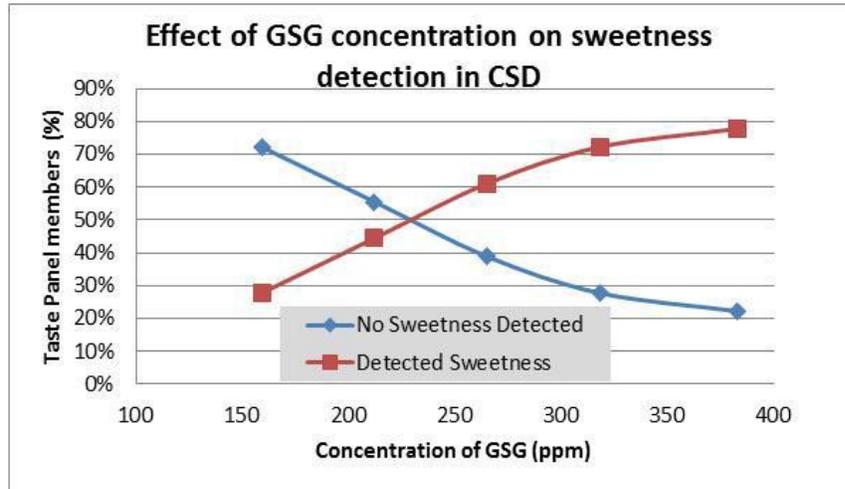
All five test samples were coded and presented to panel members in random order to detect sweetness. Crackers and water were provided in order to cleanse the palate between each sample. The panel members were asked to indicate in which samples they could detect sweetness, the choice of response was Yes or No.

Nature of Participants:	Company employees
Number of Session	1
Number of Participants:	18 (55% Male, 45% Female)
Test Design:	Randomized samples. Blind
Sensory Test Method:	Sweet perception- Forced choice
Environmental Condition	Standard room lighting
Attributes and Scales:	Detection of Sweetness; Forced choice- Yes/No
Sample Size	~2.0 oz. in a clear capped 3.5 oz. plastic drinking cup
Serving Temperature	Room temperature (~20°C)
Serving/Panelists Instruction:	Samples served simultaneously. Panelists were instructed to taste and note whether they can detect any sweetness.

Result

The majority of panel members (56%) could not detect sweetness at 212 ppm of GSG (NSF-02) and 39% panel members could not detect sweetness at 265 ppm GSG. Fig. 4 shows the GSG concentration vs the percentage of the panel members who could (or not) detect sweetness in the carbonated soft drink sample sweetened with GSG only.

Figure 4: Detection of sweetness in CSD sample with GSG



The detection of sweetness perception of GSG is 125 ppm in water and 250 ppm in a CSD beverage. In other beverages, the GSG concentration may be different, but these limits can be used as a practical guidance as the usual and maximum use limits of GSG in beverage as a flavor modifier.

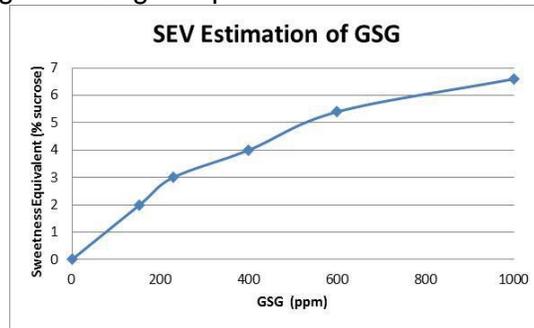
Sweetness Equivalence of GSG

Aqueous solutions of GSG at various concentrations ranging between 100 ppm and 1000 ppm were prepared using bottled water that was acidified to a pH of 3.3 using citric acid. Samples were evaluated by the judges at room temperature (70-72°F).

The judges were 10 panelists that have been previously qualified for their taste acuity and trained in the use of sweetness intensity rating scale. The evaluations were done in duplicate using the same panelists. Prior to the conduct of the study, judges were presented with sugar controls prepared with the acidified water for the intensity rating on the ballot referencing 2, 4, 6 and 8 on the evaluation scale. These solutions were provided to the judges in order to refresh the judge's memory with the intensity ratings. The evaluation was done in duplicate so that a total of 20 data points were generated for each sample. Samples were given to the judges sequentially and coded with triple digit numbers. The order of sample presentation was randomized to avoid order of presentation bias. Water and unsalted crackers were provided in order to cleanse the palate.

Results were statistically analyzed to generate standard deviation value for each solution as well as confidence level at 95% level. The sweetness equivalence value at different concentration is plotted in Figure 9. The potency ranges between 60 and 125 times sweeter than sugar in the test range.

Figure 9: Sugar Equivalence Value of GSG



Appendix I Sensory Report

Apple Blueberry Juice Drink with Glucosyl Steviol Glycosides

- a. Evaluation: SEA10321
- b. ICAM Number: 00120956
- c. Application: Fruit Juice Beverage
- d. Panel Date: 11 August 2010

Client: Internal/Design Team

SUMMARY

Thirty-six consumer panel members evaluated two samples of apple blueberry flavored juice drink for overall acceptance and attribute intensities (overall flavor, berry flavor, sweetness, tartness, bitterness and lingering sweet aftertaste intensity). The two samples included: 1) a full sugar control sample containing no Glucosyl Steviol Glycosides (GSG) and 2) a reduced sugar test sample containing GSG. The objective of the test was to determine if the addition of Glucosyl Steviol Glycosides affects the flavor profile of a reduced sugar juice drink. The results indicated:

- The Test sample had significantly more berry flavor intensity than the Control sample (at 90% confidence). Directionally, the Test sample was also more acceptable for overall flavor vs. the Control sample ($p=0.1075$).
 - There was no significant difference in overall flavor, sweetness, tartness, bitterness or lingering sweet aftertaste intensities between the two samples (at 90% confidence).
-

PROJECT OBJECTIVE

The project objective is to assess if the addition of stevia extract solids has an effect on key flavor attributes in various beverage applications.

