

GRAS Notice (GRN) No. 522

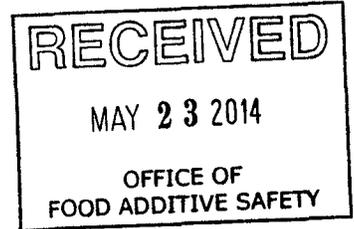
<http://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/NoticeInventory/default.htm>

**ORIGINAL SUBMISSION**



20482 Jacklight Lane  
Bend, OR 97702-3074  
541-678-5522  
mcquate@gras-associates.com

GRN 000522



May 21, 2014

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 – Luo Han Guo Extracts (with  
30%, 50% and 60% Mogroside V Minimum  
Compositions)

Dear Dr. Gaynor:

On behalf of GLG Life Tech Corporation of Vancouver, British Columbia, Canada, we are submitting for FDA review Form 3667 and the enclosed CD containing a GRAS notification for Luo Han Guo Extracts having respective minimum Mogroside V contents of 30%, 50% and 60%. The attached documentation contains the specific information that addresses the safe human food uses for the subject notified substances as discussed in the GRAS guidance document.

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

Based on previous communications with your office on the submission of GRAS notifications that are similar to other GRAS notifications that have been received and reviewed by FDA, we wish to provide some additional information for your consideration. We recognize that GRN 301 and GRN 359 both address compositions that are similar---although not identical---to the three Luo Han Guo compositions that serve as the basis for the subject notification from GLG Life Tech Corporation. However, we have undertaken an extensive in-depth search of the scientific literature to ensure that we are providing an updated and comprehensive review of the pertinent safety studies that serve as the basis for the GRAS finding from our Expert Panel.

We are providing for your review and consideration the Attachment that illustrates the notable differences of the composition of the GLG products compared to previous Luo Han Guo GRAS notifications. In addition, new scientific information is available since the last GRN was submitted on Luo Han Guo---most notably the new information on the metabolism of the components of Luo Han

guo extract (Murata et al., 2010<sup>1</sup>)---and the recent approval by Health Canada<sup>2</sup> certainly adds to the scientific consensus that luo han guo extract is safe.

If additional information or clarification is needed as you and your colleagues proceed with the review, please feel free to contact Dr. Richard C. Kraska (216-470-7280; [kraska@gras-associates.com](mailto:kraska@gras-associates.com)) or me via telephone or email.

We look forward to your feedback.

Sincerely,

(b) (6)

Robert S. McQuate, Ph.D.  
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Enclosures: GRAS Notification for GLG Life Tech Corporation (CD) – Luo Han Guo Extracts (30%, 50% and 60% Minimum Mogroside V Compositions)

FDA Form 3667

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<sup>1</sup> Murata, Y., Ogawa, T., Suzuki, Y. A., Yoshikawa, S., Inui, H., Sugiura, M., Nakano, Y., 2010. Digestion and absorption of *Siraitia grosvenorii* triterpenoids in the rat. *Biosci Biotechnol Biochem* 74(3):673-676

<sup>2</sup> Health Canada, 2013. Consultation Document on Health Canada's Proposal to Enable the Use of a New Food Additive, Monk Fruit Extract (Luo Han Guo Extract), as a Sweetener in Table-Top Sweeteners. Available at <http://www.hc-sc.gc.ca/fn-an/consult/2013-nop-adp-monk-fruit-moines/document-consultation-eng.php> (Accessed April 3, 2014).

## ATTACHMENT

### GLG Life Tech Corporation Product Compositions & Specifications Comparison

Luo Han Guo Extracts (30%, 50% and 60% Minimum Mogroside V Compositions)  
Compared to Product Compositions in GRNs 301 & 359

PARAMETER	LUO HAN GUO BIOVITTORIA GRN301	LUO HAN GUO 25% GUILIN LAYN GRN359	LUO HAN GUO 45% GUILIN LAYN GRN359	LUO HAN GUO 55% GUILIN LAYN GRN359	LUO HAN GUO MV30 GLG	LUO HAN GUO MV50 GLG	LUO HAN GUO MV60 GLG
<b>Mogroside V</b>	≥ 30%	≥ 25%	≥ 45%	≥ 55%	≥ 30.0%	≥ 50.0%	≥ 60.0%
<b>Color</b>	Light Yellow	White	White	White	Light Yellow	Light Yellow	Light Yellow
<b>Odor</b>	Mild fruity	NR	NR	NR	Mild fruity	Mild fruity	Mild fruity
<b>Taste</b>	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
<b>ID</b>	TLC	NR	NR	NR	NR	NR	NR
<b>pH</b>	6.0 ± 0.5	NR	NR	NR	NR	NR	NR
<b>Ash</b>	≤5.0%	< 5%	< 5%	< 5%	≤5.0%	≤5.0%	≤5.0%
<b>Mesh Size</b>	95% through 80 mesh	NR through 80 mesh	NR through 80 mesh	NR through 80 mesh	NR	NR	NR
<b>Bulk Density</b>	0.450-0.800 g/mL	NR	NR	NR	NR	NR	NR
<b>Solubility</b>	Freely soluble in water	NR	NR	NR	NR	NR	NR
<b>Loss on Drying</b>	≤6.0%	< 5%	< 5%	< 5%	≤6.0%	≤6.0%	≤6.0%
<b>Heavy Metal</b>	≤ 20 mg/kg	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg	≤ 10 mg/kg	≤ 10 mg/kg	≤ 10 mg/kg
<b>Arsenic</b>	≤ 0.5 mg/kg	< 0.5 mg/kg	< 0.5 mg/kg	< 0.5 mg/kg	≤ 0.5 mg/kg	≤ 0.5 mg/kg	≤ 0.5 mg/kg
<b>Cadmium</b>	NR	<0.05 mg/kg	<0.05 mg/kg	<0.05 mg/kg	≤ 1 mg/kg	≤ 1 mg/kg	≤ 1 mg/kg
<b>Lead</b>	≤ 1 mg/kg	<0.5 mg/kg	<0.5 mg/kg	<0.5 mg/kg	≤ 1 mg/kg	≤ 1 mg/kg	≤ 1 mg/kg
<b>Mercury</b>	NR	<0.1 mg/kg	<0.1 mg/kg	<0.1 mg/kg	NR	NR	NR
<b>Copper</b>	≤ 5.0 mg/kg	NR	NR	NR	NR	NR	NR
<b>Phosphate organics</b>	≤ 1 mg/kg	NR	NR	NR	NR	NR	NR
<b>Organic residues</b>	≤ 1 mg/kg	NR	NR	NR	NR	NR	NR
<b>Pesticide residues</b>	≤ 1 mg/kg	NR	NR	NR	NR	NR	NR
<b>Aerobic Plate Count</b>	≤ 10,000 cfu/g	<1,000 cfu/g	<1,000 cfu/g	<1,000 cfu/g	< 1,000 cfu/g	< 1,000 cfu/g	< 1,000 cfu/g
<b>Total Yeast &amp; Mold</b>	≤ 100 cfu/g	<100 cfu/g	<100 cfu/g	<100 cfu/g	< 100 cfu/g	< 100 cfu/g	< 100 cfu/g
<b>E. coli</b>	Negative in 25 g	Negative	Negative	Negative	Negative	Negative	Negative
<b>Salmonella</b>	Negative in 25 g	Negative	Negative	Negative	Negative	Negative	Negative
<b>Staphylococcus</b>	Negative in 25 g	Negative	Negative	Negative	Negative	Negative	Negative
<b>Aflatoxins</b>	NR	<0.2 ppb	<0.2 ppb	<0.2 ppb	NR	NR	NR

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

**FDA USE ONLY RECEIVED**  
 GRN NUMBER: 000522  
 DATE OF RECEIPT: MAY 23 2011  
 ESTIMATED DAILY INTAKE  
 INTENDED USE FOR INTERNET  
 NAME FOR INTERNET  
 OFFICE OF FOOD ADDITIVE SAFETY  
 KEYWORDS

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): NA

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**

<b>1a. Notifier</b>	Name of Contact Person Brian R. Meadows	Position President & CFO
	Company ( <i>if applicable</i> ) GLG Life Tech Corporation	
	Mailing Address ( <i>number and street</i> ) 1050 West Pender Street, Suite 2168	

City Vancouver	State or Province British Columbia	Zip Code/Postal Code V6E 3S7	Country Canada
-------------------	---------------------------------------	---------------------------------	-------------------

Telephone Number 604-669-2602 (ext 105)	Fax Number 604-662-8858	E-Mail Address brian.meadows@glglifetech.com
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<b>1b. Agent or Attorney (if applicable)</b>	Name of Contact Person Robert S McQuate	Position CEO
	Company ( <i>if applicable</i> ) GRAS Associates, LLC	
	Mailing Address ( <i>number and street</i> ) 20482 Jacklight Lane	

City Bend	State or Province Oregon	Zip Code/Postal Code 97702-3074	Country United States of America
--------------	-----------------------------	------------------------------------	-------------------------------------

Telephone Number 541-678-5522	Fax Number 541-678-5522 call first	E-Mail Address mcquate@gras-associates.com
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**PART III – GENERAL ADMINISTRATIVE INFORMATION**

**1. Name of Substance**

Luo Han Guo Extracts (with minimum respective Mogroside V levels of 30%, 50% & 60%)

**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 table top sweetener and general purpose non-nutritive sweetener for incorporation into foods other than infant formulas and meat and poultry products.

**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**

	<b>Name of Substance<sup>1</sup></b>	<b>Registry Used (CAS, EC)</b>	<b>Registry No.<sup>2</sup></b>	<b>Biological Source (if applicable)</b>	<b>Substance Category (FOR FDA USE ONLY)</b>
1	Luo Han Guo Extracts  (Mogroside V as primary constituent)	CAS  CAS	Not applicable  88901-36-4	Siraitia grosvenorii Swingle	
2					
3					

<sup>1</sup> 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*)

<sup>2</sup> 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.

Luo han guo extracts are produced as illustrated in Figure 2 on page 12 with a water extraction process that is followed by purification using ethanol to yield the detailed specifications for each of the three extracts provided on pages 13 & 14 within Tables 1A, 1B & 1C that are distinguished by the respective minimum Mogroside V contents of 30%, 50% & 60%.

Key chemical structures are provided on page 10 in Figures 1A & 1B.

**3. Synonyms**

Provide as available or relevant:

1	Monk fruit extracts and various other synonyms are found in Section III.A on page 8.
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 GLG Life Tech Corporation  
(name of notifier)

has concluded that the intended use(s) of Luo Han Guo Extracts (with minimum respective Mogroside V levels of 30%, 50% & 60%)  
(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.  GLG Life Tech Corporation  
(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.

GLG Life Tech Corporation  
(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.

1050 West Pender Street, Suite 2168 Vancouver, British Columbia CANADA V6E 3S7  
(address of notifier or other location)

GLG Life Tech Corporation  
(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**

(b) (6)

**Printed Name and Title**

Robert S McQuate

**Date (mm/dd/yyyy)**

05/21/2014

**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 N---with supporting safety information attached.	

**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.

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## **GRAS ASSESSMENT**

of

### **Luo Han Guo Extracts**

**Food Usage Conditions for General Recognition of Safety**

For

### **GLG Life Tech Corporation**

**1050 West Pender St., Suite 2168  
Vancouver, BC V6E 3S7  
Canada**

Evaluation by

**Richard C. Kraska, Ph.D., DABT  
Robert S. McQuate, Ph.D.  
Madhusudan G. Soni, Ph.D., FACN, FATS**

May 21, 2013



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## **I. GRAS EXEMPTION CLAIM**

### **A. Claim of Exemption From Requirement for Premarket Approval Pursuant to Proposed 21 CFR 170.36(c)(1)<sup>1</sup>**

GLG Life Tech Corporation (“GLG”) has determined that its Luo Han Guo extracts, which meet the specifications described below, are Generally Recognized As Safe (GRAS) in accordance with Section 201(s) of the *Federal Food, Drug, and Cosmetic Act*. This determination was made by GLG in concert with experts qualified by scientific training and experience; it is based on scientific procedures as described in the following sections; and the evaluation accurately reflects the conditions of the intended use of this substance in foods.

Signed:

(b) (6)



Robert S. McQuate, Ph.D.  
GRAS Associates, LLC  
20482 Jacklight Lane  
Bend, OR 97702-3074

May 21, 2014

### **B. Name & Address of Notifier**

GLG Life Tech Corporation  
1050 West Pender St., Suite 2168  
Vancouver, BC V6E 3S7 Canada

As the notifier, GLG Life Tech Corporation (“GLG”) accepts responsibility for the GRAS determination that has been made for its Luo Han Guo extracts, as described in the subject notification. Consequently, the Luo Han Guo extracts meeting the conditions described herein are exempt from premarket approval requirements for food ingredients.

### **C. Common Name & Identity of Notified Substance**

The common name of the notified substance is Luo Han Guo extract. Also see Section III.A.

### **D. Conditions of Intended Use in Food**

Luo Han Guo extracts are intended to be added into various food categories at per serving levels that reflect good manufacturing practices principles in that the quantities added to foods should not

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<sup>1</sup> See 62 FR 18938 (17 April 1997). Accessible at <http://www.gpo.gov/fdsys/pkg/FR-1997-04-17/pdf/97-9706.pdf>. Accessed on April 21, 2014.

exceed the amounts reasonably required to accomplish its intended technical effect. Also see Section IV.

### **E. Basis for GRAS Determination**

Pursuant to 21 CFR 170.30, the Luo Han Guo extracts have been determined to be GRAS on the basis of scientific procedures as discussed in the detailed description provided below. A comprehensive literature search conducted through April 12, 2014 was used in the preparation of this safety evaluation.

### **F. Availability of Information**

The data and information that serve as the basis for this GRAS notification will be sent to the US Food and Drug Administration (FDA) upon request or will be available for review and copying at reasonable times at the offices of GRAS Associates, LLC, located at 20482 Jacklight Lane, Bend, OR 97702-3074.

## **II. INTRODUCTION**

### **A. Objective**

At the request of GLG, GRAS Associates, LLC has undertaken an independent safety evaluation of Luo Han Guo extracts for use in foods. The purpose of the evaluation is to ascertain whether or not the intended food uses of Luo Han Guo extracts can be considered to be generally recognized as safe (GRAS) when used as components in various food products.

### **B. Foreword**

GLG provided information on intended use, specifications for the manufactured materials and manufacturing information. Determining how much of the Luo Han Guo extracts can be safely consumed by virtue of the intended uses and use levels is critical in the determination of safe exposure levels for the Luo Han Guo extracts. The composite safety/toxicity studies, in concert with exposure information, constitute the critical information components that form the basis of the GRAS evaluation.

The safety/toxicity studies, consumption/exposure information, and other related documentation supplied by GLG were augmented with an independent search of the scientific and regulatory literature conducted through April 12, 2014. Based upon the composite information, a GRAS assessment based primarily on available safety information with corroborative information based on common occurrence in food was undertaken. Those references that were deemed pertinent to the objective at hand are listed in Section VIII.

### C. FDA Regulatory Framework

Ingredients for use in foods must undergo premarket approval by FDA as food additives or, alternatively, the ingredients to be incorporated into foods must be determined to be generally recognized as safe (GRAS). The authority to make GRAS determinations is not restricted to FDA. In fact, GRAS determinations may be provided by experts who are qualified by scientific training and experience to evaluate the safety of food and food ingredients under the intended conditions of use.

In 1997, FDA altered the GRAS determination process by eliminating the formal GRAS petitioning process while replacing the petitioning process with a notification procedure. While outlining the necessary content to be considered in making a GRAS determination, FDA encouraged that such determinations be provided to FDA in the form of a notification. However, notifying FDA of such determinations is strictly voluntary.

### D. Regulatory History of Luo Han Guo & Its Extracts

Luo Han Guo (LHG) is the fruit of the perennial vine *Siraitia grosvenorii*. LHG is native to southern China, the Indo-China Peninsula, and Indonesia and was first brought to the US by Asian railroad workers in the 1800s. Currently, extracts of LHG fruit, also known as monk fruit, are found in a variety of products including beverages, foods, table-top sweeteners, and oral care products. LHG is also available in dietary supplements with available products having servings of LHG extract at 3.5 g or higher.

On March 4, 1996, HerbaSwy Laboratories, Inc. submitted a New Dietary Ingredient notification, assigned Code No. Rpt 3, to the FDA for their intended use of “Lo Han Kuo Extract” as an ingredient in dietary supplements with levels of 60-300 mg in a fluid supplement (HerbaSwy Laboratories, Inc., 1996). The extract was identified only as a “fruit extract of *Siraitia grosvenorii* S.” FDA filed this notice without comment.

On October 6, 1999, Nature’s Marvel International filed its NDI notice, assigned Code No. Rpt 57, indicating their intent to use “Lo Han Kuo Fruit Extract” as a sweetener (Nature’s Marvel International, 1999). The FDA rejected this notice, concluding that this use is incongruent with the definition of a dietary ingredient provided by DSHEA. FDA did not address the safety of the proposed use.

LHG extract is reported to be used as a sweetening agent in several countries, including Japan, China, Australia and New Zealand. In addition, in 1996, the Luo Han Guo mogrosides were approved as a sweetening agent by the Chinese government (BioVittoria, 2009). Mogroside V, the principal sweetening component of Luo Han Guo, is approved as an intense sweetener in Japan and New Zealand (Cantox, 2010).

In July 2009, BioVittoria Ltd., Hamilton, New Zealand, submitted a GRAS notification (GRN 301) to FDA for the use of Luo Han Guo fruit extract in conventional foods (BioVittoria, 2009). The notice indicated that Luo Han Guo fruit extract is to be used as a stand-alone sweetener or a food ingredient, excluding meat and poultry products, and as a component of sweetener blends that can be added to foods or used as table-top sweeteners. The estimated daily intake was determined to be

up to 6.8 mg/kg bw/day. This represents an extremely conservative estimate of intake as it is based on the assumption that the Luo Han Guo fruit extract will capture the entire intense sweetener market. FDA (FDA, 2010) issued a “no questions” letter for GRN 301 on January 15, 2010.

On October 10, 2010, Guilin Layn Natural Ingredient Corporation of Guangxi, China submitted a GRAS notification to FDA for the use of Luo Han Guo fruit extract for use in conventional foods (Guilin Layn, 2010). On April 11, 2011, FDA (FDA, 2011) issued a “no questions” letter for GRN 359. In March 2011, at the 43<sup>rd</sup> session of the Joint FAO/WHO Food (JEFCA) Standards Program/Codex Committee on Food Additives, Luo Han Guo extract was placed on the priority list of food additives proposed for evaluation. The Calorie Control Council (CCC) requested a safety evaluation and establishment of specifications for Luo Han Guo extract and confirmed that the data would be available in December of 2012 (FAO, 2011).

On March 14, 2013, Health Canada proposed adding monk fruit extract to the *List of Permitted Sweeteners*. Monk fruit was added to Health Canada’s *List of Permitted Sweeteners* on December 2, 2013 as Item M.4. Monk fruit extract was authorized for use in Canada as a table-top sweetener at a maximum use level of 0.8% calculated as Mogroside V (Health Canada, 2013).

In March 2014, the 46<sup>th</sup> session of the Joint FAO/WHO Food (JECFA) Standards Program/Codex Committee on Food Additives, maintained Luo Han Guo extract on the priority list of substances proposed for evaluation, as proposed by the US, with data availability projected for December 2014 (FAO, 2014).

### **III. INGREDIENT IDENTITY, CHEMICAL CHARACTERIZATION, MANUFACTURING PROCESS & PURITY**

#### **A. Common or Usual Name & Identity of Notified Substance**

The common or usual names of the Luo Han Guo<sup>2</sup> fruit that is the subject of this GRAS evaluation include: Luo Han Guo, LHG, Lo Han Kuo, Arhat Fruit, Fructus Momordicae, Momordicae Grosvenorii Fructus, monk fruit, and longevity fruit. The specific substances that are the subjects of this safety evaluation are identified as Luo Han Guo extracts as produced and sold by GLG under the trade names: Luo Han Guo Extract MV 30; Luo Han Guo Extract MV 50; and Luo Han Guo Extract MV 60. The subject extracts are mixtures of components found in the Luo Han Guo fruit. The compositional features of LHG extracts are described in more detail in Section III.

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<sup>2</sup> Historically the spelling of Luo Han Guo has varied. In order to be historically accurate, we have used the spelling used by the authors in our review. Two common spellings frequently used are simply “Lo Han” or “Luo Han.”

## B. Chemical Name

As the subject substance is a mixture of compounds naturally occurring in the Luo Han Guo fruit, it does not have a single CAS registry number. However, Mogroside V is the major sweetening component found in the fruit. The CAS number for Mogroside V is 88901-36-4.

## C. Chemical Identity of Luo Han Guo

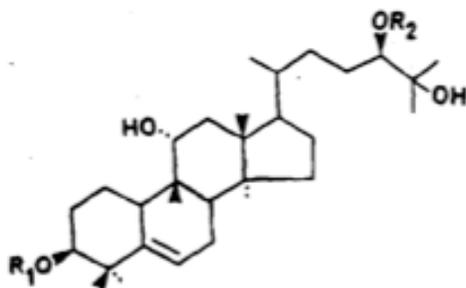
Luo Han Guo is a fruit derived from a perennial, dioecious, herbaceous climbing vine, *Siraitia grosvenorii* Swingle, which is native to the Guangxi region of China. This vine has also been previously referred to as *Thladiantha grosvenorii* Swingle and *Momordica grosvenorii* Swingle. The original description of the Luo Han Guo plant was published by W.T. Swingle in 1941 after an expedition to China. Swingle (1941) described the cultivated variety of the plant as a climbing vine with bifid tendrils and tuberous, perennial roots. He named the plant *Momordica Grosvenorii*. In 1979, Charles Jeffrey moved Luo Han from the genus *Momordica* to *Thladiantha*, and then to *Siraitia* in 1980. The fruit, which is a member of the cucumber or melon family, has been consumed in China for thousands of years.

A variety of compounds have been extracted from *S. grosvenorii*, including triterpenoids, flavonoids, polysaccharides, proteins, and essential oils (Li et al., 2014). The most remarkable characteristic of Luo Han Guo is its unique sweetness, which has been attributed to compounds in the triterpenoid chemical family: mogrosides for various glycosylated compounds, and mogrols for aglycones (Takemoto et al., 1983, Kasai et al., 1989). The compounds identified in the LHG plant include:

- pentaglycoside-conjugated mogrosides, including mogroside V (M-V), 11-oxo-mogroside V (11-oxo-M-V), and 7-oxomogroside V (7oxoM-V);
- tetraglycoside-conjugated mogrosides, including mogroside IV (M-IV), 11-oxomogroside IV A, and siamenoside I (S-I);
- triglycoside-conjugated mogrosides, including mogroside III (M-III), 11-deoxymogroside III, and mogroside III A<sub>2</sub>; and,
- diglycoside-conjugated mogrosides, including mogroside II (M-II), mogroside II A<sub>1</sub>, 7-oxomogroside II E (7-oxo-MIIE), and 11-oxomogroside II A<sub>1</sub> (Takemoto et al., 1983, Matsumoto et al., 1990, Akihisa et al., 2007).

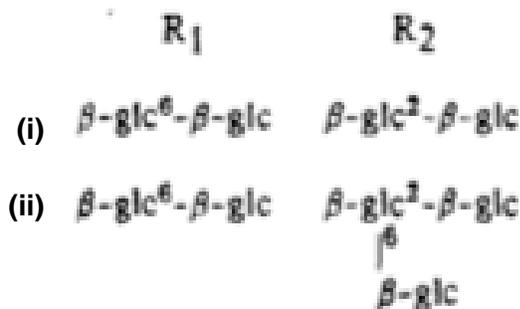
The compounds M-V, 11-oxo-M-V, M-IV, S-I, and M-III have been reported to be 378, 68, 300, 465, and 195 times sweeter than sucrose, respectively (Matsumoto et al., 1990). The chemical structure of the mogroside backbone molecule is given in Figure 1A, whereas Figure 1B depicts the side chains and positions of glucose (glc) substitution of mogroside IV and mogroside V.

**Figure 1A. Backbone Structure of Mogroside Molecule<sup>a</sup>**



<sup>a</sup> From Kinghorn, A.D. and Soejarto, D.D.,1989.

**Figure 1B. Side Chain Structures Corresponding to (i) Mogroside IV and (ii) Mogroside V<sup>a</sup>**



<sup>a</sup> From Kinghorn, A.D. and Soejarto, D.D.,1989.

A study by Makapugay et al. (1985) indicated that the mogroside V content of the whole, dried Luo Han Guo fruit ranges from 0.81% - 1.29% (w/w), whereas Li et al. (2014) report a mogroside V range of 0.5%-1.4%. Hussain et al. (1990) determined the saccharide and polyol constituents of *Thladiantha grosvenorii* and reported the saccharide and polyol content of the fruit to be about 2.4% (w/w). Of the saccharides and polyol constituents, fructose was reported to be over 70% of the content, followed by myo-inositol at about 8%.

#### D. Manufacturing Process

The source of GLG Luo Han Guo extracts of interest is the Luo Han Guo fruit (Monk fruit). The manufacturing process employed by GLG is fairly typical to that yielding Luo Han Guo extract products (Pawar et al., 2013). The food grade ethanol used in the purification process complies with FCC's 8th Edition specifications. The ion exchange resins and adsorption polymeric resins used in the manufacturing process comply with 21 CFR 173.65. The GLG Luo Han Guo extracts are

prepared in accordance with Good Manufacturing Practices (GMP) requirements. Specifications and certificates of analysis for resins and solvents used in the manufacturing process are provided in Appendix A.

GLG has developed a state-of-the-art process for extracting Luo Han Guo mogrosides from the fruit of selected varieties of Luo Han Guo plants. GLG Luo Han Guo extracts are obtained by the extraction of fresh fruits with deionized water (at 80°C). Clarificant is added to the extract solution to facilitate precipitation. The extraction solution is passed through plate filtration followed by an adsorption resin column; the extracted mogrosides are subsequently eluted with food grade ethanol, and concentrated under partial vacuum (at 60°C) with a film evaporator to remove ethanol. The concentrated solution is passed through cation and anion exchange resin columns, and then the solution is decolorized with activated carbon and filtered. The resulting filtrate is concentrated by means of a film evaporator under partial vacuum and spray dried to obtain the Luo Han Guo mogrosides extract powders. A flow chart of GLG's extraction process is provided in Figure 2.

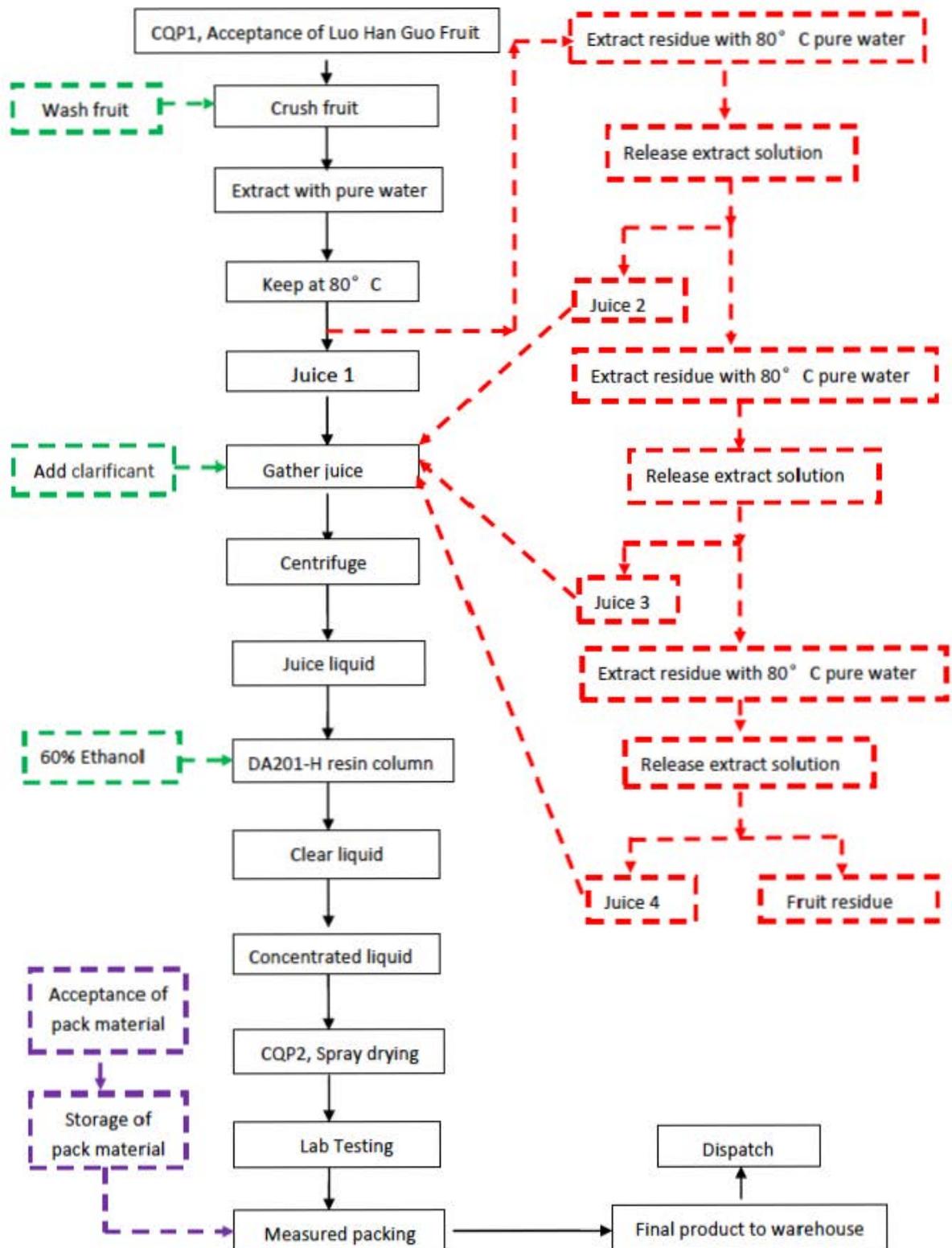
GLG utilizes the Luo Han Guo extracts to manufacture products that are marketed under the trade names: Luo Han Guo Extract MV 30; Luo Han Guo Extract MV 50; and Luo Han Guo MV 60. These products contain minimums of 30%, 50%, and 60% mogroside V, respectively.

## **E. Product Specifications & Supporting Methods**

### **1. GLG Specifications for Luo Han Guo Extracts**

GLG has established the specifications for the typical composition, the minimum mogroside content, and the maximum microbiological and heavy metal levels for its Luo Han Guo extracts. The stated specifications for the Luo Han Guo extracts are intended to demonstrate the food grade status of the final product. The food-grade specifications for GLG's Luo Han Guo extracts are listed in Tables 1A-1C, along with results of analyses performed by GLG on five production batches. The balance of the extract consists of moisture and protein fragments from the fruit, as shown for a representative sample of MV 50 in Table ID.

