CODEX ALIMENTARIUS COMMISSION

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World Health Organization

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Agenda Item 4.3 **CX/MAS 23/42/6**

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JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON METHODS OF ANALYSIS AND SAMPLING

42nd Session

Budapest, Hungary

13 – 16 June 2023 with report adoption on 20 June 2023 (virtual)

REVIEW OF METHODS OF ANALYSIS IN CXS234 PROCESSED FRUITS AND VEGETABLES WORKABLE PACKAGE

(Prepared by the EWG led by the United States of America)

Codex members and Observers wishing to submit comments on this document should do so as instructed in CL 2023/48/OCS-MAS available on the Codex webpage/Circular Letters: http://www.fao.org/fao-who-codexalimentarius/resources/circular-letters/en/

Background

1. CCMAS41 (2021) agreed to start the review of methods in the processed fruits and vegetables (PFV) package; to establish an EWG chaired by the United States of America, and working in English, to review the package and proposals for consideration by CCMAS42.
2. All interested members and Standards Development Organizations (SDOs) were invited to assist in this work, as appropriate. The protocol followed in the revision of the Dairy package would be followed for the PFV package.

EWG-PFV PROCESS

3. Although all Codex participants were welcome, all members joining the EWG were asked to be willing to review a small number of methods and provide feedback. To this end, EWG Participants were asked to supply the list of methods (e.g. ISO, EN, NMKL, AOAC) to which they had access. Based on the responses participants were invited to review certain methods.
4. As stated in the report of CCMAS41, the terms of reference of the EWG review were to ensure that the methods of analysis listed in CXS 234 are fit-for-purpose and to re-type if necessary. In order to facilitate the review process, new methods would not be added unless necessary.
5. The EWG was initiated and operated through e-mail and the on-line Codex forum. The list of participants in the EWG is presented in Appendix II.

OUTCOMES OF DISCUSSION IN THE EWG

6. Based on the comments/recommendations and conclusions from the review sheets, Appendix I was prepared to explain and track changes to CXS 234. For ease of review and comparison, the table in Appendix I maintains the information (Commodity, Provision, Method, Principle, Type) currently in CXS 234. Additional information (Codex Standard) was included to assist the Committee in its review of the recommended changes.
7. Appendix I contains the list of methods and the proposed changes to CXS 234.
    - Fill of glass and metal containers, and drained weight are broadly applicable methods that apply to canned and jarred processed fruits and vegetables. These methods are not dependent on any commodity. As such, the commodity name “Processed Fruits and Vegetables” was retained.

- There is no commodity standard for “Processed Fruits and Vegetables.” The table in Appendix I has been revised to include the relevant commodities in parentheses under the general “Processed Fruits and Vegetables” header when applicable. The Committee is invited to recommend whether the affected commodities should remain listed in parenthesis under “Processed Fruits and Vegetables” as shown in Appendix I, or should the commodity – provision pair be listed on separate lines?
    - Benzoic acid and benzoates are allowed food additives for the following commodities: Jams, Jellies, Marmalades, pickled cucumbers, mango chutney, Coconut Milk and Coconut Cream.
    - Calcium is an allowed food additive firming agent for canned strawberries, pickled cucumbers, preserved tomatoes, canned citrus fruits, and certain canned vegetables.
    - Sorbates are an allowed food additive in pickled cucumbers, and jams, jellies and marmalades.
    - pH is specified in pickled cucumbers, table olives, processed tomato concentrates, preserved tomatoes, mango chutney, and aqueous coconut products.
    - Soluble solids are specified in pickled cucumbers, processed tomato concentrates, preserved tomatoes, canned applesauce, jams, jellies and marmalades, mango chutney, and certain canned fruit.
    - Lead (Pb) falls under the *General Standard for Contaminants and Toxins in Food and Feed* (CXS 193–1995) and applies to Canned Fruits, Jams, Jellies and Marmalades, Mango Chutney, Canned Vegetables, Preserved Tomatoes, Table Olives, Pickled Cucumbers.
    - Tin (Sn) falls under the *General Standard for Contaminants and Toxins in Food and Feed* (CXS 193–1995) and applies to canned foods. Relevant Codex commodity standards include CXS 62-1981, CXS 254-2007, CXS 296-2009, CXS 242-2003, CXS 297-2009, CXS 78-1981, CXS 159-1987, CXS 42-1981, CXS 60-1981, CXS 99-1981, CXS 160-1987, CXS 66-1981, CXS 13-1981, CXS 115-1981, CXS 57-1981, CXS 145-1981, CXS 98-1981, CXS 96-1981, CXS 97-1981, CXS 88-1981, CXS 89-1981.
- Unformatted black text signals rows which do not require any change from what is currently listed in CXS 234.
- Underlined red text signals some insertion into CXS 234 and represents a change from the current CXS 234. Both substantial and editorial changes are captured with underlined text.
- Red text that has been struck through signals a deletion from the information in CXS 234. Deletions have been made for editorial changes (*i.e*. when the method now appears as part of a calculation) and to remove a method from CXS 234.

