SRI LANKA STANDARD 521 : 1981

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SPECIFICATION FOR JAGGERY

BUREAU OF CEYLON STANDARDS

SPECIFICATION FOR JAGGERY

SLS 521 : 1981
(Attahced AMD 384)

Gr. 11

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Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This Standard does not purport to include all the necessary provisions of a contract.

AMENDMENT NO : 1 APPROVED ON 2009-03-30 TO SLS 521 : 1981
SPECIFICATION FOR JAGGERY

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EXPLANATORY NOTE

Due to the present procedure relating to the preparation of jaggery, contamination with fluorine does not take place. Therefore, it was found that it is not necessary to stipulate fluorine as a trace element.

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Table 2 – Limits for trace elements

Delete SI. No. 4 - Fluorine, p.p.m. ,(max.) , 1.0

SRI LANKA STANDARD

SPECIFICATION FOR JAGGERY

FOREWORD

This Sri Lanka Standard Specification was authorized for adoption and publication by the Council of the Bureau of Ceylon Standards on 1981-06-26, after the draft, finalized by the Drafting Committee on Jaggery and Treacle had been approved by the Agricultural and Food Products Divisional Committee.

All values given in the specification are in SI units.

This specification is subject to the restrictions imposed under the Food and Drugs Act and the regulations framed thereunder.

For the purpose of deciding whether a particular requirement of this specification is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with CS 102. The number of significant places retained in the rounded off value should be the same as that of the specified value of this standard.

1 SCOPE

This specification prescribes the requirements and methods of sampling and test for jaggery.

2 REFERENCE

CS 102 Presentation of numerical values

SLS 301 Determination of copper

SLS 311 Determination of lead

SLS 312 Determination of arsenic

SLS 428 Random sampling methods

3 TYPES

Jaggery shall be of the following types :

a) Coconut jaggery ;

b) *Kitul* jaggery ;

c) Palmyrah jaggery and

d) Sugar cane jaggery.

4 DEFINITIONS

For the purpose of this specification the following definitions shall apply :

4.1 coconut jaggery : It shall be the crystallized product manufactured from the sap exudate collected from the inflorescence of the coconut palm *(Cocos nucifera)*.

4.2 *kitul* jaggery : It shall be the crystallized product manufactured from the sap exudate collected from the inflorescence of the *kitul* palm *(Caryota urens)*.

4.3 palmyrah jaggery : It shall be the crystallized product manufactured from the sap exudate collected from the inflorescence of the palmyrah palm *(Borassus flabellifer)*.

4.4 sugar cane jaggery : It shall be the crystallized product manufactured from the juice extracted from the sugar cane stalks *(Saccharum sp)*.

5 REQUIREMENTS

5.1 Jaggery shall be free from foreign matter and from any objectionable flavour.

5.2 Jaggery shall have a colour, taste and flavour characteristic of good jaggery and shall be free from off-odour, insect or fungal infestation, added colouring matter and any other extraneous matter.

5.3 Jaggery shall be made from clean, filtered, unfermented, sap/juice of the plant mentioned in 4.

5.4 Jaggery in addition may contain one or more of the optional ingredients listed below :

a) Calcium hydroxide ;

b) Sodium carbonate ;

c) Sodium bicarbonate ;

d) Calcium super-phosphate ;

e) Sodium bisulphate ;

f) Phosphoric acid and

g) Calcium oxide.

The above chemical clarificants should be of B.P. quality.

h) *Hal* bark (bark of *Vateria acuminata*) and other non-toxic vegetable matter.

5.5 Jaggery shall also conform to the limits specified in Tables 1 and 2.

TABLE 1 - Requirements for jaggery

Sl. No. (1)	Characteristic (2)	Limit (3)	Methods of test (Ref. to Appendix) (4)
1	Moisture, per cent by mass max.	10	B
2	Total ash, per cent by mass, max.	3.5	C
3	Acid insoluble ash, per cent by mass, max.	0.5	D
4	Matter insoluble in water, per cent by mass, max.	2.0	E
5	Reducing sugars, per cent by mass, max.	13	F
6	Sugars, non-reducing, per cent by mass, min.	70	G

TABLE 2 - Limits for trace elements

Sl. No. (1)	Trace elements (2)	Limit (3)	Reference (4)
1	Arsenic, p.p.m., max.	0.5	SLS 312
2	Lead, p.p.m., max.	1.0	SLS 311
3	Copper, p.p.m., max.	5.0	SLS 301
4	Fluorine, p.p.m., max.	1.0	Appendix H

6 PACKAGING AND MARKING

6.1 Packaging

The jaggery shall be packed in moisture proof material to prevent ingress of moisture. It shall be covered completely.

6.2 Marking

The packages shall be marked with the following information :

a) Manufacturer's name, address and/or registered trade mark ;

b) Type of jaggery ;

c) Net mass, in grams ;

d) Date of manufacture ; and

e) The words "Produce of Sri Lanka".

7 SAMPLING

7.1 Sampling shall be carried out as described in A.

8 CRITERIA FOR CONFORMITY

The lot shall be considered as conforming to the requirements of this specification, if the following conditions are satisfied :

8.1 Requirements other than trace element requirements

The number of defective packages in the sample shall be less than or equal to the corresponding acceptance number given in Column 3 of Table 3.