TEST OBJECTIVE

The test objective is to determine if the flavor profile and overall acceptance of a Control sample of apple blueberry juice (containing no stevia extract solids) differs from a 30% reduced sugar Test sample of the same beverage (containing stevia extract solids).

METHODOLOGY

• Nature of Participants:	Company employees
• Number of Sessions	1
• Number of Participants:	36
• Test Design:	Balanced, randomized within pair. Blind
• Sensory Test Method:	Intensity and acceptance ratings
• Environmental Condition	Standard booth lighting
• Attributes and Scales:	

<ul style="list-style-type: none"> Overall Acceptance on a 9-pt hedonic scale where 9 = Like Extremely, 5 = Neither Like Nor Dislike, and 1 = Dislike Extremely 	
<ul style="list-style-type: none"> Overall Flavor, Berry Flavor, Sweetness, Tartness, Bitterness and Lingering Sweet Aftertaste Intensity on a 11-pt continuous intensity scale where 0 = Imperceptible and 10 = Extremely Pronounced 	
<ul style="list-style-type: none"> Open Ended General Comments 	
<ul style="list-style-type: none"> Gender and Age 	
<ul style="list-style-type: none"> Statistical Analysis: 	ANOVA (by Block) with Post Hoc Duncan's Test
<ul style="list-style-type: none"> Sample Size 	~1.5 oz. in a clear capped plastic cup
<ul style="list-style-type: none"> Serving Temperature 	Refrigerated temperature (~45°F)
<ul style="list-style-type: none"> Serving/Panelists Instruction: 	Samples served simultaneously. Panelists instructed to read ingredient statement, evaluate each sample.

SAMPLES

1. Sample	Description Flavor	Use Level (% AC)
Control	Apple Juice Concentrate	6.20%
	Blueberry Juice Concentrate	0.75%
	Apple and blueberry flavor	0.86 %
	Sugar	5.60 %
Test	Apple Juice Concentrate	6.20 %
	Blueberry Juice Concentrate	0.75%
	Apple and blueberry flavor	0.86 %
	Sugar	3.90 %
	Glucosyl Steviol Glycosides	0.017 %

Samples were prepared on 8/10/10.

RESULTS

Table 1 (below) summarizes the overall acceptance and mean attribute intensity results for each sample.

Table 1: Mean Scores

Attribute	Control	Test	P-Value
Overall Flavor Acceptance	6.31	6.78	0.1075
Overall Flavor Intensity	6.78	7.00	0.3837
Berry Flavor Intensity	6.56b	7.04a	0.0675
Sweetness Intensity	6.30	6.22	0.7816
Tartness/Acidity Intensity	5.34	5.43	0.7764
Bitterness Intensity	3.49	3.17	0.2645
Lingering Sweet Aftertaste Intensity	5.20	4.96	0.4295

- The Test sample had significantly more berry flavor intensity than the Control sample (at 90% confidence). Directionally, the Test sample was also more acceptable for overall flavor vs. the Control sample ($p=0.1075$).
- There was no significant difference in overall flavor, sweetness, tartness, bitterness or lingering sweet aftertaste intensities between the two samples (at 90% confidence).

Panelist general comments are summarized in Table 2 (below) where N = the number of panelists making a particular comment.

Table 2: Panelist General Comments

<u>Control</u>	<u>N</u>	<u>Test</u>	<u>N</u>
Good	5	Tart	5
Bitter/metallic taste	3	Sweet	3
Astringent/harsh/burn	3	Good	3
Sweet	2	Balanced	2
Odd/off note	2		

CONCLUSION

Thirty-six Consumer panel members evaluated two samples of apple blueberry flavored juice drink for overall acceptance and attribute intensities (overall flavor, berry flavor, sweetness, tartness, bitterness and lingering sweet aftertaste intensity). The two samples included: 1) a full sugar control sample containing no GSG and 2) a reduced sugar test sample containing GSG. The objective of the test was to determine if the addition of GSG affects the flavor profile of a reduced sugar juice drink. The results indicated:

- The Test sample had significantly more berry flavor intensity than the Control sample (at 90% confidence). Directionally, the Test sample was also more acceptable for overall flavor vs. the Control sample ($p=0.1075$).
- There was no significant difference in overall flavor, sweetness, tartness, bitterness or lingering sweet aftertaste intensities between the two samples (at 90% confidence).

Appendix A – Demographics

Age/Gender	N	%
18-24 Years	10	27.8
25-34 Years	10	27.8
35-44 Years	3	8.3
45-54 Years	5	13.9
55-64 Years	8	22.2
TOTAL	36	100.0
Male	14	38.9
Female	22	61.1

Lemon Poppy Seed Muffins with Glucosyl Steviol Glycosides

- a. Evaluation: SEA10337
- b. ICAM Number: 00120956
- c. Application: Baked Good
- d. Panel Date: 19 August 2010

Client: Internal/Design Team

SUMMARY

Thirty-five Consumer panel members evaluated two samples of lemon poppy seed muffins for overall acceptance and attribute intensities (overall flavor, lemon flavor, sweetness, tartness and bitterness intensity). The two samples included: 1) a Control sample containing no Glucosyl Steviol Glycosides (GSG) and 2) a Test sample containing GSG. The objective of the test was to determine if the addition of Glucosyl Steviol Glycosides affects/improves the flavor profile of a lemon poppy seed muffin. The results indicated:

- The Test sample (containing Glucosyl Steviol Glycosides) had significantly more overall flavor intensity and sweetness intensity than the Control (at 90% confidence).
 - There was no significant difference in overall flavor acceptance, lemon flavor intensity, tartness intensity or bitterness intensity between the two samples (at 90% confidence). Directionally, the Test sample was more acceptable overall and had more lemon flavor intensity than the Control (p values = 0.124 and 0.190 respectively).
 - Based on panelist comments, the Control sample had less lemon flavor than the Test sample.
-

PROJECT OBJECTIVE

The project objective is to determine if the addition of Glucosyl Steviol Glycosides has an effect on key flavor attributes and/or improves flavor perception in various applications.