RECOMMENDATION

8. The Committee is invited to:
    i. Consider Appendix I and endorse the proposed revisions to CXS 234; and
    ii. recommend whether the affected commodities for certain processed fruits and vegetables should remain listed in parenthesis under the “Processed Fruits and Vegetables” as shown in Appendix I, or should the commodity – provision pair be listed on separate lines ? (see paragraph 7 above).

Appendix I – Methods of Analysis for "Processed Fruits and Vegetables" commodity

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Processed fruits and vegetables (Jams, Jellies, Marmalades, pickled cucumbers, mango chutney, Coconut Milk and Coconut Cream)	Benzoic acid	NMKL 124	Liquid Chromatography	II	CXS 192	Benzoic acid falls under CXS 192 – Food Additives
Processed fruits and vegetables (Jams, Jellies, Marmalades, pickled cucumbers, mango chutney, Coconut Milk and Coconut Cream)	Benzoic acid	~~NMKL 103; or~~ AOAC 983.16	Gas Chromatography	III	CXS 192	NMKL 103 withdrawn because of the use of hazardous solvent
Processed fruits and vegetables (canned strawberries, pickled cucumbers, preserved tomatoes, canned citrus fruits, certain canned vegetables)	Calcium	AOAC 968.31	Complexometry/ Titrimetry	II	CXS 192 CXS 62 CXS 115 CXS 13 CXS 254 CXS 297	Calcium firming agents listed in CXS 192 – food additives
Processed fruits and vegetables	Drained Weight	AOAC 968.30 (Codex General Method)	Sieving Gravimetry	I		
Processed fruits and vegetables	Fill of glass containers	~~CAC/RM 46 (reference to "metal containers" deleted and refer to ISO 90-1 for determination of water capacity in metal containers)~~ ISO 8106	Weighing	I		CCMAS36 (2015) agreed to replace CAC/RM 46 with ISO 8106

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Processed fruits and vegetables	Fill of metal containers	ISO 90-1	Weighing	I		
Processed fruits and vegetables (Canned Fruits, Jams, Jellies and Marmalades, Mango Chutney, Canned Vegetables, Preserved Tomatoes, Table Olives, Pickled Cucumbers)	Lead	AOAC 972.25 (Codex general method)	AAS (Flame absorption)	~~III~~II	CXS 193	Codex general method type II for other commodities
~~Processed fruits and vegetables~~	~~Packing medium Canned berry fruits (raspberry, strawberry)~~	~~AOAC 932.12~~ ~~ISO 2173~~	~~Refractometry~~	~~I~~		AOAC 932.12 and ISO 2173 both determine soluble solids which is already listed below. Recommend striking this row.
Processed fruits and Vegetables ((pickled cucumbers, table olives, processed tomato concentrates, preserved tomatoes, mango chutney, and aqueous coconut products except canned bamboo shoots, pH determined by AOAC 981.12)	pH	ISO 1842	Potentiometry	IV	CXS 115 CXS 66 CXS 57 CXS 13 CXS 160 CXS 240	
Processed fruits and vegetables (pickled cucumbers, table olives, processed tomato concentrates, preserved tomatoes, mango chutney, and aqueous coconut products)	pH	AOAC 981.12	Potentiometry	III	CXS 115 CXS 66 CXS 57 CXS 13 CXS 160 CXS 240	

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Processed fruits and vegetables (pickled cucumbers, table olives, processed tomato concentrates, preserved tomatoes, mango chutney, and aqueous coconut products)	pH	NMKL 179	Potentiometry	II	CXS 115 CXS 66 CXS 57 CXS 13 CXS 160 CXS 240	
Processed fruits and vegetables (pickled cucumbers, processed tomato concentrates, preserved tomatoes, canned applesauce, jams, jellies and marmalades, mango chutney, and certain canned fruit)	Soluble solids	ISO 2173 ~~AOAC 932.12~~	Refractometry	I	CXS 115 CXS 57 CXS 13 CXS 17 CXS 296 CXS 160 CXS 319	These methods are not identical. Suggest retaining ISO method which contains more detailed procedures
Processed fruits and vegetables (Jams, Jellies, Marmalades, pickled cucumbers)	Sorbates	~~NMKL 103 /~~ AOAC 983.16	Gas Chromatography	III	CXS 192	NMKL 103 withdrawn because of the use of hazardous solvent
Processed fruits and vegetables (Jams, Jellies, Marmalades, pickled cucumbers)	Sorbates	NMKL 124	Liquid Chromatography	II	CXS 192	Sorbate falls under CXS 192 – Food Additives

