# SRI LANKA STANDARD 866 : 2016

**UDC 661.321**

## SPECIFICATION FOR
# SODIUM CARBONATE
## (First Revision)

**SRI LANKA STANDARDS INSTITUTION**

Sri Lanka Standard
# SPECIFICATION FOR SODIUM CARBONATE
(*First Revision*)

**SLS 866 : 2016**

**Gr. 8**

**SRI LANKA STANDARDS INSTITUTION**
**17, Victoria Place**
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# Sri Lanka Standard
# SPECIFICATION FOR SODIUM CARBONATE
(*First Revision*)

## FOREWORD

This Standard was approved by the Sectoral Committee on Chemical and Polymer Technoloy and was authorized for adoptions and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2016-10-27.

This Standard was first published in 1986 and this First Revision introduces grades of Sodium carbonate, limits and methods to determine heavy metals, chlorides and sulphates. In addition, the aperture size of the sieve and limits of particle size distribution have been changed. Additional requirements applicable to marking have been included in this Revision.

Sodium Carbonate ($Na_2CO_3$) is commonly known as soda ash. This Specification covers following grades of Sodium carbonate i.e. Technical grade, General Purpose Ragent grade(GPR)/ Laboratory Reagent grade (LRG), Analytical Reagent grade(AR) and Food grade. Technical grade is used in a wide variety of manufacturing processes. The major consuming industries are glass, pulp and paper, textiles and other industries such as chemicals, cosmetics, steel and non ferrous metallurgy industry, GPR/LRG and AR grades are used as laboratory chemicals. Food grade sodium carbonate is used in food industries, water treatment plants etc.

For the purpose of deciding whether a particular requirement of this Specification is compiled with, the final value, observed or calculated, expressing the result of a test or an analysis, shall be rounded off in accordance with **SLS 102.** The number of significant places retained in the rounded off value shall be the same as that of the specified value in this Specification.

All values given in this specification are in SI units.

In the preparation of this Specification, the assistance obtained from the following publications are gratefully acknowledged:

| | | |
|---|---|---|
| JIS K | 8625 | Sodium Carbonate |
| BS | 3674 | Sodium Carbonate (Technical grades) |

## 1 SCOPE

**1.1** This Specification prescribes the requirements, test methods and sampling procedure for Sodium carbonate of Technical grade, General Purpose Ragent grade (GPR)/ Laboratory Reagent grade (LRG), Analytical Reagent grade (AR) and Food grade.

**1.2** It does not specify requirements for Sodium carbonate intended for pharmaceutical and photographic use.

## 2 REFERENCES

**SLS 102** Presentation of numerical values
**SLS 124** Test sieves
**SLS 428** Random sampling method

## 3 GRADES

Sodium carbonate shall be of the following grades:

a) Technical grade;
b) General Purpose Reagent grade (GPR)/ Laboratory Reagent grade (LRG);
c) Analytical Reagent grade (AR); and
d) Food grade.

## 4 TYPES

Technical grade of the Sodium carbonate shall be of the following types depending upon the bulk density.

Type 1 - Dense product; and
Type 2 - Light product.

## 5 REQUIREMENTS

### 5.1 General requirements

The product shall be in the form of a white powder and dry. It shall be free from visible impurities.

### 5.2 Other requirements

The product shall be comply with the requirements given in Table **1** when tested by the methods prescribed in Column (**8)** of Table **1**.

