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DRAFT STANDARD FOR PUBLIC COMMENT

(වෙනස්වීමට ඉඩ ඇත. திருத்தத்திற்குட்படக்கூடியது. Liable to alteration)

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Date of Issue } 2023-05-26

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அபிப்பிராயங்களை தெரிவிப்பதற்கான இறுதித்திகதி
Latest Date for Receipt of Comments } 2023-07-26

Draft Sri Lanka Standard
SPECIFICATION FOR JAGGERY
PART 2 : COCONUT JAGGERY
(DSLS ..... : .....)

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இவ்வரைவு இலங்கைக் கட்டளையெனக் கருதப்படவோ அன்றிப் பிரயோகிக்கப்படவோ கூடாது
This draft should not be regarded or used as a Sri Lanka Standard.

අදහස් එවිය යුත්තේ : ශ්‍රී ලංකා ප්‍රමිති ආයතනය, 17, වික්ටෝරියා පෙදෙස, ඇල්විටිගල මාවත, කොළඹ 08.

Comments to be sent to: SRI LANKA STANDARDS INSTITUTION, 17, VICTORIA PLACE, ELVITIGALA MAWATHA, COLOMBO 08.

<u>හැඳින්වීම</u>

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මෙම කෙටුම්පතට අදාල යෝජනා හා විවේචන නියමිත දිනට පෙර ලැබෙන්නට සැලැස්වුවහොත් අගය කොට සලකමු. තවද, මෙම කෙටුම්පත පිළිගත හැකි බැව් හැගෙන අය ඒ බව දන්වන්නේ නම් එය ආයතනයට උපකාරී වනු ඇත.

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<u>Introduction</u>

This Draft Sri Lanka Standard has been prepared by the Sri Lanka Standards Institution and is now being circulated for technical comments to all interested parties.

All comments received will be considered by the SLSI and the draft if necessary, before submission to the Council of the Institution through the relevant Divisional Committee for final approval.

The Institution would appreciate any views on this draft which should be sent before the specified date. It would also be helpful if those who find the draft generally acceptable could kindly notify us accordingly.

All Communications should be addressed to:

The Director General
Sri Lanka Standards Institution,
17, Victoria Place,
Elvitigala Mawatha,
Colombo 08.

Draft Sri Lanka Standard
SPECIFICATION FOR JAGGERY
PART 2: COCONUT JAGGERY

DSLS: Part 2

Gr.

SRI LANKA STANDARDS INSTITUTION
No, 17, Victoria Place
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Draft Sri Lanka Standard
SPECIFICATION FOR JAGGERY
PART 2: COCONUT JAGGERY

FOREWORD

This Sri Lanka Standard was approved by the Sectoral Committee on Food Products and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on .....

This Standard supersedes **SLS 521**:1981. In this specification, specific parameters including sugar profile and amino acid profile have been introduced to differentiate Coconut jaggery from other jaggery types.

This Standard is subject to the Food Act No. 26 of 1980 and the regulations framed thereunder.

For the purpose of deciding whether a particular requirement of this Standard is complied with, the final value, observed or calculated, expressing the results of a test shall be rounded off in accordance with **SLS 102**. The number of significant figures to be retained in the rounded off value shall be the same as that of the specified value in this Standard.

1 SCOPE

This Standard prescribes the requirements and methods of sampling and tests for coconut jaggery.

2 REFERENCES

SLS	102	Rules for rounding off numerical values
SLS	143	Code of practice for general principles of food hygiene
SLS	428	Random sampling methods

Official methods of Analysis, Association of Official Analytical Chemists (**AOAC**) 21st edition, 2019

3 DEFINITION

For the purpose of this Standard, the following definitions shall apply:

3.1 coconut jaggery : The solidified product manufactured from the sap exudate collected from the partially mature inflorescence of the coconut palm (*Cocos nucifera* L) (Sinhala -*Pol,* Tamil- *Tennai*)

4 INGREDIENTS

4.1 Basic ingredients

Coconut jaggery shall be made from clean, filtered, fresh sap/ juice from the inflorescence of the coconut palm (*Cocos nucifera* L)

4.1.1. Sap processing agents/fermentation arresting agent

Any one of the following agents may be used to arrest the fermentation.

4.2.1. *Bark of Vateria copallifera (Retz) Alston (Sinhala/ Tamil - Hal*)- 2 per cent by mass (max.)

4.2.2 *Calcium oxide (INS 529)*- Limited by GMP

5 REQUIREMENTS

5.1 Hygiene

Coconut jaggery shall be processed, packaged, stored and distributed under hygienic conditions as prescribed in **SLS 143**.

5.2 Appearance

Coconut Jaggery shall be free from any plant tissues and insects, insect fragments or any other extraneous and foreign matter. Jaggery shall have a colour, of good jaggery and shall be free from added colouring matter.

5.3 Odour and flavour

The product shall have a pleasant, characteristic of good jaggery taste, odour and flavour of the Coconut jaggery. It shall be free from any objectionable odour and flavour. Free from added flavour.

5.4 Adulterants

The product shall be free from adulterants.