Figure 2. Flow Chart for the Manufacturing Process of GLG Luo Han Guo Extracts



**Table 1A. Luo Han Guo MV 30 Extract Physical Properties & Specifications**

PHYSICAL & CHEMICAL PARAMETERS	GLG SPECIFICATIONS LUO HAN GUO MV 30	RESULTS OF BATCH NUMBERS				
		GLG-MV 30-131001	GLG-MV 30-20131005	GLG-MV 30-20131010	GLG-MV 30-20131012	GLG-MV 30-20131018
Appearance	Light yellow powder	Conform	Conform	Conform	Conform	Conform
Odor	Mild fruity characteristic	Conform	Conform	Conform	Conform	Conform
Taste	Sweet	Conform	Conform	Conform	Conform	Conform
Mogroside V (HPLC, ODB)	≥ 30.0% (w/w)	30.5%	30.4%	31.4%	31.7%	31.6%
Loss on Drying	≤ 6.0%	2.8%	2.9%	2.6%	2.8%	2.7%
Residue on Ignition	≤ 5.0%	1.1%	1.2%	1.1%	1.2%	1.2%
Heavy metals	≤ 10.0 mg/kg	1.1 mg/kg	1.3 mg/kg	1.3 mg/kg	1.5 mg/kg	1.6 mg/kg
Lead	≤ 1.0 mg/kg	0.06 mg/kg	0.04 mg/kg	0.07 mg/kg	0.05 mg/kg	0.6 mg/kg
Arsenic	≤ 0.5 mg/kg	0.04 mg/kg	0.03 mg/kg	0.03 mg/kg	0.04 mg/kg	0.3 mg/kg
Cadmium	≤ 1.0 mg/kg	0.03 mg/kg	0.05 mg/kg	0.04 mg/kg	0.05 mg/kg	0.3 mg/kg
Total Plate Count (cfu/g)	< 1,000	< 10	< 10	< 10	< 10	< 10
Yeast & Mold (cfu/g)	< 100	< 10	< 10	< 10	< 10	< 10
<i>E. coli</i> (MPN/g)	Negative	Negative	Negative	Negative	Negative	Negative
<i>Staphylococcus aureus</i> (cfu/g)	Negative	Negative	Negative	Negative	Negative	Negative
Salmonella (cfu/25 g)	Negative	Negative	Negative	Negative	Negative	Negative

ODB = on dry basis

**Table 1B. Luo Han Guo MV 50 Extract Physical Properties & Specifications**

PHYSICAL & CHEMICAL PARAMETERS	GLG SPECIFICATIONS LUO HAN GUO MV 50	RESULTS OF BATCH NUMBERS				
		GLG-MV 50-20131101	GLG-MV 50-20131103	GLG-MV 50-20131105	GLG-MV 50-20131110	GLG-MV 50-20131115
Appearance	Light yellow powder	Conform	Conform	Conform	Conform	Conform
Odor	Mild fruity characteristic	Conform	Conform	Conform	Conform	Conform
Taste	Sweet	Conform	Conform	Conform	Conform	Conform
Mogroside V (HPLC, ODB)	≥ 50.0% (w/w)	51.6%	51.3%	51.7%	51.4%	51.6%
Loss on Drying	≤ 6.0%	2.7%	2.6%	2.8%	2.7%	2.8%
Residue on Ignition	≤ 5.0%	1.2%	1.1%	1.3%	1.1%	1.2%
Heavy metals	≤ 10.0 mg/kg	1.3 mg/kg	1.5 mg/kg	1.3 mg/kg	1.4 mg/kg	1.5 mg/kg
Lead	≤ 1.0 mg/kg	0.02 mg/kg	0.03 mg/kg	0.02 mg/kg	0.03 mg/kg	0.4 mg/kg
Arsenic	≤ 0.5 mg/kg	0.04 mg/kg	0.03 mg/kg	0.02 mg/kg	0.04 mg/kg	0.3 mg/kg
Cadmium	≤ 1.0 mg/kg	0.07 mg/kg	0.06 mg/kg	0.05 mg/kg	0.05 mg/kg	0.6 mg/kg
Total Plate Count (cfu/g)	< 1,000	< 10	< 10	< 10	< 10	< 10
Yeast & Mold (cfu/g)	< 100	< 10	< 10	< 10	< 10	< 10
<i>E. coli</i> (MPN/g)	Negative	Negative	Negative	Negative	Negative	Negative

<i>Staphylococcus aureus</i> (cfu/g)	Negative	Negative	Negative	Negative	Negative	Negative
Salmonella (cfu/25 g)	Negative	Negative	Negative	Negative	Negative	Negative

ODB = on dry basis

**Table 1C. Luo Han Guo MV 60 Extract Physical Properties & Specifications**

PHYSICAL & CHEMICAL PARAMETERS	GLG SPECIFICATIONS LUO HAN GUO MV60	RESULTS OF BATCH NUMBERS				
		GLG-MV 60-20131201	GLG-MV 60-20131206	GLG-MV 60-20131210	GLG-MV 60-20131213	GLG-MV 60-20131220
Appearance	Light yellow powder	Conform	Conform	Conform	Conform	Conform
Odor	Mild fruity characteristic	Conform	Conform	Conform	Conform	Conform
Taste	Sweet	Conform	Conform	Conform	Conform	Conform
Mogroside V (HPLC, ODB)	≥ 60.0% (w/w)	61.6%	61.4%	61.6%	61.2%	61.4%
Loss on Drying	≤ 6.0%	2.7%	2.8%	2.6%	2.8%	2.6%
Residue on Ignition	≤ 5.0%	1.2%	1.1%	1.2%	1.1%	1.2%
Heavy metals	≤ 10.0 mg/kg	1.3 mg/kg	1.4 mg/kg	1.3 mg/kg	1.3 mg/kg	1.3 mg/kg
Lead	≤ 1.0 mg/kg	0.04 mg/kg	0.04 mg/kg	0.05 mg/kg	0.04 mg/kg	0.4 mg/kg
Arsenic	≤ 0.5 mg/kg	0.03 mg/kg	0.04 mg/kg	0.03 mg/kg	0.03 mg/kg	0.3 mg/kg
Cadmium	≤ 1.0 mg/kg	0.04 mg/kg	0.05 mg/kg	0.06 mg/kg	0.02 mg/kg	0.3 mg/kg
Total Plate Count (cfu/g)	< 1,000	< 10	< 10	< 10	< 10	< 10
Yeast & Mold (cfu/g)	< 100	< 10	< 10	< 10	< 10	< 10
<i>E. coli</i> (MPN/g)	Negative	Negative	Negative	Negative	Negative	Negative
<i>Staphylococcus aureus</i> (cfu/g)	Negative	Negative	Negative	Negative	Negative	Negative
Salmonella (cfu/25 g)	Negative	Negative	Negative	Negative	Negative	Negative

ODB = on dry basis

**Table 1D. Typical Nutritional Composition for Luo Han Guo Extracts<sup>a</sup>**

COMPONENT	TYPICAL ANALYSES LUO HAN GUO
Protein	12.2 g/100 g
Ash	0.73 g/100 g
Sodium	567.56 mg/kg
Potassium	142.82 mg/kg
Calcium	1366.28 mg/kg
Iron	Not Detected
Phosphorus	Not Detected
Total fat	0.04 g/100 g
Saturated fat	0.03 g/100 g

Mono-unsaturated fat	0.01 g/100 g
Multi-unsaturated fat	Not Detected
Trans fat	Not Detected
Cholesterol	Not Detected
Glucose	Not Detected
Fructose	Not Detected
Sucrose	Not Detected
Maltose	Not Detected
Lactose	Not Detected
Vitamin A	Not Detected
Vitamin C	3.0 mg/100 g
Moisture	2.67 g/100 g
Dietary Fiber	0.1 g/100 g
Carbohydrate (by calculation)	84.3 g/100 g
Energy (by calculation)	1643 kJ/100 g

<sup>a</sup> Based upon results obtained for Luo Han Guo Extract-MV 50,  
Lot GLG-MV 50-20131101.

The quantitative analyses of mogroside V in Luo Han Guo extracts are carried out according to the methods described in Appendix B. The mogroside V content of Luo Han Guo extracts is determined by HPLC using standard pure mogroside V. HPLC chromatograms of the mogroside V standard and five representative lots of each Luo Han Guo material are provided in Appendices C-F. The certificates of analysis for the five representative lots of each Luo Han Guo extract, reported above, are provided in Appendices G-I. The typical composition testing report is provided in Appendix J. The pesticide analysis report is provided in Appendix K.

The collection of these reports demonstrates that the Luo Han Guo extracts are well characterized and meet the established purity criteria.

## 2. Stability Data of Luo Han Guo Extracts

Stability of the GLG's Luo Han Guo extracts was analyzed in shelf-stability testing. Five batches of Luo Han Guo extracts (30%, 50%, and 60% mogroside V) were stored at 25°C ± 5°C at a relative humidity of 60% ± 5% for 0, 2, 4, 6, and 8 weeks. The stability samples were then tested for mogroside V by HPLC and microbial parameters. A summary of the shelf-stability results is presented in Table 2. A detailed stability report is provided in Appendix L.

**Table 2. Luo Han Guo Extracts Storage Stability Data**

DURATION	MOGROSIDE V (% DRY BASIS)			TOTAL PLATE COUNT	SALMONELLA	E. COLI	STAPHYLOCOCCUS
	GLG-MV 30-20131005	GLG-MV 50-20131115	GLG-MV 60-20131210				
t=0	31.6	51.7	61.6	< 10cfu/g	Negative	Negative	Negative
2 weeks	31.5	51.8	61.7	< 10cfu/g	Negative	Negative	Negative
4 weeks	31.4	51.6	61.5	< 10cfu/g	Negative	Negative	Negative
6 weeks	30.9	51.3	61.4	< 10cfu/g	Negative	Negative	Negative
8 weeks	30.9	51.4	61.3	< 10cfu/g	Negative	Negative	Negative

### 3. Sweetness Equivalence of Luo Han Guo Extracts

GLG conducted sweetness equivalence evaluations to compare its Luo Han Guo extracts to sucrose at various concentrations. The results of the comparison are summarized in Table 3. The sweetness equivalence report is provided in Appendix M.

**Table 3. Sweetness Intensity of GLG Luo Han Guo Preparations Relative to Sucrose**

PRODUCT	SWEETNESS INTENSITY
GLG-MV 30	180
GLG-MV 50	250
GLG-MV 60	280

## IV. INTENDED FOOD USES & DIETARY EXPOSURE

### A. Intended Food Uses

The subject Luo Han Guo extracts, containing mogroside V as the principal sweetening component, are intended to be used as a table-top sweetener and as a general purpose non-nutritive sweetener in various foods other than in infant formulas and in meat and poultry products. The intended use will be as a non-nutritive sweetener as defined in 21 CFR 170.3(o)(19).<sup>3</sup> The intended use levels will vary by food category, but the actual levels are self-limiting due to organoleptic characteristics and consumer taste considerations. However, the amounts of purified Luo Han Guo extracts to be added to foods will not exceed the amounts reasonably required to accomplish its intended technical effect

<sup>3</sup> Non-nutritive sweeteners: Substances having less than 2 percent of the caloric value of sucrose per equivalent unit of sweetening capacity.

in foods as required by FDA regulation.<sup>4</sup> As Luo Han Guo extracts are much sweeter than sucrose, the amounts of the extracts required to achieve comparable sweetness are appreciably reduced. Secondly, at high concentrations, Luo Han Guo fruit concentrate and its extracts have been reported to provide an aftertaste that is similar to "licorice;" this aftertaste may not be acceptable to consumers, and this may limit the food uses of Luo Han Guo extracts.

## **B. Estimated Dietary Exposure**

Luo Han Guo extracts are intended for use in the same foods and at levels proportional to those for mogrosin specified in GRN 301. No additional food uses are proposed for GLG Luo Han Guo extracts. As described in Table 3, the sweetness intensities of the three products by GLG vary. It is commonly accepted that the sweetness intensity of Luo Han Guo is proportional to the level of mogrosin present in it. However, it also depends on the level of mogrosin in a particular concentrate. Given the organoleptic characteristics of Luo Han Guo extracts, the amounts added to food products from any of the three GLG products will be self-limiting. The substance mentioned in GRN 301 has been reported to contain ~30% mogrosin, while the subjects of the present GRAS determination contain, respectively, 30%, 50% or 60% mogrosin. On the basis of mogrosin content, the three GLG products can be added at a level of 100%, 67% and 50% to that of the substance mentioned in the GRN 301. Thus, the amounts of Luo Han Guo extracts added to the food products will be proportional to that described by BioVittoria in GRN 301 (BioVittoria, 2009). However, it should be noted that sweetness intensity in these products varies to some extent, and, hence, the amounts of the extracts consumed are likely to vary.

Given the comparable food uses, one can rely upon intake assessments described in GRN 301 for the determination of estimated daily intake of Luo Han Guo extracts. The dietary analysis, described below, was summarized in GRN 301.

“At this time, the market for intense sweeteners in the U.S. may be regarded as mature. With saccharin, aspartame, sucralose, acesulfame, and alitame all available, market niches for intense sweeteners have been filled. This means that a new sweetener is not competing with sucrose, but with existing intense sweeteners. Thus, the appropriate method for estimating potential intake of Luo Han Guo concentrate is to determine existing levels of intake of intense sweeteners, convert these intakes into sucrose equivalents in order to establish a common metric, and then determine the amount of Luo Han Guo fruit concentrate needed to replace this amount of sucrose equivalence.

An assessment of intense sweetener intake, including conversion of these intakes to sucrose equivalents, was recently completed by Renwick (2008) in order to predict dietary exposures for the intense sweetener rebaudioside A.<sup>5</sup> Published data on intakes of intense sweeteners were collected from a large number of countries, including the U.S., Canada, the UK, Germany, Denmark, Netherlands, France, Australia, and New Zealand. These data were converted to sucrose equivalents using the following estimates of sweetness relative to sucrose: saccharin= 300, aspartame = 180, sucralose = 600, acesulfame = 200, alitame = 2000, and cyclamates (not available in the US.) = 30.

Renwick (2008) provided estimates of both mean and 90<sup>th</sup> percentile intakes of intense sweeteners,

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<sup>4</sup> See 21 CFR 182.1(b)(1).

<sup>5</sup> Renwick (2008) notes that FDA has used a similar method to predict the intakes of acesulfame-K and sucralose.

in sucrose equivalents, for the general population, diabetic adults, healthy children, and diabetic children. These data are presented in Table 7.<sup>6</sup> Also shown in the table are the amounts of Luo Han fruit concentrate needed to replace these intense sweeteners assuming a relative sweetness of 100.”

As described in GRN 301 (BioVittoria, 2009), the estimated intake of Luo Han Guo products represents extremely conservative estimates of the potential intake, as it is assumed that Luo Han Guo products will capture the entire intense-sweetener market. In GRN 301, the estimated mean and 90<sup>th</sup> percentile intake of Luo Han Guo fruit concentrate was determined as 2.6 and 6.8 mg/kg bw/day for an extract 100 times sweeter than sugar. Potential intakes by children were determined to be slightly higher. The use of Luo Han Guo extracts similar to that described in GRN 301 is unlikely to affect the dietary intake of Luo Han Guo from introduction into the market by another supplier who will have to compete in essentially the same markets and foods. Hence, there is no need for cumulative intake analyses.

Using the methodology presented by BioVittoria in GRN 301 and based upon the reported sweetness intensity of GLG’s LHG extract preparations as detailed in Table 3, the estimated daily intakes of the GLG’s Luo Han Guo preparations have been calculated. The results are compiled in Tables 4A-C. These results show that the intended uses of Luo Han Guo extracts as a sweetener by different populations (Tables 4A-C) will result in estimated maximum consumptions at levels that span the range of 2.41 to 5.50 mg Luo Han Guo extract/kg bw/day (from healthy populations consuming GLG-MV 60 to healthy children consuming GLG-MV 30), or at levels of 1.13 to 2.12 mg mogroside V/kg bw/day, respectively.

**Table 4A. Current Daily Intake of Sugar Equivalents & Estimated Daily Intakes of Luo Han Guo Preparation GLG-MV 30**

POPULATION GROUP	INTAKES OF SWEETENERS (G SUCROSE/KG BW/DAY) <sup>a</sup>		INTAKE OF GLG-MV 30 (MG/KG BW/DAY) <sup>b</sup>		INTAKE OF MOGROSIDE V (MG/KG) <sup>c</sup>	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
Healthy Population	255	675	1.42	3.75	0.43	1.13
Diabetic Adults	280	897	1.56	4.98	0.47	1.50
Healthy Children	425	990	2.36	5.50	0.71	1.65
Diabetic Children	672	908	3.73	5.04	1.12	1.51

<sup>a</sup> See Renwick, 2008.

<sup>b</sup> To replace all intense sweeteners, adapted from GRN 301.

<sup>c</sup> Calculated based on the minimum percent Mogroside in LHG extract; here, 30%.

<sup>6</sup> This refers to Table 7 as found in GRN 301.

**Table 4B. Current Daily Intake of Sugar Equivalents & Estimated Daily Intakes of Luo Han Guo Preparation GLG-MV 50**

POPULATION GROUP	INTAKES OF SWEETENERS (G SUCROSE/KG BW/DAY) <sup>a</sup>		INTAKE OF GLG-MV 50 (MG/KG BW/DAY) <sup>b</sup>		INTAKE OF MOGROSIDE V (MG/KG) <sup>c</sup>	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
Healthy Population	255	675	1.02	2.70	0.51	1.35
Diabetic Adults	280	897	1.12	3.59	0.56	1.79
Healthy Children	425	990	1.70	3.96	0.85	1.98
Diabetic Children	672	908	2.69	3.63	1.34	1.82

<sup>a</sup> See Renwick, 2008.

<sup>b</sup> To replace all intense sweeteners, adapted from GRN 301.

<sup>c</sup> Calculated based on the minimum percent Mogroside in LHG extract; here, 50%.

**Table 4C. Current Daily Intake of Sugar Equivalents & Estimated Daily Intakes of Luo Han Guo Preparation GLG-MV 60**

POPULATION GROUP	INTAKES OF SWEETENERS (G SUCROSE/KG BW/DAY) <sup>a</sup>		INTAKE OF GLG-MV 60 (MG/KG BW/DAY) <sup>b</sup>		INTAKE OF MOGROSIDE V (MG/KG) <sup>c</sup>	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
Healthy Population	255	675	0.91	2.41	0.55	1.45
Diabetic Adults	280	897	1.00	3.20	0.60	1.92
Healthy Children	425	990	1.52	3.54	0.91	2.12
Diabetic Children	672	908	2.40	3.24	1.44	1.95

<sup>a</sup> See Renwick, 2008.

<sup>b</sup> To replace all intense sweeteners, adapted from GRN 301.

<sup>c</sup> Calculated based on the minimum percent Mogroside in LHG extract; here, 60%.

## **V. REVIEW OF SAFETY INFORMATION ON LUO HAN GUO EXTRACTS**

### **A. Common Knowledge of Safe Use of Luo Han Guo Fruit & Extracts**

The Luo Han Guo fruit has an available written history of food use in China dating back 300 years, although historic records from the Song dynasty indicate a therapeutic use of the fruit dating back at least 800 years. A variety of anecdotal uses have been attributed to the Luo Han Guo fruit, including uses as a remedy for coughing, colds, lung congestion, and digestion. The fruits are generally sold in

a dried form and are traditionally used in herbal tea (“cooling tea”) or soup. Prior to 1970, use of Luo Han Guo as a medicinal remedy was mostly limited to the Guangxi and Guangdong areas of China. As noted in GRN 301 (BioVittoria, 2009):

The longest consistent use of Luo Han Guo by a large population is found in Guangxi Province, particularly in the region of Guilin (Croom 1999). Entire families of tens of thousands of individuals ranging from the young through the elderly consume the aqueous extract in food daily. Croom (1999) noted that there is no evidence of any associated health issue with the consistent and daily use of Luo Han Guo over entire lifetimes.

As the Chinese medicine industry has grown over the last two decades, so has the production and consumption of Luo Han Guo. As described in GRN 301, exports of Luo Han fruit juice to the US have been increasing, with one manufacturer reporting exports “from 1.8 metric tons in 1996 to 4.4 metric tons in 2004.” As a part of the European and American food markets for decades---and present in Asian food markets for hundreds of years---no adverse effects related to consumption of Luo Han Guo have been reported.

## **B. Absorption, Distribution, Metabolism & Excretion of Luo Han Guo**

Several studies are available on the metabolism of mogroside V. The inherent stability of the mogroside molecules, with covalent bonds between the triterpene framework and the carbohydrate residues, is thought to render these molecules mostly inert to degradation during digestion. Thus, the majority of ingested Luo Han Guo is thought to be excreted in the feces. Recently, Murata et al. (2010) published a study on the digestion and absorption of Luo Han Guo triterpenoids in the rat. The researchers orally administered a reconstituted *Siraitia grosvenorii* Swingle powder (SG-gly), purified from a concentrated Luo Han Guo extract and containing 72% (w/w) mogroside V (M-V). Following administration, the authors estimated the triterpenoid contents in the small intestine and portal blood (collected 120 min after administration), and feces (collected 24 h after administration), using liquid chromatography-mass spectrometry (LC-MS). Their results are reproduced in Table 5. Overall, the researchers found that the majority of SG-gly is degraded by digestive enzymes and intestinal microflora which is then excreted in the feces as mogrol and its mono- and di-glucosides. The total amount of mogrosides in the feces was about 40  $\mu\text{mol}$ , which corresponds to 61% of administered M-V (65.5  $\mu\text{mol}$ ). Trace amounts of mogrol and its monoglucoside were found in the portal blood as sulfates and/or glucuronide conjugates.

**Table 5. Quantification of Mogroside V & Its Metabolites in Small Intestine, Portal Blood & Feces After Single Oral Administration<sup>a</sup>**

	Small intestine <sup>1</sup> ( $\mu\text{mol/ml}$ )	Portal blood <sup>1</sup> ( $\text{nmol/ml}$ )	Feces <sup>2</sup> ( $\mu\text{mol/d}$ )
Mogroside V	2.70 $\pm$ 1.03	ND	0.13 $\pm$ 0.24
Siamenoside I	0.41 $\pm$ 0.22	ND	0.17 $\pm$ 0.19
Mogroside IV	0.41 $\pm$ 0.22	ND	0.18 $\pm$ 0.26
Mogroside III	0.19 $\pm$ 0.08	ND	0.63 $\pm$ 0.83
Mogroside IIE	0.03 $\pm$ 0.01	ND	0.13 $\pm$ 0.14
Mogroside IIA	ND	ND	11.46 $\pm$ 7.92
Mogroside IE	0.0003 $\pm$ 0.0003	0.07 $\pm$ 0.02	10.16 $\pm$ 0.17
Mogroside IA	ND	ND	0.01 $\pm$ 0.03
Mogrol	0.0003 $\pm$ 0.0001	0.36 $\pm$ 0.22	21.34 $\pm$ 12.25

<sup>1</sup>At 2 h and <sup>2</sup>24 h after a single oral administration.  
ND, not detected.  
Values are presented as the mean of 4–6 rats in each group with the standard deviation.

<sup>a</sup> Reproduced from Murata, et. al., 2010.

Two other studies have examined fermentation of Luo Han Guo in the colon. Gibson (2007) studied the fermentation of PureLo<sup>®</sup> (Luo Han Guo fruit concentrate) in a continuous culture model system of the human gut. The model replicates different areas of the hindgut, which consists of three vessels in a series that are maintained in an anaerobic state. The flow rate and pH in the three continuous vessels have been adjusted such that the model is thought to closely mimic the proximal, mid-, and distal human colon. Gibson (2007) utilized this model to test a slurry of fecal matter and Luo Han Guo extract for metabolism by colonic bacteria. The authors concluded that the Luo Han Guo fruit concentrate is not metabolized by the colonic bacteria. In another *in vitro* system, Yang et al. (2007) investigated metabolism of mogroside III by human intestinal bacteria. Available only as an English abstract, the authors report that incubating mogroside III with crude enzymes of human intestinal bacteria under anaerobic conditions at 37°C resulted in successive deglycosylation at C-3 of the glucosyl group and C-24 of the gentiobiosyl group resulting in biotransformation to mogroside II-A<sub>1</sub> and mogrol.

### C. Biological Activity of Luo Han Guo Extracts

As mentioned earlier, Luo Han Guo has been used in China for centuries as a home remedy for a variety of ailments, including lung congestion, coughs, colds, sore throat, gastritis, and constipation. The use of Luo Han Guo for these ailments is based on anecdotal data. However, scientific studies have shown that Luo Han Guo may provide some benefit in preventing atherosclerosis, cancer, diabetes, and allergy, while also serving as an antibacterial. The mechanism of these effects may be related to the ability of the mogroside components to function as antioxidants. As the biological action or mechanism of action of an ingredient may reveal potential safety related concerns, a summary of these studies is presented below with detailed reviews of these studies provided in Appendix N.

No adverse effects related to Luo Han Guo ingestion were reported in any of these studies.

- Mogrosive V exhibited inhibitory effects on reactive oxygen species (ROS) and DNA oxidative damage (Chen et al., 2007).
- Triterpenoids derived from an ethanol extraction of *M. grosvenorii* fruit and cucurbitane glycosides derived from an ethanol extract of *S. grosvenorii* demonstrated inhibition of Epstein-Barr virus-early antigen in Raji cells and Chang liver cells, respectively (Ukiya et al., 2002; Akihisa et al., 2007).
- *S. grosvenorii* extract was not associated with piperonyl butoxide-promoted hepatocarcinogenesis in male F344 rats (Yasuno et al., 2008).
- An aqueous extract of Luo Han Guo (31% mogroside V) was observed to suppress the dicyclanil-induced generation of ROS in ICR mice (Matsumoto et al., 2009).
- Mogroside V was observed to have inhibitory effects on papilloma development in mice (Konoshima and Takasaki, 2002).
- Mogroside I E<sub>1</sub> was shown to selectively inhibit animal DNA polymerase and cell growth of the human HL-60 promyelocytic leukemia cell line (Mizushina et al., 2006).
- An aqueous extract of cucurbitane glycosides from *S. grosvenorii* was observed to inhibit LDL oxidation. The authors concluded that 11-oxo-mogroside V was likely the active component (Takeo et al., 2002).
- An aqueous extract of Luo Han Guo was found to have anti-allergic effects in female ICR mice (Hossen et al., 2005).
- An aqueous extract of *S. grosvenorii* did not appear to have any adverse effects in spontaneously diabetic Goto-Kakizaki rats and acted as an anti-diabetic (Suzuki et al., 2007).
- The polysaccharide components of an aqueous extract of *S. grosvenorii* was also found to have anti-diabetic effects in diabetic male New Zealand rabbits (Lin et al., 2007).
- A water-soluble *M. grosvenorii* extract was observed to be a potential treatment for diabetic nephropathy in mice (Song et al., 2007).
- In complementary studies, an ethanol-extract and an aqueous extract of Luo Han Guo were found to have no toxicity or significant effect on normal mice but did exhibit anti-diabetic effects (Qi et al., 2006; Song et al., 2006).
- A purified ethanol extract of mogrosides from Lo Han fruit was administered to healthy and diabetic mice. No adverse effects were observed, and the health of the diabetic mice was improved following treatment (Qi et al., 2008).
- *In vivo* Luo Han Guo antioxidant activity was observed in rats (Yamada and Ogata, 2001).
- Luo Han Guo mogrosides have been shown to have anti-inflammatory activity in murine macrophate celss and murine ear edema model (Di et al., 2011).

## D. Toxicology Studies on Luo Han Guo Extracts

### 1. Acute Oral Toxicity

Lee (1975) was the first to report acute toxicity testing of a Luo Han Guo extract. The author administered a crude extract of a Sephadex G-25-treated extract to male albino mice (10 mice/group) at a volume of 0.3 mL/g bw (providing doses as high as 15 g extract/kg). After 1 week of observation, none of the mice died. The animals transiently exhibited mild sedation and diarrhea at a dose of 15 g, but these animals appeared normal within 30-60 minutes. The author reports the LD<sub>50</sub> to be in excess of 10 g/kg bw in mice.

Makapugay et al., (1985) reported results of acute toxicity experiments, including potential genotoxic effects, in mice with mogroside V isolated from a water-soluble Luo Han Guo extract. The authors reported that no mortality was noted at doses up to 2 g/kg bw. The LD<sub>50</sub> was greater than 2 g/kg bw. These investigators also reported that the extract was non-mutagenic, but no further information was provided in the publication.

In 1990, Hussain et al., performed acute toxicity experiments of a Luo Han Guo extract in male Swiss-Webster mice, ages 4-6 weeks. A single oral administration of extract in 1% aqueous sodium carboxymethylcellulose was administered at doses of 1 or 2 g/kg bw. Animals were observed for toxicity and changes in body weight for 14 days. The authors reported that administration of Luo Han Guo extract at doses up to 2 g/kg bw did not reveal changes in body weights or signs of toxicity. The LD<sub>50</sub> was greater than 2 g/kg bw.

## 2. Subacute Oral Toxicity

Most of the subacute studies with Luo Han Guo have been performed with a purpose other than measuring toxicity. However, a number of these studies measured endpoints that provide toxicity information for Luo Han Guo extracts. These studies are summarized below.

Marone et al. (2008) performed a 28-day toxicity study of Lou Han Guo fruit concentrate (PureLo<sup>®</sup>) in rats, following accepted US FDA and OECD guidelines for such a study. PureLo<sup>®</sup> is a table-top sweetener derived from *S. grosvenorii* extract, which is sold in the US and has a 62% mogroside content. A total of 80 Sprague Dawley rats (10/sex/group) were fed diets containing 0, 10,000, 30,000, or 100,000 ppm PureLo<sup>®</sup> for 28 days. Changes in the following parameters were examined: body weights, ophthalmic variations, toxicities, detailed clinical observations (including skin, fur, eyes, mucous membranes, gait, posture, response to handling, and clonic or tonic movements), clinical chemistry (including serum aspartate aminotransferase, serum alanine aminotransferase, sorbitol dehydrogenase, alkaline phosphatase, total bilirubin, urea nitrogen, blood creatinine, total cholesterol, triglycerides, fasting glucose, total serum protein, albumin, globulin, calcium, inorganic phosphorus, sodium, potassium, and chloride), urinalysis, organ and body weights, and histopathological findings. In this study, all animals survived and exhibited no clinical adverse effects. The authors noted:

“...transient clinical observations included brown scale around the nose for a few animals of both sexes from each dose group, red penile excreta for one low-dose male, and black optical discharge for one mid-dose male.” In addition, the authors noted some changes in weight gain in the high-dose animals, but found this was related to sporadic reductions in food consumption (possibly due to increased bulk of the test substance in the diet). The mean intake of PureLo<sup>®</sup> was calculated as 0, 0.733, 2.096, and 7.071 mg/kg bw/day for females and 0, 0.743, 2.147, and 7.478 mg/kg bw/day for males in the 0, 10,000, 30,000, and 100,000 ppm groups, respectively. Statistically significant changes in clinical chemistry, including increased hemoglobin and hematocrit in high-dose males, increased mean red blood cell hemoglobin in mid-dose females, and decreased prothrombin time in mid- and high-dose females, slight decreased total bilirubin in low-dose females and mid- and high-dose groups of both sexes, slightly increased total protein due to albumin in low- and high-dose males or globulin in mid- and high-dose females, increased potassium in high-dose females, and slightly decreased chloride in high-dose females were noted. Increases in absolute liver weights in high-dose females and relative liver weight in high dose males and in all female groups was observed. However, no change in liver histopathology or in liver enzymes was observed, indicating weight findings are of little

toxicological significance. The authors also found changes in the incidence of relative organ weights (adrenal, ovaries, and/or testis) but again these did not correlate with histopathological findings. None of these changes were considered adverse as they were slight, occurred in only one sex, were not dose-related, were transient, non-adverse, and/or inconsistent. Thus, the authors concluded “the NOAEL for PureLo<sup>®</sup> was 100,000 ppm in the diet, the highest level tested, equivalent to 7.07 and 7.48 g/kg bw/day for male and female rats, respectively.”

In a study comparing the effects of a Luo Han Guo extract on splenic lymphocyte and cytokine expression levels of normal mice and alloxan-induced diabetic mice, Qi et al. (2006) reported no adverse effects from Luo Han Guo administration in either normal or diabetic mice. For this study, male Balb/c mice were fasted for 18 hours and were then injected intraperitoneally with alloxan to induce diabetes. Subsequently, these animals were gavaged with distilled water (control), 150, or 300 mg extract/kg bw/day. The extract used was derived from a 70% ethanol extraction of fresh Luo Han fruit that was then concentrated and dried into a powder. The authors reported that, in normal mice, administration of Luo Han Guo extract for four weeks---at either 150 or 300 mg/kg bw/day---had no effect on body weight, blood glucose, T-lymphocytes, cytokine expression, or pancreatic histology. The alloxan-induced diabetic mice exhibited hyperglycemia and loss of body weight, as well as significantly increased fasting blood glucose compared with non-diabetic controls. Additional information regarding the effect of the Luo Han Guo extract on cytokine expression in diabetic mice is described in Appendix N.

