

# CODEX ALIMENTARIUS COMMISSION



Food and Agriculture  
Organization of the  
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World Health  
Organization

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Agenda item 5.3

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## JOINT FAO/WHO FOOD STANDARDS PROGRAMME CODEX COMMITTEE ON METHODS OF ANALYSIS AND SAMPLING

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### REVIEW OF METHODS OF ANALYSIS IN CXS 234: HONEY & SUGAR WORKABLE PACKAGE

(Prepared by Uruguay)

Codex Members and Observers wishing to submit comments on the recommendations in this document should do so as instructed in CL 2026/4-MAS available on the Codex webpage/Circular Letters: <https://www.fao.org/fao-who-codexalimentarius/resources/circular-letters/en/>

#### INTRODUCTION

1. The 44th Session of the Codex Committee on Methods of Analysis and Sampling (CCMAS44, 2025) agreed to start the review of methods in the sugars and honey package as part of its ongoing work on the review and update of the *Recommended methods of analysis and sampling* (CXS 234-1999).
2. CCMAS44 agreed to establish an electronic working group (EWG) chaired by Uruguay, and working in English and Spanish, to review the package and proposals for consideration by CCMAS45 (2026).
3. The methods for sugars and honey are found in the *Standards for sugars* (CXS 212-1999, last amended in 2022) and *honey* (CXS 12-1981, last amended in 2022). The Codex Committee on Sugars (CCS) was established in 1964, with the mandate to develop global standards for sugars and sugar products. CCS is currently adjourned *sine die* and it held its last physical session in London in 2000 and more recently worked by correspondence in 2000.
4. As in previous reviews, the work of the review of methods in CXS 234-1999 is to remove inconsistencies, make editorial corrections, check if the methods are still fit for purpose and to look at the typing.

#### EWG PROCESS AND PARTICIPATION

5. The EWG was initiated in July 2025 with 31 participants. The list of participants in the EWG is presented in Appendix IV.
6. In preparing for the EWG, the Chair of the EWG elaborated the following documents based on the following steps:
  - Listing methods for sugar and honey from CXS 234-1999.
  - Preparing a template for the review.
  - Preparing some instructions for the review of sugar and honey methods, along with a recommended list of methods assigned for participants who indicated their availability to review specific standards. All suggestions for improving the methods review process and associated documentation were highly appreciated. All participants were invited to submit comments on the complete list of standards.
7. A review of CXS 12-1981 and CXS 212-1999 was carried out to determine whether the analytical methods required therein had been included in CXS 234-1999, and to ensure that all methods listed in CXS 234-1999 have been specified in the relevant product standards.
8. Finally, the list of methods was reorganized by grouping commodities sharing the same provisions, with the aim of simplifying the list currently included in CXS 234-1999.

## SUMMARY OF DISCUSSION

9. The EWG's work was as follows:

- i. A review of the methods already included in CXS 234-1999 for consistency with the Codex Procedural Manual and with the Information Document, "Guidance on the Process for Submission, Consideration and Endorsement of Methods";
- ii. A cross-review of CXS 12-1981 and CXS 212-1999 against the list of methods included in CXS 234-1999 to identify the applicable provisions, commodities, and specifications of the required analytical methods; and
- iii. Editorial improvements to the list of methods included in CXS 234-1999.

### Review of methods already included in CXS 234-1999

10. Invert sugar content provision: Under CXS 212-1999, the provision states "invert sugar content (% m/m)", yet the traditional Type I methods endorsed by CCMAS are less specific and measure reducing sugars expressed as invert sugars, of which glucose and fructose are only a subset. Since the last CCS/CCMAS review, ICUMSA has introduced official methods targeting invert sugars specifically, such as GS2-4 (2007). The EWG considered whether to amend the Codex provision/standard to reflect measurement of reducing sugars or to transition to methods that measure invert sugars directly, and has opted to retain an official/reference Type I approach while offering an invert sugar method as a Type IV alternative where applicable. Because other reducing sugars can inflate results under Type I, and dual Type I/Type IV status should be exceptional, the EWG notes it is technically preferable to measure invert sugars directly (potentially via Type II/III) but proposes a detailed discussion at CCMAS45 to balance the benefits of transition with industry readiness.

11. Sulphur dioxide analyses for various food categories/sugar commodities: The EWG is concerned that current ICUMSA methods for sweeteners and sugar commodities may not be sufficiently sensitive or precise to meet the Codex General Standard for Food Additives performance criteria for residual sulphur dioxide. Evidence indicates the Optimised Monier-Williams method is reliable above a practical threshold except where endogenous sulphur compounds interfere, and the US FDA has adopted a more sensitive LC-MS/MS approach validated across multiple matrices, which is being proposed to CCMAS as a recently introduced method to support appropriate maximum limits.

12. Diastase activity: The method included in CXS 12-1981 Annex 2.2.2 is AOAC 958.09. The current entry in CXS 234-1999 follows discussions in CCMAS32 (2011) and CCMAS34 (2013)<sup>1</sup>. An alternative suggestion has been received by the EWG for the Method IHC 6.1 Determination of diastase activity after Schad.

13. Sugars added: Journal of AOAC INTERNATIONAL, 105(2), 2022, 333–345 noted that Method 978.17 has been replaced by Method 998.12. For Method 998.18, the authors were not able to identify it and believed the correct method to be Method 998.12.

14. Sample preparation: AOAC 920.180 was appropriate and identified in CXS 12-1981 but lacked an associated provision. The EWG recommends it be listed as a complementary method as needed.

### Cross review of CCS standards with CXS 234-1999

15. During the cross-review of CXS 12-1981 and CXS 212-1999 with CXS 234-1999, the following issues were identified:

- (a) CXS 212-1999 does not provide explicit specifications for sulphur dioxide for any commodity. For both CXS 212-1999 and CXS 12-1981, the standards referenced compliance with maximum limits established by the Codex Alimentarius Commission for contaminants (heavy metals, pesticides residue/veterinary drugs), the *Principles and guidelines for the establishment and application of microbiological criteria related to foods* (CXG 21-1997) for microbiological criteria. For CXS 212-1999, the standard referenced compliance with the *General standard for food additives* (CXS 192-1995) for food additives.
- (b) CXS 212-1999 does not provide explicit specifications for soft brown sugar regarding conductivity ash.
- (c) Methods for Sections 8.3 (Determination of sugar content) and 8.5 (Determination of electrical conductivity) in CXS 12-1981 were not included in CXS 234-1999 because those sections were identified in that standard as pending finalization; CXS 234-1999 also did not provide methods for starch content for CXS 212-1999.

<sup>1</sup> For more information on background discussions, see REP11/MAS para 43 and REP13/MAS para 45.

- (d) CXS 12-1981 includes the method AOAC 991.41 internal standard for SCIRA (stable carbon isotope ratio analysis) for the determination of sugars added to honey (authenticity). However, this method is not listed in CXS 234-1999. Instead, AOAC 998.12 has been recommended for endorsement and inclusion in CXS 234-1999 to replace AOAC 991.41.

#### Editorial improvements to the list of methods included in CXS 234-1999

16. Changes in new ICUMSA method number system that were updated in the table proposed.
17. Sugar commodities that share the same provision and method were consolidated so as to simplify the list of methods.