5.5 Other requirements

Coconut jaggery shall comply with the requirements given in Table **1**, when tested in accordance with the methods prescribed in Column **4** of the table.

TABLE 1 - Requirements for Coconut jaggery

SI No (1)	Characteristic (2)	Limit (3)	Method of test (4)
i)	Moisture, per cent by mass, max.	10	Appendix **B**
ii)	Total ash, per cent by mass, max.	3.5	Appendix **C**
iii)	Acid insoluble ash, per cent by mass, max.	0.5	Appendix **D**
iv)	Matter insoluble in water, per cent by mass, max.	2.0	Appendix **E**
v)	Reducing sugars, per cent by mass. max.	13	Appendix **F**
vi)	Sugars, non-reducing, per cent by mass, min.	70	Appendix **G**

5.6 Characterization of different types

5.6.1 *Sensory analysis*

Coconut jaggery shall have the characteristic odour, flavour and colour.

5.6.2 *Sugar profile*

Coconut jaggery shall comply with the requirements given in Table **2**, when tested in accordance with the methods prescribed in instrumental technique using **AACC** Method 80-04: 2010 (HPLC / RI Detection).

TABLE 2- Sugar composition of coconut jaggery

Sl No (1)	Type of sugar (2)	Requirement (3)
i)	Sucrose, per cent by mass, min	70.0
ii)	Total reducing sugar, per cent by mass, max	13.0
iii)	Total sugar, min	85.0
iv)	Reducing sugar/ Total Sugar Ratio	0.12

5.6.3 *Amino acid profile*

Analysis of the amino acid shall be carried out by HPLC method described in Appendix **H**. The chromatogram (Figure **1**) shall indicate the representative and characteristic components given in Table **3**.

TABLE 3- Free amino acid detected in coconut jaggery

SI No (1)	Amino acid (2)	Detectability (4)
i)	Alanine (ALA)	Not detected
ii)	Arginine (ARG)	Detected
iii)	Aspartine (ASP)	Not detected
iv)	Asparagine (ASN)	Detected
v)	Cystine (CYS)	Not detected
vi)	Glutamine (GLU)	Detected
vii)	Glycine (GLY)*	Not detected
viii)	Histidine (HIS)	Not detected
ix)	Isoleucine (ISO)	Not detected
x)	Leucine (LEU)	Not detected
xi)	Lysine (LYS)	Not detected
xii)	Methionine (MET)	Not detected
xiii)	Phenylalanine (PHE)	Detected
xiv)	Proline (PRO)	Detected
xv)	Serine (SER)	Not detected
xvi)	Threonine (THR)	Not detected
xvii	Tyrosine (TRY)	Detected
xviii)	Valine (VAL)*	Detected

NOTE
The chromatographic analysis is normative, contrary to typical chromatograms given for information in Appendix **H**.

*Detected in coconut and palmyrah jaggary

6 CONTAMINANTS

6.1 Potentially toxic elements

Coconut jaggery shall not exceed the limits for potentially toxic elements given in Table **4** when tested in accordance with the methods prescribed in Column **4** of the table.

TABLE 4 - Limits for potentially toxic elements

SI No (1)	**Potentially toxic element** (2)	**Limit** (3)	**Method of test** (4)
i)	Arsenic as As, mg/ kg, max.	0.5	**AOAC 986.15/ AOAC 2013.06**
ii)	Lead as Pb, mg/ kg, max.	1.0	**AOAC 999.10/ AOAC 2013.06**
iii)	Cadmium as Cd, mg/ kg, max**.**	1.0	**AOAC 999.10/ AOAC 2013.06**

7 PACKAGING

The product shall packaged in suitable moisture proof food grade containers or / packages with barrier properties for moisture which will safeguard the hygienic, and organoleptic qualities of the product. The containers including the packaging material shall be made of substances which are safe and suitable for intended use and shall not impart any toxic substances or undesirable odour or flavour to the product.

8 MARKING AND/ OR LABELLING

The following shall be marked and/ or labelled legibly and indelibly on each package:

a) Name of the product as " Coconut jaggery*"*;

b) Brand name or trade mark;

c) Net weight in grams or kg;

d) Date of manufacture;

e) Date of expiry;

f) Batch number or code number or a decipherable code marking;

g) Name and address of the manufacturer and packer/ distributor in Sri Lanka;

h) Country of origin, in case of imported products;

j) Any permitted food additive's name and INS number if added.

9 SAMPLING

Representative samples of the material shall be drawn as prescribed in Appendix **A**.

10 METHODS OF TEST

Tests shall be carried out as prescribed in Appendix **B** to **G** of this Standard and Methods of **AACC**, Analysis of the Association of Official Analytical Chemists (**AOAC**) 21st edition, 2019.

11 CRITERIA FOR CONFORMITY

A lot shall be declared as conforming to the requirements of this Standard if the following conditions are satisfied.