In a similar study, Song et al. (2006) compared the effects of Luo Han Guo extract on cytokine expression in normal and alloxan-induced diabetic mice. The methods used were the same as the Qi et al. (2006) study above, except a water extract of Luo Han Guo was used. Mice were gavaged with distilled water (control), 150, or 300 mg extract/kg bw/day for 30 days. The authors measured body weight, blood glucose and insulin levels, and examined pancreatic and splenic histology. The authors reported that the Luo Han Guo extract did not cause toxicity and had no significant effects on normal mice. The authors did report that the extract attenuated the adverse effects of diabetes, as described in Appendix N.

Song et al. (2007) performed a second study investigating the effect of the same Luo Han Guo extract on renal mitochondrial lipid peroxidation, anti-oxidative defenses, and the oxidative stress-responsive protein heme oxygenase-1 (HO-1). The methods and treatment groups were identical to those in the study above. The authors measured body weight, serum glucose, total cholesterol, triacylglycerol, blood urea nitrogen, and creatinine. In addition, the authors performed histopathological examination of the kidneys, and they analyzed the mitochondrial fraction for glutathione concentration, manganese superoxide dismutase, and glutathione peroxidase. The authors concluded that the Luo Han Guo extract caused no adverse effects on normal mice. Antioxidative effects were noted in diabetic mice. This information is described further in Appendix N.

### **3. Subchronic Studies**

Hirose (1999) performed some of the first long-term safety tests of Luo Han Guo as a food ingredient. The researchers administered a Luo Han Guo extract to rats in the form of reddish brown solid paste dissolved in tap water (Koshiro Pharmaceuticals Co., Ltd, Osaka, Japan). Five groups of ten male and ten female 6-week old rats were given access to drinking water that contained Luo Han Guo extract at respective concentrations of 0%, 0.25%, 0.5%, 1.0%, and 2.0% for 90 days. The amounts of water ingested and the weights of the animals were recorded to calculate dose levels. The

researchers reported that no significant differences attributable to the test material were observed during the experiment, and no significant changes in water intake, weights of internal organs, biochemical serum values (serum total protein, albumin, A/G ratio, bonded nitrogen, creatinine, inositol, phosphoric acid, alkaline phosphatase, GOT and GPT, total cholesterol, and total glycerin), serum mineral content, hematology or histopathological findings were found when the test groups were compared to controls.

In 2006, Qin et al. performed a combined 28-day and 90-day subchronic toxicity study of a Luo Han Guo extract in dogs. In this study, 24 hybrid dogs were divided into four groups (3/sex/group). Luo Han Guo extract (PureLo<sup>®</sup>), the subject ingredient of GRN 301, was administered via oral gavage in an aqueous solution of 10 mL/kg bw/day, providing 3,000 mg/kg bw/day to three dogs of each sex for either 28 or 90 days. The remaining two groups served as controls for the respective treatments. The authors examined the following parameters from the dogs: body weights, food consumption, hematology results, blood chemistries, urinalyses, gross necropsies, organ weights, and histopathologies. No significant adverse effects of Luo Han Guo were reported for any of these measures. Based on the results of this study, the authors determined the NOAEL for Luo Han Guo extract (PureLo<sup>®</sup>) as 3,000 mg/kg bw/day when administered to dogs by gavage for 90 consecutive days.

To assess the safety of *Siraitia grosvenorii* extract, Jin et al. (2007) performed a 13-week repeated dose toxicity study in Wistar Hannover (GALAS) rats. In this study, five groups of rats (4/sex/group) were fed respective diets containing 0%, 0.04%, 0.2%, 1%, or 5% of *S. grosvenorii* extract for 13 weeks. The extract was reported to contain 31.4% mogroside V (Saraya Co., Ltd., Osaka, Japan). The authors examined general appearance, body weights, food and water consumption, hematological and serum biochemical parameters, organ weights, and histopathological findings. The authors reported a significant increase in the stab cell and monocyte cell count in males of the 1% and 5% groups, along with a significant increase in total cholesterol; a decrease in inorganic phosphate was observed in females in the 5% group, relative liver weights of males in the 5% group were increased, and absolute and relative pituitary weights were significantly increased in females in the 5% group. All of the changes were noted to be slight, and---overall---no toxic changes due to administration of the *S. grosvenorii* extracts in any of the experimental parameters measured were observed. The authors reported the NOAEL of the *S. grosvenorii* extract in Wistar Hannover rats to be at least 5% (2,520 mg/kg bw/day in males and 3,200 mg/kg bw/day in females).

GRN 359 (Guilin Layn, 2010), submitted on behalf of Guilin Layn Natural Ingredients Corp. (Guangxi, China), contained a 90-day oral toxicity study of Go-Luo<sup>™</sup> 55% powder extract in rats. In this study rats (20 rats/sex/group) were fed diets containing 0 (control), 12,500, 25,000 or 50,000 ppm Go-Luo<sup>™</sup> 55% powder extract for 90 days. No treatment-related mortality was observed, and no significant differences in body weights or food consumption during the dosing and recovery periods were reported. There were no significant effects in hematology or serum chemistry findings, nor were there any histopathological observations in any tissue samples or organs. Therefore, the NOAEL for Go-Luo<sup>™</sup> 55% powder extract was considered to be a dietary concentration of 50,000 ppm. This dose corresponds to a time-weighted average dose over the course of the dosing period of approximately 3.12 g/kg bw and 3.75 g/kg bw/day in male and female rats, respectively.

#### 4. Genotoxicity/Mutagenicity

Hussain et al. (1990) investigated the mutagenic potential of Luo Han Guo extract in *Salmonella typhimurium* strain TM 677. In this study, five test groups and one control were assayed. The extract was dissolved in DMSO and evaluated at concentrations of 0.31, 0.62, 1.25, 2.5, and 5.0 mg/mL in the presence and absence of S9 activation. The extract was not mutagenic at any of the concentrations tested.

Matsushima (1999) also examined Luo Han Guo for reverse mutagenic effects in microorganisms in a standard Ames test. Luo Han Guo (Koshiro Pharmaceuticals Co., Ltd.) was tested in duplicate at a maximum concentration of 5,000 ug/plate. The bacterial strains used were *Salmonella typhimurium* TA98, TA100, TA1535, and TA1537, as well as *Escherichia coli* WP2uvrA/pKM101, in the presence and absence of S9 metabolic activation. The authors concluded that Luo Han Guo extract does not have a reverse mutagenic effect on microorganisms at concentrations up to 5,000 ug/mL.

GRN 301 (BioVittoria, 2009) reports unpublished Ames assays with Luo Han Guo extract in the form of PureLo<sup>®</sup> fruit concentrate. Tests were performed in accordance with OECD and US EPA guidelines. Triplicate assays were performed using *S. typhimurium* tester strains TA98, TA100, TA1535, and TA1537, and *E. coli* WP2 uvrA, with and without S9 metabolic activation. The authors reported no biologically relevant increases in revertant colony numbers in any of the strains tested at concentrations up to 5 mg/plate. The authors concluded that Luo Han Guo (PureLo<sup>®</sup>) is non-mutagenic in this assay.

In addition to the Ames assays, in GRN 301, BioVittoria reported an *in vivo* study of the Luo Han Guo PureLo<sup>®</sup> fruit concentrate in mammalian micronucleus tests of murine peripheral blood cells. This study was also performed in accordance with OECD and US EPA guidelines. Initial experiments established the maximum tolerable dose at 2,000 mg Luo Han Guo fruit concentrate/kg bw. Young adult NMRI mice, 7-13 weeks old, were administered intraperitoneally either 0, 400, 1,000, or 2,000 mg/kg bw of Luo Han Guo (PureLo<sup>®</sup>)/kg bw. Additional animals received cyclophosphamide as a positive control. Peripheral blood from the tail vein was examined at 44 and 68 h after treatment. GRN 301 states:

“A minimum of 10,000 immature erythrocytes/animal were scored for the incidence of micronucleated immature erythrocytes; additionally, the ratio between immature and mature erythrocytes was determined and expressed as relative PCE.... The investigators concluded that under the experimental conditions tested, PureLo<sup>®</sup> Luo Han fruit concentrate did not induce structural or numerical chromosomal damage in the immature erythrocytes of the mouse, and is therefore considered to be non-mutagenic with respect to clastogenicity or aneugenicity in the mammalian erythrocyte micronucleus test.”

GRN 359 (Guilin Layn, 2010) reported a bacterial reverse mutation assay of the subject test article Go-Luo<sup>™</sup> 55% powder extract on salmonella strains TA1535, TA1537, TA98, and TA100 and *E. coli* strain WP2uvrA. No cytotoxic activity was observed as assayed in the presence or absence of S9 activation at any concentration up to 5,000 µg/plate.

### E. Clinical Studies with Luo Han Guo Extracts

Two unpublished clinical studies with Luo Han Guo extract were reported in GRN 301. The GRN 301 summary of these reports is reproduced below:

In a cross-over design, Xu et al. (2005a) assessed the comparative effect of consumption of PureLo Luo Han fruit concentrate and sucrose on blood glucose level. After fasting overnight, 5 healthy men and 5 healthy women aged 19-25 years consumed 200 mg/kg bw of Luo Han fruit concentrate dissolved in water. Their blood glucose levels were tested at 0, 15, 30, 60, 120, and 180 minutes after dosing. Three days later, the same 10 participants consumed 3000 mg/kg bw of sucrose dissolved in water, again after an overnight fast, and blood samples were taken at the same time intervals. While ingestion of sucrose results in a 70% increase in blood glucose level during the first 15 minutes, gradually decreasing to the starting level over 3 hours, ingestion of Luo Han fruit concentrate had no effect on blood glucose. These results are exhibited in Table 6.

**Table 6. Effects of Luo Han Fruit Concentrate & Sucrose on Blood Glucose Level**

Time After Dosing	Blood Glucose Level (mmol/L; mean±S.D.)	
	PureLo® (200 mg/kg bw)	Sucrose (3000 mg/kg bw)
0 minutes	4.59±0.45	4.52±0.44
15 minutes	4.50±0.44	7.68±0.74
30 minutes	4.76±0.33	6.97±0.91
60 minutes	4.70±0.26	6.00±1.35
120 minutes	4.46±0.34	5.09±1.07
180 minutes	4.56±0.51	4.42±0.95

Source: Xu et al., 2005a

Xu et al. (2005b) used a similar cross-over design to assess the effect of PureLo® Luo Han fruit concentrate and that of water on blood levels of liver enzymes. Six healthy males aged 19-25 years fasted overnight and then consumed 200 mg/kg bw of Luo Han Guo fruit concentrate dissolved in water. 3 days later they consumed only water. On both days, blood samples were taken at 0, 1, 2, 3, and 6 hours after administration. Five liver enzymes were analyzed: alkaline phosphatase (ALP), gamma-glutamyl transpeptidase (GGT), alanine aminotransferase (ALT), aspartate aminotransferase (AST), and lactate dehydrogenase (LDH). As seen in Table 7, no statistically significant changes in the blood levels of any of these enzymes over time were observed, nor were there any differences between enzyme levels after dosing with Luo Han fruit concentrate or with water.

**Table 7. Effects of Luo Han Fruit Concentrate on Clinical Chemistries**

Time and Condition	Liver Enzyme (mmol/L; mean±S.D.)				
	ALP	GGT	ALT	AST	LDH
Hour 0					
PureLo®	77.49±23.30	13.75±5.02	10.60±4.65	20.03±5.07	170.60±24.17
Water	53.15±11.72	10.55±3.14	9.72±5.18	14.67±2.41	106.50±27.45
Hour 1					
PureLo®	72.65±17.66	11.91±3.32	10.03±7.33	19.95±4.32	180.36±51.83
Water	37.50±16.85	7.37±4.64	7.90±4.17	10.90±5.65	75.01±39.33
Hour 2					
PureLo®	68.76±17.66	10.97±3.43	8.78±3.52	17.13±3.26	176.03±22.81
Water	49.80±12.09	9.58±3.50	7.83±4.56	13.00±1.74	93.04±26.56
Hour 3					
PureLo®	70.03±22.89	10.57±3.20	8.82±3.23	17.18±2.50	160.67±32.24
Water	47.85±10.01	9.59±3.27	8.70±2.82	14.02±2.20	91.47±16.49
Hour 6					
PureLo®	75.74±15.36	12.78±3.90	10.28±5.24	20.53±4.40	175.60±50.23
Water	50.11±11.37	9.42±3.04	10.16±5.60	15.35±2.53	114.27±39.90
ALP = alkaline phosphatase GGT = γ-glutamyl transpeptidase ALT = alanine aminotransferase AST = aspartate aminotransferase LDH = lactate dehydrogenase Source: Xu et al., 2005b					

## **VI. DISCUSSION**

### **A. GRAS Criteria**

FDA defines “safe” or “safety” as it applies to food substances such as the subject Luo Han Guo extracts as:

“...reasonable certainty in the minds of competent scientists that the substance is not harmful under the intended conditions of use. It is impossible in the present state of scientific knowledge to establish with complete certainty the absolute harmlessness of the use of any substance.”<sup>7</sup>

Amplification is provided in that the determination of safety is to include probable consumption of the substance in question, the cumulative effect of the substance and appropriate safety factors. It is FDA’s operational definition of safety that serves as the framework against which this evaluation is provided.

Furthermore, in discussing GRAS criteria, FDA notes that:

“...General recognition of safety requires common knowledge about the substance throughout the scientific community knowledgeable about the safety of substances directly or indirectly added to food.”

“General recognition of safety through experience based on common use in food prior to January 1, 1958, shall be based solely on food use of the substance prior to January 1, 1958, and shall ordinarily be based upon generally available data and information.”<sup>8</sup>

FDA discusses in more detail what is meant by the requirement of general knowledge and acceptance of pertinent information within the scientific community, i.e., the so-called “common knowledge element,” in terms of the two following component elements:<sup>9</sup>

- Data and information relied upon to establish safety must be generally available, and this is most commonly established by utilizing published, peer-reviewed scientific journals; and
- There must be a basis to conclude that there is consensus (but not unanimity) among qualified scientists about the safety of the substance for its intended use, and this is established by relying upon secondary scientific literature such as published review articles, textbooks, or compendia, or by obtaining opinions of expert panels or opinions from authoritative bodies, such as JECFA and the National Academy of Sciences.

The apparent imprecision of the terms “appreciable,” “at the time,” and “reasonable certainty” demonstrates that the FDA recognizes the impossibility of providing absolute safety in this or any other area (Lu, 1988; Renwick, 1990; Rulis and Levitt, 2009).

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<sup>7</sup> See 21 CFR 170.3(i).

<sup>8</sup> See 21 CFR 170.30(a).

<sup>9</sup> See Footnote 1.

As noted below, this safety assessment to ascertain GRAS status for GLG's Luo Han Guo extract for the defined food uses meets FDA criteria for reasonable certainty of no harm by considering both the technical and common knowledge elements.

## **B. Safety of Luo Han Guo Extracts**

A significant amount of safety information related to the consumption of Luo Han Guo extracts has been presented herein. First, there is a history of safe consumption of Luo Han Guo fruit extract or concentrate when used as food products in China and in the US. Secondly, in a number of experimental studies, the safety of Luo Han Guo extracts has been investigated. The composite evidence from historical safe consumption of Luo Han Guo extracts and experimental studies together can be used to demonstrate the safety of the subject extracts for human food consumption.

As noted earlier, Luo Han Guo extracts are commonly used internationally and in the US as a sweetener and as a dietary supplement. Available reports indicate that, in China, large populations in Guangxi Province have consistently used aqueous extracts of Luo Han Guo fruit in foods on a daily basis for lifetimes without any associated adverse health effects. The traditional uses of Luo Han Guo and its use as a dietary supplement are similar to GLG's intended food uses of its Luo Han Guo extracts as a sweetener. The traditional uses and resulting intakes of the raw and dried Luo Han Guo fruit or its preparations are likely to be similar to the proposed intended uses. The manufacturing process for Luo Han Guo extracts employs methods that are similar to those of traditional decoction. The products are not chemically altered, and they retain the characteristic composition of the source fruit. Thus, the available history of exposure suggests safe consumption of Luo Han Guo fruit preparations; in turn, this history supports the safety of the use of the subject Luo Han Guo extracts in foods.

Luo Han Guo fruit concentrate has been well studied in laboratory animal toxicity studies. The available evidence from metabolism studies in rats and the inherent stability of the mogroside molecules---the primary constituents of Luo Han Guo extracts---demonstrate that these molecules are mostly inert to degradation during digestion. Thus, the majority of ingested Luo Han Guo is thought to be excreted in the feces. There is no evidence to suggest that the primary constituents of Luo Han Guo extracts, i.e., the mogrosides, would bioaccumulate following ingestion. In acute toxicity studies, the oral LD<sub>50</sub> of Luo Han Guo extract preparations have been reported as > 2 g/kg bw and as 10 g/kg bw, indicating that this substance is practically non-toxic.

In a short-term (28-day) oral toxicity study in rats conducted according to FDA and OECD guidelines, the NOAEL of a Luo Han Guo preparation containing 62% mogroside was determined as 7.27 g/kg bw/day. In a combined 28-day and 90-day toxicity study in dogs, the NOAEL at the only dose tested was 3,000 mg/kg bw/day. In a subchronic dietary toxicity study, rats were fed diets containing up to 5% Luo Han Guo extract (31.4% mogroside V) for 13 weeks, and no biologically significant toxic effects were noted at any tested dose. The results of this study suggest the NOAEL was the highest dose tested, i.e., 5% in diet or 2,860 mg/kg bw/day. Additionally, in genetic toxicology tests, Luo Han Guo extract preparations exhibited no mutagenic or clastogenic activity, indicating that the Luo Han Guo extracts lack the potential to be carcinogenic. These safety studies, which are strongly corroborated by history of use information, support the safety-in-use determination at the intended use levels.

The Panel has reviewed and compared the compositional similarities and differences between GLG's Luo Han Guo extracts with the products that were the subjects of BioVittoria's GRN 301 and Guilin Layn's GRN 359. All these extracts have been reported to contain > 30% mogroside V. Similar to GLG's Luo Han Guo extracts (containing 30%, 50%, 60% mogroside V), in GRN 359, three extracts--containing 25%, 45%, and 55% mogroside V---were the subjects of the GRAS assessment. In GRN 301 the substance contained 30% mogroside V. The Panel has considered these compositional similarities from the safety assessment perspective, and the Panel is of the opinion that these compositions are indeed comparable which supports the safety of GLG's Luo Han Guo extracts with the associated food uses. The intake of total mogrosides from either BioVittoria or Guilin Layn or from GLG products should be comparable. Additionally, the experimental animal safety studies provide further support for this safety determination.

The Panel has concluded that the proposed maximum consumptions of the Luo Han Guo extracts by different populations (Table 4A - 4C) at levels ranging from the lowest-high consumption of 2.41 to the highest-high consumption of 5.50 mg/kg bw/day or that of mogroside V at levels of 1.13 to 2.12 mg/kg bw/day, respectively, from the intended uses of the Luo Han Guo extracts as a general purpose sweetener proposed in Section IV is safe. The Panel has also determined that there is an approximate margin of safety of over 500-fold from using the dose of 3,000 mg/kg bw/day found to have no effect in subchronic studies in dogs and rats. The Panel also noted that the intake of the Luo Han Guo extracts from its intended uses is slightly higher in healthy and diabetic children and in adult diabetics compared to the general population. However, given the safety margin noted, it is considered to be safe for these subpopulations as well. The estimated daily intake from the food uses proposed by GLG, even if ingested on a daily basis over a lifetime, meets the required safety standard of "reasonable certainty of no harm under the intended conditions of use."

In summary, sufficient qualitative and quantitative scientific evidence in the composite is available to support the safety-in-use of GLG's Luo Han Guo extracts. The safety evidence of the Luo Han Guo extracts consists of the following:

- Luo Han Guo fruit preparations or aqueous extracts have a long history of safe human consumption;
- Luo Han Guo extract is prepared from the fruit of *Siraitia grosvenorii* Swingle in accordance with current Good Manufacturing Practices requirements;
- There is no evidence that consumption of Luo Han Guo preparations either in foods or in dietary supplements has a cumulative effect that would adversely affect its safety;
- The bioavailability of the principal components of the Luo Han Guo extracts---the mogrosides---following ingestion is limited, and it is unlikely to be accumulated in body; and,
- Varieties of experimental studies, including *in vitro* studies, support the safety of the Luo Han Guo extracts.

The Panel has reviewed the manufacturing procedures and specifications established by GLG, and the Panel finds that the specifications are adequate to define a suitable purity to be considered food grade.

### **C. Common Knowledge Elements of GRAS Determinations**

The first common knowledge element to be fulfilled for a GRAS determination is that data and information relied upon to document safety must be generally available; this is most commonly established by utilizing published, peer-reviewed scientific journals for the safety assessment. The common use of Luo Han Guo extracts in food on a global basis with the associated absence of harm is based on published information of all types. The majority of the studies reviewed in this safety assessment has been published in the scientific literature as reported in Section V. Specifically, studies by Jin et al. (2007), Qin et al. (2006), and Marone et al. (2008) have investigated the short-term and subchronic toxicities of Luo Han Guo preparations in rats and dogs, and findings from these investigations have been published in peer-reviewed journals that are readily available. In addition to the many scientific studies that have been conducted and published, history of Luo Han Guo consumption since ancient times as cited earlier is well known around the world---particularly in China.

Furthermore, safety documentation for food uses of Luo Han Guo extract is found in GRN 301 and in GRN 359. Information contained in GRAS notifications that have been submitted to FDA is generally available on FDA's GRAS Inventory website for review and evaluation by the scientific community. The composite information noted thereby fulfills the generally availability common knowledge element required for GRAS determinations.

The second common knowledge element required for GRAS determinations involves demonstrating that consensus exists among qualified scientists that the subject safety assessment is reasonable and appropriate. Regulatory approvals have been reported for various Luo Han Guo extracts by competent authorities in China, Japan, New Zealand, and Canada. The most compelling documentation of consensus for the safety of the Luo Han Guo extracts is the recognition that other Expert Panels undertaking the respective evaluations of GRN 301 and GRN 359 concluded that the intended food uses of comparable materials are considered to be safe. Furthermore, FDA reviews of these determinations yielded agreement by FDA, thereby augmenting the finding of consensus.

## VII. CONCLUSIONS<sup>10</sup>

The Expert Panel has drawn the following conclusion:

**The Expert Panel has concluded that GLG’s Luo Han Guo extracts that are produced in accordance with FDA Good Manufacturing Practices requirements while meeting the purity specifications as set forth in Section III.E.1 of this notification, are generally recognized as safe when consumed at levels up to 5.50 mg/kg bw/day as a general purpose non-nutritive sweetener in foods other than infant formulas and meat and poultry products.**

This declaration is made in accordance with FDA’s food ingredient safety standard, i.e., reasonable certainty of no harm under the intended conditions of use.

(b) (6)

Richard C. Kraska, Ph.D., DABT

(b) (6)

Robert S. McQuate, Ph.D.

(b) (6)

Madhusudan G. Soni, Ph.D., FACN

May 21, 2014

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<sup>10</sup> The detailed educational and professional credentials for two of the individuals serving on the Expert Panel can be found on the GRAS Associates website at [www.gras-associates.com](http://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. Soni’s curriculum vitae can be accessed at: <http://www.soniassociates.net>. Each individual has previously served on multiple GRAS Expert Panels. Dr. Kraska served as Chair of the Panel.

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## **APPENDIX A**

### **Specifications & Certificates of Analysis for Production Processing Aids**

**A-1 GLG Specifications for Ethanol**

**A-2 Certificate of Analysis for GLG Active Carbon**

## A-1 GLG Specifications for Ethanol

### Ethanol Specification

Prepared by GLG QA Department  
 File No. GLG-QA-PA2016

**Ethyl Alcohol** (Ethanol)

C<sub>2</sub>H<sub>6</sub>O Formula wt 46.07

**Description**

Ethyl Alcohol occurs as a clear, colorless, mobile liquid. It is miscible with water, with ether, and with chloroform.

**Function** Extraction solvent; carrier solvent.

**Physical and Organoleptic Standards**

Characteristic	Specification	Method
Appearance	Clear, colorless liquid.	Organoleptic as is
Flavor ,Aroma	Normal	Organoleptic as is

**Physical and Chemical Standards**

(According to: **GB10343-2008/FCC (8<sup>th</sup>)**)

Characteristic	Specification
Assay (C <sub>2</sub> H <sub>6</sub> O, by volume)	≥95.0%
Acidity (as acetic acid)	≤0.003%
Alkalinity(as NH <sub>3</sub> )	≤3ppm
Fusel Oil	Passes test
Ketones, Isopropyl Alcohol	Passes test
Lead	≤0.5ppm
Methanol	Passes test
Nonvolatile Residue	≤0.003%
Solubility in water	Passes test
Substances Darkened by Sulfuric Acid	Passes test
Substances Reducing Permanganate	Passes test

## A-2 Certificate of Analysis for GLG Active Carbon



### Certificate of Analysis

Product: Active Carbon  
Manufacturing Date: May 10th, 2013  
Analysis Date: May 21st, 2013  
Manufacture: Ning Guo city Hengda Active Carbon Co.,Ltd  
Country of Origin: China  
According: GB/T13803.3-1999

Lot No. (b) (6)  
Shelf Life: two years

Inspection Item	Specification	Results	Method
Adsorptive power ,ml/g	≥110	116	GBT12496.10
Ph	5-7	6.54	Q/GLG-01-2008-06
moisture, %	≤10	5.68	Q/GLG-01-2008-06
Fe, %	≤0.02	0.01	Q/GLG-01-2008-06
Ash, %	≤3	2.12	Q/GLG-01-2008-06
Lead, ppm	≤5	0.16	Q/GLG-01-2008-06

Analyzed by: (b) (6)      Checked by: (b) (6)      Approved by: (b) (6)  
21/05/2013

Chuzhou Runhai Stevia Hi-Tech Co., Ltd. is a wholly invested subsidiary of GLG Life Tech Corporation.

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\*This product should be stored and sealed in a cool and dry place.

## **APPENDIX B**

### **Analytical Method: Determination of Mogroside V in Luo Han Guo Extract by HPLC**

 <b>GLG LIFE TECH CORPORATION</b>	<b>Issue Date:20/12/2013</b>
<b>DETERMINATION OF MOGROSIDE V IN LUO HAN GUO EXTRACT BY LC</b>	<b>File No: GLG-QA-STD-HPLC-4</b>

## Principle:

This assay is capable of determining the content of mogroside V in Luo Han Guo extract using an LC system.

## Standards

Mogroside V Standard (ChromaDex Inc. Irvine, CA USA)

## Solvents and Reagents

- Acetonitrile, HPLC grade (Merck, Germany)
- Water, HPLC grade (Millipore, Germany)

## Apparatus

1. Agilent1200 HPLC system equipped with binary pump, auto sampler, thermostatted column compartment and UV detector (Agilent Technologies, USA)
2. Analytical column, Luna 5 $\mu$  C18 (2) 100A (Phenomenex, USA)
3. Analytical balance, XS205 (Mettler Toledo, USA)
6. Volumetric (class **A**) and Laboratory glassware

## Assay Procedures

### 1. Preparation of Sample Solution

- 1.1 Weight 10 - 20mg of Luo Han Guo extract sample exactly into 25ml dissolution flask.
- 1.2 Add 15ml HPLC grade methanol and ultrasonic bath until sample has totally dissolved; Cool to room temperature, then dilute to volume with HPLC grade methanol.
- 1.3 Filter sample through a 0.45  $\mu$  m membrane filter.

### 2. Preparation of Standard Solution

Weight Mogroside V to make the standard solution with the concentration of 0.25mg/ml (Cs).