#### **ITEMS FOR FURTHER CONSIDERATION**

18. Some issues may require consideration by a future EWG:
- The EWG has identified that for a number of sugar commodities e.g. Sugars (powdered sugar), method ICUMSA GS2-5 states 'after filtration if necessary to remove any anticaking agents'. However, there was no reference for the filtration. The EWG suggests that a procedure reference be provided for the filtration removal of anticaking agents in CXS 234-1999.
  - Methods that the EWG members were unable to access or for which no comments were received would need to be considered in a future review.
  - Some limitations were identified during the review of sugar methods regarding the differing segregation of sugar products as listed under ICUMSA, those listed in the 'First Commission Directive 79/796/EEC of 26 July 1979 laying down Community methods of analysis for testing certain sugars intended for human consumption' or Mercosur regulation and in Codex sugar commodity standards are all different. Trying to understand the correlation between the ICUMSA GS, regulations and Codex commodities to clearly identify applicability of a method to a listed Codex commodity and provision combination was not always easily achieved.

#### **CONCLUSION**

19. The EWG has progressed its work on the review of CCS standards and its recommendations are summarised in the appendices.
- Appendix I contains methods which the EWG has made specific recommendations with regard to its status in CXS 234-1999 (i.e. whether it should be retained, included, amended or revoked).
  - Appendix II contains a list of methods that the EWG members were unable to access or for which no comments were received and that need to be considered in a future review.
  - Appendix III contains specific comments for certain methods, provisions, and/or commodities that were deemed valuable for the work of the PWG on endorsement.

#### **RECOMMENDATIONS**

20. CCMAS45 is invited to:
- i. endorse the recommendations of the EWG on methods contained in Appendix I, taking into account the specific comments in Appendix III;
  - ii. note that the methods for determination of sugar content, determination of electrical conductivity and starch content will not be included in CXS 234-1999 at this time;
  - iii. note that the method AOAC 991.41 internal standard for SCIRA (stable carbon isotope ratio analysis) has been replaced by AOAC 998.12 and will not be included in CXS 234-1999. Consequently, AOAC 991.41 should be revoked from CXS 12-1981; and
  - iv. re-establish the EWG to consider the items for further consideration described in paragraph 18 and Appendix II.

## METHODS THAT HAVE BEEN RECOMMENDED BY THE EWG FOR RETENTION, INCLUSION, AMENDMENT OR REVOCATION IN CXS 234-1999

**Note:** Only the columns “Commodity”, “Provisions”, “Method”, “Principle”, and “Type” will be included in CXS 234-1999 following the endorsement of methods. Recommended amendments and inclusions to CXS 234-1999 are indicated in **bold, underline, strikethrough and highlight**. Recommended revocations are indicated in ~~strikethrough and red~~.

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
Honey	Acidity	MAFF Validated Method V19 <b><u>I</u></b> J. Assoc. Public Analysts (1992) 28 (4) 171-175 <b><u>I</u></b> <b><u>AOAC 962.19</u></b>	Titrimetry	I	CXS 12-1981	CCS	COMMENT: In our laboratory, “TS 13360 standard” method is validated and employed for this analysis. This method has the same principle with ours. COMMENT: Suggestion to include the Method AOAC 962.19. Validation data available. NEW METHOD PROPOSED AOAC 962.19
<b><u>Honey</u></b>	<b><u>Acidity</u></b>	<b><u>TS 13360</u></b>	<b><u>Titrimetry</u></b>	<b><u>I or IV</u></b>	CXS 12-1981	CCS	NEW METHOD PROPOSED
<b><u>Honey</u></b>	<b><u>Hydroxymethylfurfural</u></b>	<b><u>AOAC 980.23</u></b>	<b><u>Spectrophotometry</u></b>	<b><u>II</u></b>	CXS 12-1981	CCS	Provision included in CXS 12
<b><u>Honey</u></b>	<b><u>Hydroxymethylfurfural</u></b>	<b><u>IHC 5</u></b>	<b><u>HPLC-UV</u></b>	<b><u>III</u></b>	CXS 12-1981	CCS	NEW METHOD PROPOSED
Honey	Diastase activity	IHC Method for determination of diastase activity with Phadebas, 2009 except that the incubation time should be increased from 15 to 30 minutes	<b><u>Enzymatic</u></b>	IV	CXS 12-1981	CCS	COMMENT: Is not the method include in CXS 12-1981 Annex 2.2.2, where indicate the Method AOAC 958.09, which we agree with. Suggest to include also the Method IHC 6.1 Determination of diastase activity after Schad.  COMMENT: Members should also read Honey Diastase Activity discussed at CCMAS32 REP 11/MAS (2011) paragraph 43 (well after Standard CXS 12-1981 development and the last CCS7 meeting in Feb. 2000), plus the detailed discussion at CCMAS34 under ‘Agenda Item 5: Discussion Paper - Update

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
							Reference of Methods of Analysis and Related Texts' along with the CCMAS34 CRD 7 submission, with decision reported in CCMAS34 REP13/MAS(2013) paragraph 45 and culminated in the current CXS 234 entry
<b>Honey</b>	<b>Diastase activity</b>	<b>AOAC 958.09 I IHC 6.1</b>	<b>Enzymatic</b>	<b>I</b>	CXS 12-1981	CCS	AOAC 958.09 included in CXS 12-1981  NEW METHOD PROPOSED IHC 6.1 validation data available
Honey	Moisture	AOAC 969.38B <b>I</b> or MAFF Validated Method V21 <b>I J. Assoc. Public Analysts (1992) 28 (4) 183-187</b>	Refractometry	I	CXS 12-1981	CCS	COMMENT: This methods are suitable for the specified matrix. Includes validation studies
<b>Honey</b>	<b>Sample preparation</b>	<b>AOAC 920.180</b>	-	-	CXS 12-1981	CCS	COMMENT: AOAC 969.38B Method is appropriate and identified in CXS12-1981 but lacks an associated provision. It should be listed as a complementary method as needed.
Honey	Solids, water-insoluble	MAFF Validated Method V22 J. Assoc. Public Analysts (1992) 28(4) 189-193 <b>I</b> <b>IHC 8</b>	Gravimetry	I	CXS 12-1981	CCS	COMMENT: MAFF Includes validation studies.  NEW METHOD PROPOSED IHC 8 includes validation data
<b>Honey</b>	<b>Sugars added (for sugar profile)</b>	<b>AOAC 998.18</b>	<b>Carbon isotope ratio-mass spectrometry</b>	<b>I</b>	CXS 12-1981	CCS	COMMENT: AOAC 998.18 is not identified in 22 <sup>nd</sup> Ed. AOAC Official Methods. To retain this commodity/provision listing, AOAC 977.20 should be considered for endorsement as a Type IV method as it is listed in CXS 12 and provides a "profile" of sugars, but no validation

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
							data is available, nor has any performance criteria been established.
							COMMENT: It explains sample preparation procedure, however it is not a quantification method. Primary method should be AOAC 998.12.
							COMMENT: Recommendation: Include new LC-IRMS-based method: CEN EN 17958:2024 (European Committee for Standardisation): Detection of sugar syrup addition in honey (C3 and c4 plants).
Honey	Sugars added (for sugar profile)	AOAC 998.12	HPLC-DAD	II	CXS 12-1981	CCS	COMMENT: Recommended reference method. NEW METHOD PROPOSED
Honey	Sugars added (for sugar profile)	CEN EN 17958	LC-IRMS	III	CXS 12-1981	CCS	COMMENT: Alternative or supportive method to 998.12 NEW METHOD PROPOSED
Honey	Sugars added (for sugar profile)	AOAC 977.20	LC-RI	IV	CXS 12-1981	CCS	NEW METHOD PROPOSED
Honey	<del>Sugars added:- detection of corn and cane sugar products</del>	<del>AOAC 978.17</del>	<del>Carbon isotope ratio mass spectrometry</del>	<del>I</del>	CXS 12-1981	CCS	COMMENT : AOAC 978.17 has been replaced by AOAC 998.12. Update method to AOAC 998.12 and retype Type I typing. Change principle to "Stable isotope mass spectrometry" to be consistent with the listings for fruit juices and nectars.
Honey	Sugars added: detection of corn and cane sugar products	AOAC 998.12	Stable isotope mass spectrometry	II	CXS 12-1981	CCS	COMMENT: It is updated with AOAC 998.12. COMMENT 3: Outdated and replaced by AOAC 998.12. Suitable for detecting syrup of C4-plants (corn, cane) in honey.