11.1 Each container or package inspected as in **A.5.1** shall satisfies the relevant requirements.

11.2 Each individual sample tested as in **A.5.2** shall satisfies the relevant requirements.

11.3 The composite sample tested as in **A.5.3** shall satisfies the relevant requirements.

APPENDIX A
SAMPLING

The sampling scheme given in Appendix **A** should be applied where compliance of a lot to the requirements of this Standard is to be assessed based on statistical sampling and inspection.

Where compliance with this Standard is to be assured, appropriate schemes of sampling and inspection shall be adopted based on manufacturer's control systems coupled with type tests and testing procedures.

A.1 LOT

In any consignment, all the containers or packages of same size containing Coconut jaggery drawn from a single batch of manufacture of a supply shall constitute a lot.

A.2 GENERAL REQUIREMENTS OF SAMPLING

A.2.1 The sampling instrument shall be clean and dry. The product being sampled, the sampling instrument and the containers or packages for samples shall be protected from adventitious contamination.

A.2.2 The samples shall be placed in clean, dry and air-tight glass or other suitable containers.

A.2.3 Each sample container shall be sealed air-tight after filling and marked with the necessary details of sampling, the date of sampling and other important particulars of the consignment.

A.3 SCALE OF SAMPLING

A.3.1 Samples shall be tested from each lot for ascertaining conformity of the product to the requirements of this Standard.

A.3.2 The number of containers or packages to be selected from the lot shall be in accordance with Table **5**.

A.3.3 From each container or package selected as in **A.3.2**, draw number of blocks or pieces to form a sample not less than 300 g to represent that particular container or package.

A.3.4 These samples shall be transferred to suitable containers as mentioned in **A.2.2**. They shall be sealed air-tight and marked with all details of sampling as mentioned in **A.2.3**.

A.3.5 The packages and blocks/ pieces shall be selected at random. To ensure randomness of selection, a random number table selected from **SLS 428** shall be used.

TABLE 5 – Scale of sampling

Number of packages in the lot (1)	**Number of packages to be selected** (2)
Up to 50	3
51 to 150	5
151 to 500	8
501 and above	13

A.4 PREPARATION OF SAMPLES

A.4.1 From each container selected as in **A.3.3** and prepared as in **A.3.4**, draw a sufficient quantity of material using an appropriate sampling instrument to form an individual sample to represent a particular container or package in the sample. These individual samples shall be transferred to suitable containers as mentioned in **A.2.2**, sealed air-tight and marked with all details of sampling as mentioned in **A.2.3**.

A.4.2 From all containers selected as in **A.3.3** and prepared as in **A.3.4**, a sufficient quantity of material shall be drawn using an appropriate sampling instrument and mixed together to form a composite sample to represent a homogeneous sample. The composite sample shall be transferred to a suitable container as mentioned in **A.2.2**, sealed air-tight and marked with all details of sampling as mentioned in **A.2.3**.

A.5 NUMBER OF TESTS

A.5.1 Each container or package selected as in **A.3.2** shall be inspected for packaging and marking and/ or labelling requirements.

A.5.2 Each individual sample drawn as in **A.4.1** shall be tested for the requirements given in Clause **5.2**, **5.3, 5.4, 5.5** and **5.6.1**.

A.5.3 The composite sample prepared as in **A.4.2** shall be tested for requirements given in Clause **5.6.2, 5.6.3** and **6**.

APPENDIX B
DETERMINATION OF MOISTURE CONTENT

B.1 PROCEDURE

B.1.1 Preparation of sample

Mince as quickly as possible, with a sharp edged knife or grind in a dry pestle and mortar, 150 g of the sample. Mince thoroughly to secure a uniform sample. Store the minced sample immediately in an air-tight glass container and use this wherever the use of prepared sample is indicated.

B.1.2 Weigh to the nearest milligram approximately 5 grams of the prepared sample (see **B.1.1**) in a tared and covered dish having a diameter of about 40 mm and a height of about 25 mm. Distribute the material as evenly as practicable over the bottom of the dish by gently side-wise movements. Place the dish in an oven, remove the cover of the dish and dry the material for 3 hours at 103 ± 2 ˚C. Cool the dish in the desiccator and weigh with the lid on. Heat again at 103 +2˚C in the oven for 30 minutes. Cool the dish in the desiccator and weigh. Repeat this process of heating for 30 minutes, cooling and weighing till the difference in mass between two successive weighings is less than one milligram. Note the lowest mass.

NOTE - *Preserve the dish containing this dried material for the determination of total ash.*

B.2 CALCULATION

$$\textit{Moisture, per cent by mass} = \frac{(m - m_1)}{m} \text{x}100$$

where

m is mass, in grams, of the prepared sample taken for the test; and

m_1 is mass, in grams, of the material after drying.

APPENDIX C
DETERMINATION OF TOTAL ASH

C.1 PROCEDURE

Ignite the oven-dried material (see Note under **B.1.2**) in the dish, with the flame of a Mekar burner for about one hour.(Ashless filter paper may be used to prevent frothing as overflowing during initial burning) Complete the ignition by keeping in a muffle furnace at a temperature not exceeding 525 ± 25 ˚C until grey ash results. Cool in a desiccator and weigh. Heat again at 525 ± 25 ˚C in the muffle furnace for 30 minutes. Cool in the desiccator and weigh. Repeat the process of heating for 30 minutes, cooling and weighing till the difference in mass between two successive weighings is less than one milligram. Note the lowest mass.