### 3. HPLC Chromatogram Condition

**Mode:** High-performance liquid chromatography

**Detector:** UV (208 nm)

**Column:** Luna 5 $\mu$  C18 (2) 100A (Phenomenex) or equivalent (length: 250 mm; inner diameter: 4.6 mm; particle size: 5 $\mu$ m)

**Column temperature:** 40"

**Flow rate:** 1.0 mL/min

**Injection size:** 20ul

**Mobile phase:** Acetonitrile / Water =22/78(v/v)

#### 4. Calculation

$$\text{Mogroside V (\%)} = \frac{A_i \times C_s \times 10 \times 100\%}{A_s \times M}$$

A<sub>i</sub> Peak area of extract sample

A<sub>s</sub> Peak area of Mogroside V standard

C<sub>s</sub> Concentration of Mogroside V standard (mg/ml)

M Weight of extract sample (mg)

Prepared by: Zhang Lei , QA/QC manager, GLG Life Tech Corporation, 20/12/2013

Approved by: Kevin Li , VP of technology, GLG Life Tech Corporation, 20/12/2013

## APPENDIX C

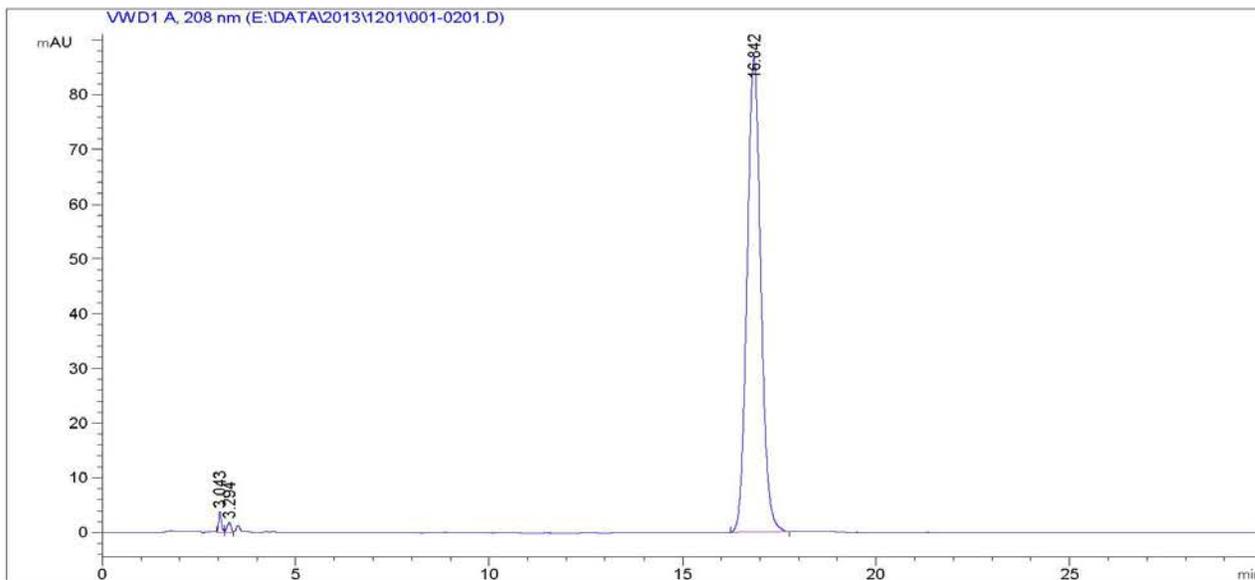
### HPLC Chromatogram for Mogroside V Standard

Date File : E:\DATA\2013\1201\001-0201.D

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=====
Operator       : sun hongkai                Line : 1
Instrument     : Instrument 1              Location : 2
Injection Date : 2013-12-01 11:35:14      Inj : 1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-01 11:09:04 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-01 11:02:05 sun hongkai
Sample Info   : Mogroside V Standard
  
```



#### External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	3.043	VV	0.0764	19.28594	3.81764	0.8849	
2	3.294	VV	0.0965	13.04503	1.85769	0.5985	
3	16.842	BB	0.3837	2147.13110	86.67348	98.5166	Mogroside V
Total:				2179.46207	92.34881		

\*\*\* End of report \*\*\*

## **APPENDIX D**

### **HPLC Chromatograms for GLG-MV 30**

**D-1 HPLC Chromatogram for Batch GLG-MV 30-20131001**

**D-2 HPLC Chromatogram for Batch GLG-MV 30-20131005**

**D-3 HPLC Chromatogram for Batch GLG-MV 30-20131010**

**D-4 HPLC Chromatogram for Batch GLG-MV 30-20131012**

**D-5 HPLC Chromatogram for Batch GLG-MV 30-20131018**

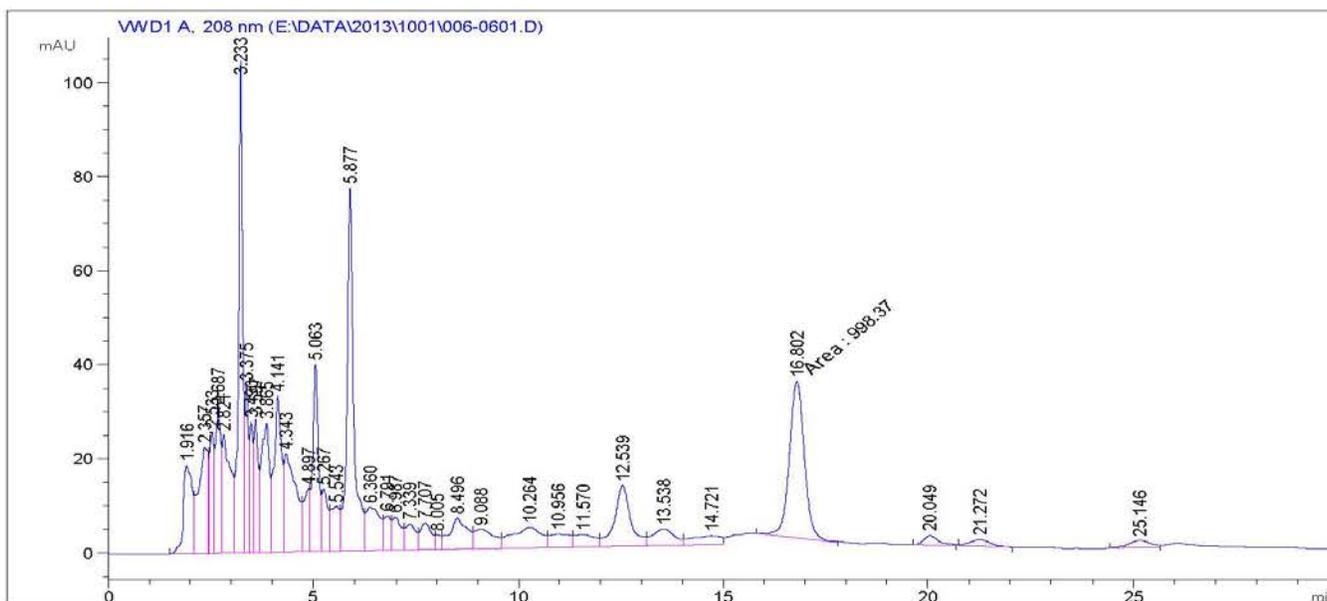
### D-1 HPLC Chromatogram for Batch GLG-MV 30-20131001

Date File : E:\DATA\2013\1001\006-0601.D

```

=====
Operator       : sun hongkai                Line :    6
Instrument     : Instrument 1              Location:  6
Injection Date : 2013-10-01 10:15:21      Inj  :   1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-10-01 08:29:52 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2014-4-24 08:20:30 sun hongkai
Sample Info   : GLG-MV30-131001
=====
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.916	BV	0.2037	281.90265	18.83624	3.2300	
2	2.357	VV	0.2136	379.65933	22.58052	4.3501	
3	2.533	VV	0.1020	187.60677	25.88833	2.1496	
4	2.687	VV	0.1328	283.97095	30.66584	3.2537	
5	2.821	VV	0.1845	359.55774	25.11810	4.1198	
6	3.233	VV	0.1021	745.33246	104.50144	8.5399	
7	3.375	VV	0.0833	206.23894	35.74903	2.3631	
8	3.490	VV	0.0792	154.25423	27.82207	1.7674	
9	3.597	VV	0.1060	211.56900	28.33839	2.4241	

Instrument 1 2014-4-24 8:37:58 sun hongkai

1/2

GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1001\006-0601.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.865	VV	0.1813	371.38699	27.42477	4.2553	
11	4.141	VV	0.1735	428.53952	33.27618	4.9102	
12	4.343	VV	0.2577	428.61862	20.93866	4.9111	
13	4.897	VV	0.1512	141.45369	13.36053	1.6208	
14	5.063	VV	0.1417	389.08185	39.82028	4.4581	
15	5.267	VV	0.1460	135.97592	13.24672	1.5580	
16	5.543	VV	0.1884	130.11400	9.52744	1.4908	
17	5.877	VV	0.1662	896.84198	77.13805	10.2759	
18	6.360	VV	0.3027	215.91284	9.15852	2.4739	
19	6.791	VV	0.1747	90.83903	7.35241	1.0408	
20	6.987	VV	0.2053	105.98821	7.07780	1.2144	
21	7.339	VV	0.2476	96.61403	5.52750	1.1070	
22	7.707	VV	0.2776	108.38070	5.68747	1.2418	
23	8.005	VV	0.1327	28.93303	3.08431	0.3315	
24	8.496	VV	0.3988	200.81441	6.59670	2.3009	
25	9.088	VV	0.4585	139.22090	4.16397	1.5952	
26	10.264	VV	0.6916	222.45528	4.39036	2.5489	
27	10.956	VV	0.4627	98.62449	2.81473	1.1300	
28	11.570	VV	0.4579	89.17840	2.62224	1.0218	
29	12.539	VV	0.3952	354.33191	12.87870	4.0599	
30	13.538	VV	0.5659	132.31357	3.52621	1.5160	
31	14.721	VV	0.6864	98.28963	1.92344	1.1262	
32	16.802	MM	0.4258	998.36975	33.62166	11.3881	Mogroside V
33	20.049	BB	0.3925	53.77571	2.03649	0.6162	
34	21.272	BB	0.5174	50.90292	1.45994	0.5832	Mogroside III

Total: 8766.71128 693.09682

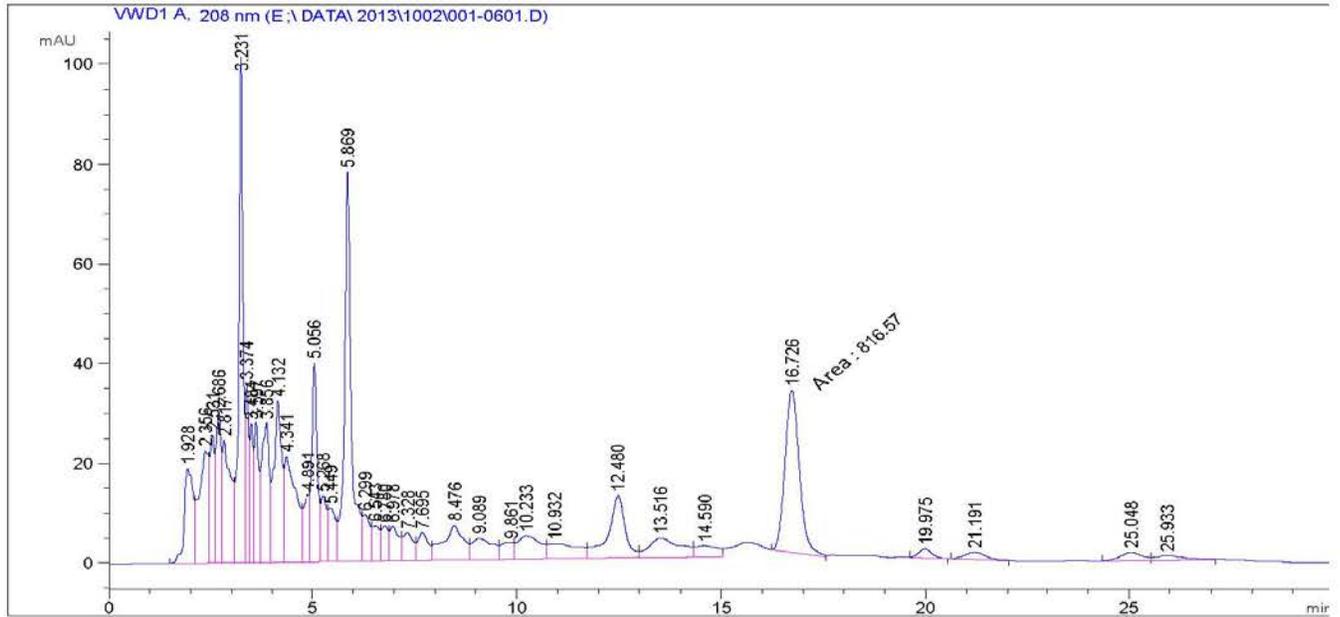
\*\*\* End of report \*\*\*

## D-2 HPLC Chromatogram for Batch GLG-MV 30-20131005

Date File : E:\DATA\2013\1002\001-0601.D

```

=====
Operator       : sun hongkai                Line   :    1
Instrument     : Instrument 1              Location:    6
Injection Date : 2013-10-02 10:35:55      Inj    :    1
                                           Inj Volum: 20.0 µl
Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed   : 2013-10-02 08:40:14 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed   : 2014-4-24 08:30:12 sun hongkai
Sample Info    : GLG-MV30-131005
  
```



External Standard Report

```

Sorted By      : Signal
Multiplier    : 1.0000
Dilution      : 1.0000

Use Multiplier and Dilution Factor with ISTDs
  
```

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.928	BV	0.2034	284.57397	19.04780	3.2348	
2	2.356	VV	0.2109	374.18176	22.57047	4.2534	
3	2.531	VV	0.1022	187.24551	25.77963	2.1285	
4	2.686	VV	0.1310	279.45303	30.25795	3.1766	
5	2.817	VV	0.1853	354.50937	24.63774	4.0298	
6	3.231	VV	0.1047	731.95319	101.31917	8.3203	
7	3.374	VV	0.0833	207.12466	35.92022	2.3544	
8	3.484	VV	0.0785	152.63312	27.85963	1.7350	

GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1002\001-0601.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
9	3.597	VV	0.1070	212.52994	28.13756	2.4159	
10	3.856	VV	0.1751	367.74329	27.99377	4.1802	
11	4.132	VV	0.1792	437.41101	32.42016	4.9722	
12	4.341	VV	0.2532	423.24921	21.20760	4.8112	
13	4.891	VV	0.1601	150.01295	13.51284	1.7052	
14	5.056	VV	0.1426	393.05014	39.89787	4.4679	
15	5.268	VV	0.1372	128.27666	13.30675	1.4582	
16	5.449	VV	0.1896	139.22568	10.80520	1.5826	
17	5.869	VV	0.1667	923.04333	78.25932	10.4925	
18	6.299	VV	0.1775	116.14135	9.31610	1.3202	
19	6.543	VV	0.1793	87.23565	7.05013	0.9916	
20	6.780	VV	0.1665	80.94333	6.94944	0.9201	
21	6.978	VV	0.2104	106.45452	6.96375	1.2101	
22	7.328	VV	0.2495	98.47548	5.58265	1.1194	
23	7.695	VV	0.2643	99.03427	5.49023	1.1257	
24	8.476	VV	0.4517	245.12157	7.00918	2.7864	
25	9.089	VV	0.5148	152.57211	4.29633	1.7343	
26	9.861	VV	0.2906	75.06857	3.33062	0.8533	
27	10.233	VV	0.5518	177.20137	4.70212	2.0143	
28	10.932	VV	0.6564	153.92192	2.98765	1.7497	
29	12.480	VV	0.4134	365.25720	12.51254	4.1520	
30	13.516	VV	0.7480	209.00137	3.93349	2.3758	
31	14.590	VV	0.5160	86.98933	2.20321	0.9888	
32	16.726	MM	0.4085	816.56783	32.76515	9.2601	Mogroside V
33	19.975	BB	0.3429	42.36911	1.87034	0.4816	
34	21.191	BB	0.5450	55.39529	1.52902	0.6297	
35	25.048	BV	0.5410	58.94990	1.60901	0.6701	
36	25.933	VB	0.6788	45.16304	9.27431e-1	0.5134	
Total :				8817.6682	673.96208		

\*\*\* End of report \*\*\*

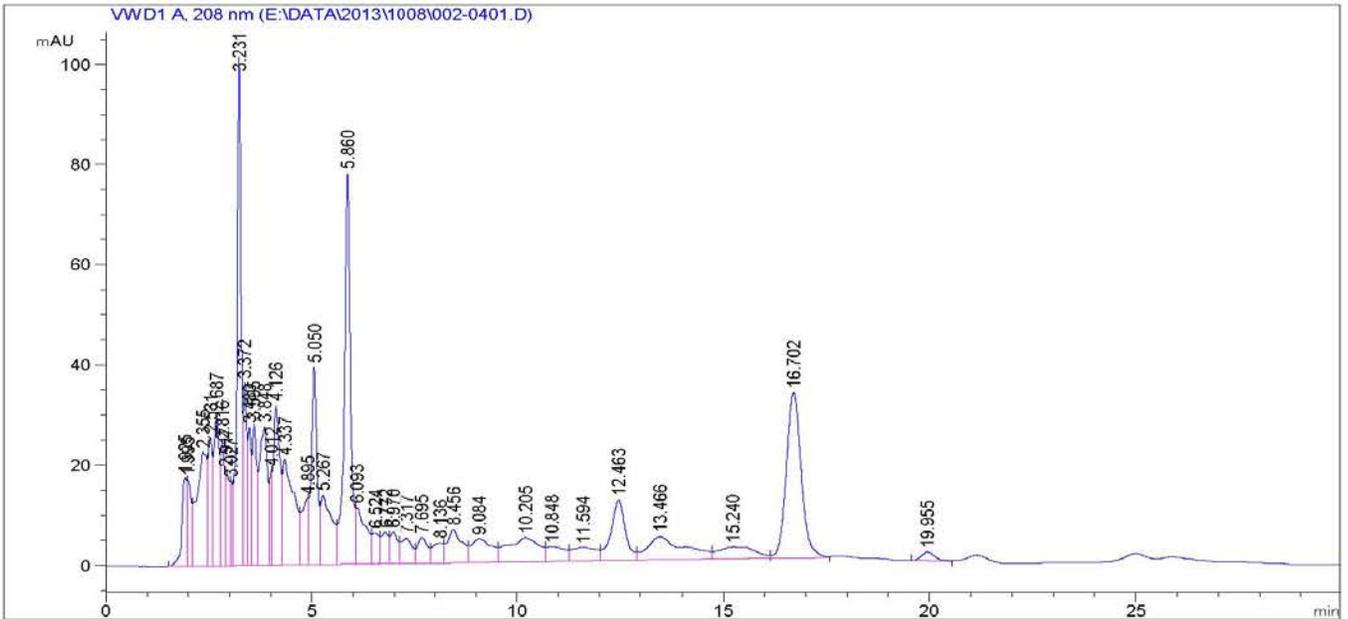
### D-3 HPLC Chromatogram for Batch GLG-MV 30-20131010

Date File : E:\DATA\2013\1008\002-0401.D

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=====
Operator       : sun hongkai                      Line :    2
Instrument     : Instrument 1                    Location:    4
Injection Date : 2013-10-08 13:05:35           Inj :    1
                                                    Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-10-08 08:37:44 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-10-08 08:31:26 sun hongkai
Sample Info   : GLG-MV30-131010
    
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area [mAU*s]	Peak Height [mAU]	Amt/Area %	Name
1	1.925	BV	0.1258	146.99232	17.74224	1.6948	
2	1.995	VV	0.1004	120.09840	17.20830	1.3847	
3	2.355	VV	0.2136	385.98993	22.78984	4.4505	
4	2.531	VV	0.1001	182.03720	25.68899	2.0989	
5	2.687	VV	0.1299	274.53339	30.03106	3.1654	
6	2.816	VV	0.0998	171.83495	24.33954	1.9813	
7	2.917	VV	0.0850	116.66679	18.92604	1.3452	
8	3.027	VV	0.0608	69.02497	16.87826	0.7959	
9	3.231	VV	0.1036	723.77191	101.46942	8.3451	

Instrument 1 2013-10-08 16:23:39 sun hongkai

1/2

GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1008\002-0401.D

Peak #	Ret [min]	Time Type	Peak Width [min]	Area mAU+s	Peak Height [mAU]	Amt/Area %	Name
10	3.372	VV	0.0835	211.25969	36.51283	2.4358	
11	3.480	VV	0.0782	150.75166	27.64244	1.7382	
12	3.595	VV	0.1086	216.79919	28.20022	2.4997	
13	3.848	VV	0.1714	358.39920	27.68667	4.1324	
14	4.012	VV	0.0668	87.01707	18.90486	1.0033	
15	4.126	VV	0.1488	350.70850	31.87333	4.0437	
16	4.337	VV	0.2473	410.97839	21.12711	4.7386	
17	4.895	VV	0.1550	146.32591	13.25980	1.6871	
18	5.050	VV	0.1400	384.54791	39.42271	4.4339	
19	5.267	VV	0.2427	258.26154	13.82512	2.9778	
20	5.860	VV	0.1531	827.78979	77.91994	9.5445	
21	6.093	VV	0.2186	188.34093	11.25301	2.1716	
22	6.524	VV	0.1767	77.09734	6.21546	0.8889	
23	6.772	VV	0.1740	77.00768	6.32750	0.8879	
24	6.970	VV	0.1823	82.63714	6.29505	0.9528	
25	7.317	VV	0.2761	99.88013	5.04628	1.1516	
26	7.695	VV	0.2546	88.29300	5.09462	1.0180	
27	8.136	VV	0.2939	76.15944	3.96722	0.8781	
28	8.456	VV	0.3366	165.53630	6.59422	1.9086	
29	9.084	VV	0.5003	161.67046	4.64927	1.8641	
30	10.205	VV	0.6834	253.06622	4.80128	2.9179	
31	10.848	VV	0.4224	90.69862	2.97685	1.0458	
32	11.594	VV	0.5778	112.65504	2.67978	1.2989	
33	12.463	VV	0.3555	291.70816	12.03730	3.3634	
34	13.466	VV	0.8698	295.44312	4.63819	3.4065	
35	15.240	VV	0.8044	149.58965	2.40942	1.7248	
36	16.702	VB	0.3849	830.81604	33.05737	9.5793	Mogroside V
37	19.955	BB	0.3349	38.60604	1.75760	0.4451	

Total: 8672.99401 731.24915

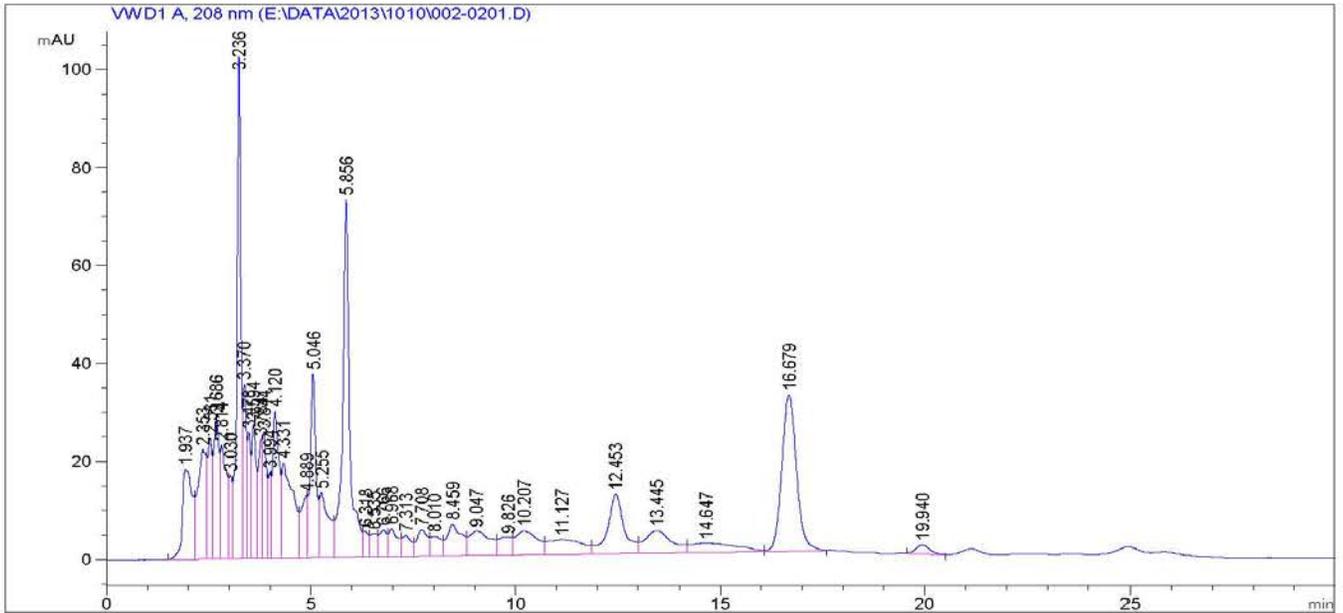
\*\*\* End of report \*\*\*

### D-4 HPLC Chromatogram for Batch GLG-MV 30-20131012

Date File : E:\DATA\2013\1010\002-0201.D

```

=====
Operator       : sun hongkai                Line   :    2
Instrument     : Instrument 1              Location:    2
Injection Date : 2013-10-10 14:15:36      Inj    :    1
                                           Inj Volum: 20.0 µl
Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-10-10 13:07:41 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-10-10 13:01:29 sun hongkai
Sample Info   : GLG-MV30-131012
  
```



External Standard Report

```

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

Signal: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.937	BV	0.2280	316.73334	18.44366	3.8331	
2	2.353	VV	0.1875	328.13098	22.32554	3.9711	
3	2.531	VV	0.1032	181.89392	24.75737	2.2013	
4	2.686	VV	0.1286	260.88882	28.89789	3.1573	
5	2.814	VV	0.1443	255.68222	23.24764	3.0943	
6	3.030	VV	0.0820	96.27630	17.02807	1.1651	
7	3.236	VV	0.0984	699.59363	102.64886	8.4665	
8	3.370	VV	0.0846	209.69077	35.65902	2.5377	
9	3.478	VV	0.0754	134.43747	25.75895	1.6270	

Instrument 1 2013-10-10 16:31:37 sun hongkai

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GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1010\002-0201.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.594	VV	0.1081	209.57899	27.41178	2.5363	
11	3.784	VV	0.0829	139.30737	24.28430	1.6859	
12	3.844	VV	0.1077	198.33910	25.64233	2.4003	
13	3.994	VV	0.0699	85.45670	17.54576	1.0342	
14	4.120	VV	0.1487	325.95520	29.97762	3.9447	
15	4.331	VV	0.2484	382.53397	19.44978	4.6295	
16	4.889	VV	0.1589	139.88484	12.71386	1.6929	
17	5.046	VV	0.1402	361.05139	37.43816	4.3695	
18	5.255	VV	0.2141	215.76920	13.29622	2.6113	
19	5.856	VV	0.1720	894.26898	73.02489	10.8225	
20	6.318	VV	0.1323	49.12443	5.25719	0.5945	
21	6.535	VV	0.1704	56.24764	4.74112	0.6807	
22	6.766	VV	0.1773	68.46462	5.44220	0.8286	
23	6.968	VV	0.2231	93.18420	5.68981	1.1277	
24	7.313	VV	0.2204	66.27744	4.23639	0.8021	
25	7.708	VV	0.2762	101.31576	5.31641	1.2261	
26	8.010	VV	0.2788	74.81271	4.03695	0.9054	
27	8.459	VV	0.3381	162.36469	6.43449	1.9650	
28	9.047	VV	0.5039	174.62491	4.96057	2.1133	
29	9.826	VV	0.2967	84.25210	3.65357	1.0196	
30	10.207	VV	0.5521	182.61786	4.89042	2.2101	
31	11.127	VV	0.7461	177.71405	2.97617	2.1507	
32	12.453	VV	0.3966	338.21094	12.13009	4.0931	
33	13.445	VV	0.6581	208.62766	4.59303	2.5248	
34	14.647	VV	0.9587	149.63908	1.94501	1.8109	
35	16.679	VB	0.3810	796.94098	31.98228	9.6447	Mogroside V
36	19.940	BB	0.3451	43.13855	1.88875	0.5221	

Total: 8263.03078 689.72617

\*\*\* End of report \*\*\*

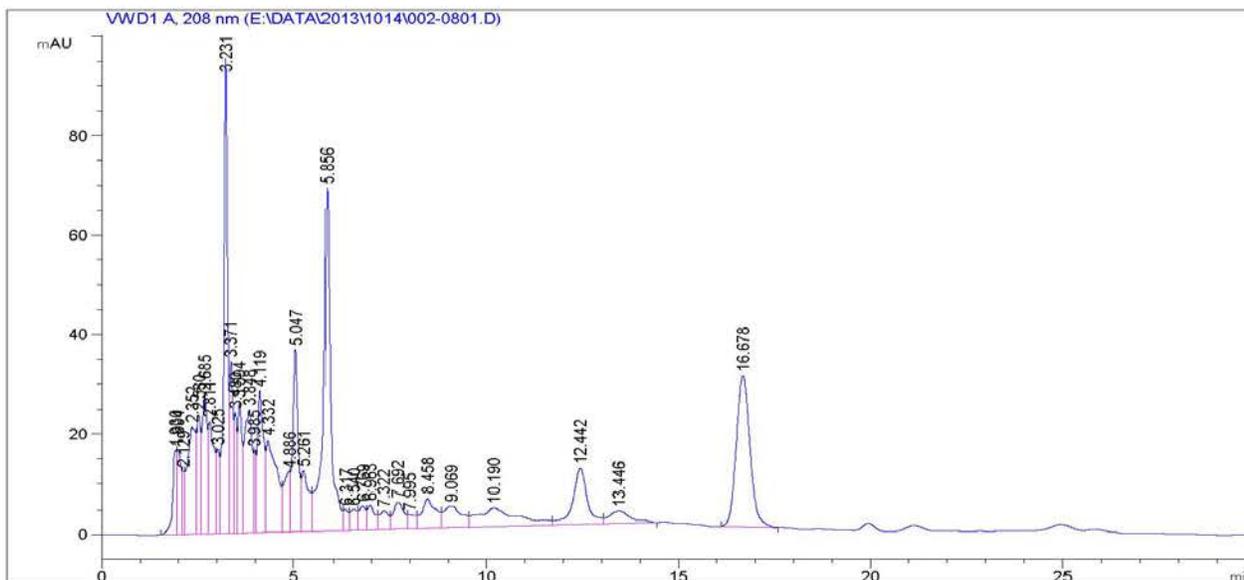
### D-5 HPLC Chromatogram for Batch GLG-MV 30-20131018

Date File : E:\DATA\2013\1014\002-0801.D

```

=====
Operator       : sun hongkai                Line :    2
Instrument     : Instrument 1                Location:  8
Injection Date : 2013-10-14 15:10:41      Inj :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-10-14 13:10:23 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-10-14 13:05:51 sun hongkai
Sample Info   : GLG-MV30-131018
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.930	BV	0.1159	128.03070	16.64697	1.7504	
2	1.994	VV	0.1052	125.69935	16.71848	1.7185	
3	2.129	VV	0.0526	45.43790	12.49292	0.6212	
4	2.352	VV	0.1905	317.42944	21.40219	4.3398	
5	2.530	VV	0.1024	173.22026	23.79738	2.3682	
6	2.685	VV	0.1281	248.91626	27.71100	3.4031	
7	2.811	VV	0.1430	240.63727	22.37192	3.2899	
8	3.025	VV	0.0847	98.79176	16.78602	1.3507	
9	3.231	VV	0.1006	666.51776	95.22979	9.1124	

Instrument 1 2013-10-14 16:46:30 sun hongkai

1/2

GRAS Assessment – GLG Life Tech Corporation  
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Date File : E:\DATA\2013\1014\002-0801.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.371	VV	0.0881	208.23923	34.37944	2.8470	
11	3.480	VV	0.0718	120.95167	24.04892	1.6536	
12	3.594	VV	0.1069	197.99661	26.25098	2.7069	
13	3.848	VV	0.1769	331.84418	24.50409	4.5369	
14	3.985	VV	0.0636	72.55650	16.29888	0.9920	
15	4.119	VV	0.1503	311.57916	28.29419	4.2598	
16	4.332	VV	0.2418	350.38382	18.33748	4.7903	
17	4.886	VV	0.1764	143.96507	11.87470	1.9682	
18	5.047	VV	0.1420	355.99527	36.32881	4.8671	
19	5.261	VV	0.1792	156.50638	11.93480	2.1397	
20	5.856	VV	0.1749	859.51740	68.77733	11.7511	
21	6.317	VV	0.1362	40.59650	4.24872	0.5550	
22	6.540	VV	0.1898	54.43396	4.17931	0.7442	
23	6.769	VV	0.1731	58.36390	4.82771	0.7979	
24	6.963	VV	0.1916	68.30494	4.99391	0.9338	
25	7.322	VV	0.2426	65.91204	3.78207	0.9011	
26	7.692	VV	0.2845	107.02800	5.44775	1.4633	
27	7.995	VV	0.2006	42.81540	2.86508	0.5854	
28	8.458	VV	0.3426	152.58942	5.95572	2.0862	
29	9.069	VV	0.4864	146.38696	4.29577	2.0014	
30	10.190	VV	0.9167	277.68552	3.79950	3.7964	
31	12.442	VV	0.3855	296.26794	11.05366	4.0505	
32	13.446	VB	0.5923	100.78049	2.53326	1.3778	
33	16.678	BB	0.3791	749.00061	30.25239	10.2401	Mogroside V

Total: 7314.38167 642.42114

\*\*\* End of report \*\*\*

## **APPENDIX E**

### **HPLC Chromatograms for GLG-MV 50**

E-1 HPLC Chromatogram for Batch GLG-MV 50-20131101

E-2 HPLC Chromatogram for Batch GLG-MV 50-20131103

E-3 HPLC Chromatogram for Batch GLG-MV 50-20131105

E-4 HPLC Chromatogram for Batch GLG-MV 50-20131110

E-5 HPLC Chromatogram for Batch GLG-MV 50-20131115

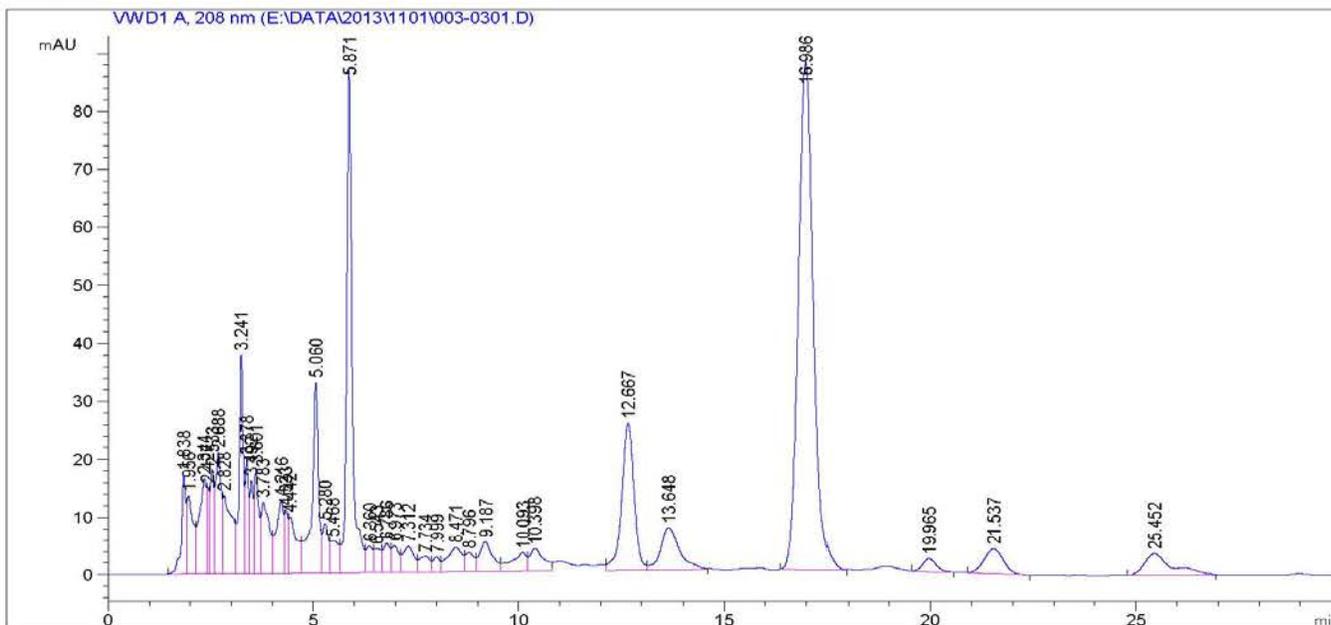
## E-1 HPLC Chromatogram for Batch GLG-MV 50-20131101