## TABLE 1- Requirements for Sodium carbonate

| Sl. No. | Characteristic | Requirement | | | | | Method of test reference |
|---|---|---|---|---|---|---|---|
| | | Technical grade | | GPR-grade/ LRG | AR grade | Food grade | |
| | | Dense product | Light product | | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | Bulk density, g/l | 950 – 1250 | 500 -750 | 510 – 610 | 510 – 600 | 50- 900 | Appendix B |
| ii) | Particle size distribution; | | | | | | Appendix C |
| | a) Particles retaining on 600 µm sieve, percent by mass, max. | 1 | 1 | 1 | 1 | 1 | |
| | b) Particles passing through 150 µm sieve, percent by mass, max. | 6 | 30 | 25 | 15 | 15 | |
| iii) | Loss of mass on heating at 250 ±20 °C , per cent by mass, max. | 5.0 | 1.0 | 0.5 | 0.5 | 0.5 | Appendix D |
| iv) | Total soluble alkali content (as $Na_2CO_3$), on dry basis per cent by mass, min. | 98.0 | 98.0 | 99.0 | 99.0 | 99.0 | Appendix F |
| v) | Water insoluble matter, per cent by mass, max. | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | Appendix G |
| vi) | Sulphates (as $Na_2SO_4$) mg/kg , max. | 150 | 150 | 100 | 50 | 30 | Appendix H |
| vii) | Chloride content (as NaCl), per cent by mass, max. | 1.0 | 1.0 | 0.003 | 0.002 | 0.3 | Appendix J |
| viii) | Iron (as Fe ), mg/kg , max. | 70 | 70 | 25 | 5 | 5 | Appendix K |
| ix) | *Copper (as Cu ), mg/kg, max. | 1 | 1 | 20 | 20 | 1.0 | APHA 3111 B |
| x) | Arsenic (as As), mg/kg , max. | 2 | 2 | 2 | 2 | 0.01 | APHA 3114 C |
| xi) | Lead (as Pb), mg/kg , max. | 4 | 4 | 4 | 3 | 0.01 | APHA 3113 B |
| xii) | Cadmium (as Cd), mg/kg , max. | 2 | 2 | 2 | 2 | 0.003 | APHA 3113 B |
| xiii) | Chromium (as Cr ), mg/kg , max. | 2 | 2 | 2 | 2 | 0.05 | APHA 3114 C |
| xiv) | Mercury ( as Hg ), mg/kg , max. | 1 | 1 | 1 | 1 | 0.001 | APHA 3111 B |

*Applicable only when used in the soap industry

## 6 PACKAGING AND MARKING

The product shall be suitably packed in air-tight, clean, dry, proper seal containers. Each container shall be legibly and indelibly marked or labeled with the following:

a) Name of the product;
b) Type and grade;
c) The manufacturer's and supplier's or distributor's name and address including country of origin;
(***NOTE:*** *Additional contact details should be included as agreed to between the purchaser and the supplier*)
d) Registered trade mark, if any;
e) Brand name, if any;
f) Batch or code number;
g) Date of manufacture; and
h Net mass, in kilograms (kg).

## 7 SAMPLING

The method of drawing representative samples of the product for ascertaining conformity to the requirements of this specification shall be as prescribed in Appendix **A**.

## 8 METHODS OF TEST

**8.1** Tests shall be carried out as prescribed in Appendices **B** to **L** of this specification. The preparation of dried sample for testing the relevant parameters shall be as given in Appendix **E**.

**8.2** Analytical grade chemical and distilled water or water of equivalent purity shall be used for testing purposes.

## APPENDIX A
## SAMPLING

The sampling scheme given in this Appendix 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 based on manufacturer's control systems coupled with type testing and check tests or any other procedure, appropriate schemes of sampling and inspection should be adopted.

### A.1 LOT

All the containers of the same size, same type and containers belonging to one batch of manufacture or supply of any consignment shall constitute a lot.

## A.2 SCALE OF SAMPLING

**A.2.1** The samples shall be tested from each lot for ascertaining its conformity of the material to the requirements of this specification.

**A.2.2** The number of containers to be selected from a lot shall be in accordance with Table **2**.

**TABLE 2 - Scale of sampling**

| Number of containers in the lot (1) | Number of containers to be selected (2) |
|---|---|
| Up to 50 | 2 |
| 51 to 150 | 3 |
| 151 to 300 | 5 |
| 301 to 500 | 8 |
| 501 to 1000 | 10 |
| 1001 and above | 13 |

**A.2.3** The containers shall be selected at random. In order to ensure randomness of selection, tables of random numbers as given in **SLS 428** shall be used.

## A.3 NUMBER OF TESTS

**A.3.1** Each container selected as in **A.2.2** shall be inspected for packaging and marking requirements.

**A.3.2** Each container selected as in **A.2.2** shall be examined for the requirement given in **5.1.**

**A.3.3** A sufficient quantity of the material from at least two different places shall be drawn from each container, selected as in **A.2.2** and mix to form a composite sample. The composite sample thus obtained shall be tested for the requirements given in **5.2.**