TEST OBJECTIVE

The test objective is to determine if the flavor profile and overall acceptance of a Control sample of lemon poppy seed muffin (containing no Glucosyl Steviol Glycosides) differs from a Test sample of the same muffin (containing Glucosyl Steviol Glycosides).

METHODOLOGY

• Nature of Participants:	Company employees
• Number of Sessions	1
• Number of Participants:	35
• Test Design:	Balanced, randomized within pair. Blind
• Sensory Test Method:	Intensity and acceptance ratings
• Environmental Condition	Standard booth lighting
• Attributes and Scales:	
	<ul style="list-style-type: none"> • Overall Acceptance on a 9-pt hedonic scale where 9 = Like Extremely, 5 = Neither Like Nor Dislike, and 1 = Dislike Extremely • Overall Flavor, Lemon Flavor, Sweetness, Tartness and Bitterness Intensity on a 11-pt continuous intensity scale where 0 = Imperceptible and 10 = Extremely Pronounced • Open Ended General Comments • Gender and Age
• Statistical Analysis:	ANOVA (by Block) with Post Hoc Duncan's Test
• Sample Size	¼ muffin (~14 grams) in a 3.5 oz. plastic soufflé cup
• Serving Temperature	ambient temperature (~68°F)
• Serving/Panelists Instruction:	Samples served simultaneously. Panelists instructed to read ingredient statement, evaluate each sample.

SAMPLES

Ingredients	Control (%)	Test (%)
AP Flour	24.37	24.35
Milk	24.01	23.99
Sugar	23.16	23.14
Vegetable Oil	14.79	14.78
Eggs	9.54	9.53
Poppy Seeds	1.00	1.00
Lemon Flavor	0.83	0.83
Salt	0.72	0.71
Lemon Juice	0.59	0.59
Vanilla Extract	0.52	0.52
Baking Powder	0.48	0.48
GSG		0.07
TOTAL	100.00	100.00

Samples were provided by the client (PureCircle) and received week of August 16, 2010.

RESULTS

Table 1 (below) summarizes the overall acceptance and mean attribute intensity results for each sample.

Table 1: Mean Scores

Attribute	<u>Control</u> (Sugar Only)	<u>Test</u> (Sugar + Glucosyl Steviol Glycosides)	P-Value
Overall Flavor Acceptance	6.60	7.00	0.124
Overall Flavor Intensity	5.71b	6.37a	0.086
Lemon Flavor Intensity	5.44	6.15	0.190
Sweetness Intensity	5.29b	5.95a	0.011
Tartness/Acidity Intensity	3.70	3.49	0.453
Bitterness Intensity	2.03	2.27	0.340

- The Test sample (containing Glucosyl Steviol Glycosides) had significantly more overall flavor intensity and sweetness intensity than the Control (at 90% confidence).
- There was no significant difference in overall flavor acceptance, lemon flavor intensity, tartness intensity or bitterness intensity between the two samples (at 90% confidence). Directionally, the Test sample was more acceptable overall and had more lemon flavor intensity than the Control (p values = 0.124 and 0.190 respectively).

Panelist general comments are summarized in Table 2 (below) where N = the number of panelists making a particular comment.

Table 2: Panelist General Comments

<u>Control</u> (Sugar Only)	<u>N</u>	<u>Test</u> (Sugar + GSG)	<u>N</u>
Low lemon	7	Good/good lemon	4
Good/good lemon	3	Low lemon	3
Dry	2		

CONCLUSION

Thirty-five Consumer panel members evaluated two samples of lemon poppy seed muffins for overall acceptance and attribute intensities (overall flavor, lemon flavor, sweetness, tartness and bitterness intensity). The two samples included: 1) a Control sample containing no Glucosyl Steviol Glycosides (GSG) and 2) a Test sample containing GSG. The objective of the test was to determine if the addition of Glucosyl Steviol Glycosides affects/improves the flavor profile of a lemon poppy seed muffin. The results indicated:

- The Test sample (containing Glucosyl Steviol Glycosides) had significantly more overall flavor intensity and sweetness intensity than the Control (at 90% confidence).
- There was no significant difference in overall flavor acceptance, lemon flavor intensity, tartness intensity or bitterness intensity between the two samples (at 90% confidence).

Directionally, the Test sample was more acceptable overall and had more lemon flavor intensity than the Control (p values = 0.124 and 0.190 respectively).

- Based on panelist comments,
 1. the Control sample had less lemon flavor than the Test sample,
 2. the Control sample had less blueberry flavor than the Test sample.
 3. The Control sample was judged as having significantly more intense astringency

Appendix A – Demographics

Age/Gender	N	%
18-24 Years	4	11.4
25-34 Years	7	20.0
35-44 Years	10	28.6
45-54 Years	6	17.1
55-64 Years	8	22.9
TOTAL	35	100.0
Male	15	42.9
Female	20	57.1

Strawberry Topping with Glucosyl Steviol Glycosides

- a. Evaluation: SEA10331
- b. ICAM Number: 00120956
- c. Application: Fruit Spread
- d. Panel Date: 17 August 2010

Client: Internal/Design Team

SUMMARY

Twenty-eight Consumer panel members evaluated two samples of strawberry flavored reduced sugar topping for overall acceptance and attribute intensities (overall flavor, fresh strawberry flavor, sweetness, tartness and bitterness intensity). The two samples included: 1) a control sample sweetened with sugar and Rebaudioside A containing no Glucosyl Steviol Glycosides (GSG) and 2) a test sample sweetened with sugar and Rebaudioside A containing GSG. The objective of the test was to determine if the addition of GSG affects/improves the flavor profile of strawberry flavored topping. The results indicated:

- There was no significant difference in overall flavor acceptance, overall flavor intensity, fresh strawberry flavor intensity, sweetness intensity or tartness intensity (at 90% confidence).
 - The test sample was significantly less bitter than the control (at 90% confidence).
-

PROJECT OBJECTIVE

The project objective is to determine if the addition of Glucosyl Steviol Glycosides has an effect on key flavor attributes and/or improves flavor perception in various applications.