Date File : E:\DATA\2013\1101\003-0301.D

```

=====
Operator       : sun hongkai                Line   :    3
Instrument     : Instrument 1              Location:    3
Injection Date : 2013-11-01 11:35:34      Inj    :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-01 11:19:25 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-01 11:12:42 sun hongkai
Sample Info   : GLG-MV50-131101
    
```



### External Standard Report

```

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

Signal1: VWD1 A, Sig =208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.838	BV	0.1003	125.52859	17.38247	1.6114	
2	1.956	VV	0.1485	150.69676	13.72024	1.9345	
3	2.344	VV	0.1587	200.95660	16.60565	2.5797	
4	2.427	VV	0.0591	61.48078	15.12262	0.7892	
5	2.533	VV	0.0902	115.65018	18.18621	1.4846	
6	2.688	VV	0.1360	208.94556	21.08568	2.6823	
7	2.828	VV	0.1968	213.33221	13.65641	2.7386	
8	3.241	VV	0.1000	263.02209	37.84946	3.3765	
9	3.378	VV	0.0860	116.98112	19.92505	1.5017	

Instrument 1 2013-11-01 13:07:23 sun hongkai

1/2

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Date File : E:\DATA\2013\1101\003-0301.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.492	VV	0.0776	87.77482	16.23710	1.1268	
11	3.601	VV	0.1060	139.72879	18.42381	1.7937	
12	3.783	VV	0.1863	180.32413	12.45796	2.3149	
13	4.216	VV	0.1650	155.29892	12.78851	1.9936	
14	4.333	VV	0.0931	71.66857	11.05909	0.9200	
15	4.442	VV	0.1736	128.70752	9.89147	1.6523	
16	5.060	VV	0.1605	380.26028	33.02331	4.8815	
17	5.280	VV	0.1449	88.17632	8.66656	1.1319	
18	5.468	VV	0.1664	71.65503	5.55788	0.9199	
19	5.871	VV	0.1421	839.98022	86.74500	10.7831	
20	6.360	VV	0.1520	49.93452	4.63237	0.6410	
21	6.543	VV	0.1780	49.49574	4.16412	0.6354	
22	6.786	VV	0.1713	60.36827	5.05786	0.7750	
23	6.973	VV	0.1759	57.32556	4.64719	0.7359	
24	7.312	VV	0.2714	83.32623	4.46842	1.0697	
25	7.734	VV	0.2811	49.62673	2.68589	0.6371	
26	7.999	VV	0.1680	30.85526	2.61940	0.3961	
27	8.471	VV	0.3422	102.64417	4.21701	1.3177	
28	8.796	VV	0.2170	49.30922	3.29210	0.6330	
29	9.187	VV	0.3106	115.22012	5.20631	1.4791	
30	10.093	VV	0.3404	83.81091	3.24747	1.0759	
31	10.398	VV	0.3289	93.20226	3.93316	1.1965	
32	12.667	EV	0.3203	534.66998	25.50437	6.8637	
33	13.648	VB	0.4693	238.31018	7.50851	3.0593	
34	16.986	BB	0.3909	2217.12866	87.75139	28.4619	Mogroside V
35	19.965	VB	0.3572	53.78970	2.30105	0.6905	
36	21.537	BB	0.5088	139.01662	4.29311	1.7846	
37	25.452	BB	0.6837	181.61050	3.77423	2.3314	

Total : 7789.81318 567.68842

\*\*\* End of report \*\*\*

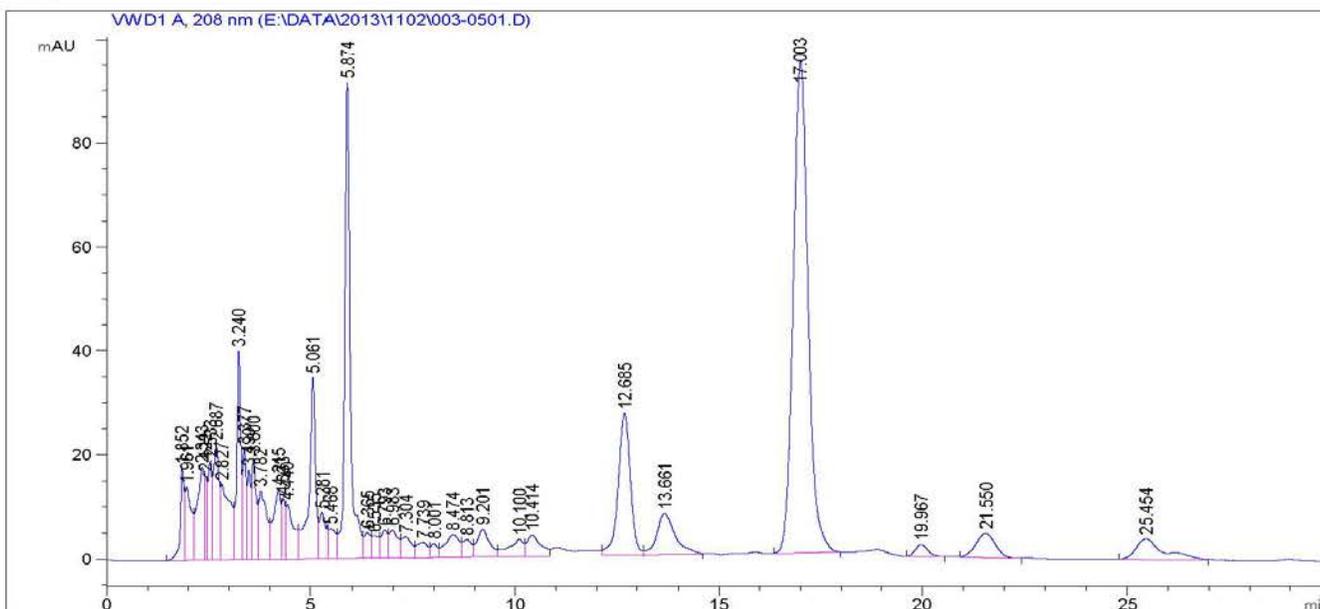
## E-2 HPLC Chromatogram for Batch GLG-MV 50-20131103

Date File : E:\DATA\2013\1102\003-0501.D

```

=====
Operator       : sun hongkai                Line   :    3
Instrument     : Instrument 1                Location:    5
Injection Date : 2013-11-02 11:15:43       Inj     :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-02 09:09:50 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-02 09:07:32 sun hongkai
Sample Info   : GLG-MV50-131103
  
```



### External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.852	BV	0.0956	118.65759	17.72162	1.4425	
2	1.961	VV	0.1461	151.47458	14.05595	1.8415	
3	2.343	VV	0.1571	213.75998	17.85709	2.5987	
4	2.422	VV	0.0592	65.73038	16.12976	0.7991	
5	2.533	VV	0.0889	117.90297	18.86763	1.4334	
6	2.687	VV	0.1368	221.46436	22.19954	2.6924	
7	2.827	VV	0.2085	238.45992	14.45340	2.8990	
8	3.240	VV	0.0981	276.97327	40.06258	3.3672	
9	3.377	VV	0.0847	125.93420	21.37716	1.5310	

Instrument 1 2013-11-02 13:01:40 sun hongkai

1/2

GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1102\003-0501.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.490	VV	0.0774	92.29047	17.12951	1.1220	
11	3.600	VV	0.1084	149.31987	19.47623	1.8153	
12	3.782	VV	0.1838	188.36661	13.21001	2.2900	
13	4.215	VV	0.1652	163.98561	13.34332	1.9936	
14	4.333	VV	0.0919	75.59139	11.62625	0.9190	
15	4.440	VV	0.1746	135.49008	10.44568	1.6472	
16	5.061	VV	0.1607	396.56180	34.77675	4.8210	
17	5.281	VV	0.1447	90.13442	8.87105	1.0958	
18	5.468	VV	0.1836	69.09335	5.70321	0.8400	
19	5.874	VV	0.1424	887.73572	91.40936	10.7923	
20	6.365	VV	0.1585	56.21191	4.95738	0.6834	
21	6.535	VV	0.1715	48.20314	4.30056	0.5860	
22	6.793	VV	0.1677	62.58965	5.32682	0.7609	
23	6.983	VV	0.2059	79.30128	5.36641	0.9641	
24	7.304	VV	0.2443	68.91206	4.00733	0.8378	
25	7.739	VV	0.2880	54.42388	2.85447	0.6616	
26	8.001	VV	0.1675	31.34922	2.67134	0.3811	
27	8.474	VV	0.3468	106.62582	4.37676	1.2963	
28	8.813	VV	0.2164	49.72614	3.33126	0.6045	
29	9.201	VV	0.2985	112.58573	5.33747	1.3687	
30	10.100	VV	0.3381	84.37353	3.31051	1.0257	
31	10.414	VV	0.3302	96.35284	4.09032	1.1714	
32	12.685	BV	0.3158	567.43903	27.23887	6.8984	
33	13.661	VB	0.4662	248.62288	7.89974	3.0225	
34	17.003	BB	0.3880	2388.55835	94.52493	29.0379	Mogroside V
35	19.967	BB	0.3330	48.53167	2.25143	0.5900	
36	21.550	BB	0.5167	153.22594	4.63552	1.8628	
37	25.454	BB	0.6829	189.70230	3.98919	2.3062	

Total : 8225.66192 599.18640

\*\*\* End of report \*\*\*

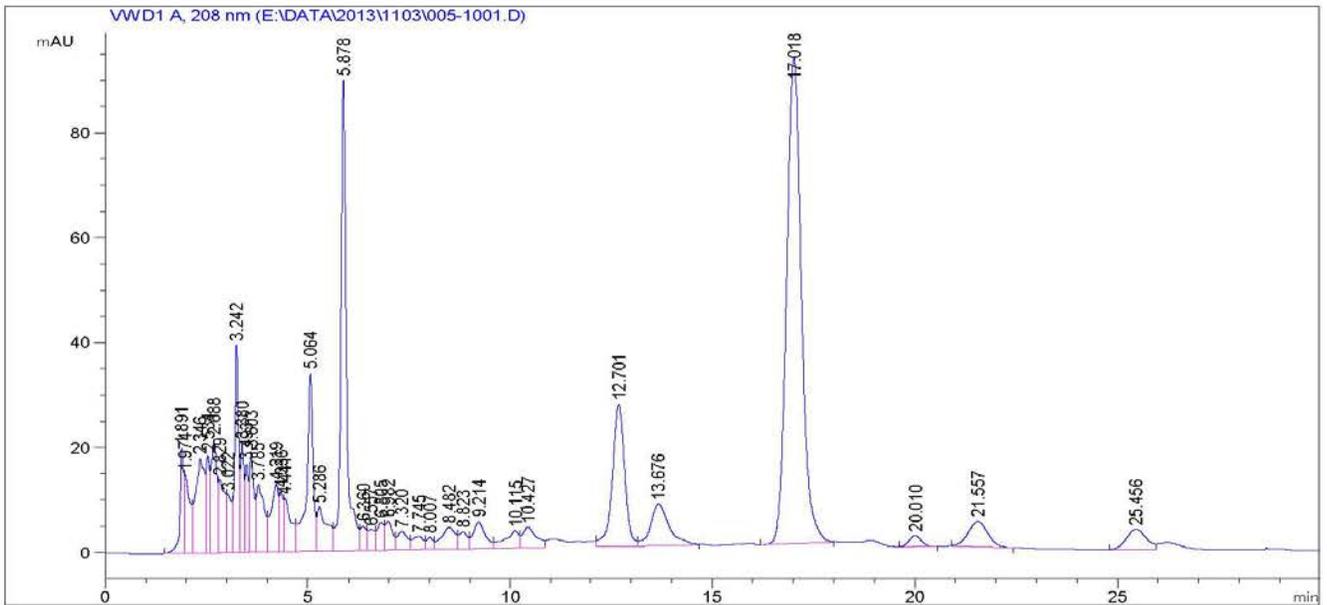
### E-3 HPLC Chromatogram for Batch GLG-MV 50-20131105

Date File : E:\DATA\2013\1103\005-1001.D

```

-----
Operator       : sun hongkai           Line :    5
Instrument     : Instrument 1         Location: 10
Injection Date : 2013-11-03 15:35:24 Inj  :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-03 08:49:42 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-03 08:47:27 sun hongkai
Sample Info   : GLG-MV50-131105
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.891	BV	0.0925	131.36267	20.03275	1.6440	
2	1.974	VV	0.1232	135.60246	14.96913	1.6971	
3	2.346	VV	0.1972	277.00974	17.98469	3.4668	
4	2.534	VV	0.0889	116.25970	18.59935	1.4550	
5	2.688	VV	0.1373	213.91721	21.61728	2.6772	
6	2.829	VV	0.1459	155.36902	13.95498	1.9444	
7	3.022	VV	0.1081	84.92323	11.11553	1.0628	
8	3.242	VV	0.0975	266.43488	39.58318	3.3344	
9	3.380	VV	0.0851	123.21387	20.31612	1.5420	

Instrument 1 2013-11-03 16:26:20 sun hongkai

1/2

GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1103\005-1001.D

Peak #	Ret [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.493	VV	0.0770	89.76706	16.75949	1.1234	
11	3.603	VV	0.1078	145.77943	19.13928	1.8244	
12	3.785	VV	0.1827	180.97914	12.77647	2.2650	
13	4.219	VV	0.1663	159.83626	12.90568	2.0004	
14	4.336	VV	0.0936	76.50275	11.51095	0.9574	
15	4.441	VV	0.1690	128.15016	10.16272	1.6038	
16	5.064	VV	0.1578	383.05087	33.95319	4.7939	
17	5.286	VV	0.2326	148.31400	8.44524	1.8562	
18	5.878	VV	0.1418	866.17694	89.70406	10.8402	
19	6.360	VV	0.1546	51.36798	4.66604	0.6429	
20	6.557	VV	0.1709	44.77913	3.92539	0.5604	
21	6.805	VV	0.1669	62.30991	5.33231	0.7798	
22	6.982	VV	0.1863	71.03570	5.47548	0.8890	
23	7.320	VV	0.2457	60.24806	3.53098	0.7540	
24	7.745	VV	0.2579	47.19978	2.48552	0.5907	
25	8.007	VV	0.1633	26.67168	2.34536	0.3338	
26	8.482	VV	0.3415	99.63169	4.14651	1.2469	
27	8.823	VV	0.2166	47.63837	3.18754	0.5962	
28	9.214	VV	0.2940	105.92120	5.11482	1.3256	
29	10.115	VV	0.3360	82.22560	3.26530	1.0291	
30	10.427	VV	0.3330	93.85877	3.96380	1.1746	
31	12.701	BV	0.3198	568.24341	27.00232	7.1116	
32	13.676	VB	0.4782	253.57613	7.89294	3.1735	
33	17.018	VB	0.3907	2351.73169	92.66349	29.4319	Mogroside V
34	20.010	BB	0.3170	42.36109	2.07336	0.5301	
35	21.557	BB	0.5224	163.80688	4.81159	2.0500	
36	25.456	BV	0.5331	135.15208	3.89372	1.6914	

Total : 7990.40856 579.80657

\*\*\* End of report \*\*\*

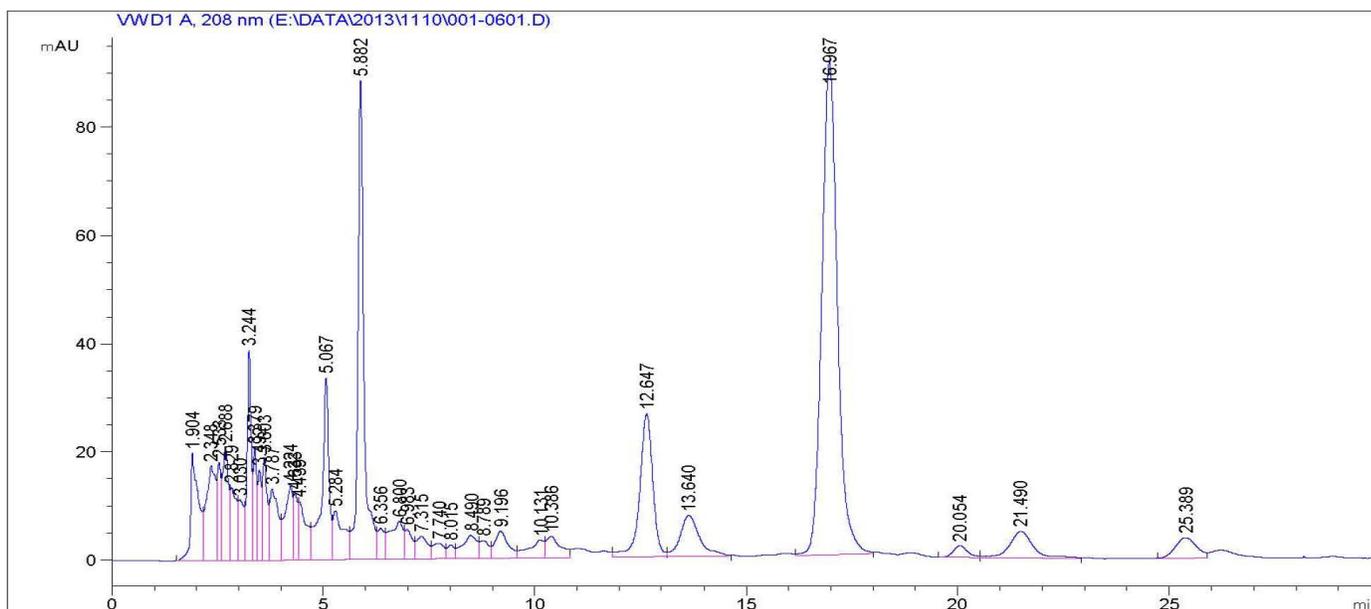
### E-4 HPLC Chromatogram for Batch GLG-MV 50-20131110

Date File : E:\DATA\2013\1110\001-0601.D

```

=====
Operator       : sun hongkai                Line   :    1
Instrument     : Instrument 1                Location:    6
Injection Date : 2013-11-10 11:01:30      Inj    :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-10 10:49:05 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-10 10:22:12 sun hongkai
Sample Info   : GLG-MV50-131110
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area [mAU*s]	Peak Height [mAU]	Amt/Area %	Name
1	1.904	BV	0.1658	255.43585	19.89872	3.1300	
2	2.348	VV	0.1946	268.79578	17.55715	3.2937	
3	2.533	VV	0.0896	114.82940	18.20271	1.4071	
4	2.688	VV	0.1363	206.65623	21.07190	2.5323	
5	2.829	VV	0.1388	141.89232	13.48109	1.7387	
6	3.030	VV	0.1237	99.44269	11.22425	1.2185	
7	3.244	VV	0.0993	263.45270	38.93793	3.2282	
8	3.379	VV	0.0846	121.94580	20.75510	1.4943	
9	3.492	VV	0.0774	90.09480	16.73219	1.1040	

Instrument 1 2013-11-10 11:57:23 sun hongkai

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Date File : E:\DATA\2013\1110\001-0601.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.603	VV	0.1082	145.86617	19.07012	1.7874	
11	3.787	VV	0.1875	191.49539	13.14081	2.3465	
12	4.224	VV	0.1714	175.50970	13.69018	2.1506	
13	4.333	VV	0.0921	79.72729	12.21782	0.9769	
14	4.439	VV	0.1750	141.20006	10.75510	1.7302	
15	5.067	VV	0.1654	397.77936	33.68848	4.8742	
16	5.284	VV	0.2337	160.19231	9.07085	1.9629	
17	5.882	VV	0.1467	891.14545	88.43122	10.9196	
18	6.356	VV	0.1535	62.09170	5.69269	0.7608	
19	6.800	VV	0.2954	155.60057	6.96927	1.9066	
20	6.983	VV	0.1706	65.68874	5.47128	0.8049	
21	7.315	VV	0.2700	77.29632	4.14461	0.9471	
22	7.740	VV	0.2808	53.91167	2.84521	0.6606	
23	8.015	VV	0.1629	29.71280	2.59138	0.3641	
24	8.490	VV	0.3388	103.41264	4.23506	1.2672	
25	8.789	VV	0.2121	47.87943	3.31747	0.5867	
26	9.196	VV	0.3184	111.46868	5.02766	1.3659	
27	10.131	VV	0.3296	83.14050	3.32514	1.0188	
28	10.386	VV	0.3270	94.92949	3.99103	1.1632	
29	12.647	VV	0.3261	571.52216	26.47227	7.0031	
30	13.640	VB	0.4779	244.40620	7.61372	2.9948	
31	16.967	VB	0.3933	2340.54028	90.98559	28.6797	Mogroside V
32	20.054	VV	0.3578	50.62428	2.18368	0.6203	
33	21.490	VB	0.5817	189.91040	4.88445	2.3271	
34	25.389	BV	0.5321	133.36272	3.82349	1.6342	

Total: 8160.95986 561.49963

\*\*\* End of report \*\*\*

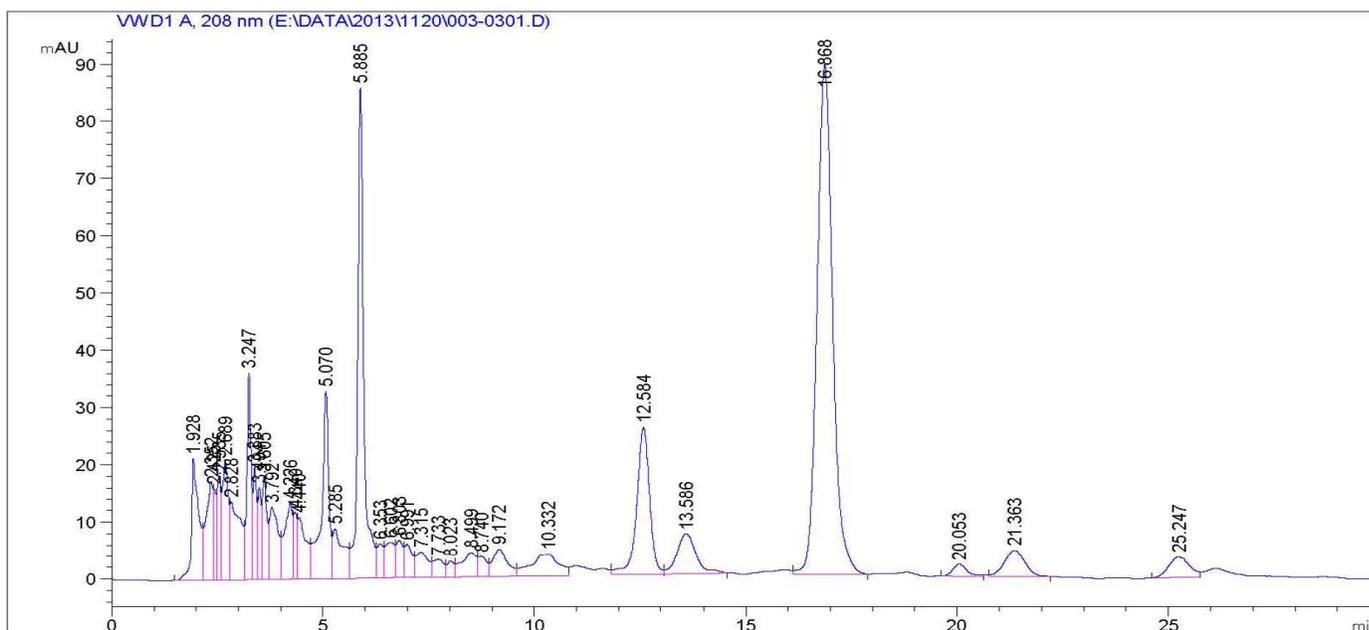
## E-5 HPLC Chromatogram for Batch GLG-MV 50-20131115

Date File : E:\DATA\2013\1120\001-1001.D

```

=====
Operator       : sun hongkai                Line   :    1
Instrument     : Instrument 1              Location:   10
Injection Date : 2013-11-20 14:13:04      Inj     :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-20 11:39:21 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-11-20 11:33:02 sun hongkai
Sample Info   : GLG-MV50-131115
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area [mAU*s]	Peak Height [mAU]	Amt/Area %	Name
1	1.928	BV	0.1559	256.28516	21.37513	3.1956	
2	2.352	VV	0.1546	203.77911	17.34130	2.5409	
3	2.425	VV	0.0569	62.06045	15.99859	0.7738	
4	2.535	VV	0.0900	116.31590	18.34679	1.4503	
5	2.689	VV	0.1371	208.02301	21.05661	2.5938	
6	2.828	VV	0.2189	237.20563	13.73576	2.9577	
7	3.247	VV	0.1023	254.28217	36.23171	3.1706	
8	3.383	VV	0.0855	115.59373	19.82780	1.4413	
9	3.494	VV	0.0777	87.55518	16.16783	1.0917	

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Date File : E:\DATA\2013\1120\001-1001.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.605	VV	0.1080	138.66554	18.15268	1.7290	
11	3.792	VV	0.1927	186.47897	12.73644	2.3252	
12	4.226	VV	0.1737	175.84001	13.37643	2.1925	
13	4.340	VV	0.0866	73.06205	11.82459	0.9110	
14	4.440	VV	0.1811	146.85579	10.85651	1.8311	
15	5.070	VV	0.1689	397.59799	32.84922	4.9576	
16	5.285	VV	0.2358	157.66743	8.77602	1.9660	
17	5.885	VV	0.1475	871.49994	85.86469	10.8667	
18	6.353	VV	0.1475	63.32396	6.09168	0.7896	
19	6.602	VV	0.2236	94.68597	6.29411	1.1806	
20	6.803	VV	0.1646	76.76793	6.61252	0.9572	
21	6.991	VV	0.1821	76.29848	5.87412	0.9514	
22	7.315	VV	0.2798	86.68201	4.47628	1.0808	
23	7.733	VV	0.2780	59.25665	3.14565	0.7389	
24	8.023	VV	0.1648	32.79022	2.82034	0.4089	
25	8.499	VV	0.3311	104.09266	4.31234	1.2979	
26	8.740	VV	0.2095	50.16804	3.56171	0.6255	
27	9.172	VV	0.3544	115.69063	4.79352	1.4425	
28	10.332	VV	0.5785	176.60394	3.90595	2.2021	
29	12.584	VV	0.3224	551.57001	25.77771	6.8775	
30	13.586	VB	0.4467	223.06267	7.07013	2.7814	
31	16.868	VB	0.3944	2289.08154	89.10169	28.5425	Mogroside V
32	20.053	BB	0.3548	48.73631	2.10283	0.6077	
33	21.363	BB	0.5191	155.97250	4.63664	1.9448	
34	25.247	BV	0.4884	126.34583	3.64897	1.5754	

Total: 8019.89741 558.74429

\*\*\* End of report \*\*\*

## **APPENDIX F**

### **HPLC Chromatograms for GLG-M V60**

F-1 HPLC Chromatogram for Batch GLG-MV 60-20131201

F-2 HPLC Chromatogram for Batch GLG-MV 60-20131206

F-3 HPLC Chromatogram for Batch GLG-MV 60-20131210

F-4 HPLC Chromatogram for Batch GLG-MV 60-20131213

F-5 HPLC Chromatogram for Batch GLG-MV 60-20131220

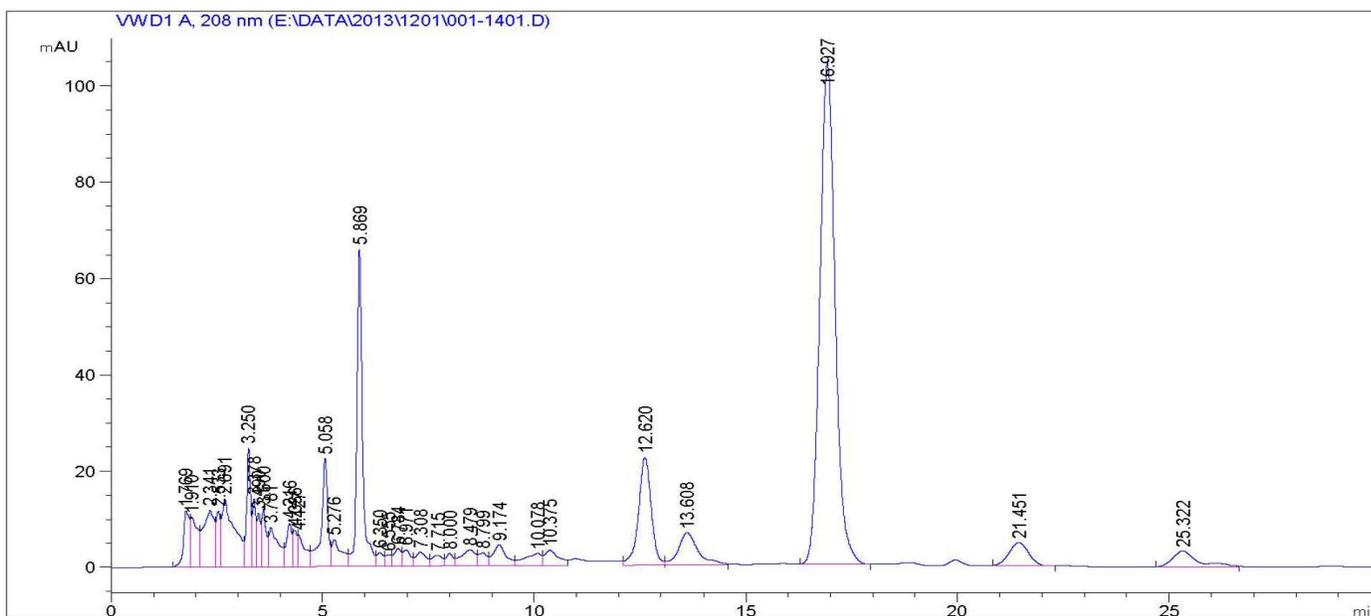
## F-1 HPLC Chromatogram for Batch GLG-MV 60-20131201