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
Sugars (dextrose anhydrous and dextrose monohydrate)	D-Glucose	ISO 5377	Titrimetry	I	CXS 212-1999	CCS	
Sugars (dextrose anhydrous and dextrose monohydrate)	Solids, total	ISO 1741	Gravimetry (vacuum oven)	I	CXS 212-1999	CCS	
Sugars (glucose syrup and dried glucose syrup)	Solids, total	ISO 1742	Gravimetry (vacuum oven)	I	CXS 212-1999	CCS	
Sugars (dextrose anhydrous and dextrose monohydrate, dried glucose syrup, glucose syrup, powdered dextrose, lactose)	Sulphated ash	ISO 5809	Single sulphonation	I	CXS 212-1999	CCS	
Sugars (soft brown sugar)	Sulphated ash	ICUMSA GS 1/3/4/7/8-11 3-11	Gravimetry & Ashing at 650 °C	I	CXS 212-1999	CCS	
Sugars (fructose, lactose)	pH	ICUMSA GS 1/2/3/4/7/8-23 1-23	Potentiometry	I	CXS 212-1999	CCS	
<del>Sugars (lactose)</del>	<del>pH</del>	<del>ICUMSA GS 1/2/3/4/7/8-23</del>	<del>Potentiometry</del>	<del>I</del>	CXS 212-1999	CCS	
Sugars (fructose, powdered sugar, white sugar)	Conductivity ash	ICUMSA GS 2/3-47-2-17	Conductimetry	I	CXS 212-1999	CCS	Sugars (plantation or mill white sugar) COMMENT: ICUMSA Official Method Includes validation studies
<del>Sugars (powdered sugar)</del>	<del>Conductivity ash</del>	<del>ICUMSA GS 2/3-47</del>	<del>Conductimetry</del>	<del>I</del>	CXS 212-1999	CCS	

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
<del>Sugars (white sugar)</del>	<del>Conductivity ash</del>	<del>ICUMSA GS 2/3-47</del>	<del>Conductimetry</del>	<del>I</del>	CXS 212-1999	CCS	
Sugars (plantation or mill white sugar, <u>soft white sugar and soft brown sugar</u> )	Conductivity ash	ICUMSA GS <u>1/3/4/7/8-13</u> <u>1-13</u>	Conductimetry	I	CXS 212-1999	CCS	COMMENT: ICUMSA Official Method Includes validation studies
<del>Sugars (soft white sugar and soft brown sugar)</del>	<del>Conductivity ash</del>	<del>ICUMSA GS 1/3/4/7/8-13</del>	<del>Conductimetry</del>	<del>I</del>	CXS 212-1999	CCS	
Sugars (fructose)	D-Fructose	ISO 10504	<u>Liquid chromatography (refractive index detection)</u> <u>LC-RI</u>	II	CXS 212-1999	CCS	
Sugars (fructose)	D-Glucose	ISO 10504	<u>Liquid chromatography (refractive index detection)</u> <u>LC-RI</u>	II	CXS 212-1999	CCS	
Sugars (fructose)	Loss on drying	ISO 1742	Gravimetry	I	CXS 212-1999	CCS	COMMENT: The method is suitable for the specified matrix.
Sugars (lactose)	Loss on drying	USP General Chapter 731	Gravimetry (drying at 120 °C for 16 h)	I	CXS 212-1999	CCS	COMMENT: The method is suitable for the specified matrix COMMENT: The test conditions are not specified (time-temperature).
Sugars (plantation or mill white sugar, <u>powdered sugar, soft white sugar and soft brown sugar, white sugar</u> )	Loss on drying	ICUMSA GS <u>2/4/3-15</u> <u>2-15</u>	Gravimetry	I	CXS 212-1999	CCS	COMMENT: The method is suitable for the specified matrix  plantation or mill white sugar, powdered sugar, soft white sugar and soft brown sugar



Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
<del>Sugars (powdered sugar)</del>	<del>Loss on drying</del>	<del>ICUMSA GS-2/4/3-15</del>	<del>Gravimetry</del>	<del>I</del>	CXS 212-1999	CCS	COMMENT: ICUMSA Official Method Includes validation studies
<del>Sugars (soft white sugar and soft brown sugar)</del>	<del>Loss on drying</del>	<del>ICUMSA GS-2/4/3-15</del>	<del>Gravimetry</del>	<del>I</del>	CXS 212-1999	CCS	
<del>Sugars (white sugar)</del>	<del>Loss on drying</del>	<del>ICUMSA GS-2/4/3-15</del>	<del>Gravimetry</del>	<del>I</del>	CXS 212-1999	CCS	
Sugars (glucose syrup and dried glucose syrup)	Reducing sugar	ISO 5377	Titrimetry	I	CXS 212-1999	CCS	
Sugars (lactose)	Lactose, anhydrous <u>(as reducing sugars)</u>	<u>USP General Chapter 731 and ICUMSA GS 4/3-34-3</u>	<u>Titrimetry Calculation from Loss on drying (80 °C) and Titrimetry - Lane &amp; Enyon</u>	<u>II IV</u>	CXS 212-1999	CCS	COMMENT: "GS4-3 determines total 'reducing sugar' and not validated specifically for lactose. Options include: - to change the 'provision' to Lactose, anhydrous (as reducing sugars) and assign as a 'traditional' type IV. - If a 'lactose, anhydrous' Type II method is to be retained, we suggest greater specificity is required e.g. FCC 14 Ed. Lactose Assay by HPLC-RI detector, however the method acceptance criteria NLT 98.0% and NMT 100.5% Lactose calculated on a dry basis and require CXS 212 limit to be changed."
Sugars (plantation or mill white sugar)	Invert sugar <u>(as reducing sugars)</u>	ICUMSA GS <u>4/3/7-3 1-3</u>	Titrimetry (Lane & Enyon)	<u>I IV</u>	CXS 212-1999	CCS	COMMENT: Either retain as Type IV (if still in wide use which was case in 2005) with ICUMSA 'Official' method GS1-5 (2009), principle 'Titrimetry - Luff & Schoorl' (would need to be included in list of 'principles') as Type I. But our preference is to delete the GS1-3 'accepted' method and replace with the GS1-5 'official' method. Another option is a Type II method by FCC 14th Ed. for Sucrose -