TEST OBJECTIVE

The test objective is to determine if the flavor profile and overall acceptance of a Control sample of strawberry topping (containing no GSG) differs from a Test sample of the same topping (containing GSG).

METHODOLOGY

• Nature of Participants:	Company employees
• Number of Sessions	1
• Number of Participants:	28
• Test Design:	Balanced, randomized within pair. Blind
• Sensory Test Method:	Intensity and acceptance ratings
• Environmental Condition	Standard booth lighting
• Attributes and Scales:	
• Overall Acceptance on a 9-pt hedonic scale where 9 = Like Extremely, 5 = Neither Like Nor Dislike, and 1 = Dislike Extremely	

<ul style="list-style-type: none"> Overall Flavor, Fresh Strawberry Flavor, Sweetness, Tartness and Bitterness Intensity on a 11-pt continuous intensity scale where 0 = Imperceptible and 10 = Extremely Pronounced 	
<ul style="list-style-type: none"> Open Ended General Comments 	
<ul style="list-style-type: none"> Gender and Age 	
<ul style="list-style-type: none"> Statistical Analysis: 	ANOVA (by Block) with Post Hoc Duncan's Test
<ul style="list-style-type: none"> Sample Size 	~0.5 oz. in a clear capped 1 oz. plastic cup
<ul style="list-style-type: none"> Serving Temperature 	Refrigerated temperature (~45°F)
<ul style="list-style-type: none"> Serving/Panelists Instruction: 	Samples served simultaneously. Panelists instructed to read ingredient statement, evaluate each sample.

SAMPLES

Ingredients	Control (%)	Test (%)
Sugar	39.23	39.18
Water	29.43	29.39
Diced Strawberries	15.44	15.42
Strawberry Juice	15.44	15.42
Pectin	0.26	0.26
Potassium Benzoate	0.10	0.10
RebA	0.06	0.06
Citric Acid	0.05	0.05
GSG		0.022
TOTAL	100.00	100.00

- Samples were provided by the client (Purecircle) and received week of August 16, 2010.

RESULTS

Table 1 (below) summarizes the overall acceptance and mean attribute intensity results for each sample.

Table 1: Mean Scores

Attribute	Control (Sugar and Reb A)	Test (Sugar + Reb A + GSG)	P-Value
Overall Flavor Acceptance	6.18	6.36	0.4079
Overall Flavor Intensity	6.74	6.94	0.3416
Fresh Strawberry Flavor Intensity	5.29	5.24	0.8707
Sweetness Intensity	7.99	8.19	0.5043
Tartness/Acidity Intensity	3.24	3.18	0.8152
Bitterness Intensity	2.39a	1.85b	0.0916

- There was no significant difference in overall flavor acceptance, overall flavor intensity, fresh strawberry flavor intensity, sweetness intensity or tartness intensity (at 90% confidence).
- The test sample was significantly less bitter than the control (at 90% confidence).

Panelist general comments are summarized in Table 2 (below) where N = the number of panelists making a particular comment.

Table 2: Panelist General Comments

Control (Sugar and Reb A)	N	Test (Sugar + Reb A + GSG)	N
Very sweet	4	Very sweet	3
Weak flavor	2	Weak flavor	2
Fresher strawberry	2		
Metallic/bitter	2		

CONCLUSION

Twenty-eight Consumer panel members evaluated two samples of strawberry flavored topping for overall acceptance and attribute intensities (overall flavor, fresh strawberry flavor, sweetness, tartness and bitterness intensity). The two samples included: 1) a control sample containing no Glucosyl Steviol Glycosides and 2) a test sample containing Glucosyl Steviol Glycosides. The objective of the test was to determine if the addition of Glucosyl Steviol Glycosides affects/improves the flavor profile of strawberry flavored topping. The results indicated:

- There was no significant difference in overall flavor acceptance, overall flavor intensity, fresh strawberry flavor intensity, sweetness intensity or tartness intensity (at 90% confidence).
- The test sample was significantly less bitter than the control (at 90% confidence).

Appendix A – Demographics

Age/Gender	N	%
18-24 Years	6	21.4
25-34 Years	7	25.0
35-44 Years	4	14.3
45-54 Years	4	14.3
55-64 Years	7	25.0
TOTAL	28	100.0
Male	16	57.1
Female	12	42.9

Banana Flavored Milk Drink with Glucosyl Steviol Glycosides

- a. Evaluation: SEA10332
- b. ICAM Number: 00120956
- c. Application: Dairy Beverage
- d. Panel Date: 18 August 2010

Client: Internal/Design Team

SUMMARY

Thirty-two Consumer panel members evaluated two samples of reduced sugar banana flavored milk drink for overall acceptance and attribute intensities (overall flavor, banana flavor, dairy flavor, sweetness, tartness and bitterness intensity). The two samples included: 1) a control sample sweetened with sugar and stevia extract (SG95) and containing no Glucosyl Steviol Glycosides (GSG) and 2) a test sample sweetened with sugar and stevia extract (SG95) containing Glucosyl Steviol Glycosides. The objective of the test was to determine if the addition of Glucosyl Steviol Glycosides affects/improves the flavor profile of banana flavored milk drink. The results indicated:

- The Test sample (containing GSG) had significantly more overall flavor intensity, banana flavor intensity, sweetness intensity, tartness intensity and bitterness intensity than the Control sample (at 90% confidence).
 - There was no significant difference in overall flavor acceptance or dairy flavor intensity between the two samples (at 90% confidence).
-

PROJECT OBJECTIVE

The project objective is to determine if the addition of Glucosyl Steviol Glycosides has an effect on key flavor attributes and/or improves flavor perception in various applications.

TEST OBJECTIVE

The test objective is to determine if the flavor profile and overall acceptance of a Control sample of banana flavored milk drink (containing no GSG) differs from a Test sample of the same drink (containing GSG).