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Processed fruits and vegetables	Tin	AOAC 980.19 (Codex general method)	Flame Atomic Absorption Spectrophotometry~~AAS~~	II	CXS 193	Relevant Codex commodity standards include CXS 62-1981, CXS 254-2007, CXS 296-2009, CXS 242-2003, CXS 297-2009, CXS 78-1981, CXS 159-1987, CXS 42-1981, CXS 60-1981, CXS 99-1981, CXS 160-1987, CXS 66-1981, CXS 13-1981, CXS 115-1981, CXS 57-1981, CXS 145-1981, CXS 98-1981, CXS 96-1981, CXS 97-1981, CXS 88-1981, CXS 89-1981.
Processed fruits and vegetables	Total solids	AOAC 920.151	Gravimetry	I		
Aqueous Coconut Products	Total Fats	ISO 1211 | IDF 1	Gravimetry (Röse-Gottlieb)	I	CXS 240	Validated on cow, sheep, goat milk
Aqueous Coconut Products	Total solids	ISO 6731 | IDF 21	Gravimetry	I	CXS 240	Validated on milk, cream, and evaporated milk
Aqueous Coconut Products	Non-fat solids	ISO 1211 | IDF 1 ISO 6731 | IDF 21	Calculation: Gravimetry (Röse-Gottlieb) Gravimetry	I	CXS 240	Validated on cow, sheep, goat milk
Aqueous Coconut Products	Moisture	ISO 6731 | IDF 21	Calculation: Gravimetry	I	CXS 240	Validated on milk, cream, and evaporated milk
Canned Apple Sauce	Fill of glass containers	~~CAC/RM 46* (for glass containers) (Codex general method for processed fruits and vegetables) and ISO 90-1 (for metal containers) (Codex general method for processed fruits and vegetables)~~ ISO 8106	Weighing	I	CXS 17	CAC/RM 46 resides in the Standard for certain canned vegetables (CXS 297). CCMAS 36 (2015) agreed to replace CAC/RM 46 with ISO 8106

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Canned Apple Sauce	Fill of metal containers	ISO 90-1 (for metal containers) (Codex general method for processed fruits and vegetables)	Weighing	I	CXS 17	
Canned Apple Sauce	Soluble solids	~~AOAC 932.12~~ ISO 2173 (Codex general method for processed fruits and vegetables)	Refractometry	I	CXS 17	These methods are not identical. Suggest retaining ISO method which contains more detailed procedures
Canned green beans and wax beans	Tough Strings	CAC/RM 39	Stretching	I	CXS 297	
Canned green peas	Fill of glass containers	ISO 8106	Weighing	I	CXS 297	CCPFV 24 (2008) agreed to revoke CAC/RM 45
Canned green peas	~~Proper fill (in lieu of drained weight)~~ Fill of metal containers	~~CAC/RM 45~~ ISO 90-1	~~Pouring and measuring~~ Weighing	I	CXS 297	CCPFV 24 (2008) agreed to revoke CAC/RM 45
Canned green peas	Types of peas, distinguishing	CAC/RM 48	Visual inspection	I	CXS 297	
Canned mangoes	Syrup	AOAC 932.14C	Brix spindle method	I	CXS 319	Method is “solids in syrups”
Canned mushrooms	~~Washed~~ Drained weight	~~CAC/RM 44~~ AOAC 968.30	Sieving	I	CXS 297	CCPFV25 (2010) revoked CXS 55 (Standard for canned mushrooms) containing CAC/RM 44. Annex on mushrooms now included in CXS 297, containing provision for drained weight. Suggest replacing CAC/RM 44 with AOAC 968.30
Canned palmito	Mineral impurities	ISO 762	Gravimetry	I	CXS 297	