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
							invert sugar NMT 0.1% by HPLC-PAD with lactose internal standard ).
<b>Sugars (plantation or mill white sugar)</b>	<b>Invert sugar (as reducing sugars)</b>	<b>ICUMSA GS 1-5</b>	<b>Titrimetry – Luff Schoorl</b>	<b>I</b>	CXS 212-1999	CCS	COMMENT: Type I as replacement or in addition to ICUMSA GS1-3 as Type IV, (but only if the latter is still in wide use, which ICUMSA reported as the case in 2005 but hopefully no longer the case in 2025). Another option is a Type II method by FCC 14th Ed. for Sucrose - invert sugar NMT 0.1% by HPLC-PAD) NEW METHOD PROPOSED
<b>Sugars (plantation or mill white sugar)</b>	<b>Invert sugar</b>	<b>Food Chemical Codex 14th Ed.,(2024), Sucrose monograph, for Organic Impurities - Invert Sugar</b>	<b>HPLC - PAD</b>	<b>II</b>	CXS 212-1999	CCS	COMMENT: As a rational method alternative to the previous 'empirical Type I' method NEW METHOD PROPOSED
Sugars ( <b>white sugar</b> , powdered sugar)	Invert sugar ( <b>as reducing sugars</b> )	ICUMSA GS 2-5 after filtration if necessary to remove any anticaking agents	Titrimetry <b>- Knight &amp; Allen</b>	<b>I</b>	CXS 212-1999	CCS	COMMENT: Type I, method assumes reducing sugars present are all glucose and fructose. Suggest the inclusion of GS 2-4 as an alternative Type IV.
<b>Sugars (white-sugar)</b>	<b>Invert-sugar</b>	<b>ICUMSA GS 2/3-5-</b>	<b>Titrimetry</b>	<b>I</b>	CXS 212-1999	CCS	
<b>Sugars (powdered sugar)</b>	<b>Invert sugar</b>	<b>ICUMSA GS 2-4 after filtration if necessary to remove any anticaking agents</b>	<b>Enzymatic</b>	<b>IV</b>	CXS 212-1999	CCS	COMMENT: Type IV as an 'Invert sugar' method being newly introduced. NEW METHOD PROPOSED

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
Sugars (soft white sugar and soft brown sugar)	Invert sugar <b>(as reducing sugars)</b>	ICUMSA GS <b>4/3-3 4-3</b> (applicable at levels >10% m/m)	Titrimetry (Lane & Eynon)	I	CXS 212-1999	CCS	COMMENT: Method not validated for Soft brown or soft white sugars; assumes reducing sugars present are all glucose and fructose, also has a correction for Sucrose present in final titration.
Sugars (soft white sugar and soft brown sugar)	Invert sugar <b>(as reducing sugars)</b>	ICUMSA GS <b>4/3/7-3 1-3</b> (applicable at levels <10% m/m)	Titrimetry (Lane & Eynon)	<b>I</b> <b>IV</b>	CXS 212-1999	CCS	COMMENT: Method not validated for Soft brown or soft white sugars; assumes reducing sugars present are all glucose and fructose, also has a correction for Sucrose present in final titration.  Either retain as Type IV (is still in wide use which was case in 2005) but in the absence of an alternative collaborative method it may need to be retained as a Type I
<b>Sugars (plantation or mill white sugars)</b>  CCMAS should consider whether these commodities should be included: Sugars (dextrose anhydrous and dextrose monohydrate) Sugars (fructose) Sugars (glucose syrup and dried glucose syrup) Sugars (powered sugars and	<b>Sulphur dioxide</b>	<b>AOAC 962.16</b>	<b>Titrimetry Modified Monier – Williams</b>	<b>III</b>	CXS 212-1999	CCS	COMMENT: Note, AOAC 962.16 refers to the Modified Monier Williams Method. While the AOAC Official Method 990.28, Sulfites in Foods, Optimized Monier-Williams Method is already endorsed in CXS 234(2025) for Hominy, fruit juice, seafood and Dried or dehydrated ginger.  The AOAC 962.16 is a predecessor of AOAC 990.28 not optimized for enforcement at the 10 mg/kg sulfite level. Thus, we suggest the AOAC 962.16 could only be used for the Sugar commodities with a >50 mg/kg maximum limit i.e.  11.1.5 Plantation or mill white sugar 11.3 Sugar solutions and syrups, also (partially) inverted, including treacle and molasses, excluding products of food category 11.1.3.  While the LC-MSMS sulfite method should be separately listed

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
powered dextrose) Sugars (raw cane sugar) Sugars (soft white sugar and soft brown sugar) Sugars (white sugars)							NEW METHOD PROPOSED
<b>Sugars (plantation or mill white sugar)</b>	<b>Sulphur dioxide</b>	<b>ICUMSA GS 2-33</b>	<b>Colorimetry</b>	<b>IV</b>	CXS 212-1999	CCS	COMMENT: NEW METHOD PROPOSED
<b>Sugars (all)</b>	<b>Sulphur dioxide</b>	<b>US FDA Method C-004.04</b>	<b>LC-MS/MS</b>	<b>IV</b>	CXS 212-1999	CCS	As a 'recently introduced' method NEW METHOD PROPOSED
<b>Sugars- (plantation or mill white sugar)</b>	<b>Sulphur dioxide</b>	<b>ICUMSA GS 2/3-35</b> <b>NMKL-135</b> <b>EN 1988-2</b>	<b>Enzymatic method</b>	<b>II</b>	CXS 212-1999	CCS	plantation or mill white sugar COMMENT : "AOAC, No: 962.16" method is employed and validated in our laboratory. COMMENT:
<b>Sugars- (powdered sugar and powdered dextrose)</b>	<b>Sulphur dioxide</b>	<b>ICUMSA GS 2/3-35</b> <b>NMKL-135</b> <b>EN 1988-2</b>	<b>Enzymatic method</b>	<b>II</b>	CXS 212-1999	CCS	Type II (but only in the absence of method with appropriate sensitivity LOQ ≤ 14 mg/kg and precision conforming to the Codex method performance criteria RSDR% = 16.9%)
<b>Sugars (raw cane sugar)</b>	<b>Sulphur dioxide</b>	<b>ICUMSA GS 2/3-35</b> <b>NMKL-135</b> <b>EN 1988-2</b>	<b>Enzymatic method</b>	<b>II</b>	CXS 212-1999	CCS	powdered sugar and powdered dextrose COMMENT: "AOAC, No: 962.16" method is employed and validated in our laboratory. COMMENT:
<b>Sugars (soft white sugar and soft brown sugar)</b>	<b>Sulphur dioxide</b>	<b>ICUMSA GS 2/3-35</b> <b>NMKL-135</b> <b>EN 1988-2</b>	<b>Enzymatic method</b>	<b>II</b>	CXS 212-1999	CCS	Type II (but only in the absence of method with appropriate sensitivity LOQ ≤ 3 mg/kg and precision conforming to the Codex criteria RSDR% = 21.3%).