8.2 Trace element requirements

The test results of each individual sample shall satisfy the requirements given in Column 3 of Table 2.

APPENDIX A

SAMPLING

A.1 DEFINITIONS

A.1.1 **lot** : In any consignment all the packages containing the same size and same type of jaggery blocks or pieces and belonging to the same batch of manufacture shall be grouped together to form a lot.

A.1.2 **defective package** : Any package of jaggery which fails to conform to any one or more requirements of this specification, other than requirements for trace elements shall be called a defective package.

A.2 SCALE OF SAMPLING

A.2.1 Samples shall be tested from each lot for ascertaining conformity of the product to the requirements of this specification.

A.2.2 The number of packages to be selected from each lot shall be in accordance with Columns 1 and 2 of Table 3.

TABLE 3 - Packages to be selected

No. of packages in the lot (1)	No. of packages to be selected (2)	Acceptance no. (3)
Up to 25	2	0
26 to 50	3	0
51 to 150	5	1
151 to 300	8	1
301 and above	13	2

A.2.3 The packages shall be selected at random. To ensure randomness of selection, a random number table selected from SLS 428 shall be used.

A.2.4 From each of the packages selected as in A.2.2. draw a suitable number of blocks or pieces to form an individual sample not less than 300 g and to represent that particular package.

A.2.5 These individual samples shall be transferred to suitable clean, dry glass containers or polythene bags. They shall be sealed air-tight and marked with full details of sampling.

A.3 NUMBER OF TESTS

All the individual samples selected as in A.2.4 shall be individually tested for all the requirements of this specification.

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 five 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 105 ± 1 °C. Cool the dish in the desiccator and weigh with the lid on. Heat again at 105 ± 1 °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

B.2.1 Moisture, per cent, by mass $= \dfrac{100\ (m - m_1)}{m}$

where

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

m_1 = 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. Complete the ignition by keeping in a muffle furnace at a temperature not exceeding 550 °C until grey ash results. Cool in a desiccator and weigh. Heat again at 550 °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

$$\text{Total ash per cent, by mass} = 100 \times \frac{m_2}{m}$$

where

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

m_2 = mass, in grams, of the ash.

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 contained 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 Whatman filter paper No. 42 or its equivalent. Wash the filter-paper with water until the washings are free from the acid and return it to the dish. Keep it in an air-oven maintained at 105 ± 2 °C for about three hours. Ignite in a muffle furnace at 600 ± 20 °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 Acid insoluble ash, per cent, by mass $= \dfrac{100 \times m_3}{m}$

where

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

m_3 = mass, in grams, of the acid insoluble ash.

APPENDIX E

DETERMINATION OF MATTER INSOLUBLE IN WATER

E.1 PROCEDURE

Weigh to the nearest milligram approximately 20 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 Whatman filter paper No. 41 or No. 1, 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 to a constant mass.

E.2 CALCULATION

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

where

m_4 = mass, in grams, of the sample taken for the test; and

m_5 = 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 gram 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 solution) 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 millilitre 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 millilitre 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 in one millilitre of the standard dextrose solution to obtain the dextrose factor. Compare this factor with the dextrose factor given in Table 4 and determine correction, if any, to be applied to the dextrose factor derived from Table 4.

EXAMPLE:

Concentration, in mg/100 ml, 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 x number of mg of anhydrous dextrose in one millilitre of standard dextrose solution
	=	30.1 x 1.670
		50.267 0
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	=	50.267 0 - 50.11
	=	+0.157 0

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. Make up to the mark with water.

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 millilitre 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 millilitre 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 millilitre 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 to two minutes, add one millilitre of methylene blue indicator solution and complete the titration by adding the prepared solution in small quantities (less than one millilitre 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 millilitre 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 millilitre 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 the 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 be 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 4 for the dextrose factor corresponding to the titre (determined as given under **F.2.3**) and apply the correction previously determined under **F.1.3.3**. Calculate the dextrose content of the prepared solution (see **F.2.1**) as follows:

Milligrams of anhydrous dextrose present in one millilitre of the prepared solution $= m_6 = \frac{\text{dextrose factor}}{\text{titre}}$

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.1.3.3**).

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 $= 25 \times \frac{m_6}{m_7}$

where

m_6 = milligrams of reducing sugar in 1 ml of the solution of the material (see F.3.1) ; and

m_7 = mass, in grams, of the prepared sample used for making 250 ml of solution (see **F.2.1**).

APPENDIX G

DETERMINATION OF 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.1.3.1.**

G.1.2.2 Solution *B*

Prepared as in **F.1.3.2.**

G.2 PROCEDURE

Take 25 ml of the prepared solution (see **F.2.1**) in a conical flask and add 2.5 ml of the concentrated hydrochloric acid and about 10 ml water. Keep the flask at 60 °C to 70 °C for 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 250 ml.