## A.4 CRITERIA FOR CONFORMITY

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

**A.4.1** Each container inspected as in **A.3.1** satisfies the relevant requirements.

**A.4.2** Each container examined as in **A.3.2** satisfies the relevant requirements. .

**A.4.3** The test results of the composite sample tested as in **A.3.3** satisfy the relevant requirements.

# APPENDIX B
# DETERMINATION OF BULK DENSITY

## B.1 APPARATUS

**B.1.1** Funnel, glass, with an angle of 60°.

**B.1.2** Apparatus as shown in Figure **1**, consisting of the following:

**B.1.2.1** *Measuring cylinder,* 250 ml capacity and 220 mm to 240 mm distance between the zero and 250 ml mark.

**B.1.2.2** *Rubber base pad*

**B.1.2.3** *Holder*

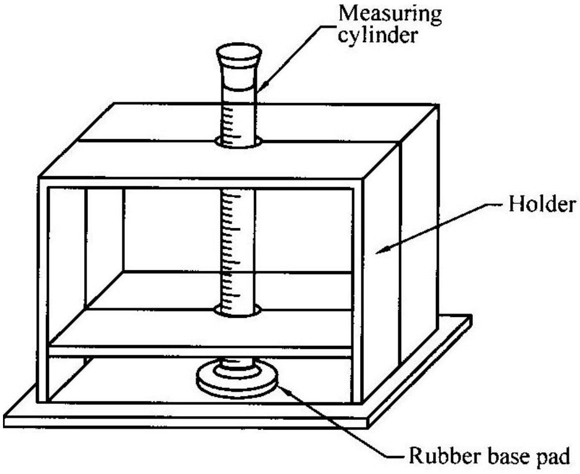

**Figure 1 – Apparatus for determination of bulk density**

## B.2 PROCEDURE

Take a sufficient quantity of the sample on a glazed paper and slip it through the funnel **(B.1.1)** into the measuring cylinder **(B.1.2.1)** up to 100-ml mark without knocking. Gently lift the cylinder to a height of 50 mm and release on to the rubber base pad twice. Slip more of the sample into the cylinder up to 200 ml mark and give two knocks as before. Finally, slip more of the sample into the cylinder up to 250-ml mark and give two further knocks. Level to 250 ml mark with the sample without any further knocking. Empty the cylinder and. weigh the sample to the nearest 0.1 g.

## B.3 CALCULATION

Bulk density, g/1 = 4 m
where,

m is the mass, in g, of the sample in the cylinder.

# APPENDIX C
# DETERMINATION OF PARTICLE SIZE DISTRIBUTION

## C.1 APPARATUS

Test sieves of aperture size 600 µm and 150 µm conforming to **SLS 124 .**

## C.2 PROCEDURE

Place the sieve of aperture size 600 µm on top of the 150 µm, sieve. Weigh to the nearest 0.1g, about 100 g of the sample and place it on the upper sieve. Shake the sieve till no more material passes through the sieves. Weigh the particles retained on the sieve of aperture size 600 µm and the particles passed through the sieve of aperture size 150 µm.

## C.3 CALCULATION

Particles retaining on the sieve of aperture size 600 µm, per cent by mass $= \frac{m_1}{m_o} \times 100$

Particles passing through the sieve of aperture size 150 µm, per cent by mass $= \frac{m_2}{m_o} \times 100$

where,

$m_o$ is the mass, in g, of the sample taken for the test;

$m_1$ is the mass, in g, of the particles retained on the sieve of aperture size 600 µm; and

$m_2$ is the mass, in g, of the particles passed through the sieve of aperture size 150 µm.

# APPENDIX D
# DETERMINATION OF LOSS OF MASS ON HEATING

## D.1 APPARATUS

**D.1.1** Weighing bottle of capacity approximately 100 ml and diameter approximately 75 mm, with ground glass stopper.

**D.1.2** Electric oven capable of reaching a temperature of 250 °C and capable of being regulated so as not to exceed a temperature of 270 °C.

## D.2 PROCEDURE

Dry the weighing bottle **(D.1.1)** for 30 minutes in the oven. Allow to cool to room temperature in a desiccator and weigh to the nearest 0.1 mg. Place about 5 g of the sample, weigh to the nearest 0.1 mg, in the weighing bottle. Keep the weighing bottle in the oven (see **Note 1**) with the ground glass stopper of the weighing bottle placed slantwise, together with a watch glass of diameter slightly greater than that of the weighing bottle. Increase the temperature gradually to 250 °C and maintain this temperature for 3 hours (see **Note 2**).

Replace the stopper by the watch glass and place the weighing bottle and watch glass in a desiccator. After cooling to room temperature, insert the stopper in the weighing bottle and weigh to the nearest 0.1 mg.

**NOTES**
*1. The starting temperature of the oven should not exceed 100 °C.*
*2. The temperature of the oven should not exceed* 270 °C.