NOTE

Preserve the dish containing this ash for the determination of acid insoluble ash.

C.2 CALCULATION

$$\text{Total ash per cent, by mass on dry basis} = \frac{m_2}{m} \times 100 \times \frac{100}{100 - M}$$

where

m is mass, in grams, of the prepared sample taken for the test; and
m_2 is mass, in grams, of the ash.
M is the water content of the sample

APPENDIX D
DETERMINATION OF ACID INSOLUBLE ASH

D.1 REAGENT

D.1.1 *Dilute hydrochloric acid,* approximately 5 N.

D.2 PROCEDURE

To the ash content in the dish (see Note under **C.1**) add 25 ml of dilute Hydrochloric acid, cover with a watch glass and heat on a water-bath for 10 minutes. Allow to cool and filter the contents of the dish through ashless filter paper No.42 or its equivalent. Wash the filter-paper with hot water until the washings are free from the acid and return it to the dish. Keep it in an air-oven maintained at 103 ± 2 ˚C for about one hour. Ignite in a muffle furnace at 525 ± 25˚C for one hour. Cool the dish in a desiccator and weigh. Heat again for 30 minutes, in the muffle furnace, cool and weigh. Repeat this process of heating for 30 minutes, cooling and weighing till the difference between two successive weighings is less than one milligram. Note the lowest mass.

D.3 CALCULATION

D.3.1 $$\text{Acid insoluble ash, per cent, by mass on dry basis} = \frac{m_3}{m} \times 100 \times \frac{100}{100 - M}$$

where,

m is mass, in grams, of the prepared sample taken for the test; and
m_3 is mass, in grams, of the acid insoluble ash
M is water content of the sample

APPENDIX E
DETERMINATION OF MATTER INSOLUBLE IN WATER

E.1 PROCEDURE

Weigh to the nearest milligram, approximately 40 g of the prepared sample (see **B.1.1**). Boil gently with 200 ml of hot water for 30 minutes with periodical stirring. Filter through a funnel using a No. 41 or No.l or equivalent filter paper which has been previously dried at oven temperature, and weighed in a covered dish. Wash the residue thoroughly with hot water till it is free of sugar. Place the filter paper in the dish and dry in an oven maintained at 103 ± 2 ˚ C to a constant mass.

E.2 CALCULATION

E.2.1 $$\text{Matter insoluble in water, per cent, by mass} = \frac{m_5}{m_4} \times 100$$

where,

m_4 is mass, in grams, of the sample taken for the test ; and
m_5 is mass, in grams, of the matter insoluble in water

APPENDIX F
DETERMINATION OF REDUCING SUGARS

F.1 REAGENTS

F.1.1 *Standard dextrose solution*

Weigh accurately 10 g of anhydrous dextrose into a one-litre graduated flask, dissolve it in water, and make up the volume to the mark with water.

Dilute a known aliquot of this solution of dextrose with water to such a concentration that more than 15 ml, but less than 50 ml of it will be required to reduce all the copper in the Fehling's

solution taken for titration. Note the concentration of anhydrous dextrose in this solution as milligrams per 100 ml (see **NOTE**). Prepare this solution afresh every day.

NOTE

When 10 *ml of Fehling's solution are taken for titration, a standard dextrose solution containing* 0.11 *per cent to* 0.30 *per cent (m/v) of anhydrous dextrose is convenient for use.*

F.1.2 *Methylene blue indicator solution*

Dissolve 0.2 g of methylene blue in water and dilute to 100 ml.

F.1.3 *Fehling's solution*

Prepared by mixing immediately before use, equal volumes of Solution A and Solution B.
F.1.3.1 Solution A

Dissolve 34.639 g of Copper sulphate ($CuSO_4.5H_2O$) in water, add 0.5 ml of concentrated Sulphuric acid of relative density 1.84 and dilute to 500 ml in a graduated flask. Filter the solution through prepared asbestos.

F.1.3.2 Solution B

Dissolve 173 g of Rochelle salt [Potassium sodium tartrate ($KNaC_4H_4O_6.4H_2O$)] and 50 g of Sodium hydroxide, analytical reagent in water, dilute to 500 ml in a graduated flask and allow the solution to stand for two days. Filter the solution through prepared asbestos.