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Canned Stone Fruits	Drained weight	AOAC 968.30 ~~ISO:2173~~	Gravimetry	I	CXS 242	ISO 2173 is a method for soluble solids, not drained weight. Wrong provision
Canned Stone Fruits	Soluble solids	~~AOAC 932.14C~~ ISO 2173	Refractometry	I	CXS 242	Methods are not identical. Suggest retaining ISO method which contains more detailed procedures
Canned strawberries	Calcium	AOAC 968.31	Complexometric titrimetry	II	CXS 62	Validated for canned tomatoes, lima beans, potatoes
Canned strawberries	Mineral impurities	~~AOAC 971.33~~ ISO 762	Gravimetry	I	CXS 62	AOAC 971.33 is acid-insoluble residue. Recommend replacing with ISO 762
Certain canned citrus fruits	Calcium	NMKL 153	Flame Atomic Absorption Spectrophotometry	II	CXS 254	Calcium firming agents listed in CXS 192 – food additives
Certain canned citrus fruits	Calcium	AOAC 968.31	Complexometry Titrimetry	III	CXS 254	Calcium firming agents listed in CXS 192 – food additives
~~Certain Canned Vegetables (palmito)~~	~~Mineral impurities (sand)~~	~~AOAC 971.33~~ ~~ISO 762~~	~~Gravimetry~~	I		Methods are not identical and AOAC 971.33 is acid-insoluble residue. Mineral impurities in canned palmito already listed above.
Citrus marmalade	Calcium	AOAC 968.31	Complexometric titrimetry	II	CXS 296	Calcium firming agents listed in CXS 192 – food additives
Dates	Identification of defects	Described in the Standard	Visual inspection	I	CXS 143	
Dates	Moisture	AOAC 934.06	Gravimetry (vacuum oven)	I	CXS 143	
Desiccated coconut	Total acidity of the extracted oil	ISO 660 | AOCS Cd 3d-63 ~~ISO 660 or AOCS Cd 3d-63~~	Titrimetry	I	CXS 177	Changed method format to maintain consistency with previous decisions, i.e. named vegetable oils
Desiccated coconut	Ash	AOAC 950.49	Gravimetry	I	CXS 177	

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Desiccated coconut	Extraneous vegetable matter	Described in the Standard	Counting extraneous material with the naked eye	IV	CXS 177	
Desiccated coconut	Moisture	AOAC 925.40	Gravimery (loss on drying)	I	CXS 177	
Desiccated coconut	Oil content	AOAC 948.22	Gravimetry	I	CXS 177	Titled “Fat (Crude)” in method title
Dried apricots	Identification of defects	Described in the Standard	Visual inspection (weighing)	I	CXS 130	n.b. CCPFV29 (2020) forwarded proposed draft standard for dried fruits to CAC43 at Step 5/8. CAC43 adopted this Standard, pending certain endorsements. This Standard once published will supersede CXS 130.
Dried apricots	Moisture	AOAC 934.06	Gravimetry (vacuum oven)	I	CXS 130	n.b. CCPFV29 (2020) forwarded proposed draft standard for dried fruits to CAC43 at Step 5/8. CAC43 adopted this Standard, pending certain endorsements. This Standard once published will supersede CXS 130.
Dried apricots	Sulphur dioxide	AOAC 963.20	Colorimetry	II	CXS 130	n.b. CCPFV29 (2020) forwarded proposed draft standard for dried fruits to CAC43 at Step 5/8. CAC43 adopted this Standard, pending certain endorsements. This Standard once published will supersede CXS 130.
Jams (fruit preserves) and jellies	Fill of Glass Containers	~~CAC/RM 46~~ ISO 8106	Weighing	I	CXS 296	CCMAS 36 (2015) agreed to replace CAC/RM 46 with ISO 8106
Jams (fruit preserves) and jellies	Soluble solids	ISO 2173 ~~AOAC 932.12~~	Refractometry	I	CXS 296	Methods are not identical. Suggest retaining ISO method which contains more detailed procedures

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Mango chutney	Ash insoluble in HCl	ISO 763	Gravimetry	I	CXS 160	
Pickled cucumbers	Acidity, total	AOAC 942.15	Titrimetry	I	CXS 115	
Pickled cucumbers	Drained weight	AOAC 968.30	Gravimetry	I	CXS 115	
Pickled cucumbers	Mineral impurities	~~AOAC 971.33~~ ISO 762	Gravimetry	I	CXS 115	AOAC 971.33 is acid-insoluble residue. Recommend replacing with ISO 762
Pickled cucumbers	Salt in brine	AOAC 971.27 (Codex general method)	Potentiometry	II	CXS 115	
Pickled cucumbers	Volume fill by displacement	Described in the Standard	Displacement	I	CXS 115	
Preserved tomatoes	Calcium	NMKL 153	Flame Atomic Absorption Spectrophotometry	II	CXS 13	Calcium firming agents listed in CXS 192 – food additives
Preserved tomatoes	Calcium	AOAC 968.31	Complexometric titrimetry	III	CXS 13	Calcium firming agents listed in CXS 192 – food additives
~~Preserved tomatoes~~	~~Calcium~~	~~NMKL 153~~	~~Atomic Absorption Spectrophotometry~~	II		
Preserved tomatoes	~~Minimum~~ Drained Weight	AOAC 968.30	Gravimetry (sieving) note: Use a No. 14 screen instead of '7/16' or No. 8	I	CXS 13	
Preserved tomatoes	Mould count	AOAC 965.41	Howard mould count	I	CXS 13	Mould count for preserved tomatoes to be set according to the legislation of the country of retail sale
Processed tomato concentrates	Lactic acid	~~EN 2631~~ EN 12631	Enzymatic determination	II	CXS 57	Should be EN 12631. EN 2631 is "Evaluation of human exposure to whole-body vibration"
Processed tomato concentrates	Mineral impurities (sand)	~~AOAC 971.33~~ ISO 762	Gravimetry	~~IV~~ I	CXS 57	AOAC 971.33 is acid-insoluble residue. Recommend replacing with ISO 762