METHODOLOGY

• Nature of Participants:	Company employees
• Number of Sessions	1
• Number of Participants:	32
• Test Design:	Balanced, randomized within pair. Blind
• Sensory Test Method:	Intensity and acceptance ratings
• Environmental Condition	Standard booth lighting
• Attributes and Scales:	
• Overall Acceptance on a 9-pt hedonic scale where 9 = Like Extremely, 5 = Neither Like Nor Dislike, and 1 = Dislike Extremely	

<ul style="list-style-type: none"> Overall Flavor, Banana Flavor, Dairy Flavor, Sweetness, Tartness and Bitterness Intensity on a 11-pt continuous intensity scale where 0 = Imperceptible and 10 = Extremely Pronounced 	
<ul style="list-style-type: none"> Open Ended General Comments 	
<ul style="list-style-type: none"> Gender and Age 	
<ul style="list-style-type: none"> Statistical Analysis: 	ANOVA (by Block) with Post Hoc Duncan's Test
<ul style="list-style-type: none"> Sample Size 	~2.0 oz. in a clear capped 3.5 oz. plastic drinking cup
<ul style="list-style-type: none"> Serving Temperature 	Refrigerated temperature (~45°F)
<ul style="list-style-type: none"> Serving/Panelists Instruction: 	Samples served simultaneously. Panelists instructed to read ingredient statement, evaluate each sample.

SAMPLES

Control: Sugar and Stevia Extract (SG95)
 Test: Sugar, Stevia Extract (SG95) & GSG

Ingredients	Control	Test
MILK	97.46	97.46
SUGAR	2.33	2.33
BANANA FLV	0.20	0.20
SG95	0.004	0.004
GSG		0.01
TOTAL	100	100

Samples were provided by the client (Purecircle) and received week of August 16, 2010.

RESULTS

Table 1 (below) summarizes the overall acceptance and mean attribute intensity results for each sample.

Table 1: Mean Scores

Attribute	Control (Sugar + Stevia Extract)	Test (Sugar + Stevia Extract + GSG)	P-Value
Overall Flavor Acceptance	6.09	6.25	0.4198
Overall Flavor Intensity	6.04 ^b	6.70 ^a	0.0697
Banana Flavor Intensity	5.67 ^b	6.43 ^a	0.0211
Dairy Flavor Intensity	5.67	5.72	0.8671
Sweetness Intensity	5.84 ^b	6.54 ^a	0.0110
Tartness/Acidity Intensity	2.00 ^b	2.62 ^a	0.0183
Bitterness Intensity	1.69 ^b	2.13 ^a	0.0558

- The Test sample (containing GSG) had significantly more overall flavor intensity, banana flavor intensity, sweetness intensity, tartness intensity and bitterness intensity than the Control sample (at 90% confidence).
- There was no significant difference in overall flavor acceptance or dairy flavor intensity between the two samples (at 90% confidence).

Panelist general comments are summarized in Table 2 (below) where N = the number of panelists making a particular comment.

Table 2: Panelist General Comments

Control (Sugar + Stevia Extract)	N	Test (Sugar + Stevia Extract + GSG)	N
Too sweet	2	Too sweet	3
Weak flavor	2	Strong banana flavor	2
		Good	2

CONCLUSION

Thirty-two consumer panel members evaluated two samples of banana flavored milk drink for overall acceptance and attribute intensities (overall flavor, banana flavor, dairy flavor, sweetness, tartness and bitterness intensity). The two samples included: 1) a control sample containing no GSGs and 2) a test sample containing Glucosyl Steviol Glycosides. The objective of the test was to determine if the addition of Glucosyl Steviol Glycosides affects/improves the flavor profile of banana flavored milk drink. The results indicated:

- The Test sample (containing GSG) had significantly more overall flavor intensity, banana flavor intensity, sweetness intensity, tartness intensity and bitterness intensity than the Control sample (at 90% confidence).
- There was no significant difference in overall flavor acceptance or dairy flavor intensity between the two samples (at 90% confidence).
- Based on panelists comments:
 1. Control sample had more intense dairy note and lingering dairy taste
 2. Control sample had less lingering banana taste than Test sample

Appendix A – Demographics

Age/Gender	N	%
18-24 Years	2	6.3
25-34 Years	10	31.3
35-44 Years	8	25.0
45-54 Years	7	21.9
55-64 Years	5	15.6
TOTAL	32	100.0
Male	14	43.8
Female	18	56.2

Orange Pineapple Passion Fruit Carbonated Drink With Glucosyl Steviol Glycosides

- a. Evaluation: SEA10322
- b. ICAM Number: 00120956
- c. Application: Carbonated Beverage
- d. Panel Date: 24 August 2010

Client: Internal/Design Team

SUMMARY

Seventeen company employees evaluated two samples of orange pineapple passion fruit flavored carbonated drink for overall acceptance and attribute intensities (overall flavor, orange flavor, pineapple flavor, passion fruit flavor, sweetness, and aftertaste). The two samples included: 1) a full sugar control sample containing no stevia extract solids and 2) a reduced sugar test sample containing stevia extract solids. The objective of the test was to determine if the addition of stevia extract solids affects the flavor profile of a reduced sugar carbonated drink. The results indicated:

- The Test sample had significantly more pineapple flavor intensity than the Control sample (at 95% confidence).
 - The Test sample had significantly more orange flavor intensity, pineapple flavor intensity, and sweetness intensity than the Control sample (at 90% confidence).
 - There was no significant difference in overall flavor, passion fruit intensity, or aftertaste intensity between the two samples (at 90% confidence).
-

PROJECT OBJECTIVE

The project objective is to assess if the addition of stevia extract solids has an effect on key flavor attributes in various beverage applications.

TEST OBJECTIVE

The test objective is to determine if the flavor profile and overall acceptance of a Control sample of orange pineapple passion fruit carbonated drink (containing no stevia extract solids) differs from a reduced sugar Test sample of the same beverage (containing stevia extract solids).