F.1.3.3 Standardization of Fehling's solution

Pour standard dextrose solution (see **F.1.1**) into a 50 ml burette (see **NOTE** 3 under **F.2.3**). Find the titre (that is the volume of standard dextrose solution required to reduce all the copper in 10 ml of Fehling's) corresponding to the concentration of standard dextrose solution from Table 4. (If, for example; the standard dextrose solution contains 167.0 mg of anhydrous dextrose per 100 ml, the corresponding titre would be 30 ml). Pipette 10 ml (see **F.3.1.1**) Fehling's solution into a 300 ml conical flask and run in from the burette almost the whole of the standard dextrose solution required to effect reduction of all the copper, so that not more than one milliliter will be required later to complete the titration. Heat the flask containing the mixture over a wire gauze. Gently boil the contents of the flask for 2 minutes. At the end of 2 minutes of boiling, add, without interrupting boiling, one milliliter of methylene blue indicator solution. While the contents of the flask continue to boil, begin to add standard dextrose solution (one or two drops at a time) from the burette till the blue colour of the indicator just disappears. (The titration should be completed within one minute, so that the contents of the flask boil altogether for 3 minutes without interruption (see **NOTE** 2 under **F.2.3**). Note the titre (that is the total volume in millilitres of standard dextrose solution used for the reduction of all the copper in 10 ml of Fehling's solution). Multiply the titre (obtained by direct titration) by the number of milligrams of anhydrous dextrose factor. Compare this factor with the dextrose factor given in Table **6** and determine correction, if any, to be applied to the dextrose factor derived from Table **6**.
EXAMPLE :

Concentration, in mg/100ml, of anhydrous dextrose in standard dextrose solution	=	167.0
Titre, in ml, obtained by direct titration	=	30.1
Dextrose factor for 30.1 ml of standard dextrose solution	=	Titre in ml × number of mg of anhydrous dextrose in one milliliter of standard dextrose solution
	=	30.1 × 1.670
	=	50.2670
Dextrose factor for 30.1 ml of standard dextrose solution from Table 4 (calculated by interpolation)	=	50.11
Correction to be applied to the dextrose factor derived from Table 4	=	50.2670 – 50.11
	=	+ 0.1570

F.2 PROCEDURE

F.2.1 Preparation of solution

Weigh to the nearest milligram approximately five grams of the prepared sample (see **B.1.1**). Transfer to a standard 250 ml flask. Dissolve in water and make up to the mark.

F.2.2 *Incremental method of titration*

Pour the prepared solution (see **F.2.1**) into a 50 ml burette (see **NOTE 3** below **F.2.3**). Pipette 10 ml of Fehling's solution into a 300 ml conical flask and run in from the burette 15 ml of the prepared solution. Without further dilution, heat the contents of the flask over a wire gauze, and boil. (After the liquid has been boiling for about 15 seconds it will be possible to judge if almost, all the copper is reduced by the bright red colour imparted to the boiling liquid by the suspended cuprous oxide). When it is judged that nearly all the copper is reduced, add one milliliter of methylene blue indicator solution (see **NOTE 1**). Continue boiling the contents of the flask for one to two minutes from the commencement of ebullition, and then add the prepared solution in small quantities (one milliliter or less at a time), allowing the liquid to boil for about 10 seconds between successive additions, till the blue colour of the indicator just disappears (see **NOTE** 2 below **F.2.3**). In case there still appears to be much unreduced copper, after the mixture of Fehling's solution with 15 ml of the prepared solution, has been boiling for 15 seconds, add the prepared solution from the burette in larger increments (more than one milliliter at a time according to judgement), and allow the mixture to boil for 15 seconds after each addition. Repeat the addition of the prepared solution at intervals of 15 seconds until it is considered unsafe to add a large increment of the prepared solution. At this stage, continue the boiling for an additional one or two minutes, add one milliliter of methylene blue indicator solution and complete the titration by adding the prepared solution in small quantities (less than one milliliter at a time (see also **NOTE** 2).

NOTES

1. It is advisable not to add the indicator until the end point has been nearly reached because the indicator retains its full colour until the end point is almost reached and thus gives no warning to the operator to go slowly.

2.When the operator has had a *fair amount of experience with the method*, a *sufficiently accurate result may often be obtained by a single estimation by the incremental method of titration. For the utmost degree of accuracy of which the method is capable, a second titration should be carried out by the standard method of titration (see* **F.2.3***).*

F.2.3 Standard method of titration

Pipette 10 ml of Fehling's solution into a 300 ml conical flask and run in from the burette almost the whole of the prepared solution required to effect reduction of all the copper (determined under **F.2.2**), so that, if possible, not more than one milliliter will be required later to complete the titration. Gently boil the contents of the flask for two minutes.

At the end of two minutes of boiling, add without interrupting boiling, one milliliter of methylene blue indicator solution. While the contents of the flask continue to boil, start adding the prepared solution (one or two drops at a time) from the burette till the blue colour of indicator just disappears (see **NOTE 1**). (The titration should be completed within one minute so that the contents of the flask boil altogether for three minutes without interruption (see **NOTE 2***)*.

In case of doubt, the flame may be removed from the wire gauze for one or two seconds and the flask held against a sheet of white paper. (A hold of paper, suitably fixed around the neck of the flask is very convenient for this purpose as it can be left round the neck of the flask without the risk of overbalancing it). The top edge of the liquid would appear bluish if the indicator is not completely decolourized. It is inadvisable to interrupt the boiling for more than a few seconds as the indicator undergoes back oxidation rather rapidly when air is allowed free access into the flask, but there is no danger of this as long as a continuous stream of steam is issuing from the mouth of the flask.