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
Sugars (white-sugar)	Sulphur dioxide	<del>ICUMSA GS 2/3-35</del> NMKL 135 <del>EN 1988-2</del>	Enzymatic method	II	CXS 212-1999	CCS	raw cane sugars COMMENT: "AOAC, No: 962.16" method is employed and validated in our laboratory. COMMENT:
Sugars (plantation or mill white sugar, powdered sugar and powdered dextrose, raw cane sugar, soft white sugar and soft brown sugar, white sugar)	Sulphur dioxide	ICUMSA GS 2-35	Enzymatic	II	CXS 212-1999	CCS	Type II (but only in the absence of a method with appropriate sensitivity $LOQ \leq 4$ mg/kg and precision conforming to the codex criteria $RSDR(\%) = 20.4\%$ ).  soft white sugar and soft brown sugar COMMENT: If the analyst has very limited experience with enzymatic methods, a high coefficient of variation can be expected. Therefore, it is a challenging analysis that requires experience. The AOAC Official Method 2006, No. 962.16 has been used by us since 2003 (and has been accredited since 2005), and it consistently passes proficiency tests for non-alcoholic beverages, meat, jam, biscuits, wine, and both dried and fresh fruits. Therefore, the primary method should be AOAC Official Method 2006, No. 962.16 (Monier-Williams). COMMENT: II (but only in the absence of a method with appropriate sensitivity $LOQ \leq 4$ mg/kg and precision conforming to the codex criteria $RSDR\% = 20.4\%$ ).  white sugar COMMENT : "AOAC, No: 962.16" method is employed and validated in our laboratory. COMMENT : Type II (but only in the absence of method with

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
							appropriate sensitivity LOQ≤3 mg/kg and precision conforming to codex criteria RSDR%=21.3%)
<b>Sugars (plantation or mill white sugar, powdered sugar and powdered dextrose, raw cane sugar, soft white sugar and soft brown sugar, white sugar)</b>	<b>Sulphur dioxide</b>	<b>NMKL 135</b>	<b>Enzymatic</b>	<b>II or III</b>	CXS 212-1999	CCS	<p>COMMENT: If the analyst has very limited experience with enzymatic methods, a high coefficient of variation can be expected. Therefore, it is a challenging analysis that requires experience.</p> <p>The AOAC Official Method 2006, No. 962.16 has been used by us since 2003 (and has been accredited since 2005), and it consistently passes proficiency tests for non-alcoholic beverages, meat, jam, biscuits, wine, and both dried and fresh fruits. Therefore, the primary method should be AOAC Official Method 2006, No. 962.16 (Monier-Williams).</p> <p>COMMENT: The method was collaboratively tested for the following foods: potato flakes, wine, juice, and dried apples.</p>
<b>Sugars (plantation or mill white sugar, powdered sugar and powdered dextrose, raw cane sugar, soft white sugar and soft brown sugar, white sugar)</b>	<b>Sulphur dioxide</b>	<b>EN 1988-2</b>	<b>Enzymatic</b>	<b>II</b>	CXS 212-1999	CCS	To retain in CXS 234-1999 until more information is available on this method

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
Sugars (dextrose anhydrous and dextrose monohydrate, <b>fructose, glucose syrup and dried glucose syrup</b> )	Sulphur dioxide	ISO 5379	Acidimetry and nephelometry	IV	CXS 212-1999	CCS	COMMENT: The AOAC Official Method 2006, No. 962.16 (Monier-Williams) and the ISO 5379:2013 method overlap by approximately 80%. However, the sulfur collection part in the ISO 5379:2013 apparatus is lengthy and problematic. The AOAC Official Method 2006, No. 962.16 has been used by us since 2003 (and has been accredited since 2005), and it consistently passes proficiency tests involving non-alcoholic beverages, meat, jam, biscuits, wine, and both dried and fresh fruits. Therefore, the primary method should be AOAC Official Method 2006, No. 962.16 (Monier-Williams). PROPOSED METHODS: AOAC 962.16 & US FDA Method C-004.04
<del>Sugars (fructose)</del>	<del>Sulphur dioxide</del>	<del>ISO 5379</del>	<del>Acidimetry and nephelometry</del>	<del>IV</del>	<del>CXS 212-1999</del>	<del>CCS</del>	
<del>Sugars (glucose syrup and dried glucose syrup)</del>	<del>Sulphur dioxide</del>	<del>ISO 5379</del>	<del>Acidimetry and nephelometry</del>	<del>IV</del>	<del>CXS 212-1999</del>	<del>CCS</del>	
Sugars (soft white sugar and soft brown sugar)	Sucrose plus invert sugar ( <b>as reducing sugars</b> )	ICUMSA GS <b>4/3-7-4-7</b>	Titrimetry	<b>I</b> <b>IV</b>	CXS 212-1999	CCS	COMMENT Preferably a Type IV as an existing Type I methods without a full set of validation data. Ideally an alternative collaborative studied candidate-method can be identified.
Sugars (plantation and mill white sugar)	Colour	ICUMSA GS <b>9/1/2/3-8</b>	Photometry	I	CXS 212-1999	CCS	COMMENT: ICUMSA Reference Method COMMENT: ICUMSA Accepted Method Includes validation studies
Sugars (soft white sugar, <b>powdered sugar</b> )	Colour	ICUMSA GS <b>2/3-9-2-9</b>	Photometry	I	CXS 212-1999	CCS	COMMENT: ICUMSA Accepted Method Includes validation studies
<del>Sugars (powdered sugar)</del>	<del>Colour</del>	<del>ICUMSA GS 2/3-9</del>	<del>Photometry</del>	<del>I</del>	<del>CXS 212-1999</del>	<del>CCS</del>	
Sugars (white sugar, <b>powdered sugar</b> )	Polarization	ICUMSA GS <b>2/3-4-2-1</b>	Polarimetry	<b>II</b> <b>III</b>	CXS 212-1999	CCS	COMMENT: Type III (as an alternative to the reference Type

Commodity	Provisions	Method	Principle	Type	Codex Standard	Committee	Participant Comments
<del>Sugars- (powdered- sugar)</del>	<del>Polarization</del>	<del>ICUMSA GS 2/3-1 after filtration- if necessary to remove any anticaking agents</del>	<del>Polarimetry</del>	<del>II</del>	CXS 212-1999	CCS	II method) Powdered sugar The ICUMSA website Method Search for 'Powdered sugar', 'Polarimetric sucrose content' provides a techniques result of 'ICUMSA Method GS3-1
<b>Sugars (powdered sugar)</b>	<b>Polarization</b>	<b>ICUMSA GS 3-1</b>	<b>Polarimetry</b>	<b>III</b>	CXS 212-1999	CCS	COMMENT: As an alternative to the reference Type II method GS1-1. Also details of the filtration removal of anticaking agents is not included, suggest a procedure reference is provided in CXS 234 NEW METHOD PROPOSED
<b>Sugars (white sugar, powdered sugar)</b>	<b>Polarization</b>	<b>ICUMSA GS 1-1 (powdered sugars, if filtration to remove any anticaking agents is unnecessary)</b>	<b>Polarimetry</b>	<b>II</b>	CXS 212-1999	CCS	COMMENT: Recommended reference method Updaed method GS1-1 (2022) to include the use of Carrez reagents or other clarification agent alternatives to basic lead acetate, however not fully accepted or implemented at this time NEW METHOD PROPOSED
<b>Sugars (white sugar, powdered sugar, plantation or mill white sugar)</b>	<b>Polarization</b>	<b>ICUMSA GS 1-2</b>	<b>Polarimetry</b>	<b>III</b>	CXS 212-1999	CCS	COMMENT: III (as a new alternative to the recommended reference GS1-1 Type II method) NEW METHOD PROPOSED
Sugars (plantation or mill white sugar)	Polarization	ICUMSA GS <del>1/2/3-1</del> <b>1-1</b>	Polarimetry	II	CXS 212-1999	CCS	COMMENT: Note recommendation from 34th ICUMSA Session 2025 to 'Update Method GS1-1 (2022) to include the use of Carrez reagents or other clarification agent alternatives to basic lead acetate', however this is not fully accepted or implemented at this time."