Date File : E:\DATA\2013\1201\001-1401.D

```

=====
Operator       : sun hongkai                Line   :    1
Instrument     : Instrument 1                Location:   14
Injection Date : 2013-12-01 12:35:10      Inj     :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-01 11:09:04 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-01 11:02:05 sun hongkai
Sample Info   : GLG-MV60-131201
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.769	BV	0.1349	114.61314	11.68085	1.7060	
2	1.910	VV	0.1596	123.95932	10.39036	1.8451	
3	2.341	VV	0.2318	215.53140	11.72958	3.2082	
4	2.533	VV	0.0918	75.91910	11.69216	1.1300	
5	2.691	VV	0.2675	294.84210	14.08556	4.3887	
6	3.250	VV	0.0959	162.86232	24.68694	2.4242	
7	3.378	VV	0.0864	83.22636	14.07903	1.2388	
8	3.490	VV	0.0777	59.99843	11.09461	0.8931	
9	3.600	VV	0.1048	89.90175	12.01101	1.3382	

Instrument 1 2013-12-01 13:30:10 sun hongkai

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Date File : E:\DATA\2013\1201\001-1401.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.781	VV	0.2053	129.84238	8.12826	1.9327	
11	4.216	VV	0.1268	80.02240	9.01600	1.1911	
12	4.336	VV	0.0980	52.24397	7.57037	0.7776	
13	4.427	VV	0.1614	78.77248	6.58440	1.1725	
14	5.058	VV	0.1550	244.89728	22.44600	3.6453	
15	5.276	VV	0.2111	90.00745	5.63439	1.3397	
16	5.869	VV	0.1376	613.13885	65.95721	9.1265	
17	6.350	VV	0.1460	29.42377	2.83089	0.4380	
18	6.555	VV	0.1588	25.56659	2.38107	0.3806	
19	6.784	VV	0.1740	44.71191	3.67557	0.6655	
20	6.971	VV	0.1754	41.82259	3.40245	0.6225	
21	7.308	VV	0.2422	50.92423	2.94899	0.7580	
22	7.715	VV	0.2565	38.05912	2.23928	0.5665	
23	8.000	VV	0.1681	30.79979	2.64092	0.4585	
24	8.479	VV	0.3314	78.51581	3.31777	1.1687	
25	8.799	VV	0.1788	38.72584	2.70315	0.5764	
26	9.174	VV	0.2992	91.54035	4.35325	1.3626	
27	10.078	VV	0.3665	71.62377	2.54225	1.0661	
28	10.375	VV	0.3213	73.71046	3.16386	1.0972	
29	12.620	BV	0.3022	466.62900	22.31814	6.9457	
30	13.608	VB	0.4736	212.70416	6.67587	3.1661	
31	16.927	BB	0.3869	2619.04126	104.03120	38.9840	Mogroside V
32	21.451	BB	0.5056	156.67343	4.80580	2.3321	
33	25.322	BB	0.6205	137.99156	3.25073	2.0540	

Total: 6718.24239 424.06789

\*\*\* End of report \*\*\*

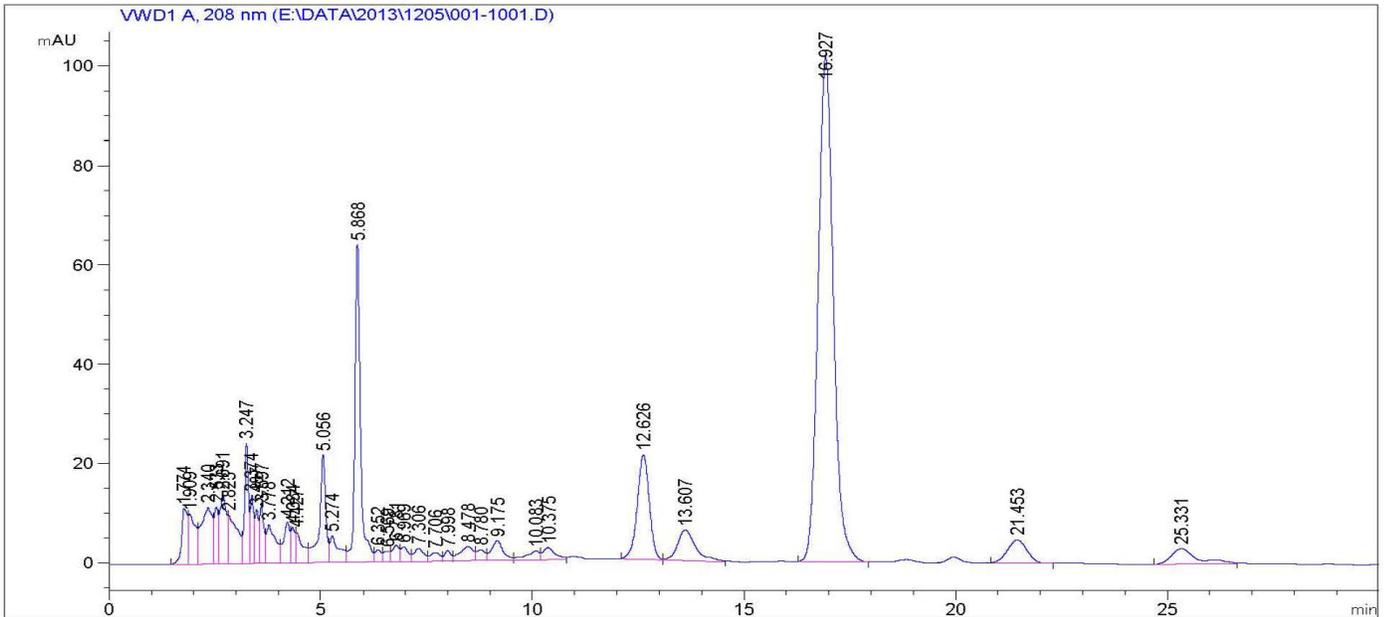
## F-2 HPLC Chromatogram for Batch GLG-MV 60-20131206

Date File : E:\DATA\2013\1205\001-1001.D

```

=====
Operator       : sun hongkai                Line :    1
Instrument     : Instrument 1              Location:   10
Injection Date : 2013-12-05 10:12:35      Inj :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-05 08:18:14 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-05 08:10:05 sun hongkai
Sample Info   : GLG-MV60-131206
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig =208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.774	BV	0.1355	109.36037	11.22889	1.7257	
2	1.909	VV	0.1561	118.85625	10.10846	1.8755	
3	2.340	VV	0.2301	209.37627	11.41172	3.3039	
4	2.533	VV	0.0921	75.24722	11.53822	1.1874	
5	2.691	VV	0.1472	150.26300	13.98320	2.3711	
6	2.823	VV	0.1979	152.04759	9.75224	2.3993	
7	3.247	VV	0.0955	159.28323	24.27950	2.5135	
8	3.374	VV	0.0843	80.30059	13.71757	1.2671	
9	3.487	VV	0.0794	58.65992	10.79787	0.9257	

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Date File : E:\DATA\2013\1205\001-1001.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.597	VV	0.1061	87.05231	11.64642	1.3737	
11	3.778	VV	0.1877	111.76888	7.72409	1.7637	
12	4.212	VV	0.1442	86.08530	8.30669	1.3584	
13	4.334	VV	0.0983	49.55705	7.15396	0.7820	
14	4.427	VV	0.1597	73.78858	6.17756	1.1644	
15	5.056	VV	0.1523	231.37335	21.65165	3.6511	
16	5.274	VV	0.2067	82.22047	5.31373	1.2974	
17	5.868	VV	0.1375	586.39502	63.99483	9.2533	
18	6.352	VV	0.1437	24.62709	2.44595	0.3886	
19	6.569	VV	0.1701	24.18447	2.15696	0.3816	
20	6.781	VV	0.1699	39.26134	3.32123	0.6195	
21	6.969	VV	0.1700	35.00626	2.95972	0.5524	
22	7.306	VV	0.2339	43.39788	2.62217	0.6848	
23	7.706	VV	0.2458	28.31554	1.74729	0.4468	
24	7.998	VV	0.1560	22.67137	2.10882	0.3578	
25	8.478	VV	0.3208	64.09054	2.84745	1.0113	
26	8.780	VV	0.2065	30.22120	2.12793	0.4769	
27	9.175	VV	0.2760	75.51009	3.96533	1.1915	
28	10.083	VV	0.2957	40.06819	1.81295	0.6323	
29	10.375	VV	0.2815	48.29664	2.42925	0.7621	
30	12.626	BV	0.3044	420.13214	21.16625	6.6297	
31	13.607	VB	0.4451	183.13199	6.17351	2.8898	
32	16.927	BB	0.3861	2550.54883	101.59490	40.2476	Mogroside V
33	21.453	BB	0.5083	153.58783	4.71305	2.4236	
34	25.331	BB	0.6245	132.46388	3.11317	2.0903	

Total: 6337.15068 416.09254

=====  
 \*\*\* End of report \*\*\*  
 =====

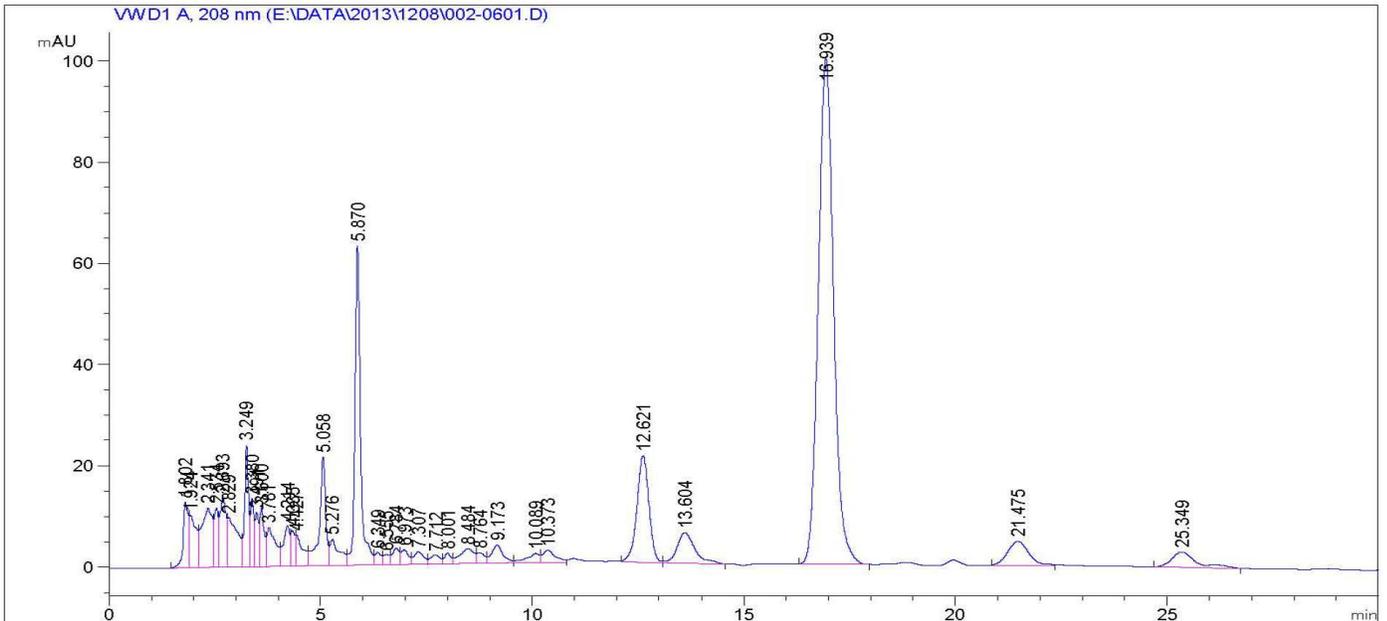
### F-3 HPLC Chromatogram for Batch GLG-MV 60-20131210

Date File : E:\DATA\2013\1208\002-0601.D

```

=====
Operator       : sun hongkai                Line   :    2
Instrument     : Instrument 1              Location:    6
Injection Date : 2013-12-08 14:20:31      Inj     :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-08 09:35:30 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-08 09:10:19 sun hongkai
Sample Info   : GLG-MV60-131210
  
```



GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1208\002-0601.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.600	VV	0.1042	86.22487	11.59693	1.3771	
11	3.781	VV	0.1882	112.13520	7.73051	1.7909	
12	4.214	VV	0.1473	84.41589	8.03583	1.3482	
13	4.335	VV	0.0987	49.00343	7.03678	0.7826	
14	4.427	VV	0.1587	72.32533	6.09860	1.1551	
15	5.058	VV	0.1522	228.24866	21.37592	3.6454	
16	5.276	VV	0.2076	81.96600	5.22871	1.3091	
17	5.870	VV	0.1361	578.13531	63.06487	9.2334	
18	6.349	VV	0.1462	25.39089	2.46917	0.4055	
19	6.555	VV	0.1577	21.61808	2.00729	0.3453	
20	6.784	VV	0.1706	37.98290	3.19703	0.6066	
21	6.973	VV	0.1717	34.82048	2.90848	0.5561	
22	7.307	VV	0.2304	40.53027	2.49288	0.6473	
23	7.712	VV	0.2463	27.83599	1.71369	0.4446	
24	8.001	VV	0.1583	22.85905	2.11170	0.3651	
25	8.484	VV	0.3263	69.07849	2.97436	1.1033	
26	8.764	VV	0.1950	27.51216	2.08116	0.4394	
27	9.173	VV	0.2761	67.53498	3.56960	1.0786	
28	10.089	VV	0.2883	39.18761	1.82579	0.6259	
29	10.373	VV	0.2854	49.34481	2.44082	0.7881	
30	12.621	BV	0.3040	415.24982	20.95726	6.6320	
31	13.604	VB	0.4405	179.50838	6.08074	2.8669	
32	16.939	BB	0.3893	2511.09839	99.92787	40.1048	Mogroside V
33	21.475	BB	0.5322	166.04240	4.79457	2.6519	
34	25.349	BB	0.6250	127.53443	3.06669	2.0369	

Total : 6261.34432 413.10111

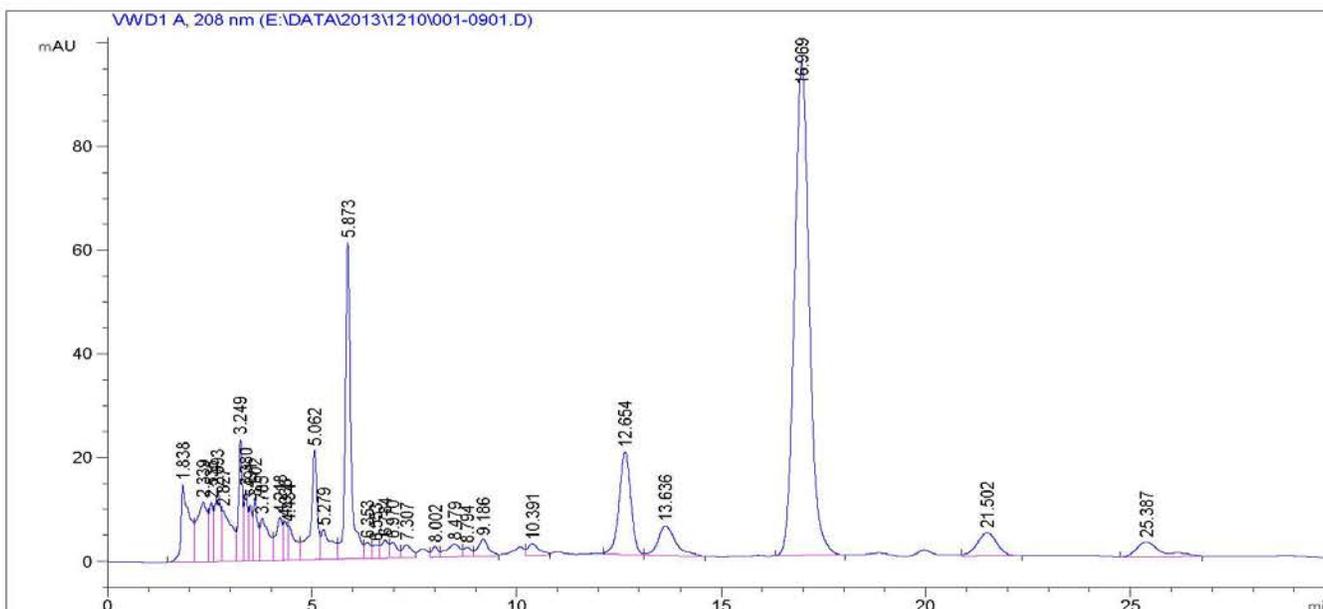
\*\*\* End of report \*\*\*

### F-4 HPLC Chromatogram for Batch GLG-MV 60-20131213

Date File : E:\DATA\2013\1210\001-0901.D

```

=====
Operator       : sun hongkai                Line   :    1
Instrument     : Instrument 1                Location:    9
Injection Date : 2013-12-10 13:30:03       Inj     :    1
                                           Inj Volum: 20.0 µl
Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-10 10:49:45 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-10 10:22:05 sun hongkai
Sample Info   : GLG-MV60-131213
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
1	1.838	BV	0.1885	219.15166	14.94860	3.6150	
2	2.339	VV	0.2221	202.15518	11.52540	3.3346	
3	2.535	VV	0.0925	74.46349	11.35842	1.2283	
4	2.693	VV	0.1465	143.04887	13.54355	2.3597	
5	2.827	VV	0.2056	158.40157	9.74674	2.6129	
6	3.249	VV	0.0956	154.28561	23.48824	2.5450	
7	3.380	VV	0.0859	81.79862	13.65078	1.3493	
8	3.491	VV	0.0778	58.45232	10.77549	0.9642	
9	3.602	VV	0.1072	87.65468	11.58448	1.4459	

Instrument 1 2013-12-10 14:51:09 sun hongkai

1/2

GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1210\001-0901.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.785	VV	0.1912	121.10213	8.13230	1.9976	
11	4.218	VV	0.1571	94.26154	8.31118	1.5549	
12	4.338	VV	0.0971	52.12408	7.50043	0.8598	
13	4.434	VV	0.1666	81.45657	6.56395	1.3437	
14	5.062	VV	0.1596	238.55096	21.09098	3.9350	
15	5.279	VV	0.2269	99.52855	5.78628	1.6418	
16	5.873	VV	0.1413	587.82751	61.11728	9.6965	
17	6.353	VV	0.1503	32.83312	3.08796	0.5416	
18	6.553	VV	0.1644	27.69622	2.52531	0.4569	
19	6.784	VV	0.1739	42.78264	3.51835	0.7057	
20	6.970	VV	0.1699	36.49419	3.05568	0.6020	
21	7.307	VV	0.2321	40.33376	2.47836	0.6653	
22	8.002	VV	0.1602	22.64069	2.06087	0.3735	
23	8.479	VV	0.3185	54.36716	2.40986	0.8968	
24	8.794	VV	0.2056	24.48150	1.73289	0.4038	
25	9.186	VV	0.2596	57.71142	3.24922	0.9520	
26	10.391	VV	0.2809	43.35055	2.21398	0.7151	
27	12.654	BV	0.3073	394.07007	19.84871	6.5004	
28	13.636	VB	0.4516	170.99817	5.70464	2.8207	
29	16.969	BB	0.3859	2386.52393	95.11277	39.3668	Mogroside V
30	21.502	BB	0.5184	147.84882	4.41968	2.4388	
31	25.387	BB	0.6262	125.87746	2.91415	2.0764	

Total: 6062.27304 393.45653

=====  
 \*\*\* End of report \*\*\*

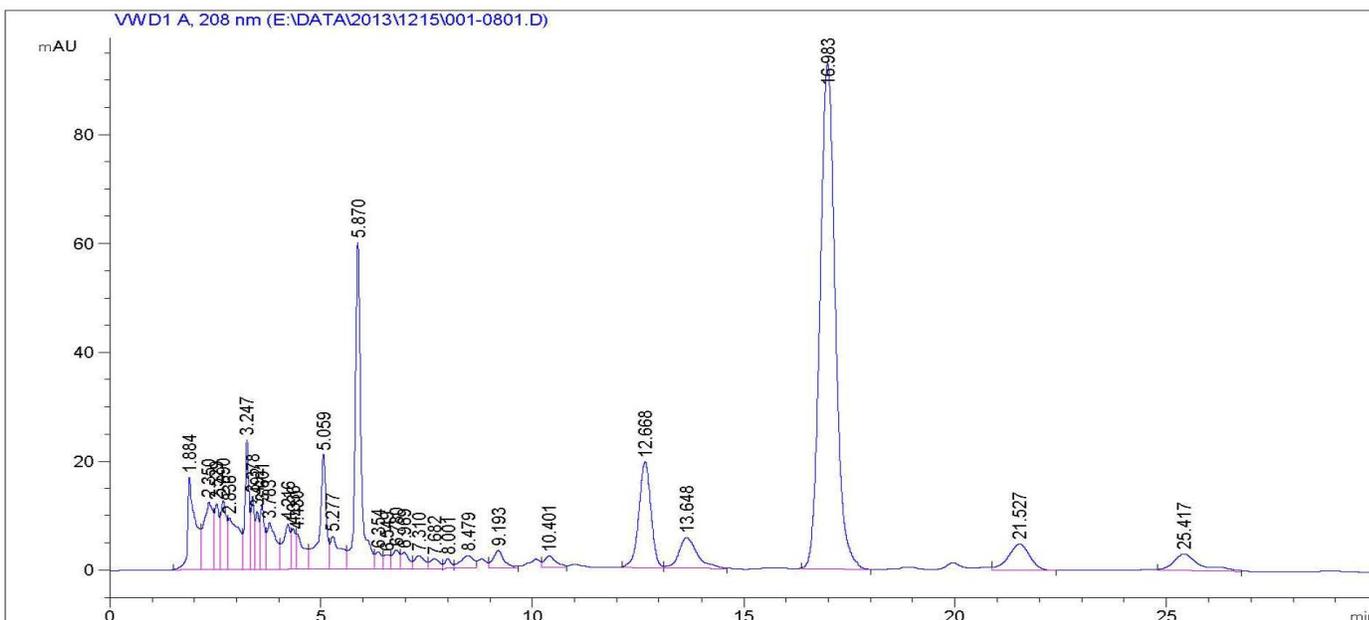
### F-5 HPLC Chromatogram for Batch GLG-MV 60-20131220

Date File : E:\DATA\2013\1215\001-0801.D

```

=====
Operator       : sun hongkai                Line   :    1
Instrument     : Instrument 1              Location:    8
Injection Date : 2013-12-15 09:15:17      Inj     :    1
                                           Inj Volum: 20.0 µl

Acq.Method    : D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-15 08:29:51 sun hongkai
Analysis Method: D:\CHEM32\1\METHODS\LUOHANGUO.M
Last Changed  : 2013-12-15 08:20:26 sun hongkai
Sample Info   : GLG-MV60-131220
  
```



External Standard Report

```

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

Signal1: VWD1 A, Sig=208 nm

Peak #	Ret Time [min]	Type	Peak Width [min]	Area [mAU*s]	Peak Height [mAU]	Amt/Area %	Name
1	1.884	BV	0.1626	215.18770	16.96350	3.5721	
2	2.350	VV	0.1996	193.51477	12.39684	3.2123	
3	2.529	VV	0.0981	83.35823	12.06249	1.3837	
4	2.690	VV	0.1367	124.33775	12.62899	2.0640	
5	2.836	VV	0.2297	172.44995	9.41697	2.8627	
6	3.247	VV	0.0970	159.26047	23.80292	2.6437	
7	3.378	VV	0.0867	79.16418	13.34299	1.3141	
8	3.492	VV	0.0776	57.15172	10.57495	0.9487	
9	3.601	VV	0.1069	90.38721	11.78861	1.5004	

GRAS Assessment – GLG Life Tech Corporation  
 Luo Han Guo Extracts

Date File : E:\DATA\2013\1215\001-0801.D

Peak #	Ret Time [min]	Type	Peak Width [min]	Area mAU*s	Peak Height [mAU]	Amt/Area %	Name
10	3.783	VV	0.1941	128.21803	8.53932	2.1284	
11	4.216	VV	0.1582	95.42059	8.24994	1.5840	
12	4.336	VV	0.0998	52.87680	7.49045	0.8778	
13	4.430	VV	0.1683	81.88966	6.52494	1.3594	
14	5.059	VV	0.1613	243.35049	21.00953	4.0396	
15	5.277	VV	0.2290	105.47303	6.02526	1.7508	
16	5.870	VV	0.1428	584.43951	59.96540	9.7017	
17	6.354	VV	0.1493	32.38189	3.07029	0.5375	
18	6.549	VV	0.1660	28.24352	2.54193	0.4688	
19	6.780	VV	0.1722	41.06321	3.41715	0.6816	
20	6.969	VV	0.1744	36.01427	2.98095	0.5978	
21	7.310	VV	0.2298	39.68880	2.41199	0.6588	
22	7.682	VV	0.2424	27.56177	1.71903	0.4575	
23	8.001	VV	0.1504	17.79258	1.75396	0.2954	
24	8.479	VV	0.3126	50.70278	2.33861	0.8417	
25	9.193	VB	0.2663	59.60349	3.22857	0.9894	
26	10.401	VV	0.2842	43.33652	2.18110	0.7194	
27	12.668	BV	0.3066	384.28741	19.41838	6.3791	
28	13.648	VB	0.4575	169.85030	5.61867	2.8195	
29	16.983	BB	0.3861	2332.69238	92.90501	38.7226	Mogroside V
30	21.527	BB	0.5380	165.26169	4.73726	2.7433	
31	25.417	BB	0.6307	129.15558	2.96410	2.1440	

Total: 6024.11631 392.07014

\*\*\* End of report \*\*\*

## **APPENDIX G**

### **Certificates of Analysis for Multiple Production Batches of GLG-MV 30**

- G-1 Certificate of Analysis for Batch GLG-MV 30-131001
- G-2 Certificate of Analysis for Batch GLG-MV 30-131005
- G-3 Certificate of Analysis for Batch GLG-MV 30-131010
- G-4 Certificate of Analysis for Batch GLG-MV 30-131012
- G-5 Certificate of Analysis for Batch GLG-MV 30-131018

## G-1 Certificate of Analysis for Batch GLG-MV 30-131001



Research and Development  
 GLG Life Tech Corporation  
 www.glglifetech.com  
 GLG-QA-COA-62

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 30    **Manufacturing Date:** Oct. 1st, 2013  
**Lot Number:** GLG-MV30-20131001    **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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 Suite 2168-1050 West Pender Street    Fax: 1.604.662.8858  
 Vancouver, B.C. V6E 3S7    Email: sales@glglifetech.com  
 Canada    Web: www.glglifetech.com

**Date of Analysis:** Oct. 6th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥30.0% (on dry basis)	30.5%	HPLC
Loss on dry	≤6.0%	2.8%	USP 32 <731>
Residue on Ignition	≤5.0%	1.1%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.1mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.06mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.04mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.03mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion: QC DEPART  
QUALIFIED  
\* 017

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6)    **Date:** 06/10/2013  
**Checked by:** (b) (6)    **Date:** 06/10/2013  
**Approved by:** (b) (6) (Quality Manager)    **Date:** 06/10/2013

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## G-2 Certificate of Analysis for Batch GLG-MV 30-131005

### Certificate of Analysis



Research and Development  
GLG Life Tech Corporation  
www.glglifetech.com  
GLG-QA-COA-02

**Product:** GLG Luo Han Guo Extract - MV 30 **Manufacturing Date:** Oct. 2nd, 2013  
**Lot Number:** GLG-MV30-20131005 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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Canada  
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Email: sales@glglifetech.com  
Web: www.glglifetech.com

**Date of Analysis:** Oct. 7th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥30.0% (on dry basis)	30.4%	HPLC
Loss on dry	≤6.0%	2.9%	USP 32 <731>
Residue on Ignition	≤5.0%	1.2%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.3mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.04mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.05mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	<10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	<10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 07/10/2013  
**Checked by:** (b) (6) **Date:** 07/10/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 07/10/2013

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### G-3 Certificate of Analysis for Batch GLG-MV 30-131010



Research and Development  
 GLG Life Tech Corporation  
 www.glglifetech.com  
 GLG-QA-COA-62

## Certificate of Analysis

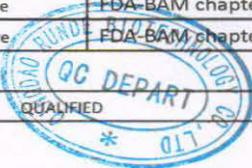
**Product:** GLG Luo Han Guo Extract - MV 30 **Manufacturing Date:** Oct. 8th, 2013  
**Lot Number:** GLG-MV30-20131010 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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 Email: sales@glglifetech.com  
 Web: www.glglifetech.com

**Date of Analysis:** Oct. 13th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥30.0% (on dry basis)	31.4%	HPLC
Loss on dry	≤6.0%	2.6%	USP 32 <731>
Residue on Ignition	≤5.0%	1.1%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.3mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.07mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.04mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion 

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 13/10/2013  
**Checked by:** (b) (6) **Date:** 13/10/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 13/10/2013

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## G-4 Certificate of Analysis for Batch GLG-MV 30-131012



Research and Development  
GLG Life Tech Corporation  
www.glglifetech.com  
GLG-QA-COA-62

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 30 **Manufacturing Date:** Oct.10th, 2013  
**Lot Number:** GLG-MV30-20131012 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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Suite 2168-1050 West Pender Street  
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Canada

Phone: 1.604.669.2602  
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Email: sales@glglifetech.com  
Web: www.glglifetech.com

**Date of Analysis:** Oct. 15th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥30.0% (on dry basis)	31.7%	HPLC
Loss on dry	≤6.0%	2.8%	USP 32 <731>
Residue on Ignition	≤5.0%	1.2%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.5mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.05mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.04mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.05mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

**Conclusion** QC DEPART  
QUALIFIED  
\*  
10/15/2013

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 15/10/2013  
**Checked by:** (b) (6) **Date:** 15/10/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 15/10/2013

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## G-5 Certificate of Analysis for Batch GLG-MV 30-131018



Research and Development  
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www.glglifetech.com  
GLG-QA-COA-62

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 30      **Manufacturing Date:** Oct. 14th, 2013  
**Lot Number:** GLG-MV30-20131018      **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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 Canada      Web: www.glglifetech.com

**Date of Analysis:** Oct. 19th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥30.0% (on dry basis)	31.6%	HPLC
Loss on dry	≤6.0%	2.7%	USP 32 <731>
Residue on Ignition	≤5.0%	1.2%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.3mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.06mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.03mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	<10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	<10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion \_\_\_\_\_



Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6)      **Date:** 19/10/2013  
**Checked by:** \_\_\_\_\_      **Date:** 19/10/2013  
**Approved by:** \_\_\_\_\_ (Quality Manager)      **Date:** 19/10/2013

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## **APPENDIX H**

### **Certificates of Analysis for Multiple Production Batches of GLG-MV 50**

H-1 Certificate of Analysis for Batch GLG-MV 50-131101

H-2 Certificate of Analysis for Batch GLG-MV 50-131103

H-3 Certificate of Analysis for Batch GLG-MV 50-131105

H-4 Certificate of Analysis for Batch GLG-MV 50-131110

H-5 Certificate of Analysis for Batch GLG-MV 50-131115



## H-2 Certificate of Analysis for Batch GLG-MV 50-131103



Research and Development  
 GLG Life Tech Corporation  
 www.glglifetech.com  
 GLG-QA-COA-63

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 50    **Manufacturing Date:** Nov. 2nd, 2013  
**Lot Number:** GLG-MV50-20131103    **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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 Suite 2168-1050 West Pender Street    Fax: 1.604.662.8858  
 Vancouver, B.C. V6E 3S7    Email: sales@glglifetech.com  
 Canada    Web: www.glglifetech.com

**Date of Analysis:** Nov. 7th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥50.0% (on dry basis)	51.3%	HPLC
Loss on dry	≤6.0%	2.6%	USP 32 <731>
Residue on Ignition	≤5.0%	1.1%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.5mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.03mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.06mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	<10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	<10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion QC DEPART  
QUALIFIED  
\* 017

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6)    **Date:** 07/11/2013  
**Checked by:** \_\_\_\_\_    **Date:** 07/11/2013  
**Approved by:** \_\_\_\_\_ (Quality Manager)    **Date:** 07/11/2013

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### H-3 Certificate of Analysis for Batch GLG-MV 50-131105



Research and Development  
GLG Life Tech Corporation  
www.glglifetech.com  
GLG-QA-COA-63

## Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 50 **Manufacturing Date:** Nov. 3rd, 2013  
**Lot Number:** GLG-MV50-20131105 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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Email: sales@glglifetech.com  
Web: www.glglifetech.com

**Date of Analysis:** Nov. 8th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥50.0% (on dry basis)	51.7%	HPLC
Loss on dry	≤6.0%	2.8%	USP 32 <731>
Residue on Ignition	≤5.0%	1.3%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.3mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.02mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.02mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.05mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion



Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 08/11/2013  
**Checked by:** (b) (6) **Date:** 08/11/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 11/20/13

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## H-4 Certificate of Analysis for Batch GLG-MV 50-131110