NOTES

1. The indicator is so sensitive that it is possible to determine the end point within one drop of the prepared solution in many cases. The complete decolouration of the methylene blue is usually indicated by the whole reaction liquid, in which the cuprous oxide is continuously churned up, becoming bright red or orange in colour.

2. It should he observed that with both incremental and standard methods of titration, the flask containing the reaction mixture is left on the wire gauze over the flame throughout the titration, except when it may be removed for a few seconds to ascertain if the end point is reached.

*3. In adding sugar solution to the reaction mixture, the burette may be held in hand over the flask. The burette may be fitted with a small outlet tube bent twice at right angles, so that the body of the burette can be kept out of the steam while adding sugar solution***.** *Burettes with glass taps are unsuitable for this work, as the taps become heated by the steam and thus are liable to jam.*

F.3 CALCULATION

F.3.1 Refer Table **6** for the dextrose factor corresponding to the titre (determined as given under **F.2.3)** and apply the correction previously determined under **F.l.3.3**. Calculate the dextrose content of the prepared solution (see **F.2.1**) as follows:

Milligrams of anhydrous dextrose present in one milliliter of the prepared solution

$$m_6 = \frac{dextrose\ \ factor}{titre}$$

F. 3.1.1 Instead of using 10 ml of Fehling's solution, a 25-ml portion may also be substituted throughout the procedure (including standardization of Fehling's solution' under **F.l.3.3**).

In this case, the standard dextrose solution, used in standardizing the Fehling's solution and the prepared solution of the material (see **F.2,1**) shall contain 0.25 per cent to 0.75 per cent (m/v) of anhydrous dextrose, and Table **5** shall be used for all calculations.

F.3.2 Reducing sugars, (as Invert) per cent by mass $= \frac{m_6}{m_7} \times 25$

where

m_6 is milligrams of reducing sugar in 1 ml of the solution of the material (see **F.3.1**); and
m_7 is mass, in grams, of the prepared sample used for making 250 ml of solution (see **F.2.1**).

APPENDIX G
DETERMINATION ON NON- REDUCING SUGARS

G.1 REAGENTS

G.1.1 *Concentrated Hydrochloric acid*

Relative density 1.16, of analytical reagent grade.

G.1.2 *Fehling's solution*

Prepared by mixing immediately before use, equal volumes of Solution A and Solution B.

G.1.2.1 Solution A

prepared as in **F.l.3.1.**

G.1.2.2 Solution B

Prepared as in **F.1.3.1**

G.2 PROCEDURE

Take 25 ml of the prepared solution (see **F.2.1**) in a conical flask and add 2.5ml of the concentrated hydrochloric acid and about 10ml water. Keep the flask at 60˚C to 70˚Cfor 10 minutes in a water bath. Cool immediately and neutralize with 30 per cent sodium hydroxide (m/ v) and transfer quantitatively the neutralized inverted solution to a graduated flask and make up the volume to 250ml.

Determine the reducing sugars in the inverted solution as described in **F**.

G.3 CALCULATION

G.3.1 Sucrose, per cent, by mass = (T-R) 0.95

where,

$$T = \frac{m_9}{m_8} \times 10$$

R is reducing sugars, per cent by mass (see **F.3.2**)
m_8 is mass, in grams, of the original material taken for the test (see **F.2.1**); and
m_9 is milligrams of total reducing sugars in 1 ml of the inverted solution.

Table 6 – Dextrose table for 10ml of Fehling's solution

ml of Sugar Solution Required (1)	Dextrose Factor* (2)	mg dextrose per 100ml (3)
15	49.1	237
16	49.2	307
17	49.3	289
18	49.3	274
19	49.5	260
20	49.5	247.4
21	49.5	235.4
22	49.6	225.5
23	49.7	216.1
24	49.8	207.4
25	49.8	199.3
26	49.9	191.8
27	49.9	184.9
28	50.0	178.5
29	50.0	172.5
30	50.1	167.0
31	50.2	161.8
32	50.2	156.9
33	50.3	152.4
34	50.3	148.0
35	50.4	143.9
36	50.4	140.0
37	50.5	136.4
38	50.5	132.9
39	50.6	129.6
40	50.6	126.5
41	50.7	123.6
42	50.7	120.8
43	50.8	118.1
44	50.8	115.5
45	50.9	113.0
46	50.9	110.6
47	51.0	108.4
48	51.0	106.2
49	51.0	104.1
50	51.1	102.2

*mg of dextrose corresponding to 10ml of Fehling's solution.