## APPENDIX II

## LIST OF METHODS THAT THE EWG MEMBERS WERE UNABLE TO ACCESS OR FOR WHICH NO COMMENTS WERE RECEIVED

Commodity	Provisions	Codex Standard	Method	Principle	Type	Committee
Sugars (plantation or mill white sugar)	Sulphur dioxide	CXS 212-1999	EN 1988-2	Enzymatic	II	CCS
Sugars (powdered sugar and powdered dextrose)	Sulphur dioxide	CXS 212-1999	EN 1988-2	Enzymatic	II	CCS
Sugars (raw cane sugar)	Sulphur dioxide	CXS 212-1999	EN 1988-2	Enzymatic	II	CCS
Sugars (soft white sugar and soft brown sugar)	Sulphur dioxide	CXS 212-1999	EN 1988-2	Enzymatic	II	CCS
Sugars (white sugar)	Sulphur dioxide	CXS 212-1999	EN 1988-2	Enzymatic	II	CCS

## APPENDIX III

## SPECIFIC COMMENTS FOR CERTAIN METHODS, PROVISIONS, AND/OR COMMODITIES

(for information)

Appendix III sets out specific comments on selected methods, provisions and/or commodities regarded as valuable to the PWG's work on endorsement.

The EWG acknowledges the collaboration withof INTECO (the Costa Rican Institute of Technical Standards (INTECO) in reviewing the methods' revision year and for NMKL (the Nordic-Baltic Committee on Food Analysis (NMKL) for the comments provided by their expert group.

## CXS 12-19811 STANDARD FOR HONEY

MAFF methods are available on:

- MAFF V19 Acidity in Honey [http://apajournal.org.uk/019\\_Acidity\\_in\\_Honey.pdf](http://apajournal.org.uk/019_Acidity_in_Honey.pdf)
- MAFF V21 Moisture in Honey [http://www.apajournal.org.uk/Vol\\_28\\_Part\\_4.pdf](http://www.apajournal.org.uk/Vol_28_Part_4.pdf) (p29)
- MAFF V22 Solids, water insoluble in honey [http://www.apajournal.org.uk/Vol\\_28\\_Part\\_4.pdf](http://www.apajournal.org.uk/Vol_28_Part_4.pdf) (p35)

Commodity	Provisions	Participant Comment
Honey	Diastase activity	The method included in CXS 12-1981 Annex 2.2.2 is AOAC 958.09. The current entry in CXS 234-1999 follows discussions in CCMAS32 (2011) and CCMAS34 (2013) <sup>1</sup> . An alternative suggestion has been received by the EWG for the Method IHC 6.1 Determination of diastase activity after Schad
Honey	Sugars added	Journal of AOAC INTERNATIONAL, 105(2), 2022, 333–345 noted that Method 978.17 has been replaced by Method 998.12. For Method 998.18, the authors were not able to identify it and believed the correct method to be Method 998.12.
Honey	Sample preparation	AOAC 920.180 was appropriate and identified in CXS 12-1981 but lacked an associated provision. The EWG recommends it be listed as a complementary method as needed.

## CXS 212-1999 STANDARD FOR SUGARS

Commodity Provisions	Method	Participant Comment	
Sugars (lactose)  Lactose, anhydrous (as reducing sugars)	USP General Chapter 731 and ICUMSA GS 4/3-3 GS4-3	Validated for a different commodity; indicate which commodity	As an ICUMSA 'official' method, we can expect it has undergone full collaborative testing according to IUPAC standards for the method scope, but not included validation for 'Sugars (lactose)'. The GS4-3 method provides summary data for precision, specifying absolute difference between two results under reproducibility conditions should be <1.60% reducing sugars in molasses. .
Sulphur dioxide	Sulphur dioxide analyses for various food categories/sugar commodities: concerns were expressed in the EWG that the relevant ICUMSA methods for various food categories/sugar commodities may not have the required sensitivity/precision to meet the method performance criteria based on the <i>General standard for food additives</i> (CXS 192-1995) maximum levels under Sulfites (as residual SO <sub>2</sub> ) for Food Categories under '11.0 Sweeteners, including honey'. A recent study (Bhujel et al.,(2025) <sup>2</sup> ) gives 10 mg/kg as the limit of quantification (LOQ) for the Optimised Monier Williams Method (AOAC 990.28), and states 'The method has good reproducibility and is acceptable for samples with an		

<sup>1</sup> For more information on background discussions, see REP11/MAS para 43 and REP13/MAS para 45.

<sup>2</sup> Bhujel et al.,(2025) Comparison of three different methods for the determination of sulphur dioxide in fruit and vegetable products, Czech J. Food Sciences, 43, (1) p1–7; 2 Carlos K.,(2023)

Commodity Provisions	Method	Participant Comment	
	SO <sub>2</sub> level over 10 mg/kg, except for samples suspected to include endogenous sulphur compounds'. Further, the US FDA final rule added a recently developed, accurate, and more efficient analytical method that FDA will use to determine sulfite concentrations in foods <sup>3</sup> (i.e. 'Determination of Sulfites in Food using Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) where the multi-commodity validation includes Molasses with an MDL = 0.67 (ppm as SO <sub>2</sub> ), which could be used to support a maximum Sulfite limit = 6.7 mg/kg . The validation data summary states average recoveries for all matrices ranged from 86-114% with % RSDr and % RSDR of 4.5-17.5 % and 8.6-22.5 % respectively. CCMAS45 is requested to consider this method as a Type IV 'recently introduced' method.		
Sugars (plantation or mill white sugar)  Sulphur dioxide	ICUMSA <del>GS 2/3-35</del> <u>GS2-35</u>	Published, multi-lab validation; indicate reference:	M.A Godshall and M.A. Nemeth from the collaborative test data report in Proc. 21st Session ICUMSA, 1994, p45. Unfortunately, this collaborative study data showed for white sugar in the sulphite range 4.02 - 23.84 mg/kg, reproducibility ranged from 1.74 to 14.58 with an average reproducibility of 7.32 mg/kg. We do not have the average of the sulphite range, but calculations using the upper 23.84 mg/kg sulphite concentration still exceeds the Codex Precision RSD <sub>R</sub> (%) criteria for a 70 mg/kg limit - 16.9%.
<u>Sugars (plantation or mill white sugar)</u>  <u>Sulphur dioxide</u>	ICUMSA <del>GS 2/1/7/9-33</del> <u>GS2-33</u>	<u>Published, single lab validation; indicate reference:</u>	<u>Unfortunately, the Collaborative study data ICUMSA 21st Session 31-69, showed for a mean concentration 14.62 mg/kg the Mean RSDR = 24.3%, exceeds the Codex Precision RSD<sub>R</sub>(%) criteria for a 70 mg/kg limit - 16.9%. Further based on the single laboratory method validation data presented at the 33rd Session of ICUMSA and findings of the 2025 GS9 report, Method GS2-33 (2022) "Sulphite in White Sugar by the Rosaniline Colorimetric Method", should be updated to include details required for testing of plantation white sugar.</u>
Sugars (raw cane sugar)  Sulphur dioxide	ICUMSA <del>GS 2/3-35</del> <u>GS2-35</u>	Published, multi-lab validation; indicate reference:	M.A Godshall and M.A. Nemeth from the collaborative test data report in Proc. 21st Session ICUMSA, 1994, p45. Unfortunately, this collaborative study data showed for white sugar in the sulphite range 4.02 - 23.84 mg/kg, reproducibility ranged from 1.74 to 14.58 with an average reproducibility of 7.32 mg/kg. We do not have the average of the sulphite range, but calculations using the upper 23.84 mg/kg sulphite concentration still exceeds the Codex Precision RSD <sub>R</sub> (%) criteria for a 20 mg/kg limit - 20.4%.
Sugars (soft white sugar and soft brown sugar)  Sulphur dioxide	ICUMSA <del>GS 2/3-35</del> <u>GS2-35</u>	Published, multi-lab validation; indicate reference:	M.A Godshall and M.A. Nemeth from the collaborative test data report in Proc. 21st Session ICUMSA, 1994, p45. Unfortunately, this collaborative study data showed for white sugar in the sulphite range 4.02 - 23.84 mg/kg, reproducibility ranged from 1.74 to 14.58 with an average reproducibility of 7.32 mg/kg. We do not have the average of the sulphite range, but calculations using the upper 23.84 mg/kg