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

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

R = reducing sugars, per cent by mass (see **F.3.2**) ;

m_8 = mass, in grams, of the original material taken for the test (see **F.2.1**) ; and

m_9 = milligrams of total reducing sugars in 1 ml of the inverted solution.

APPENDIX H

DETERMINATION OF FLUORINE

H.1 APPARATUS

H.1.1 *Steam distillation apparatus*

A 250-ml Claisen flask is fitted with a 2-holed stopper through which passes a thermometer and a steam inlet tube, both of which extend close to the bottom of the flask. The side neck is stoppered and steam is generated from water made alkaline with sodium hydroxide.

H.2 PROCEDURE

H.2.1 Distillation

Mix about 10 g of the sample in platinum basin with one gram fluorine-free lime and 50 ml water. Evaporate on a water bath, char and ignite at 600 °C. Introduce into the flask some fragments of glass, 0.2 gram silver sulphate (to precipitate all the chloride), 7 ml of water and 15 ml of perchloric acid (60 per cent). Assemble the apparatus and heat the flask until the temperature reaches the range of 120 °C to 125 °C. Then connect the steam supply and maintain the distillation between 137 °C to 140 °C. Distil 150 ml in 30 minutes steaming out the condenser towards the end of the distillation. Discard the distillate. Distil a further 150 ml as before and titrate the *apparatus blank* (should not exceed 1.5 µg) by the method given in H.2.2. After cooling, transfer the acid in the Claisen flask to a clean beaker and rinse the flask out with water, rejecting the rinsings. Transfer the dry ash to the flask, washing in with five millilitres of water containing a few drops of the acid. Add the rest of the acid, while keeping the flask cool, rinse down with two millilitres of water and distil 150 ml as before.

H.2.2 Titration

Titrate 50 ml of distillate with 0.05 M sodium hydroxide in a Nessler glass using methyl orange as indicator until the colour matches that of a similar tube containing water and the same amount of methyl orange.

Transfer the remaining 100 ml of distillate to a Nessler glass and add sufficient 0.05 M hydrochloric acid to make the total acidity equal to 5.0 ml 0.05 M acid. Prepare a *control* cylinder containing 5.0 ml 0.05 M hydrochloric acid and water and add to both the *test* and *control* cylinders, exactly two millilitres of 0.01 per cent aqueous alizarin S solution. From a burette add thorium nitrate solution (0.025 per cent), to the *test* cylinder, until a slight pink persists as compared with the yellow of the *control* cylinder which should become more pink than the first solution. Then add slowly to the *control* cylinder from a burette,

standard sodium fluoride solution (0.0221 g/l; 1 ml = 10 µgF) until the tints of *test* and *control* solutions exactly match. From the titration, calculate, the amount of fluoride in 150 ml of distillate, subtract the *apparatus blank* and calculate the amounts of fluorine as parts per million.

H.3 CALCULATION

H.3.1 Apparatus blank

Volume of standard fluoride solution used in the titration = v_1 ml

Therefore apparatus blank = $v_1 \times \frac{150}{100} \times 10$ µg

H.3.2 Sample

Volume of standard fluoride solution used in the titration = v_2 ml

Therefore fluoride in 150 ml of sample = $(v_2 - v_1) \frac{150}{100} \times 10$ µg

TABLE 4 - Dextrose table for 10 ml of Fehling's solution

ml of sugar solution required (1)	Dextrose factor* (2)	mg dextrose per 100 ml (3)
15	49.1	327
16	49.2	307
17	49.3	289
18	49.3	274
19	49.4	260
20	49.5	247.4
21	49.5	235.8
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 10 ml of Fehling's solution.*

TABLE 5 - Dextrose table for 25 ml of Fehling's solution

ml of sugar solution required (1)	Dextrose factor** (2)	mg dextrose per 100 ml (3)
15	120.2	801
16	120.2	751
17	120.2	707
18	120.2	668
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 25 ml of Fehling's solution.*

TABLE 8 - Invert sugar table for 10 ml of Fehling's solution

ml of sugar solution required	Solutions containing besides invert sugar: No sucrose		1 g sucrose per 100 ml		5 g sucrose per 100 ml		10 g sucrose per 100 ml		25 g sucrose per 100 ml	
	Invert sugar factor*	mg Invert sugar per 100 ml	Invert sugar factor*	mg Invert sugar per 100 ml	Invert sugar factor*	mg Invert sugar per 100 ml	Invert sugar factor*	mg Invert sugar per 100 ml	Invert sugar factor*	mg Invert sugar per 100 ml
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(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	282	50.1	278	47.6	264	46.1	256	43.3	240
19	50.8	267	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	193.8	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	170.6	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	42.6	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

mg of invert sugar corresponding to 10 ml of Fehling's solution.

TABLE 7 - Invert sugar table for 25 ml of Fehling's solution

ml sugar solution required	Solutions containing besides invert sugar			
	No sucrose		1g sucrose per 100 ml	
	Invert sugar factor*	mg Invert sugar per 100 ml	Invert sugar factor*	mg Invert sugar per 100 ml
(1)	(2)	(3)	(4)	(5)
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	123.9	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	124.4	388.7	123.2	385.0
33	124.4	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 25 ml of Fehling's solution.*

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