METHODOLOGY

• Nature of Participants:	Company employees
• Number of Sessions	1
• Number of Participants:	17
• Test Design:	Balanced, randomized within pair. Blind
• Sensory Test Method:	Intensity and acceptance ratings
• Environmental Condition	Standard booth lighting
• Attributes and Scales:	
	<ul style="list-style-type: none"> • Overall Acceptance on a 6-pt hedonic scale where 5 = Like and 0 = Dislike
	<ul style="list-style-type: none"> • Overall Flavor, Orange Flavor, Pineapple Flavor, Passion Fruit Flavor, Aftertaste, and Sweetness 6-pt continuous intensity scale where 0 = Imperceptible and 5 = Extremely Pronounced
	<ul style="list-style-type: none"> • Open Ended General Comments
	<ul style="list-style-type: none"> • Gender and Age
• Statistical Analysis:	ANOVA (by Block) with Post Hoc Duncan's Test
• Sample Size	~1.5 oz. in a clear capped plastic cup
• Serving Temperature	Refrigerated temperature (~45°F)
• Serving/Panelists Instruction:	Samples served simultaneously. Panelists instructed to read ingredient statement, evaluate each sample.

SAMPLES

Ingredients	Control (%)	Test (%)
HFCS Isosweet 100 (70.6 Brix)	72.65	72.65
Water	25.90	25.90
Citric	0.66	0.66
Orange BE ZNA	0.20	0.20
Passion Fruit	0.13	0.13
Orange	0.13	0.13
K Benzoate	0.13	0.13
K Citrate	0.13	0.13
Pineapple	0.040	0.040
Malic	0.024	0.024
GSG		0.017
Total	100	100

RESULTS

Table 1 (below) summarizes the overall acceptance and mean attribute intensity results for each sample.

Table 1: Mean Scores

Attribute	Control	Test	P-Value
Overall Flavor Acceptance	3.41	3.35	0.8649
Orange Flavor Intensity	2.41	3.11	0.0608
Pineapple Flavor Intensity	1.82a	2.53b	0.0436
Passion Fruit Intensity	2.19	2.00	0.6730
Aftertaste Intensity	1.82	1.88	0.8874
Sweetness Intensity	2.47	3.00	0.0733

- The Test sample had significantly more pineapple flavor intensity than the Control sample (at 95% confidence).
- The Test sample had significantly more orange flavor intensity, pineapple flavor intensity, and sweetness intensity than the Control sample (at 90% confidence).
- There was no significant difference in overall flavor, passion fruit intensity, or aftertaste intensity between the two samples (at 90% confidence).

Panelist general comments are summarized in Table 2 (below) where N = the number of panelists making a particular comment.

Table 2: Panelist General Comments

<u>Control</u>	<u>N</u>	<u>Test</u>	<u>N</u>
Good/very good	2	Good/very good	4
Less aftertaste	2	More flavor	3
More flavor	1	High acid/carbonation	2
Less carbonation	1	Preferred	2
Good sweetness	1	Diluted flavor	1
		Too sweet	1
		Less sweetness	1

CONCLUSION

Seventeen company employees evaluated two samples of orange pineapple passion fruit flavored carbonated drink for overall acceptance and attribute intensities (overall flavor, orange flavor, pineapple flavor, passion fruit flavor, sweetness, and aftertaste). The two samples included: 1) a full sugar control sample containing no stevia extract solids and 2) a 30% reduced sugar test sample containing stevia extract solids. The objective of the test was to determine if the addition of stevia extract solids affects the flavor profile of a reduced sugar carbonated drink. The results indicated:

- The Test sample had significantly more pineapple flavor intensity than the Control sample (at 95% confidence).

- The Test sample had significantly more orange flavor intensity, pineapple flavor intensity, and sweetness intensity than the Control sample (at 90% confidence).
- There was no significant difference in overall flavor, passion fruit intensity, or aftertaste intensity between the two samples (at 90% confidence).

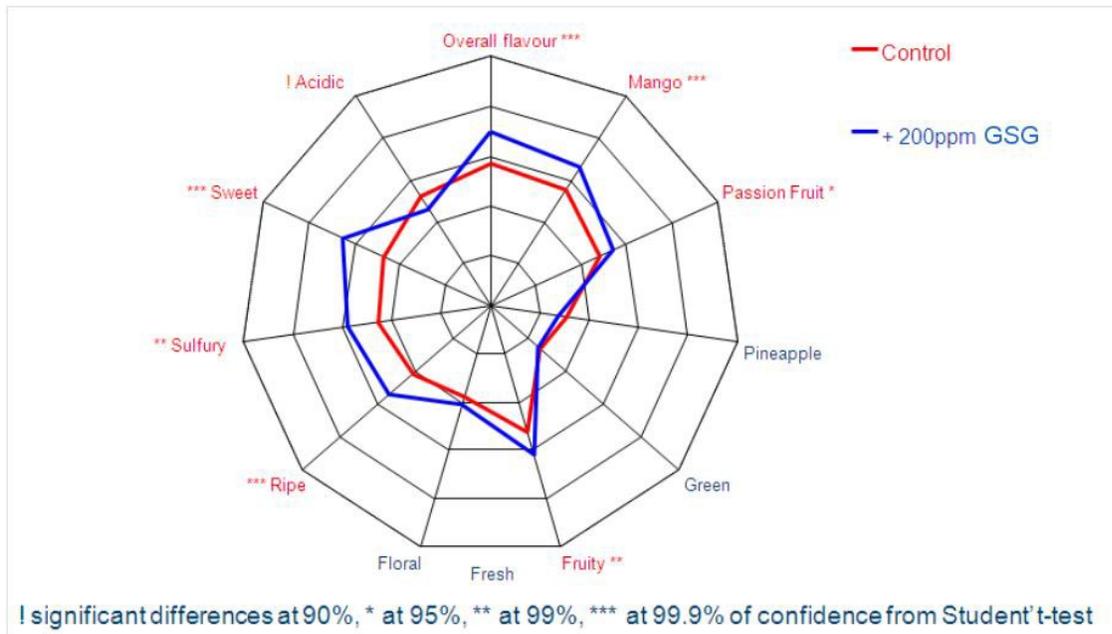
Appendix A – Demographics

Age/Gender	N	%
18-24 Years	2	11.8
25-34 Years	5	29.4
35-44 Years	7	41.2
45-54 Years	3	17.6
55-64 Years	0	0
TOTAL	17	100.0
Male	7	41.2
Female	10	58.8