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Processed tomato concentrates	Mould count	AOAC 965.41	Howard mould count	I	CXS 57	Mould count for processed tomato concentrates to be set according to the legislation of the country of retail sale.
~~Processed tomato concentrates~~	~~Natural tomato soluble solids~~	~~AOAC 970.59~~	~~Refractometry~~	I		Redundant of "Tomato soluble solids" below
Processed tomato concentrates	Sodium chloride	AOAC 971.27 (Codex general method)	Potentiometry	II	CXS 57	
Processed tomato concentrates	Tomato soluble solids	AOAC 970.59	Refractometry	I	CXS 57	
Raisins	Mineral impurities	~~CAC/RM 51~~ ISO 762	Ashing	I	CXS 67	CCPFV29 (2020) forwarded proposed draft Standard for dried fruits to CAC43 at Step 5/8. CAC43 adopted the Standard, pending certain endorsements. This Standard once published will supersede CXS 67. Recommend replacing with ISO 762
Raisins	Mineral oil	CAC/RM 52	Extraction and separation on alumina	II	CXS 67	Cannot find CAC/RM 51 or 52 in CXS 67. CXS 67 will be superseded by the Standard for dried fruits once it is published. Retain until new standard is published?
Raisins	Moisture	AOAC 972.20	Electrical conductance	I	CXS 67	
Raisins	Sorbitol	AOAC 973.28	Gas chromatography	II	CXS 67	
Raisins	Sulphur dioxide	AOAC 963.20	Colorimetry	II	CXS 67	
Table olives	Drained weight	AOAC 968.30 (Codex general method for processed fruits and vegetables)	Sieving Gravimetry	I	CXS 66	

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Table olives	Fill of glass containers	~~CAC/RM 46* (for glass containers) (Codex general method for processed fruits and vegetables) and ISO 90-1 (for metal containers) (Codex general method for processed fruits and vegetables)~~ ISO 8106	Weighing	I	CXS 66	CCMAS 36 (2015) agreed to replace CAC/RM 46 with ISO 8106
Table olives	Fill of metal containers	ISO 90-1 (for metal containers) (Codex general method for processed fruits and vegetables)	Weighing	I	CXS 66	
Table olives	pH of brine	NMKL 179 (Codex general method for processed fruits and vegetables)	Potentiometry	II	CXS 66	
Table olives	pH of brine	AOAC 981.12 (Codex general method for processed fruits and vegetables)		III	CXS 66	
Table olives	pH of brine	ISO 1842		IV	CXS 66	

Processed Fruits and Vegetables – Appendix I						
Commodity	***Provision***	***Method***	***Principle***	***Type***	**Standard**	**Comments**
Table olives	Salt in brine	AOAC 971.27 | NMKL 178 (Codex general method)	Potentiometry	II	CXS 66	
Table olives	Lead	AOAC 999.11 | NMKL 139 (Codex general method)	Flame Atomic Absorption Spectrophotometry ~~AAS (Flame absorption)~~	II	CXS 66	
Table olives	Tin	NMKL 190 | EN 15764	Flame Atomic Absorption Spectrophotometry ~~AAS~~	II	CXS 66	

Appendix III

List of Participants

Chair

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United States of America

Participant	Country
Richard Coghlan	Australia
Thea Rawn	Canada
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Susan Morris	New Zealand
Chanchai Jaengsawang	Thailand
Songkhla Chulakasian	Thailand
Rungrassamee Mahakhaphong	Thailand
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Reem Alqaisi	Jordan

Participant	Organization
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Tom Phillips	AAFCO
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