<sup>3</sup> Determination of Sulfites in Food using Liquid Chromatography-Tandem Mass Spectrometry (LC-MSMS), USFDA Method C-004.04. Downloaded 21/12/2025, <https://www.fda.gov/media/114411/download>

Commodity Provisions	Method	Participant Comment	
			sulphite concentration still exceeds the Codex Precision RSD <sub>R</sub> (%) criteria for a 20 mg/kg limit - 20.4%.
Sugars (white sugar)  Sulphur dioxide	ICUMSA <del>GS 2/3-35</del> <u>GS2-35</u>	Published, multi-lab validation; indicate reference:	M.A Godshall and M.A. Nemeth from the collaborative test data report in Proc. 21st Session ICUMSA, 1994, p45. Unfortunately, this collaborative study data showed for white sugar in the sulphite range 4.02 - 23.84 mg/kg, reproducibility ranged from 1.74 to 14.58 with an average reproducibility of 7.32 mg/kg. We do not have the average of the sulphite range, but calculations using the upper 23.84 mg/kg sulphite concentration still exceeds the Codex Precision RSD <sub>R</sub> (%) criteria for a 15 mg/kg limit - 21.3%.
Sugars (powdered sugar and powdered dextrose)  Sulphur dioxide	ICUMSA <del>GS 2/3-35</del> <u>GS2-35</u>	Published, multi-lab validation; indicate reference:	M.A Godshall and M.A. Nemeth from the collaborative test data report in Proc. 21st Session ICUMSA, 1994, p45. Unfortunately, this collaborative study data showed for white sugar in the sulphite range 4.02 - 23.84 mg/kg, reproducibility ranged from 1.74 to 14.58 with an average reproducibility of 7.32 mg/kg. We do not have the average of the sulphite range, but calculations using the upper 23.84 mg/kg sulphite concentration still exceeds the Codex Precision RSD <sub>R</sub> (%) criteria for a 15 mg/kg limit - 21.3%.
Invert sugar	<p>Invert sugar content provision: in CXS 212-1999, the provision was 'Invert sugar content (% m/m)' but the 'traditional' Type I methods accepted/endorsed by CCMAS for the various commodities with this provision are less specific and measure 'reducing sugars expressed as invert sugars'. The provision 'invert sugar (glucose and fructose)' is a subset of 'reducing sugars' and since the last CCS, or during a review of the sugar methods by CCMAS, there have been ICUMSA methods introduced specifically for invert sugars with 'official' status' e.g. Method GS2-4 (2007) based on enzymatic analysis 'suitable to establish the EU-limit of 0.04% of invert sugar (glucose +fructose)' in white sugar. The EWG considered whether it would be better to amend the Codex 'provision' and 'standard' so it is clear that the method is a 'measurement of reducing sugars expressed as invert sugars' (utilizing ICUMSA 'official' methods for each sugar product), or transition to methods measuring specifically invert sugars (i.e. glucose and fructose individually or in combination). The EWG has taken an approach of retaining an 'official' or 'reference' method (with provision stated as 'reducing sugars expressed as invert sugars' but introduced the invert sugar method as a Type IV alternative where the EWG considered it was applicable to the commodity. The issue with the existing Type I, is the presence of other 'reducing sugars' which may inflate the 'invert sugar' concentration expressed. Furthermore, a co-existing Type I &amp; IV methods 'can only occur under exceptional circumstances for the same commodity and provision if there is a justifiable reason'. Technically, it would be preferable to measure the 'invert sugars' (which could be type II or III methods) instead of 'reducing sugars' by Type I methods. Noting the industry may not be in a position for the change and in reality, the EWG considers it useful to have a detailed discussion at CCMAS45 to highlight benefits of the transition but also ensure that the industry has the capability to implement these methods.</p>		

Commodity Provisions	Method	Participant Comment	
Sugars (plantation or mill white sugar)  Invert sugar (as reducing sugars)	<del>ICUMSA GS 1/3/7-3</del> <u>GS1-3</u>	Published, multi-lab validation; indicate reference:	Collaborative testing in 1998 gave an unsatisfactory Horwitz of 12.53(Proc. 22nd Session ICUMSA (1998) p357. However due to its wide use, it has been retained and downgraded to an ICUMSA 'Accepted' method.
Sugars (plantation or mill white sugar)  Invert sugar (as reducing sugars)	<del>ICUMSA GS 1/3/7-3</del> <u>GS1-5</u>	Published, multi-lab validation; indicate reference:	<u>As an official method the method 'has undergone full collaborative testing according to IUPAC standards'. Based on Saska et al.,(2016) which states 'In 1998 a collaborative test (Proc. 22nd Session ICUMSA 1198, 358) showed a superior precision and repeatability of the ICUMSA GS1-5 Luff- Schoorl (LS) method over the Lane Eynon (LE) and Berlin procedures. Following this test, the LS method was elevated by ICUMSA to the "Official" and the LE method downgraded to the "Accepted" status for cane raw sugar. This reviewer has access to the ICUMSA methods but not to the 'proceedings' where method validation studies are presumably published and discussed.</u>
Sugars (powdered sugar)  Invert sugar (as reducing sugars)	<del>ICUMSA GS 2/3-5</del> <u>GS2-5 after filtration if necessary to remove any anticaking agents</u>	Published, multi-lab validation; indicate reference:	For white sugars containing between 0.009% and 0.04% reducing sugars. The absolute difference between two results obtained under reproducibility conditions should be not greater than 0.007%. Reference - Proc. 23rd Session ICUMSA, 2002, p310.
<u>Sugars (powdered sugar)</u>  <u>Invert sugar</u>	<u>ICUMSA GS2-4 after filtration if necessary to remove any anticaking agents</u>	<u>Published, multi-lab validation; indicate reference:</u>	<u>For white sugars containing between 0.001% and 0.04% of Glucose &amp; Fructose, the absolute difference between two results obtained under reproducibility conditions should be not greater than 0.003%. Reference - Proc. 23rd Session ICUMSA, 2002, p310.</u>
Sugars (soft white sugar and soft brown sugar)  Invert sugar (as reducing sugars)	<del>ICUMSA GS 4/3-3</del> <u>GS4-3 (applicable at levels &gt;10% m/m)</u>	Validated for a different commodity; indicate which commodity	Molasses and refined syrups.{Schneider F., ed. (1979): Sugar Analysis: ICUMSA methods, 41-55}. The absolute difference between two results obtained under repeatability conditions should be not greater than 1.60% reducing sugars in molasses.
Sugars (soft white sugar and soft brown sugar)  Invert sugar (as reducing sugars)	<del>ICUMSA GS 4/3/7-3</del> <u>GS1-3 (applicable at levels &lt;10% m/m)</u>	Published, multi-lab validation; indicate reference:	Collaborative testing in 1998 gave an unsatisfactory Horwitz of 12.53(Proc. 22nd Session ICUMSA (1998) p357. However due to its wide use, it has been retained and downgraded to an Accepted method.