Table 7 – Dextrose table for 25 ml of Fehling's solution

ml of Sugar Solution Required (1)	Dextrose Factor** (2)	mg dextrose per 100ml (3)
15	120.2	801
16	120.2	751
17	120.2	707
18	120.2	448
19	120.3	633
20	120.3	601.5
21	120.3	572.9
22	120.4	547.6
23	120.4	523.6
24	120.5	501.9
25	120.5	482.0
26	120.6	463.7
27	120.6	446.8
28	120.7	431.1
29	120.7	416.4
30	120.8	402.7
31	120.8	389.7
32	120.8	377.6
33	120.9	366.3
34	120.9	355.6
35	121.0	345.6
36	121.0	336.3
37	121.1	327.4
38	121.2	318.8
39	121.2	310.7
40	121.2	303.1
41	121.3	295.9
42	121.4	289.0
43	121.4	282.4
44	121.5	276.1
45	121.5	270.1
46	121.6	264.3
47	121.6	258.8
48	121.7	253.5
49	121.7	248.4
50	121.8	243.6

**mg of dextrose corresponding to 25ml of Fehling's solution.

ml of sugar solution required (1)	No sucrose		Solutions containing besides invert sugar							
			1g sucrose per 100ml		5g sucrose per 100ml		10g sucrose per 100ml		25g sucrose per 100ml	
	Invert Sugar Factor (2)	mg Invert Sugar per 100 ml (3)	Invert Sugar Factor (4)	mg Invert Sugar per 100 ml (5)	Invert Sugar Factor (6)	mg Invert Sugar per 100 ml (7)	Invert Sugar Factor (8)	mg Invert Sugar per 100 ml (9)	Invert Sugar Factor (10)	mg Invert Sugar per 100 ml (11)
15	50.5	336	49.9	333	47.6	317	46.1	307	43.4	289
16	50.6	316	50.0	312	47.6	297	46.1	288	43.4	271
17	50.7	298	50.1	295	47.6	280	46.1	271	43.4	255
18	50.8	286	50.1	278	47.6	264	46.1	256	43.3	240
19	50.8		50.2	264	47.6	250	46.1	243	43.3	227
20	50.9	254.5	50.2	251.0	47.6	238.0	46.1	230.5	43.2	216
21	51.0	242.9	50.2	239.0	47.6	226.7	46.1	219.5	43.2	206
22	51.0	231.8	50.3	228.2	47.6	216.4	46.1	209.5	43.1	196
23	51.1	222.2	50.3	218.7	47.6	207.0	46.1	200.4	43.0	187
24	51.2	213.3	50.3	209.8	47.6	198.3	46.1	192.1	42.9	179
25	51.2	204.8	50.4	201.6	47.6	190.4	46.0	184.0	42.8	171
26	51.3	197.4	50.4	198.8	47.6	183.1	46.0	176.9	42.8	164
27	51.4	190.4	50.4	186.7	47.6	176.4	46.0	170.4	42.7	158
28	51.4	183.7	50.5	180.2	47.7	170.3	46.0	164.5	42.7	152
29	51.5	177.6	50.5	174.1	47.7	164.5	46.0	158.6	43.6	147
30	51.5	171.7	50.5	168.3	47.7	159.0	46.0	153.3	42.5	142
31	51.6	166.3	50.6	163.1	47.7	153.9	45.9	148.1	42.5	137
32	51.6	161.2	50.6	158.1	47.7	149.1	45.9	143.4	42.4	132
33	51.7	156.6	50.6	153.3	47.7	144.5	45.9	139.1	42.3	128
34	51.7	152.2	50.6	148.9	47.7	140.3	45.8	134.9	42.2	124
35	51.8	147.9	50.7	144.7	47.7	136.3	45.8	130.9	42.2	121
36	51.8	143.9	50.7	140.7	47.7	132.5	45.8	127.1	42.1	117
37	51.9	140.2	50.7	137.0	47.7	128.9	45.7	123.5	42.0	114
38	51.9	136.6	50.7	133.5	47.7	125.5	45.7	120.3	42.0	111
39	52.0	133.3	50.8	130.2	47.7	122.3	45.7	117.1	41.9	107
40	52.0	130.1	50.8	127.0	47.7	119.2	45.6	114.1	41.8	104
41	52.1	127.1	50.8	123.9	47.7	116.3	45.6	111.2	41.8	102
42	52.1	124.2	50.8	121.0	47.7	113.5	45.6	108.5	41.7	99
43	52.2	121.4	50.8	118.2	47.7	110.9	45.5	105.8	41.6	97
44	52.2	118.7	50.9	115.6	47.7	108.4	45.5	103.4	41.5	94
45	52.3	116.1	50.9	113.1	47.7	106.0	45.4	101.0	41.4	92
46	52.3	113.7	50.9	110.6	47.7	103.7	45.4	98.7	41.4	90
47	52.4	111.4	50.9	108.2	47.7	101.5	45.3	96.4	41.3	88
48	52.4	109.2	50.9	106.0	47.7	99.4	45.3	94.3	41.2	86
49	52.5	107.1	51.0	104.0	47.7	97.4	45.2	92.3	41.1	84
50	52.5	105.1	51.0	102.0	47.7	95.4	45.2	90.4	41.0	82