Research and Development  
 GLG Life Tech Corporation  
 www.glglifetech.com  
 GLG-QA-COA-63

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 50    **Manufacturing Date:** Nov. 10th, 2013  
**Lot Number:** GLG-MV50-20131110    **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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 Canada    Web: www.glglifetech.com

**Date of Analysis:** Nov. 15th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥50.0% (on dry basis)	51.4%	HPLC
Loss on dry	≤6.0%	2.7%	USP 32 <731>
Residue on Ignition	≤5.0%	1.1%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.4mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.03mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.04mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.05mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5



**Conclusion:** QUALIFIED

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6)    **Date:** 15 / 11 / 2013  
**Checked by:** (b) (6)    **Date:** 15 / 11 / 2013  
**Approved by:** (b) (6) (Quality Manager)    **Date:** (b) (6) 11 / 2013

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## H-5 Certificate of Analysis for Batch GLG-MV 50-131115



Research and Development  
GLG Life Tech Corporation  
www.glglifetech.com  
GLG-QA-COA-63

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 50 **Manufacturing Date:** Nov. 20th, 2013  
**Lot Number:** GLG-MV50-20131115 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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**Date of Analysis:** Nov. 25th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥50.0% (on dry basis)	51.6%	HPLC
Loss on dry	≤6.0%	2.8%	USP 32 <731>
Residue on Ignition	≤5.0%	1.2%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.5mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.04mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.06mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion QA DEPART  
QUALIFIED  
\* 017

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 25/11/2013  
**Checked by:** (b) (6) **Date:** 25/11/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 11/2013

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## **APPENDIX I**

### **Certificates of Analysis for Multiple Production Batches of GLG-MV 60**

- I-1 Certificate of Analysis for Batch GLG-MV 60-131201
- I-2 Certificate of Analysis for Batch GLG-MV 60-131206
- I-3 Certificate of Analysis for Batch GLG-MV 60-131210
- I-4 Certificate of Analysis for Batch GLG-MV 60-131213
- I-5 Certificate of Analysis for Batch GLG-MV 60-131220



## I-2 Certificate of Analysis for Batch GLG-MV 60-131206



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GLG-QA-COA-64

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 60 **Manufacturing Date:** Dec. 5th, 2013  
**Lot Number:** GLG-MV60-20131206 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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Web: www.glglifetech.com

**Date of Analysis:** Dec. 10th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥60.0% (on dry basis)	61.4%	HPLC
Loss on dry	≤6.0%	2.8%	USP 32 <731>
Residue on Ignition	≤5.0%	1.1%	AOAC 942.05, 17th
Heavy metals	≤10.0 mg/kg	1.4mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.04mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.04mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.05mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion: QUALIFIED



Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 10/12/2013  
**Checked by:** (b) (6) **Date:** 10/12/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 10/12/2013

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### I-3 Certificate of Analysis for Batch GLG-MV 60-131210



Research and Development  
GLG Life Tech Corporation  
www.glglifetech.com  
GLG-QA-COA-64

## Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 60 **Manufacturing Date:** Dec. 8th, 2013  
**Lot Number:** GLG-MV60-20131210 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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 Web: www.glglifetech.com

**Date of Analysis:** Dec. 13th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥60.0% (on dry basis)	61.6%	HPLC
Loss on dry	≤6.0%	2.6%	USP 32 <731>
Residue on Ignition	≤5.0%	1.2%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.3mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.05mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.06mg/kg	AOAC 993.14
Total Plate Count	< 1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	< 100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion: QUALIFIED

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 13/12/2013  
**Checked by:** (b) (6) **Date:** 13/12/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 13/12/2013

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## I-4 Certificate of Analysis for Batch GLG-MV 60-131213



Research and Development  
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www.glglifetech.com  
GLG-QA-COA-64

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 60 **Manufacturing Date:** Dec. 10th, 2013  
**Lot Number:** GLG-MV60-20131213 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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Web: www.glglifetech.com

**Date of Analysis:** Dec. 15th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥60.0% (on dry basis)	61.2%	HPLC
Loss on dry	≤6.0%	2.8%	USP 32 <731>
Residue on Ignition	≤5.0%	1.1%	AOAC 942.05,17th
Heavy metals	≤10.0 mg/kg	1.3mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.04mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.02mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion: QUALIFIED \* 017 00

Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 15/12/2013  
**Checked by:** (b) (6) **Date:** 15/12/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 15/12/2013

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## I-5 Certificate of Analysis for Batch GLG-MV 60-131220



Research and Development  
GLG Life Tech Corporation  
www.glglifetech.com  
GLG-QA-COA-64

### Certificate of Analysis

**Product:** GLG Luo Han Guo Extract - MV 60 **Manufacturing Date:** Dec. 15th, 2013  
**Lot Number:** GLG-MV60-20131220 **Country of Origin:** China  
**Shelf Life:** 2 years

**Product Description:** GLG Luo Han Guo extract is sourced from the Luo Han Guo (Monk) fruit, and is used as a sweetener in various food and beverage applications. GLG Luo Han Guo extract is up to 300 times sweeter than sucrose.

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Web: www.glglifetech.com

**Date of Analysis:** Dec. 20th, 2013

CHARACTERISTIC	SPECIFICATION	RESULTS	METHOD
Appearance	Light yellow powder	Conform	GB/T 5492-2008
Odor	Mild fruity Characteristic	Conform	GB/T 5492-2008
Taste	Sweet	Conform	GB/T 5492-2008
Identification	Positive reaction	Conform	CP2010
Mesh size	Through 80 mesh	Conform	80 mesh screen
Mogroside V (wt/wt)	≥60.0% (on dry basis)	61.4%	HPLC
Loss on dry	≤6.0%	2.6%	USP 32 <731>
Residue on Ignition	≤5.0%	1.2%	AOAC 942.05, 17th
Heavy metals	≤10.0 mg/kg	1.3mg/kg	USP 32 <231>
Lead	≤1.0 mg/kg	0.04mg/kg	AOAC 993.14
Arsenic	≤0.5 mg/kg	0.03mg/kg	AOAC 993.14
Cadmium	≤1.0 mg/kg	0.03mg/kg	AOAC 993.14
Total Plate Count	<1000 CFU/g	< 10cfu/g	FDA-BAM chapter 3
Yeast & Mold	<100 CFU/g	< 10cfu/g	FDA-BAM chapter 18
E. coli	Negative	Negative	FDA-BAM chapter 4
Staphylococcus aureus	Negative	Negative	FDA-BAM chapter 12
Salmonella (/25g)	Negative	Negative	FDA-BAM chapter 5

Conclusion QUALIFIED



Note: This product should be stored sealed in a cool, dry place.

**Analyzed by:** (b) (6) **Date:** 20/12/2013  
**Checked by:** (b) (6) **Date:** 20/12/2013  
**Approved by:** (b) (6) (Quality Manager) **Date:** 20/12/2013

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## **APPENDIX J**

### **Nutritional Composition Testing Report from SGS-CSTC Consumer Testing Services, Quigdao, China**



**Test Report**

**Report No:** QDAFF140403831

**Date:** May 06 2014

Client name: Qingdao Runde Biotechnology Co., Ltd.  
Client address: Lingshanwei Town, Jiaonan City Qingdao, Shandong, China  
Sample name: GLG Luo Han Guo Extract-MV50  
Sample Batch No.: GLG-MV50-20131101  
Product Date: /  
Manufacturer: /

-----  
**Above information and sample(s) was/were submitted and certified by the client, SGS quoted the information with no responsibility as to the accuracy, adequacy and/or completeness.**

SGS Sample No.: (b) (6)  
SGS reference No.: [Redacted]  
Date of sample received: Apr 23 2014  
Testing period: Apr 23 2014 ~ May 06 2014

**TEST(S) REQUESTED:**  
Selected test(s) as requested by applicant

**TEST METHOD(S):**  
Please refer to the next page(s)

**TEST RESULT(S):**  
Please refer to the next page(s)

**The results shown in this test report refer only to the sample(s) tested, and for clients internal use only.**



SGS-CSTC Standards Technical Services Co., Ltd. Qingdao Branch  
Page 1 of 3  
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中国·青岛·高科技工业园株洲路143号通标中心 邮编: 266101 | (86-532) 69991165 | (86-532) 83684538 | e-sgs.china@sgs.com

Member of the SGR Group (SGS SA)



Test Report

Report No: QDAFF140403831

Date: May 06 2014

**TEST METHOD(S):**

Protein: GB 5009.5-2010 National food safety standard Determination of protein in foods I  
 Ash: GB 5009.4-2010 National food safety standard Determination of ash in foods  
 Sodium, Potassium: GB/T 5009.91-2003 Determination of potassium and sodium in foods  
 Calcium: GB/T 5009.92-2003 Determination of calcium in foods  
 Iron: GB/T 5009.90-2003 Determination of iron, magnesium and manganese in foods  
 Phosphorus: GB/T 5009.87-2003 Determination of phosphorus in foods I  
 Total fat, Saturated fat, Mono-unsaturated fat, Multi-unsaturated fat, Trans fat: AOAC 996.06  
 Fat (Total, Saturated, and Unsaturated) in foods  
 Cholesterol: GB/T 22220-2008 Determination of cholesterol in foods-High performance liquid chromatography  
 Glucose, Fructose, Sucrose, Maltose, Lactose: AOAC 982.14 Glucose, Fructose, Sucrose and Maltose in presweetened cereals  
 Vitamin A: GB/T 5009.82-2003 Determination of retinol and tocopherol in foods I  
 Vitamin C: Refer to GB/T 5009.86-2003 Determination of total ascorbic acid in fruits, vegetables and derived products-Fluorometric method and colorimetric method I  
 Moisture: GB 5009.3-2010 National food safety standard Determination of moisture in foods I  
 Dietary Fiber: AOAC 991.43 Total, Soluble, and Insoluble Dietary Fiber in Foods Enzymatic Energy, Carbohydrate: GB/Z 21922-2008 Fundamental Terminology and definition of nutritional component in foods

**TEST RESULT(S):**

Test item(s)	Unit(s)	Test method(s)	Test result(s)	Method detection limit(s)
Protein	g/100g	GB 5009.5-2010 I	12.2	/
Ash	g/100g	GB 5009.4-2010	0.73	/
Sodium	mg/kg	GB/T 5009.91-2003	567.56	1.0
Potassium	mg/kg	GB/T 5009.91-2003	142.82	1.0
Calcium	mg/kg	GB/T 5009.92-2003	1366.28	1.0
Iron	mg/kg	GB/T 5009.90-2003	Not detected	1.0
Phosphorus	mg/100g	GB/T 5009.87-2003 I	Not detected	20
Total fat	g/100g	AOAC 996.06	0.04	0.01
Saturated fat	g/100g	AOAC 996.06	0.03	0.01
Mono-unsaturated fat	g/100g	AOAC 996.06	0.01	0.01
Multi-unsaturated fat	g/100g	AOAC 996.06	Not detected	0.01
Trans fat	g/100g	AOAC 996.06	Not detected	0.01
Cholesterol	mg/100g	GB/T 22220-2008	Not detected	2.6
Glucose	g/100g	AOAC 982.14	Not detected	0.05

SGS-CSTC Standards Technical Services Co., Ltd. Qingdao Branch

Page 2 of 3

RAND: 5921009



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SGS (Shanghai) Technical Services Co., Ltd.  
 Qingdao Branch

SGS Center No.143 Zhuzhou Road, Hi-Tech Industrial Park, Qingdao, China 266101  
 中国·青岛·高科技工业园株洲路143号通标中心 邮编: 266101

QDAF  
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Member of the SGS Group (SGS SA)



Test Report

Report No: QDAFF140403831

Date: May 06 2014

Test item(s)	Unit(s)	Test method(s)	Test result(s)	Method detection limit(s)
Fructose	g/100g	AOAC 982.14	Not detected	0.05
Sucrose	g/100g	AOAC 982.14	Not detected	0.05
Maltose	g/100g	AOAC 982.14	Not detected	0.05
Lactose	g/100g	AOAC 982.14	Not detected	0.05
Vitamin A	mg/100g	GB/T 5009.82-2003 I	Not detected	0.020
Vitamin C	mg/100g	Refer to GB/T 5009.86-2003 I	3.0	0.3
Moisture	g/100g	GB 5009.3-2010 I	2.67	/
Dietary Fiber	g/100g	AOAC 991.43	0.1	/

**CALCULATION RESULT(S):**

Calculate item(s)	Unit(s)	Calculate method(s)	Calculate result(s)
Carbohydrate	g/100g	GB/Z 21922-2008	84.3
Energy	kJ/100g	GB/Z 21922-2008	1643

**Remark:**

1. According to GB/Z 21922-2008 Fundamental Terminology and definition of nutritional component in foods minus calculate method, "100% deduct the percentage of protein, fat, moisture, ash and dietary fiber is the percentage of carbohydrate."
2. Energies calculate method is reference to GB/Z 21922-2008 Fundamental Terminology and definition of nutritional component in foods Form 1.
3. Conversion factor of nitrogen to protein is 6.25.
4. The test was carried out by a SGS laboratory.
5. Total fat= Saturated fat+Mono-unsaturated fat+ Multi-unsaturated fat+ Trans fat

**SAMPLE DESCRIPTION:** Sample in bag

\*\*\* End of Report\*\*\*

SGS-CSTC Standards Technical Services Co., Ltd. Qingdao Branch

Page 3 of 3

RAND: 5921009



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**QDAF**

SGS Standards Technical Services Co., Ltd.  
Qingdao Branch

SGS Center, No.143 Zhuzhou Road, Hi-Tech Industrial Park, Qingdao, China 266101

T (86-532) 6999185 F (86-532) 83884538

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中国·青岛·高科技工业园株洲路143号通标中心 邮编: 266101

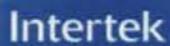
T (86-532) 6999185 F (86-532) 83884538

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Member of the SGS Group (SGS SA)

## **APPENDIX K**

### **Pesticide Analytical Report from Intertek Testing Services, Ltd., Shanghai, China**



No.: SHF131B4875-1

## TEST REPORT

### 检测报告

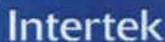
Name of Sample: **Luo Han Guo Extract**  
样品名称:

Applicant: **Qingdao Runde Biotechnology Co., Ltd.**  
委托单位: **青岛润德生物科技有限公司**

**Lingshanwei Town, Jiaonan City Qingdao, China**  
**266427**  
青岛胶南市灵山卫街道办事处驻地

Test Purpose: **ENTRUST TEST**  
检验类别: **委托检验**

**Intertek Testing Services Ltd., Shanghai**  
6/F., No. 2 Building, Shanghai Comalong Industrial Park,  
No. 889 Yishan Road, Shanghai, 200233, China.  
上海天祥质量技术服务有限公司  
中国 上海市宜山路 889 号齐来工业城 2 号楼 6 层西侧 邮政编码: 200233  
Tel: 0086-21-61206565, Fax: 0086-21-64954500



**TEST REPORT (检测报告)**

**REPORT No.: SHF131B4875-1**

NAME OF SAMPLE 产品名称	Luo Han Guo Extract	TEST PURPOSE 检验类别	ENTRUST TEST 委托检测
SPECIFICATION 型号、规格、等级	MV50	TRADEMARK 商标	/
SAMPLE DESCRIPTION 样品描述	Solid in bulk 散装固体		
CLIENT 委托单位	Qingdao Runde Biotechnology Co.,Ltd. 青岛润德生物科技有限公司		
MANUFACTURER 生产单位	Qingdao Runde Biotechnology Co.,Ltd. 青岛润德生物科技有限公司		
DATE SAMPLE RECEIVED 委托样品收到日期	Dec. 31, 2013 2013 年 12 月 31 日	SAMPLE QUANTITY 样品数量	50g
PRODUCTION DATE 生产日期	Nov. 10, 2013 2013 年 11 月 10 日	CODE / NUMBER 批号或编号	GLG-MV50-131110
TEST STANDARD 检验依据或判定标准	GB/T 19649-2006; GB/T 20770-2008; GB/T 5009.23-2006		
TEST PERIOD 检验日期	Dec. 31, 2013 To Jan. 08, 2014 2013 年 31 月 10 日至 2014 年 01 月 08 日		
TEST CONTENT 检验内容	CIRCUMSTANCES ARE IN THE REPORT ATTACHMENT. 详见检验报告附页。		
CONCLUSION 检验结论	SUPPLY REAL MEASURING DATA 提供实测数据 CIRCUMSTANCES ARE IN THE REPORT ATTACHMENT 详见检验报告附页 签批日期 2014 年 01 月 09 日		
REMARK 备注	THE TESTING RESULTS ARE ONLY VALID FOR THE SAMPLE TESTED. 检测结果仅对来样负责。 WITHOUT CONSENT OF THE TESTING ORGANIZATION, THE CLIENTS SHALL NOT BE UNAUTHORIZED USE OF TEST RESULTS FOR IMPROPER PROPAGANDA. 未经检验机构同意, 委托人不得擅自使用检验结果进行不当宣传。		

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TO BE CONTINUED (接下页)

PREPARED AND CHECKED BY:  
INTERTEK TESTING SERVICES  
LTD., SHANGHAI

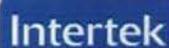
(b) (6)

STELLA LUO  
SUPERVISOR

AUTHORIZED BY:  
INTERTEK TESTING SERVICES  
LTD., SHANGHAI

(b) (6)

SAMMY SHEN  
ASSISTANT MANAGER



TEST REPORT (检测报告)

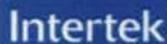
REPORT No.: SHF131B4875-1

GC/MS Results Table – GC/MS 结果表  
Pesticides Found and Concentration – 发现的农药及其浓度

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs, mg/kg 限量标准	Result, mg/kg 检测结果	Item Judgement 单项判定
1	2-phenylphenol 2-苯基苯酚	0.01	—	ND 未检出	—
2	2, 4'-DDE o,p'-滴滴伊	0.01	—	ND 未检出	—
3	2, 4'-DDD o,p'-滴滴滴	0.01	—	ND 未检出	—
4	2, 4'-DDT o,p'-滴滴涕	0.01	—	ND 未检出	—
5	4, 4'-DDD p,p'-滴滴滴	0.01	—	ND 未检出	—
6	4, 4'-DDE p,p'-滴滴伊	0.01	—	ND 未检出	—
7	4, 4'-DDT p,p'-滴滴涕	0.01	—	ND 未检出	—
8	Acephate 乙酰甲胺磷	0.02	—	ND 未检出	—
9	BHC 六六六	0.01	—	ND 未检出	—
10	Acetochlor 乙草胺	0.01	—	ND 未检出	—
11	Ametryn 莠灭净	0.01	—	ND 未检出	—
12	Aldrin 艾氏剂	0.005	—	ND 未检出	—
13	Dieldrin 狄氏剂	0.005	—	ND 未检出	—
14	Atrazine 莠去津	0.01	—	ND 未检出	—
15	Benalaxyl 苯霜灵	0.01	—	ND 未检出	—
16	Benfluralin 乙丁氟灵	0.01	—	ND 未检出	—
17	Benoxacor 解草酮	0.01	—	ND 未检出	—
18	Bifenthrin 联苯菊酯	0.01	—	ND 未检出	—
19	Bromopropylate 溴螨酯	0.01	—	ND 未检出	—
20	Bupirimate 乙嘧酚磺酸酯	0.01	—	ND 未检出	—
21	Buprofezin 噻嗪酮	0.01	—	ND 未检出	—
22	Butachlor 丁草胺	0.01	—	ND 未检出	—
23	Cadusafos 硫线磷	0.01	—	ND 未检出	—
24	Captan 克菌丹	0.01	—	ND 未检出	—
25	Chlordane 克氯丹	0.01	—	ND 未检出	—
26	Chlorfenapyr 溴虫腈	0.05	—	ND 未检出	—
27	Chlorfenvinphos 毒虫畏	0.01	—	ND 未检出	—
28	Chlorfluazuron 氟啶脲	0.01	—	ND 未检出	—
29	Chlorpropham 氯苯胺灵	0.01	—	ND 未检出	—
30	Chlorpyrifos 毒死蜱	0.01	—	ND 未检出	—

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TEST REPORT (检测报告)

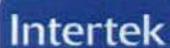
REPORT No.: SHF131B4875-1

GC/MS Results Table – GC/MS 结果表  
Pesticides Found and Concentration – 发现的农药及其浓度

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs, mg/kg 限量标准	Result, mg/kg 检测结果	Item Judgement 单项判定
31	Chlorpyrifos-methyl	甲基毒死蜱	0.01	—	ND 未检出
32	Clethodim	烯草酮	0.01	—	ND 未检出
33	Coumaphos	蝇毒磷	0.01	—	ND 未检出
34	Cyanazine	草净津	0.05	—	ND 未检出
35	Cyflufenamid	环氟菌胺	0.02	—	ND 未检出
36	Cyfluthrin	氟氯氰菊酯	0.01	—	ND 未检出
37	Cypermethrin	氯氰菊酯	0.01	—	ND 未检出
38	Cyprodinil	啉菌环胺	0.05	—	ND 未检出
39	Deltamethrin	溴氰菊酯	0.01	—	ND 未检出
40	Diazinon	二嗪磷	0.01	—	ND 未检出
41	Dichlofluanid	苯氟磺胺	0.01	—	ND 未检出
42	Dichlorvos	敌敌畏	0.01	—	ND 未检出
43	Dicloran	氯硝胺	0.01	—	ND 未检出
44	Dicofol	三氯杀螨醇	0.01	—	ND 未检出
45	Diethofencarb	乙霉威	0.01	—	ND 未检出
46	Difenoconazole	苯醚甲环唑	0.05	—	ND 未检出
47	Diphenylamine	二苯胺	0.01	—	ND 未检出
48	Edifenphos	克瘟散	0.01	—	ND 未检出
49	Endosulfan-1	硫丹-1	0.01	—	ND 未检出
50	Endosulfan-2	硫丹-2	0.01	—	ND 未检出
51	Endosulfan-sulfate	硫丹硫酸酯	0.01	—	ND 未检出
52	Endrin	异狄氏剂	0.01	—	ND 未检出
53	EPN	苯硫磷	0.01	—	ND 未检出
54	Ethion	乙硫磷	0.01	—	ND 未检出
55	Ethoprophos	灭线磷	0.01	—	ND 未检出
56	Etofenprox	醚菊酯	0.01	—	ND 未检出
57	Etrimfos	乙啉硫磷	0.01	—	ND 未检出
58	Fenamiphos	苯线磷	0.01	—	ND 未检出
59	Fenarimol	氯苯嘧啶醇	0.01	—	ND 未检出
60	Fenitrothion	杀螟硫磷	0.01	—	ND 未检出

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TEST REPORT (检测报告)

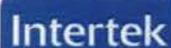
REPORT No.: SHF131B4875-1

**GC/MS Results Table – GC/MS 结果表**  
**Pesticides Found and Concentration – 发现的农药及其浓度**

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs,mg/kg 限量标准	Result,mg/kg 检测结果	Item Judgement 单项判定
61	Fenoxycarb 苯醚威	0.01	—	ND 未检出	—
62	Fenpropathrin 甲氧菊酯	0.05	—	ND 未检出	—
63	Fenpropimorph 丁苯吗啉	0.05	—	ND 未检出	—
64	Fenobucarb 仲丁威	0.01	—	ND 未检出	—
65	Fenthion 倍硫磷	0.01	—	ND 未检出	—
66	Fenvalerate 氟戊菊酯	0.01	—	ND 未检出	—
67	Fipronil 氟虫腴	0.005	—	ND 未检出	—
68	Fluazifop-P-butyl 吡氟禾草灵	0.01	—	ND 未检出	—
69	Flucythrinate 氟氰戊菊酯	0.01	—	ND 未检出	—
70	Flufenoxuron 氟虫脲	0.01	—	ND 未检出	—
71	Flumioxazin 氟噁嗪酮	0.05	—	ND 未检出	—
72	Flusilazole 氟硅唑	0.01	—	ND 未检出	—
73	Fluvalinate 氟胺氰菊酯	0.05	—	ND 未检出	—
74	Gamma-HCH 林丹	0.01	—	ND 未检出	—
75	Halfenprox 卤醚菊酯	0.01	—	ND 未检出	—
76	Heptachlor 七氯	0.01	—	ND 未检出	—
77	Hexachlorobenzene 六氯苯	0.01	—	ND 未检出	—
78	Hexythiazox 噻嗪酮	0.05	—	ND 未检出	—
79	Imazalil 稀菌灵	0.01	—	ND 未检出	—
80	Iprobenfos 异稻瘟净	0.01	—	ND 未检出	—
81	Iprodione 异菌脲	0.01	—	ND 未检出	—
82	Isocarbophos 水胺硫磷	0.01	—	ND 未检出	—
83	Isofenphos 异柳磷	0.01	—	ND 未检出	—
84	Isoprothiolane 稻瘟灵	0.01	—	ND 未检出	—
85	Isoprocarb 异丙威	0.01	—	ND 未检出	—
86	Kresoxim-methyl 亚胺菌	0.01	—	ND 未检出	—
87	Lambda-cyhalothrin 高效氯氟氰菊酯	0.01	—	ND 未检出	—
88	Malathion 马拉硫磷	0.01	—	ND 未检出	—
89	Mefenoxam 精甲霜灵	0.01	—	ND 未检出	—
90	Metalaxyl 甲霜灵	0.01	—	ND 未检出	—

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TEST REPORT (检测报告)

REPORT No.: SHF131B4875-1

GC/MS Results Table – GC/MS 结果表  
Pesticides Found and Concentration – 发现的农药及其浓度

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs, mg/kg 限量标准	Result, mg/kg 检测结果	Item Judgement 单项判定
91	Metamitron 灭它通	0.05	—	ND 未检出	—
92	Methamidophos 甲胺磷	0.01	—	ND 未检出	—
93	Methidathion 杀扑磷	0.01	—	ND 未检出	—
94	Metolachlor 异丙甲草胺	0.01	—	ND 未检出	—
95	Mevinphos 速灭磷	0.01	—	ND 未检出	—
96	Myclobutanil 腈菌唑	0.01	—	ND 未检出	—
97	Napropamide 敌草胺	0.01	—	ND 未检出	—
98	Nitrothal-isopropyl 酞菌酯	0.01	—	ND 未检出	—
99	Oxadixyl 恶霜灵	0.01	—	ND 未检出	—
100	Oxadiazon 恶草灵	0.01	—	ND 未检出	—
101	Oxyfluorfen 乙氧氟草醚	0.01	—	ND 未检出	—
102	Paclobutrazol 多效唑	0.01	—	ND 未检出	—
103	Paraoxon-ethyl 对氧磷	0.01	—	ND 未检出	—
104	Parathion 对硫磷	0.01	—	ND 未检出	—
105	Parathion-methyl 甲基对硫磷	0.01	—	ND 未检出	—
106	Propham 苯胺灵	0.01	—	ND 未检出	—
107	Penconazole 戊菌唑	0.01	—	ND 未检出	—
108	Pendimethalin 二甲戊灵	0.01	—	ND 未检出	—
109	Permethrin 氯菊酯	0.01	—	ND 未检出	—
110	Phenthoate 稻丰散	0.01	—	ND 未检出	—
111	Phorate 甲拌磷	0.01	—	ND 未检出	—
112	Phosalone 伏杀硫磷	0.01	—	ND 未检出	—
113	Phosmet 亚胺硫磷	0.01	—	ND 未检出	—
114	Pirimicarb 抗蚜威	0.01	—	ND 未检出	—
115	Pirimiphos-ethyl 嘧啶磷	0.01	—	ND 未检出	—
116	Pirimiphos-methyl 甲基嘧啶磷	0.01	—	ND 未检出	—
117	Prochloraz 咪鲜胺	0.05	—	ND 未检出	—
118	Propetamphos 胺丙畏	0.01	—	ND 未检出	—
119	Phosphamidon 磷胺	0.01	—	ND 未检出	—
120	Procymidone 腐霉利	0.01	—	ND 未检出	—

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TO BE CONTINUED(接下页)



TEST REPORT (检测报告)

REPORT No.: SHF131B4875-1

GC/MS Results Table – GC/MS 结果表  
Pesticides Found and Concentration – 发现的农药及其浓度

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs,mg/kg 限量标准	Result,mg/kg 检测结果	Item Judgement 单项判定
121	Profenofos 丙溴磷	0.01	—	ND 未检出	—
122	Prometryn 扑草净	0.01	—	ND 未检出	—
123	Propargite 炔螨特	0.01	—	ND 未检出	—
124	Propiconazole 丙环唑	0.01	—	ND 未检出	—
125	Propoxur 残杀威	0.01	—	ND 未检出	—
126	Propyzamide 炔苯酰草胺	0.01	—	ND 未检出	—
127	Pymetrozine 拒嗉酮	0.02	—	ND 未检出	—
128	Pyrazophos 吡菌磷	0.01	—	ND 未检出	—
129	Pyridaben 吡螨灵	0.01	—	ND 未检出	—
130	Pyridaphenthion 吡啶硫磷	0.01	—	ND 未检出	—
131	Pyrimethanil 甲基嘧菌胺	0.01	—	ND 未检出	—
132	Quinalphos 喹硫磷	0.05	—	ND 未检出	—
133	Quintozene 五氯硝基苯	0.01	—	ND 未检出	—
134	Simazine 西玛津	0.05	—	ND 未检出	—
135	Spiroxamine 谷物和葡萄杀菌剂	0.01	—	ND 未检出	—
136	S-421 S-421	0.01	—	ND 未检出	—
137	TBHQ 特丁基对苯二酚	0.01	—	ND 未检出	—
138	Tebuconazole 戊唑醇	0.05	—	ND 未检出	—
139	Tecnazene 四氯硝基苯	0.01	—	ND 未检出	—
140	Tetrachlorvinphos 杀虫畏	0.01	—	ND 未检出	—
141	Tetradifon 三氯杀螨砜	0.01	—	ND 未检出	—
142	Thiamethoxam 噻虫嗪	0.05	—	ND 未检出	—
143	Tolclofos-methyl 甲基立枯磷	0.01	—	ND 未检出	—
144	Tolyfluanid 甲苯氟磺胺	0.05	—	ND 未检出	—
145	Triadimefon 三唑酮	0.01	—	ND 未检出	—
146	Triadimenol 三唑醇	0.01	—	ND 未检出	—
147	Triazophos 三唑磷	0.01	—	ND 未检出	—
148	Trifloxystrobin 肟菌酯	0.01	—	ND 未检出	—
149	Trifluralin 氟乐灵	0.01	—	ND 未检出	—
150	Vinclozolin 乙烯菌核利	0.01	—	ND 未检出	—

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TEST REPORT (检测报告)

REPORT No.: SHF131B4875-1

LC/MS/MS Results Table – LC/MS/MS 结果表  
Pesticides Found and Concentration – 发现的农药及其浓度