Commodity Provisions	Method	Participant Comment	
Sugars (powdered sugar)  Invert sugar (as reducing sugars)	ICUMSA <del>GS 2/3-5</del> <u>GS2-5</u>	Published, multi-lab validation; indicate reference:	For white sugars containing between 0.009% and 0.04% reducing sugars. The absolute difference between two results obtained under reproducibility conditions should be not greater than 0.007%. Reference - Proc. 23rd Session ICUMSA, 2002, p310.
Sugars (soft white sugar and soft brown sugar)  Sucrose plus invert sugar (as reducing sugars)	ICUMSA <del>GS 4/3-7</del> <u>GS4-7</u>	Validated for a different commodity; indicate which commodity	Molasses and refined syrups
Sugars (soft brown sugar)  Sulphated ash	ICUMSA <del>GS 1/3/4/7/8-44</del> <u>GS3-11</u>	Published, multi-lab validation; indicate reference:	This method was validated for raw sugar, which should also be representative of soft brown sugar, thus has been given 'official method' status by ICUMSA The reference Proc. 20 Session ICUMSA, 1990 p 12-13, & 336-37.
Sugars (white sugar)  Polarization	ICUMSA <del>GS 2/3-1</del> <u>GS2-1</u>	Published, multi-lab validation; indicate reference:	Emmerich A. (1993): Measurement of the polarization (optical rotation) of white sugar. Description of a modified method and collaborative tests, Zuckerind, 118, 591-601. As stated in GS2-1, the absolute difference between the two results obtained under reproducibility conditions should not be greater than 0.094 °Z.
<u>Sugars (powdered sugar)</u>  <u>Polarization</u>	<u>ICUMSA GS1-1</u>	<u>Published, multi-lab validation; indicate reference:</u>	<u>Player, M.R. (1988) Zuckering 113, 512-14 I is mentioned in the method. However Schoonees, B.(2003) refers to Player et al., (2000). Polarization of raw sugar without basic lead acetate: International collaborative test. Zuckerind 125(10): 777-782</u>
<u>Sugars (powdered sugar)</u>  <u>Polarization</u>	<u>ICUMSA GS1-2</u>	<u>Published, multi-lab validation; indicate reference:</u>	<u>Player, M.R. (1988) Zuckering 113, 512-14 I is mentioned in the method. However Schoonees, B.(2003) refers to Player et al., (2000). Polarization of raw sugar without basic lead acetate: International collaborative test. Zuckerind 125(10): 777-782</u>
Sugars (plantation or mill white sugar)  Polarization	ICUMSA <del>GS 1/2/3-4</del> <u>GS1-1</u>	Published, multi-lab validation; indicate reference:	Player, M.R. (1988) Zuckering 113, 512-14 I is mentioned in the method. However Schoonees, B.(2003) refers to Player et al., (2000). Polarization of raw sugar without basic lead acetate: International collaborative test. Zuckerind 125(10): 777-782

Commodity Provisions	Method	Participant Comment	
<u>Sugars (plantation or mill white sugar)</u>  <u>Polarization</u>	<u>ICUMSA GS 1/2/3-4</u> <u>GS1-2</u>	<u>Published, multi-lab validation; indicate reference:</u>	<u>Player, M.R. (1988) Zuckering 113, 512-14 I is mentioned in the method. However Schoonees, B.(2003) refers to Player et al., (2000). Polarization of raw sugar without basic lead acetate: International collaborative test. Zuckerind 125(10): 777-782</u>  <u>The absolute difference between two results obtained under reproducibility conditions should not be &gt;0.27 °Z</u>
<u>Sugars (powdered sugar)</u>  <u>Polarization</u>	<u>ICUMSA GS 2/3-4</u> <u>GS2-1 after filtration to remove any anticaking agents if filtration to remove any anticaking agents is unnecessary.</u>	<u>Published, multi-lab validation; indicate reference:</u>	<u>Emmerich A. (1993): Measurement of the polarization (optical rotation) of white sugar. Description of a modified method and collaborative tests, Zuckerind, 118, 591-601.</u> <u>As stated in GS2-1 , the absolute difference between the two results obtained under reproducibility conditions should not be greater than 0.094 °Z.</u>
<u>Sugars (powdered sugar)</u>  <u>Polarization</u>	<u>ICUMSA GS1-1 after filtration if necessary to remove any anticaking agents</u>	<u>Published, multi-lab validation; indicate reference:</u>	<u>Player, M.R. (1988) Zuckering 113, 512-14 I is mentioned in the method. However Schoonees, B.(2003) refers to Player et al., (2000). Polarization of raw sugar without basic lead acetate: International collaborative test. Zuckerind 125(10): 777-782</u>
<u>Sugars (powdered sugar)</u>  <u>Polarization</u>	<u>ICUMSA GS1-2 after filtration if necessary to remove any anticaking agents</u>	<u>Published, multi-lab validation; indicate reference:</u>	<u>Player, M.R. (1988) Zuckering 113, 512-14 I is mentioned in the method. However Schoonees, B.(2003) refers to Player et al., (2000). Polarization of raw sugar without basic lead acetate: International collaborative test. Zuckerind 125(10): 777-782</u>

**APPENDIX IV****LIST OF PARTICIPANTS****CHAIR****Uruguay**

Laura Flores

**MEMBER NATIONS AND MEMBER ORGANIZATIONS  
ÉTATS MEMBRES ET ORGANISATIONS MEMBRES  
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Richard Coghlan

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Ligia Lindner Schreiner**CHINA - CHINE**Hao Ding  
Yuzhe Li  
Yu Wei  
Jing Xiao  
Luhan Zhang**COSTA RICA**Karla Rojas  
Melina Flores Rodríguez**EGYPT - ÉGYPTÉ - EGIPTO**

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Sh. Jamin Patel  
Prof (Dr) Alka Rao**JAPAN - JAPÓN**Hidetaka Kobayashi  
Yushi Yamamoto**MALAYSIA - MALAISIE - MALASIA**Siti Fatimah binti Leham  
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Mr. RAHLAOUI Mounir**PANAMA - PANAMÁ**Andrés Rivera Mondragón  
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Abdullah A. Al Sayari  
Mohrah A. Alenazi  
Mubarak M. AL-Garaiwi**SENEGAL - SÉNÉGAL**M. Léon Niassy COLY  
Mme Maréme SANDANI**SPAIN - ESPAGNE - ESPAÑA**

Ana Cristina Pérez de Diego Camacho

**THAILAND - THAÏLANDE - TAILANDIA**Ms Chitlada Booncharoen  
Ms Kittiporn Phuangasuk  
Ms Rungrassamee Mahakhaphong  
Mr Wittawat Kaewdee**TÜRKIYE**Afranur OZCOBAN  
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Joseph Iberet  
Michael Bamuwamye  
Moses Matovu  
Pamela Akwap**UNITED KINGDOM OF GREAT BRITAIN AND  
NORTHERN IRELAND  
ROYAUME-UNI DE GRANDE-BRETAGNE ET  
D'IRLANDE DU NORD  
REINO UNIDO DE GRAN BRETAÑA E IRLANDA  
DEL NORTE**  
Bhavna Parmar



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RÉPUBLIQUE-UNIE DE TANZANIE –  
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**NORDIC-BALTIC COMMITTEE ON FOOD ANALYSIS (NMKL)**

Eystein Oveland