Carbonated juice drink

GSG was added to modify the sensory attributes of a mixed fruit juice beverage. Thirty five semi-trained (employees) panel evaluated control and the test product for different flavor, acid and sweetness profile. This Juice drink contains sugar from fruit juice and added sugar. The addition of 200ppm of GSG led to more flavor impact and modified differentially the profile with an increase in sweetness perception resulting from the synergy between GSG and the sweet components of the beverage. Note that GSG had significant effect on mango, sulfur and ripe note, which contributed significantly to the overall flavor modification. However, GSG had a little or no effect on other flavor notes as shown in Fig. 6.

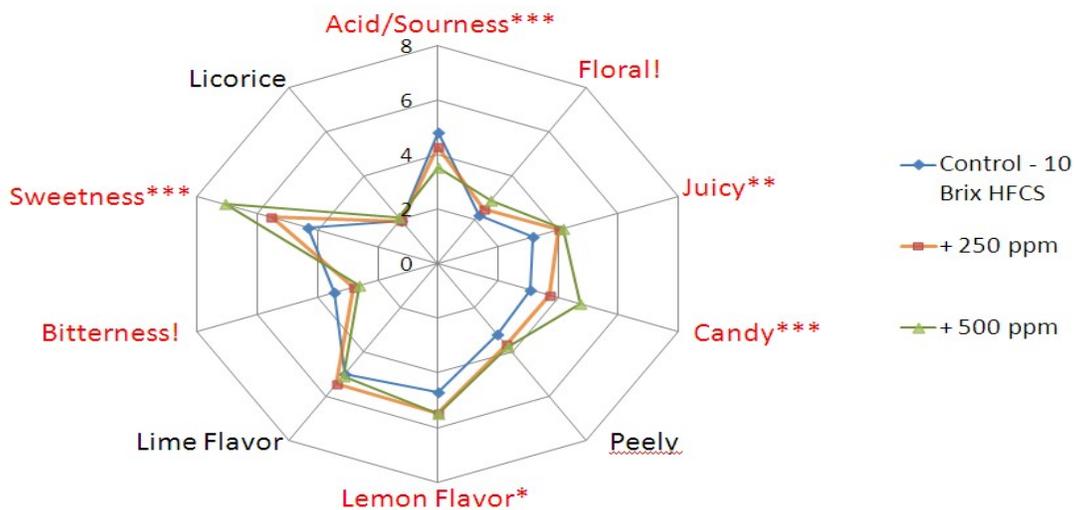
Fig. 6: Effect of GSG on flavor and sweetness profile of a carbonated juice beverage



Carbonated Lemon Drink

Beverages containing 10 Brix of HFCS and 0, 250 and 500ppm of GSG were evaluated by 35 semi-trained (employees) panel. The addition of 250ppm of GSG led to improved overall flavor and taste with significant improvement in several flavor attributes and sweetness perception. Increasing the level of GSG to 500ppm resulted mainly in improvement of sweetness perception and attributes associated with sweetness (Candy). It is concluded that at 500ppm, in this particular case the use of 500ppm is not compatible with a flavor modification. It is however worth noting that in other foods and beverages (and other flavor tonalities) the addition of 500ppm of GSG can have a flavor modification impact with moderate impact on sweetness.

Fig. 7: Contribution of different levels of GSG on the overall flavor and sweetness perception of carbonated lemon drink



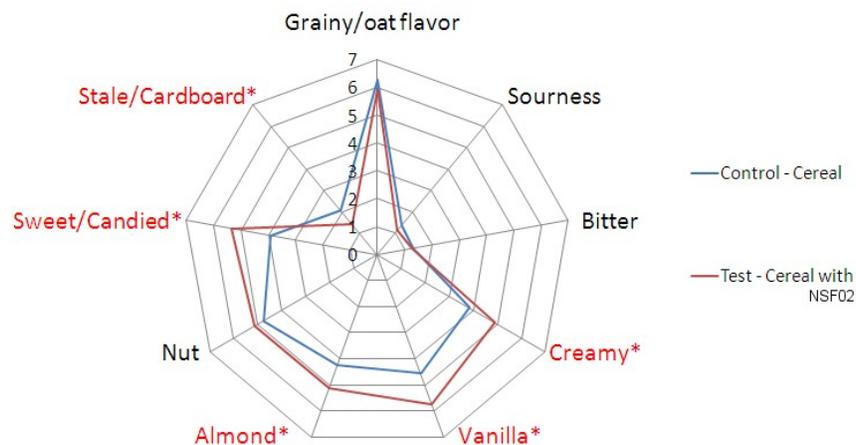
! significantly different at 90%, * at 95%, ** at 99% and *** at 99.9% of confidence from Analysis of Variance

Breakfast cereal

Breakfast cereal coating contains flavor, sweetener/bulking agent to provide different technological function. Breakfast cereal samples were prepared in the lab with and without GSG (400 ppm) incorporated in the cereal coating.

The cereals were evaluated by a semi-trained panel of employees (34 people) by tasting the cereal in milk (25g cereals + 75 of 1% milk). The addition of GSG improved the overall flavor of the product by increasing desirable attribute such as sweet/candied, almond, vanilla and creamy while decreasing the undesirable 'stale/cardboard' descriptor.

Fig. 8: Contribution of GSG on flavor and sweetness perception of breakfast cereal



*significant differences at 95% confidence

Discussion & Conclusion

The detection of sweetness perception of GSG is 125 ppm in water and 250 ppm in a CSD beverage. In other beverages, the GSG concentration may be different, but these limits can be used as a practical guidance as the usual and maximum use limits of GSG as a flavor modifier in beverage.