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs,mg/kg 限量标准	Result,mg/kg 检测结果	Item Judgement 单项判定
1	3-hydroxycarbofuran 3-羟基呋喃丹	0.01	—	ND 未检出	—
2	Abamectin 阿维菌素	0.01	—	ND 未检出	—
3	Acetamiprid 啉虫脒	0.01	—	ND 未检出	—
4	Aldicarb 涕灭威	0.01	—	ND 未检出	—
5	Aldicarb sulfone 涕灭威砜	0.01	—	ND 未检出	—
6	Aldicarb sulfoxide 涕灭威亚砜	0.01	—	ND 未检出	—
7	Aldoxycarb 砒灭威	0.01	—	ND 未检出	—
8	Allethrin 丙烯菊酯	0.01	—	ND 未检出	—
9	Azinphos-methyl 保棉磷	0.01	—	ND 未检出	—
10	Azoxystrobin 啞菌酯	0.005	—	ND 未检出	—
11	Bendiocarb 恶虫威	0.005	—	ND 未检出	—
12	Benfuracarb 丙硫克百威	0.005	—	ND 未检出	—
13	Bensulfuron-methyl 苄嘧磺隆	0.005	—	ND 未检出	—
14	Benzoyl Peroxide 过氧化苯甲酰	0.005	—	ND 未检出	—
15	Boscalid 啞酰菌胺	0.005	—	ND 未检出	—
16	Butocarboxim 丁酮威	0.01	—	ND 未检出	—
17	Captafol 敌菌丹	0.01	—	ND 未检出	—
18	Carbaryl 甲萘威	0.005	—	ND 未检出	—
19	Carbendazim 多菌灵	0.005	—	ND 未检出	—
20	Carbofuran 虫螨威	0.01	—	ND 未检出	—
21	Chlorbenzuron 灭幼脲	0.01	—	ND 未检出	—
22	Chlorothalonil 百菌清	0.01	—	ND 未检出	—
23	Cyclamic Acid 甜蜜素	0.005	—	ND 未检出	—
24	Cymoxanil 霜脲氰	0.01	—	ND 未检出	—
25	Cyromazine 灭蝇胺	0.005	—	ND 未检出	—
26	Daminozide 丁酰肼	0.01	—	ND 未检出	—
27	Dimethoate 乐果	0.005	—	ND 未检出	—
28	Omethoate 氧乐果	0.002	—	ND 未检出	—
29	Dimethomorph 啞酰吗啉	0.005	—	ND 未检出	—
30	Dithiocarbamates 二硫代氨基甲酸酯	0.01	—	ND 未检出	—

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**Pesticides Found and Concentration – 发现的农药及其浓度**

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs,mg/kg 限量标准	Result,mg/kg 检测结果	Item Judgement 单项判定
31	Emamectin benzoate 甲胺基阿维菌素苯甲酸盐	0.01	—	ND 未检出	—
32	Ethiofencarb 乙硫甲威	0.005	—	ND 未检出	—
33	Ethoxyquin 乙氧喹啉	0.01	—	ND 未检出	—
34	Fenhexamid 环乙酰胺类化合物	0.01	—	ND 未检出	—
35	Fthalide 四氯苯酐	0.01	—	ND 未检出	—
36	Furathiocarb 呋线威	0.005	—	ND 未检出	—
37	Glyphosate 草甘磷	0.01	—	ND 未检出	—
38	Heptenophos 庚烯磷	0.005	—	ND 未检出	—
39	Imidacloprid 吡虫啉	0.01	—	ND 未检出	—
40	Indoxacarb 茚虫威	0.005	—	ND 未检出	—
41	Iprovalicarb 丙森锌	0.005	—	ND 未检出	—
42	Isofenphos-methyl 甲基异硫磷	0.005	—	ND 未检出	—
43	Isoproturon 异丙隆	0.002	—	ND 未检出	—
44	Linuron 利谷隆	0.002	—	ND 未检出	—
45	Methiocarb 灭虫威	0.005	—	ND 未检出	—
46	Methomyl 灭多威	0.01	—	ND 未检出	—
47	Thiodicarb 硫双威	0.01	—	ND 未检出	—
48	Methoxyfenozide 甲氧虫酰肼	0.005	—	ND 未检出	—
49	Monocrotophos 久效磷	0.005	—	ND 未检出	—
50	Naled 二溴磷	0.01	—	ND 未检出	—
51	Nicosulfuron 烟嘧磺隆	0.005	—	ND 未检出	—
52	Oxydemeton-methyl 砒吸磷	0.01	—	ND 未检出	—
53	Phoxim 辛硫磷	0.005	—	ND 未检出	—
54	Promecarb 猛杀威	0.01	—	ND 未检出	—
55	Propamocarb 霜霉威	0.005	—	ND 未检出	—
56	Quizalofop-ethyl 禾草克	0.005	—	ND 未检出	—
57	Rimsulfuron 砒嘧磺隆	0.01	—	ND 未检出	—
58	Spinosad 多杀菌素	0.01	—	ND 未检出	—
59	Tebufenozide 虫酰肼	0.01	—	0.02	—
60	Terbufos 丁硫磷	0.01	—	ND 未检出	—

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TO BE CONTINUED(接下页)



TEST REPORT (检测报告)

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**LC/MS/MS Results Table – LC/MS/MS 结果表**  
**Pesticides Found and Concentration – 发现的农药及其浓度**

No 编号	Compound Name 化合物名称	Rpt Limit, mg/kg 检出限	MRLs, mg/kg 限量标准	Result, mg/kg 检测结果	Item Judgement 单项判定
61	Thiabendazole 噻菌灵	0.01	—	ND 未检出	—
62	Thiacloprid 噻虫啉	0.005	—	ND 未检出	—
63	Thifensulfuron-methyl 阔叶散	0.01	—	ND 未检出	—
64	Thiofanox-sulfone 久效威砒	0.005	—	ND 未检出	—
65	Thiofanox-sulfoxid 久效威亚砒	0.01	—	ND 未检出	—
66	Thiophanate-methyl 甲基托布津	0.01	—	ND 未检出	—
67	Tralomethrin 四溴菊酯	0.01	—	ND 未检出	—
68	Triasulfuron 醚苯磺隆	0.01	—	ND 未检出	—
69	Trichlorfon 敌百虫	0.005	—	ND 未检出	—
70	Triflumizole 氟菌唑	0.005	—	ND 未检出	—
71	Triflusulfuron-methyl 氟胺磺隆	0.01	—	ND 未检出	—
72	Vamidotion 完灭硫磷	0.01	—	ND 未检出	—

Remark: ND=less than the limitation of detection

备注:未检出表示低于检出限

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END OF REPORT (结束)

## **APPENDIX L**

### **Storage Stability Data for Luo Han Guo Extracts**

 GLG LIFE TECH CORPORATION	Issue Date:10/03/2014
GLG Storage Stability Data of Luo Han Guo Extract	File No: GLG-QA-SSD-LHG

## GLG Storage Stability Data for Luo Han Guo Extract

Prepared by: Zhang Lei ( QA/QC Manager, GLG Life Tech Corporation )

Date: 10/03/2014

Approved by: Kevin Li ( VP of Technology, GLG Life Tech Corporation )

Date: 10/03/2014

 <b>GLG LIFE TECH CORPORATION</b> <b>GLG Storage Stability Data of Luo Han Guo Extract</b>	<b>Issue Date:10/03/2013</b>
	<b>File No: GLG-QA-SSD-LHG</b>

**Objective**

To determine storage stability of Luo Han Guo Extract produced by GLG.

**Samples**

Samples representing commercial lots of Luo Han Guo Extract labeled as  
 “GLG-MV30-20131018”, “GLG-MV50-20131115”, “GLG-MV60-20131210”

**Standards**

Mogroside V Standard; (Chromadex Inc. Irvine, CA USA);

**Solvents and Reagents**

- Acetonitrile, HPLC grade (Merck, Germany)
- Water, HPLC grade (Millipore, Germany)
- Ammonium acetate, reagent grade (Merck, Germany)
- Acetic acid, reagent grade (Merck, Germany)

**Apparatus**

1. Agilent1200 HPLC system equipped with binary pump, auto sampler, thermostatted column compartment and UV detector, (Agilent Technologies, USA)
2. Analytical column, Luna 5µ C18(2) 100A (Phenomenex, USA)
3. Analytical balance, XS205, (Mettler Toledo, USA)
4. Volumetric (class **A**) and Laboratory glassware

**Sample Storage**

Samples were stored in original packaging at 25°C±5°C and 60%±5% relative humidity.

**Solution Preparation**

Sample solutions were prepared at approx. 5,000 ppm concentration in Diluent

**The assay results are summarized in Table 1.**

Table 1

Lot# “GLG-MV30-20131018”, “GLG-MV50-20131115”, “GLG-MV60-20131210”, % dry basis							
Duration	MV30	MV50	MV60	Total plate count	Salmonella	E. Coli	Staphylococcus
t=0	31.6	51.7	61.6	<10cfu/g	Negative	Negative	Negative
2 weeks	31.5	51.8	61.7	<10cfu/g	Negative	Negative	Negative
4 weeks	31.4	51.6	61.5	<10cfu/g	Negative	Negative	Negative
6 weeks	30.9	51.3	61.4	<10cfu/g	Negative	Negative	Negative
8 weeks	30.9	51.4	61.3	<10cfu/g	Negative	Negative	Negative

## **APPENDIX M**

### **Sweetness Data for Luo Han Guo Extracts**

 <b>GLG LIFE TECH CORPORATION</b>	<b>Issue Date:28/12/2013</b>
<b>Sweetness Intensity Data for Luo Han Guo Extract</b>	<b>File No:GLG-QA-SD-110</b>

## Sweetness Data for Luo Han Guo Extract

Prepared by: Zhang Lei, QA/QC Manager, GLG Life Tech Corporation

Date: 28/12/2013

Approved by: Kevin Li, VP of Technology, GLG Life Tech Corporation

Date: 28/12/2013

	<b>GLG LIFE TECH CORPORATION</b>	<b>Issue Date:20/12/2013</b>
<b>Sweetness Intensity Data for Luo Han Guo Extract</b>		<b>File No:GLG-QA-SD-110</b>

### **Objective**

To determine the sweetness intensity of *Luo Han Guo Extract* manufactured by *GLG Life Tech Corporation*.

### **Samples**

Samples representing commercial lot of GLG *Luo Han Guo Extract Mogroside V* labeled as “GLG-MV30-20131005”, “GLG-MV50-20131115” and “GLG-MV60-20131210”

### **Solvents and Reagents**

- Sucrose
- Purified water
- Unsalted crackers

### **Apparatus**

1. Analytical balance, XS205, (Mettler Toledo, USA)
2. Volumetric (class **A**) and Laboratory glassware

### **ASSAY and Procedures**

The sweetness intensity tests are following with “ISO 8587:2006 Sensory Analysis-Methodology-Ranking” testing method.

28 panelists have been previously qualified for taste acuity and trained for the sweetness intensity test. The panelists were presented with 5 samples (5.0% of sucrose water solution, purified water, GLG MV30, GLG MV50, and GLG MV60 water solutions with different concentrations).

### **Test Results**

Test results, see Table 1

**Table 1, Sweetness Potency of GLG Luo Han Guo Extract with Different Mogroside V Contents**

Sample	GLG Mogroside V Concentration % ( Sweetness equivalent to 5.0% of sucrose at 20° C )	Sweetness Intensity
GLG Mogroside V 30%	0.028	180 times sweeter than sucrose
GLG Mogroside V 50%	0.020	250 times sweeter than sucrose
GLG Mogroside V 60%	0.018	280 times sweeter than sucrose

## **APPENDIX N**

### **Summary Studies on Biological Activity of Luo Han Guo Extracts**

Several studies have demonstrated that the mogroside components of the Luo Han Guo extract can function as antioxidants. Chen et al. (2007) studied the antioxidant activities of mogroside V and 11-oxo-mogroside V from an ethanol extract of the *M. grosvenorii* fruit. In an *in vitro* chemiluminescent-based antioxidant assay, these investigators found that mogroside V and 11-oxo-mogroside V exhibited significant inhibitory effects on reactive oxygen species and DNA oxidative damage. 11-Oxo-mogroside V showed a higher scavenging activity towards  $O_2^-$  and  $H_2O_2$ , while mogroside V was more effective scavenging  $\cdot OH$ . The authors also noted that 11-oxo-mogroside V exhibited a significant inhibitory effect on  $\cdot OH$ -induced DNA damage. The  $EC_{50}$  values of these 2 compounds toward the tested reactive oxygen species (ROS) is reproduced in Table N-1.

**Table N-1.  $EC_{50}$  Value Comparison of Antioxidant Activity Between Mogroside V & 11-Oxo-Mogroside V (ug/mL)<sup>a</sup>**

ROS	Mogroside V	11-Oxo-mogroside V
$O_2^-$	3528.75 ( $R^2 = 0.9873$ )	4.79 ( $R^2 = 0.9980$ )
$\cdot OH$	48.44 ( $R^2 = 0.9147$ )	146.17 ( $R^2 = 0.9346$ )
$H_2O_2$	623.81 ( $R^2 = 0.9491$ )	16.52 ( $R^2 = 0.9506$ )
$\cdot OH$ -induced DNA damage	1420.60 ( $R^2 = 0.9356$ )	3.09 ( $R^2 = 0.9722$ )

<sup>a</sup> From Chen, et al., 2007.

The antioxidant activity of the mogrosides found in Luo Han Guo extracts may provide various health benefits, including functioning as a cancer chemopreventive agent. *In vitro* and animal studies support this notion. In a study aimed at the identification of potent antitumor promoters in natural resources, Ukiya et al. (2002) isolated 18 triterpenoids and 11-oxomogrol from an ethanol extract of the *M. grosvenorii* fruit. The authors examined each of these compounds for inhibition of Epstein-Barr virus-early antigen (EBV-EA) activation after 12-O-tetradecanoylphorbol-13-acetate (TPA) induction in Raji cells. The authors found that all of the compounds tested demonstrated a potent inhibitory effect (70-100% inhibition at  $1 \times 10^3$  mol ratio/TPA) when compared to an *n*-butyric acid positive control. The level of inhibition of all of the compounds was equivalent to, or more potent than,  $\beta$ -carotene (70% inhibition at  $1 \times 10^3$  mol ratio/TPA).

Akihisa et al. (2007) isolated 8 different cucurbitane glycosides from an ethanol extract of *S. grosvenorii*. All of these compounds were evaluated for inhibition of EBV-EA activation and activation of ( $\pm$ )-(*E*)-methyl-2-[(*E*)-hydroxyimino]-5-nitro-6-methoxy-3-hexemide (NOR 1), a nitric oxide donor, in normal human hepatic cells (Chang liver cells). In this model, all of the compounds tested exhibited inhibitory effects with  $IC_{50}$  values of 346-400 mol ratio/32 pmol TPA. All of the compounds also showed a weak inhibitory ratio (I.R.) on activation of NOR1 (I.R. 1.4-1.6) when compared to known inhibitors glycyrrhizin (I.R. 2.2) and carboxy-PTIO (I.R. 8.8). The authors concluded that as inhibitors of EBV-EA, the mogrosides found in Luo Han Guo may be valuable as antitumor promoters.

Yasuno et al. (2008) studied the effect of a *S. grosvenorii* extract (SGE) on piperonyl butoxide (PBO)-promoted hepatocarcinogenesis in male F344 rats. Previous studies by these authors have shown that PBO induces CYP1A1, which may generate reactive oxygen species and induce DNA damage. A total of 36 rats were assigned to the control, PBO-treated, or PBO + SGE groups. The PBO + SGE

group was administered 1,000 ppm SGE (Saraya Co., Ltd., Japan) in tap water, available *ad libitum* for 7 weeks. The dose of 1,000 ppm was selected based on an unpublished preliminary study in which rats were fed a diet containing 2% PBO and water containing SGE at 40 ppm, 200 ppm, or 1,000 ppm for 4 weeks. “A dose-dependent increased expression of phase II drug-metabolizing enzyme genes was observed in real-time RT-PCR analysis.” In this study, all rats were administered N-diethylnitrosamine (200 mg/kg bw) by intraperitoneal injection to initiate hepatocarcinogenesis, and all rats were subjected to a two-thirds partial hepatectomy to induce hepatocellular proliferation. Seven rats died postoperatively. Body weight and food consumption were measured weekly. Livers were isolated and fixed for histopathological examination. Liver microsomes were obtained from 3 rats/group to study ROS production. The authors found a decrease in final body weight, centrilobular hepatocytic hypertrophy, and increased ROS production in the PBO and the PBO + SGE groups. However, for all of these findings there was no significant difference between the PBO and the PBO + SGE groups. According to the authors, the results suggest “that SGE was not associated with ROS generation during PBO metabolism through the induction of CYP1A1.” In contrast, SGE coadministration did inhibit lipid peroxidation, as assessed by quantitation of the generated thiobarbituric acid-reactive substances in the liver (4 control rats, 6 PBO and PBO + SGE rats). The authors also analyzed RNA expression in the 3 groups using a Rat Toxicology and Drug Resistance Microarray (ORN-401; SuperArray Bioscience Corp., Frederick, MD) and real-time RT-PCR. The authors found that SGE coadministration

“...increased hepatic GST and glutathione peroxidase (GSH-Px) antioxidant activities and mRNA expression levels of the phase II enzymes that are known to be transcriptionally up-regulated through the Nrf 2-Keap1-antioxidant responsive element (ARE) as well as the phase III enzymes. The results suggest that SGE may exert hepatic antioxidant activity by up-regulating the genes under the control of the Nrf-2-Keap1-ARE transcriptional machinery; however, this activity was neither effective nor sufficient for suppression of PBO-promoted early hepatocarcinogenesis.”

Matsumoto et al. (2009) also studied the effect of Luo Han Guo on hepatocellular tumors. However, they utilized a 2-stage liver carcinogenesis model involving dicyclanil (DC) tumor induction in partially hepatectomized male ICR mice. In a preliminary experiment to select the appropriate dose of SGE, a hot water extract with a final mogroside V concentration of 31% was administered to mice for 4 weeks in a diet containing 0, 25, 250, or 2,500 ppm SGE. A dose-dependent decrease in Cyp1a1 expression was observed in all groups. A final dose of 2,500 ppm of SGE was selected. Mice were maintained on a diet with 1,500 ppm of DC for 9 weeks, after a single intraperitoneal injection of diethylnitrosamine (DEN, 30 mg/kg), the animals were fed *ad libitum* 2,500 ppm of SGE in the water for a total of 11 weeks, including 2 weeks prior to DC administration. The authors reported no differences in weights among the 3 groups, an equivalent increase in liver weight in the DC and DC + SGE group, hypertrophy of centrilobular hepatocytes with vacuolation in the DC and DC + SGE groups, increased GGT histochemical staining in hepatocytes with highest levels in the DC group and lowest levels in control group, increased PCNA-positive hepatocytes in DC and DC + SGE groups, and increased TBARS (an oxidative stress marker) in the DC and the DC + SGE groups. Matsumoto et al. (2009) also analyzed gene expression in livers from C57BL/6J and DBA/2J mice, using the same untreated, DC and DC + SGE groups as used for the above studies. The authors found that induction of Cyp1a1 by DC treatment was significantly decreased with SGE supplementation in C57BL/6J mice, but that was not the case in DBA/2J mice. Previous studies have shown that Cyp1a1 induction may depend on Ahr and that C57BL/6J mice have a high affinity Ahr while DBA/2J mice have a low affinity Ahr. Thus, the authors indicate that “SGE inhibits Ahr-induced Cyp1a1

activity and suggest that SGE has antagonistic effects against Ahr.” These investigators concluded that SGE appears to play an important role in suppressing the DC-induced generation of ROS and that the mechanism of generation of ROS is probably from activation of Ahr involving Cyp1a1. The results of Matsumoto et al. (2009) in mice contrast with those of Yasuno et al. (2008), described above, in rats.

In a search for naturally-occurring tumor prevention compounds, Konoshima and Takasaki (2002) studied the effects of two EBV-EA inhibitors, stevioside, from the leaves of *Stevia rebaudiana*, and mogroside V, from *M. grosvenorii*. In a two-stage skin mouse carcinogenesis model, in which skin tumors are induced by 7,12-dimethylbenz[a]anthracene (DMBA) and 12-O-tetradecanoylphorbol-13-acetate (TPA), both mogroside V and stevioside exhibited significant inhibitory effects. With a dose level of 85 nmol of mogroside V, 40%, 60% and 87% of mice bore papillomas at weeks 10, 15, and 20, respectively. This was significantly less than the control, in which 100% of mice bore papillomas within 9 weeks. Treatment with mogroside V also resulted in a 50% reduction to the number of papillomas per mouse over a 15-week period. This inhibitory effect was greater than the known anti-tumor promoter glycyrrhizin. In another *in vivo*, two-stage skin carcinogenesis mouse model utilizing peroxynitrite as the inducer, Takasaki et al. (2003) also noted that 11-oxo-mogroside V and mogroside V have inhibitory effects on papilloma development. Mice ingesting mogroside V or 11-oxomogroside V showed delayed development and reduced numbers of papillomas at 10 and 15 weeks, respectively, when compared to control animals.

In addition to its antioxidant effects, Mizushina, et al. (2006) reported that mogroside I E<sub>1</sub>, a steroidal glycoside, selectively inhibited animal DNA polymerase and cell growth of the human HL-60 promyelocytic leukemia cell line. Five other isolated mogrosides did not inhibit DNA polymerase. The IC<sub>50</sub> values for mogroside I E<sub>1</sub> with a variety of animal DNA polymerases ranged from 58.8 to 98.0 μM. A 100 μM concentration of mogroside I E<sub>1</sub> had a potent effect on the HL-60 cell line, and the LD<sub>50</sub> was 73.3 μM. The other mogrosides tested did not inhibit cell growth.

The antioxidant effect of Luo Han Guo may also be beneficial for treating heart disease. Takeo et al. (2002) examined the sweet elements of the Luo Han Guo extract for their ability to inhibit LDL oxidation. The authors extracted cucurbitane glycosides (CGs) from *Siraitia grosvenorii* (SG) using a hot water extraction method and column chromatography. The extract contained mogroside V, mogroside IV, 11-oxo-mogroside V, and siamenoside. *In vitro* experiments with LDL isolated by density gradient from healthy, human plasma after a 12 h fast demonstrated that SG extract suppressed copper-mediated LDL oxidation dose-dependently. In addition, SG extract inhibited human umbilical vein endothelial cell (HUVEC)-mediated LDL oxidation in a dose-dependent manner. When the CGs were tested independently, only 11-oxo-mogroside V suppressed copper-mediated LDL oxidation at a concentration of 200 μM. Similarly, 11-oxo-mogroside V dose-dependently inhibited HUVEC-mediated LDL oxidation. Thus, the authors concluded that 11-oxo-mogroside V appears to be the active component in the SG extract inhibiting LDL oxidation. However, as the authors discussed, it is unclear whether CGs are absorbed in the human intestine after consumption of Luo Han Guo, and whether significant concentrations of CGs exist in plasma.

The release of histamine and other allergy-related modulators from mast cells is known to be induced by superoxide generation. Thus, compounds that inhibit antioxidant activity may also have anti-allergic effects. For this reason, Hossen et al. (2005) investigated the effect of a hot water Luo Han Guo extract on allergic symptoms in female ICR mice. The authors found that repeated daily doses (*via gavage*) of 300 and 1000 mg/kg bw/day of Luo Han Guo extract for 2-4 weeks showed a gradual inhibition of nasal rubbing behavior induced by histamine, as well as skin scratching induced by

compound 48/80 (Sigma, St. Louis, MO). Single doses of 300 or 1000 mg/kg bw of the extract had no effect on skin scratching or nasal rubbing behavior. To understand the mechanism of inhibition, the authors studied the effects of the extract on release of histamine from rat peritoneal mast cells. Treatment of mast cells with 300 ug/mL or more of the Luo Han Guo extract inhibited histamine release. The authors concluded that “the inhibitory effects of Lo Han Kuo on nasal rubbing and scratching behavior may be due to an inhibition of histamine release from mast cells through the prevention of superoxide anion generation.”

Oxidative stress, induced by hyperglycemia, plays an important role in the pathogenesis of diabetes. A number of studies have examined the effects of Luo Han Guo extracts as an anti-diabetic. Suzuki et al. (2007) studied the effects of a water-soluble *S. grosvenorii* extract (SG-ex) in spontaneously diabetic Goto-Kakizaki (GK) rats. The mogroside V, 11-oxo M-V, mogroside IV, mogroside II and siamenoside I contents of the extract were approximately 2.1%, 0.2%, 0.8%, 0.7%, and 0.3%, respectively. The extract was added to the diet at a concentration of 4 g/kg, and the diet was fed to rats for 13 weeks. The authors stated that “13 week supplementation of SG-ex did not show any adverse effects in GK rats, including feeding behavior, body weight, and various biochemical parameters in various organs.” In addition, the authors found that the SG-ex improved insulin response in the oral glucose tolerance tests OGTT, accumulation of insulin in the pancreas in the fasting state, ameliorated kidney function, and enhanced anti-oxidative properties in the liver and plasma.

Lin et al. (2007) also studied the anti-diabetic effects of an extract of *S. grosvenorii*. However, in this study the authors started with the water-soluble fraction and then used a pancreatin digestion/ethanol precipitation method followed by Sephadex G-200 chromatography, to isolate the polysaccharide components (SGP). Using male New Zealand rabbits exhibiting mild type 2 diabetes with high plasma glucose levels, the authors administered 50, 100, or 200 mg/kg bw of SGP extract in the diet. Administration of SGP extract significantly decreased plasma total cholesterol, triglyceride, and glucose levels, and elevated HDL-C levels after 4 weeks of treatment. In addition, the authors found that SGP extract restored the blood lipid levels of diabetic rabbits. The authors concluded that “SGP is potentially beneficial for the treatment of hyperglycemia and lipid disorder which are commonly associated with diabetes.”

Song et al. (2007) investigated the effect of a water-soluble *M. grosvenorii* (MG) extract on renal mitochondrial lipid peroxidation, along with heme oxygenase-1 (HO-1) in non-diabetic and alloxan-induced diabetic mice. Following induction of hyperglycemia, mice were treated with 150 mg/kg or 300 mg/kg of MG extract by gavage daily. After 8 weeks, serum glucose, lipid profile, renal function and histopathology, malondialdehyde (MDA) concentration, glutathione concentration (GSH), manganese superoxide dismutase (Mn-SOD), glutathione peroxidase (GSH-Px), and HO-1 activities and expression were evaluated. The authors found that the diabetic mice exhibited a loss of body weight after alloxan induction; however, MG partially---but significantly---increased body weights of diabetic mice compared to the diabetic controls. The high glucose levels of diabetic mice were partially restored after 4 weeks and 8 weeks of MG administration. MG administration restored the total cholesterol level to normal in diabetic mice and partially prevented an increase in creatinine levels in diabetic mice. The effects measured by Song et al. (2007), after 8 weeks of MG treatment, on serum glucose, lipid profile, and renal function in non-diabetic and diabetic mice are reproduced in Table N-2. The authors also found that low dose MG extract inhibited HO-1 and Mn-SOD mRNA expression and reduced HO-1, Mn-SOD, GSH-Px activities. The authors concluded:

“Treatment with MG can prevent the development of diabetic nephropathy through its anti-oxidative action relevant to inhibition/activation of HO-1 due to its dual roles, and exhibit no toxic effect on normal mice, considered promising as a dietary supplement for treatment of diabetic nephropathy.”

**Table N-2. Effects of MG Treatment for 8 Weeks on Serum Glucose, Lipid Profile & Renal Function in Diabetic & Non-Diabetic Mice<sup>a</sup>**

Group	Glucose (mM)	Total cholesterol (mM)	Triacylglycerols (mM)	Urea nitrogen (mM)	Creatinine (μM)
C (7)	4.94 ± 0.63	2.80 ± 0.50	0.89 ± 0.28	3.74 ± 1.20	81.4 ± 8.95
C-LMG (7)	4.78 ± 0.51**	3.24 ± 0.57**	1.28 ± 0.13**	4.01 ± 0.88	87.4 ± 10.7**
C-HMG (7)	4.30 ± 0.58**	2.99 ± 0.35**	0.71 ± 0.17**	3.20 ± 1.49	91.2 ± 8.87**
D (7)	28.1 ± 2.07*	4.43 ± 0.76*	2.03 ± 0.45*	5.53 ± 1.11*	123 ± 14.0*
D-LMG (8)	19.7 ± 4.17***	3.56 ± 0.70**	1.69 ± 0.28*	6.04 ± 1.16*	109 ± 11.6***
D-HMG (7)	20.2 ± 3.55***	3.09 ± 0.54**	1.69 ± 0.45*	6.00 ± 1.08*	113 ± 10.5*

<sup>a</sup> From Song et al., 2007.

In a different set of similar experiments, Qi et al. (2006) and Song et al. (2006) compared the effects of a Luo Han Guo extract on normal and alloxan-induced diabetic mice. To prepare the Luo Han Guo extract, Qi et al. (2006) used an ethanol-based extraction method, while Song et al. (2006) used a water-based extraction method. In both experiments, mice were divided into 3 groups, consisting of a control group, a low-dose group (150 mg extract/kg bw/day), and a high-dose group (300 mg extract/kg bw/day). The extract was administered by gavage for 30 days. The study by Qi et al. (2006) focused on islet changes of the pancreas after administration of the Luo Han Guo extract. The alloxan-treated mice exhibited significant injury to the pancreatic islet cells, which were atrophic. The diabetic mice also had a “notable increase in CD8+ lymphocytes to form a dramatic decrease in CD4+/CD8+ ratio (while CD4+ was unchanged).” The authors found that the Luo Han Guo extract “attenuated the early clinical symptoms, biochemical abnormalities, and pathological damage in pancreatic islets.” The Luo Han Guo extract also up-regulated CD4+ T-lymphocyte subsets, thus increasing the CD4+/CD8+ ratio. Luo Han Guo extract-treated mice revealed positively altered cytokine profiles, with IFN-gamma, TNF-alpha, altered toward a beneficial Th2 pattern. The study by Song et al. (2006) focused on whether Luo Han Guo extract would enhance the immune system in diabetes by inducing heme oxygenase-1 (HO-1) expression. Luo Han Guo extract was found to up-regulate CD4+ T lymphocyte subsets, remodeling the cytokine profiles toward a beneficial Th2 pattern. The authors ascribed this change to the induction and up-regulation of HO-1. The investigators concluded that the Luo Han Guo extract has no toxicity or significant effect on normal mice, but does exhibit antidiabetic effects.

To further study these effects, Qi et al., (2008) compared a purified ethanol mogrosides extract of Luo Han fruit with a compound commonly used in China for the treatment of diabetes, XiaoKeWann-pill. After a 1-week adaptation to a basal diet, Balb/c mice were injected with alloxan to induce diabetes. For 4 weeks, groups of mice received 0, 50, 100, 300, or 500 mg/kg/bw of mogrosides (MG) extract or 849 mg/kg/bw XiaoKeWann-pill. A non-diabetic control group was also used. Both treatments improved the health of the mice. Diabetic mice treated with MG extract gained as much weight as those receiving XiaoKeWann-pill. Treatment with different doses of MG (100, 300, and 500 mg/kg bw) and the XiaoKeWan-pill in diabetic mice caused a significant decrease in blood glucose levels

and water intake. The highest effect observed was with 100 mg/kg/bw, which is comparable to 848 mg/kg/bw XiaoKeWan-pill. In addition, significantly decreased total cholesterol and triacylglycerol levels, and increased HDL-cholesterol levels, were observed in all treated mice. Lo Han extract treatment also reactivated antioxidant enzymes and reduced levels of lipid peroxide. The authors did not report any adverse effects as a result of ingestion of Lo Han extract.

Antioxidant activity of Luo Han Guo was demonstrated *in vivo* by Yamada and Ogata (2001). Rats were divided (numbers not reported) and placed on either a vitamin-E-free diet or a diet with Lo Han Guo extract (dose not reported). The hemolysis among the vitamin-E-free rats was 100% after 4 weeks, while the rats receiving Lo Han Guo had a hemolysis rate of less than 80%. The rats that received Luo Han Guo also showed lower levels of serum cholesterol and serum lipid peroxide, which further demonstrates an antioxidant effect.

The mogrosides from Luo Han Guo appear to have an anti-inflammatory effect in both the murine macrophage RAW 264.7 cells and a murine ear edema model (Di et al., 2011). The results of the study showed that inflammation induced by lipopolysaccharides in RAW 264.7 cells is a result of the down-regulation of inflammatory genes such as iNOS, COX-2, and IL-6, and the up-regulation of inflammation protective genes such as PARP1, BCL2I1, TRP53, and MAPK9. In the murine ear edema model, 12-O-tetradecanoylphorbol-13-acetate-induced inflammation was inhibited by mogrosides by down-regulating the expression of COX-2 and IL-6, and up-regulating the expression of PARP1, BCL2I1, TRP53, MAPK9, and PPAR $\delta$ . The authors suggest that the anticancer and antidiabetic effects of Luo Han Guo may be partly due to its anti-inflammatory activity.

**SUBMISSION END**