Table 8 – Invert sugar table for 25ml of Fehling's solution

ml sugar solution required	Solution containing besides invert sugar			
	No sucrose		1g sucrose per 100ml	
	Invert sugar factor* (2)	mg invert sugar per 100 ml (3)	Invert sugar factor* (4)	mg invert sugar per 100 ml (5)
(1)				
15	123.6	824	122.6	817
16	123.6	772	122.7	767
17	123.6	727	122.7	721
18	123.7	687	122.7	682
19	123.7	651	122.8	646
20	123.8	619.0	122.8	614.0
21	123.8	589.5	122.8	584.8
22	123.9	563.2	122.9	558.2
23	124.9	538.7	122.9	534.0
24	124.0	516.7	122.9	512.1
25	124.0	496.0	123.0	492.0
26	124.1	477.3	123.0	473.1
27	124.1	459.7	123.0	455.6
28	124.2	443.6	123.1	439.6
29	124.2	428.3	123.1	424.4
30	124.3	414.3	123.1	410.4
31	124.3	401.0	123.2	397.4
32	124.3	388.7	123.2	385.0
33	124.3	377.0	123.2	373.4
34	124.5	366.2	123.3	362.6
35	124.5	355.8	123.3	352.3
36	124.6	346.1	123.3	342.5
37	124.6	336.8	123.4	333.5
38	124.7	328.1	123.4	324.7
39	124.7	319.7	123.4	316.4
40	124.8	311.9	123.4	308.6
41	124.8	304.4	123.5	301.2
42	124.9	297.3	123.5	294.1
43	124.9	290.5	123.5	287.3
44	125.0	284.1	123.6	280.9
45	125.0	277.9	123.6	274.7
46	125.1	272.0	123.6	268.7
47	125.1	266.3	123.7	263.1
48	125.2	260.8	123.7	257.7
49	125.2	255.5	123.7	252.5
50	125.3	250.6	123.8	247.6

*mg of invert sugar corresponding to 25ml of Fehling's solution.

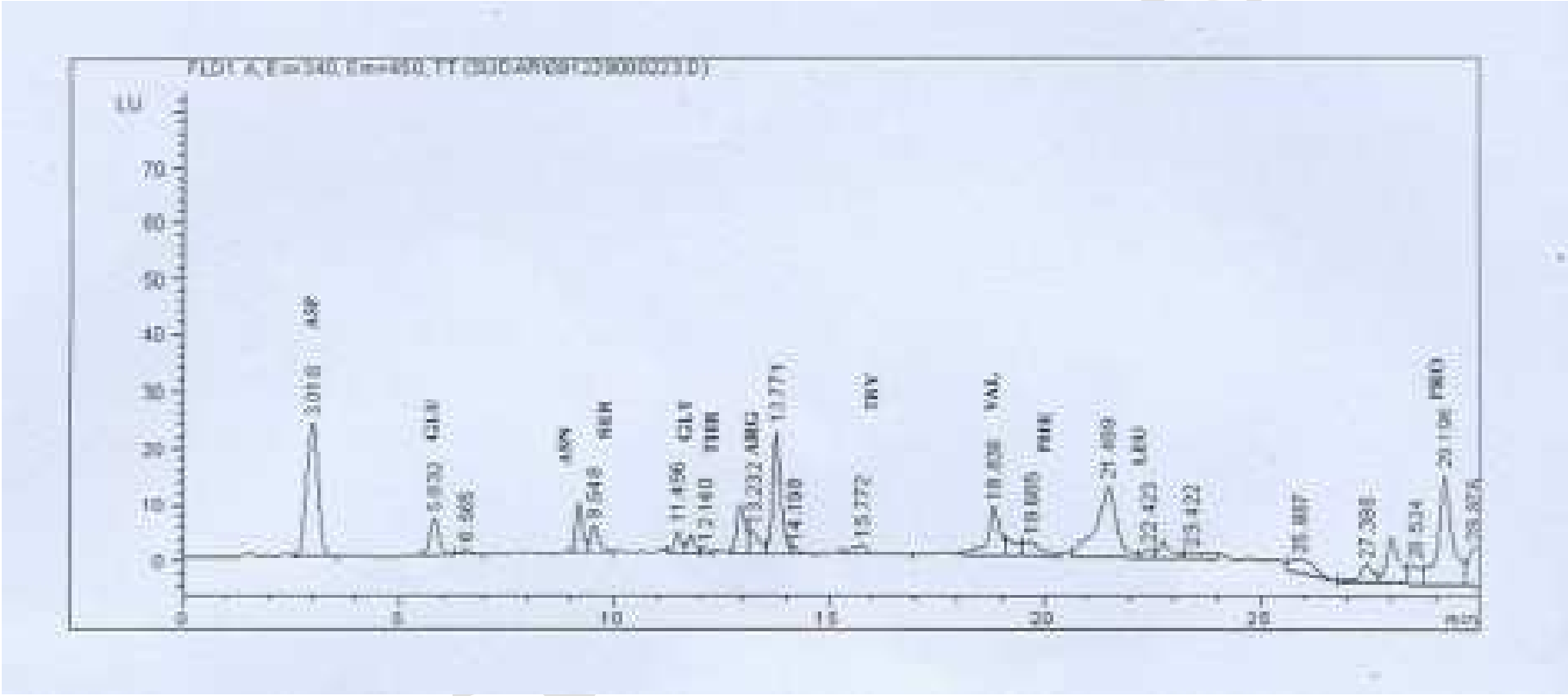

FIGURE 1 - Amino acids chromatogram of coconut jaggery