But the similar limit may not be adequate for semi-solid and dry foods. The consumption of a dry foods calls on an increased level of mastication, with typical residence times in the mouth in the range of 20-30 seconds, depending on size, composition and texture of the food, and the physiology of the consumer. This leads to the incorporation of significant amounts of saliva in the bolus leading to a dilution which can exceed 2 folds dilution in many cases. This justifies an use limit for foods that is 2x greater for solid foods such as breakfast cereals, bakery, snacks, etc. compared to their beverage counterparts which experience a far lower in-mouth residence time and thus dilution with saliva. (See for example: Gavião et al., European Journal of Oral Sciences 112: 19- 24, 2004)

Furthermore, in for some solid foods, the “normal” method of consumption involves an additional pseudo-dilution. An example is breakfast cereals where a typical serving size of 30-40g is typically consumed with the addition of 100-200ml of milk leading to a dilution of 2 to 5 folds on average.

Proposed use levels in different applications

Since the FEMA GRAS approval of GSG in 2010, the product has been tested in a much wider range of products and their contribution to flavor and taste profiles is better understood. Considering the accumulated sensory data and the protocol used for differentiating the functional attributes of a bi-functional ingredient like GSG, the use levels in different food and beverages have been updated as shown in Table 5.

Conclusion

GSG or glucosylated steviol glycosides is made from stevia extract and shows flavor modification characteristics in food and beverages depending on the pH, flavor, acid, sweeteners and other ingredients present in the product matrix. GSG has much lower sweetness potency than steviol glycosides, such as Reb A, stevioside or Reb D and considerably higher flavor modification characteristics. The detectable sweetness of GSG is below 125 ppm in water and below 250 ppm in a typical beverage system. GSG also shows synergistic effect with other caloric and non-caloric sweeteners. The potency ranges between 60 and 125 times sweeter than sugar in the test range. Therefore, GSG can modify flavor profile and increase the sweetness in an application depending on the concentration used. Considering the bi-functional characteristics of GSG and with the accumulated experience with different food and beverage applications, the anticipated and maximum use levels have been reviewed and updated for different categories.

Table 5: Modified Use Level in Food and Beverages (From GRAS 26)

Food Category	Anticipated Usual Use Level (ppm)	Anticipated Maximum Use Level (ppm)
Baked Goods	150	400
Beverages Type I, Non-alcoholic	125	250
Beverages Type II, Alcoholic	125	250
Breakfast cereals	200	500
Cheese	100	200
Chewing Gum	500	1000
Condiments & Relishes	125	250
Confectionery & Frostings	50	100
Egg Products		
Fats & oils	125	250
Fish Products		
Frozen Dairy	125	250
Fruit Ices	125	250
Gelatins & Puddings	125	250
Granulated Sugar		
Gravies	125	250
Hard Candy	100	300
Imitation Dairy Products	125	250
Instant Coffee & Tea	125	250
Jams & Jellies	150	300
Meat Products		
Milk products	150	300
Nut Products	200	400
Other grains	100	200
Poultry		
Processed Fruits	150	400
Processed Vegetables	100	200
Reconstituted Vegetables	150	300
Seasonings & Flavors	200	400
Snack Foods	150	300
Soft Candy	100	300
Soups	150	300
Sugar Substitutes	300	800
Sweet Sauce	200	400

Categories modified by FEMA and published in GRAS 26

Appendix J FEMA Use Levels

Use Levels and Estimated Consumption of PureCircle GSG in Different Food and Beverage Applications					
Food Category	No.	Mean Consumption, g/day*	Anticipated Usual Use Level (ppm)	Anticipated Maximum Use Level (ppm)	PADI mg/person/d**
Baked Goods	1	137.2	150	400	20.58
Beverages Type I, Non-alcoholic	23	104.0	125	250	13.00
Beverages Type II, Alcoholic	24	32.5	125	250	4.06
Breakfast cereals	2	20.0	150	350	3.00
Cheese	6	9.4	100	200	0.94
Chewing Gum	31	0.2	1000	2000	0.20
Condiments & Relishes	15	8.8	100	200	0.88
Confectionery & Frostings	17	0.3	50	100	0.02
Frozen Dairy	7	25.6	150	350	3.84
Fruit Ices	9	0.7	150	300	0.11
Gelatins & Puddings	20	20.4	150	350	3.06
Granulated Sugar	32	8.6	100	200	0.86
Gravies	27	8.3	50	100	0.42
Hard Candy	30	0.6	100	300	0.06
Imitation Dairy Products	28	0.9	50	100	0.05
Instant Coffee & Tea	34	121.1	150	300	18.17
Jams & Jellies	18	5.7	150	400	0.86
Milk products	5	39.5	150	300	5.93
Nut Products	25	5.2	200	500	1.04
Other grains	3	27.8	100	200	2.78
Processed Fruits	8	118.3	150	400	17.75
Processed Vegetables	14	85.0	100	200	8.50
Reconstituted Vegetables	26	0.2	150	300	0.03
Seasonings & Flavors	45	0.01	150	300	0.00
Snack Foods	22	1.3	150	300	0.20
Soft Candy	16	5.8	200	400	1.16
Soups	21	31.7	200	300	6.34
Sugar Substitutes	33	0.08	250	500	0.02
Sweet Sauce	19	6.8	200	400	1.36
TOTAL		*****	*****	*****	115.18
REFERENCE: Market Research Corporation of America (MRCA), in conjunction with the "Food intake and nutritive value of the diets of men, women, and children in the United States, Spring 1965", a preliminary report by the consumer and Food Economics Research Division, Agricultural Research Service, United States Department of Agriculture.					
*Based on MRCA mean frequency of eating and USDA mean portion size					
**PADI, mg/person/day calculated by: (Mean consumption, grams/day) x (Anticipated Usual Use Level, ppm) x 0.001					

SUBMISSION END