## D.3 CALCULATION

$$\text{Loss of mass on heating, per cent by mass} = \frac{m_1 - m_2}{m_0} \times 100$$

where,

$m_0$ is the mass, in g, of the sample taken for the test;
$m_1$ is the mass, in g, of the sample and weighing bottle before heating; and
$m_2$ is the mass, in g, of the sample and weighing bottle after heating.

## APPENDIX E
## PREPARATION OF THE DRIED SAMPLE

## E.1 PROCEDURE

Dry about 500 g of the sample at 250 ºC at 3 hours in an electric oven and dried sample keeps in a desiccator for subsequent analysis (Appendices **F** to **L**)

## APPENDIX F
## DETERMINATION OF TOTAL SOLUBLE ALKALI CONTENT

## F.1 REAGENTS

**F.1.1** Methyl orange,0.5 g/1 solution.

**F.1.2** Hydrochloric acid, standard volumetric solution, C(HCl) = 1 mol/1.

## F.2 APPARATUS

**F.2.1** Beaker**,** of 600 ml capacity.

**F.2.2** Volumetric flask, of 500 ml capacity.

**F.2.3** Conical flask**,** of 500 ml capacity.

## F.3 PROCEDURE

Weigh, to the nearest 0.01 g, about 50 g of the dried sample (see Appendix **E**). Dissolve it by addition of small quantities at a time, while stirring into the 600 ml beaker containing 200 ml of water at about 50 °C. Filter the decanted solution through a medium speed filter, collecting the filtrate in the 500-ml volumetric flask. Wash the insoluble matter with water at about 50 °C, collecting all the washings in the volumetric flask, Allow to cool, dilute to the mark and mix. Pipette 25 ml of this solution to the conical flask. Add approximately 75 ml of water, 5 drops of the methyl orange solution and titrate with the Hydrochloric acid solution until the indicator turns from yellow to orange pink.

## F.4 CALCULATION

$$\text{Total soluble alkali content, as } Na_2CO_3\text{, on dry basis, per cent by mass} = \frac{M \times V \times 500 \times 100 \times 0.0530}{25 \times m}$$

where,

V is the volume, in ml, of the hydrochloric acid solution **(F.1.2)** used for the titration;
m is the mass, in g, of the dried sample taken for the test; and
M is the morlarity of the HCl used to titration.

# APPENDIX G
# DETERMINATION OF MATTER INSOLUBLE IN WATER

## G.1 REAGENT

Phenolphthalein , 10 g/l solution, Dissolve 1g of phenolphthalein in 85 per cent (V/V) ethanol and dilute to 100 ml with the same ethanol.

## G.2 APPARATUS

**G.2.1** Glass filter crucible with sintered disk of pore size between 5 µm and 15 µm

**G.2.3** Electric oven capable of being controlled at 110 ±5 °C.

### G.3 PROCEDURE

Weigh, to the nearest 0.01 g, about 50 g of the dried sample (see Appendix **E**). Dissolve it by addition of small quantities at a time, while stirring into a beaker containing 200 ml of water at about 50 °C. Place the crucible **(G.2.1)** in the oven **(G.2.2)** controlled at 110 ± 5 °C. After drying for 1 hour, allow to cool in a desiccator to room temperature and weigh to the nearest 0.01 g. Filter the decanted solution through the tarred filter crucible maintaining a reduced pressure by means of a filter pump or a vacuum pump. Wash the insoluble matter with water at about 50 °C until 20 ml of the filtrate show no colour on addition of 2 drops of the phenolphthalein **(G.1).** Place the filter crucible containing the insoluble matter in the oven controlled at 110 ± 5 °C and leave to dry for 1 hour. Cool in a desiccator to the room temperature and weigh to the nearest 0.01 g. Repeat drying, cooling and weighing procedures until the difference in mass between two successive weightings does not exceed 0.001 g.

### G.4 CALCULATION

Matter insoluble in water, on dry basis, per cent by mass

$$= \frac{m_1}{m_o} \times 100$$

where,

$m_o$ is the mass, in g, of the dried sample taken for the test; and
$m_1$ is the mass, in g, of the dried insoluble matter.

## APPENDIX H
## DETERMINATION OF SULFATE

### H.1 REAGENTS

**H.1.1** Hydrochloric acid**,** concentrated, relative density =1.18

**H.1.2** Barium chloride, 100 g/1 solution

### H.2 APPARATUS

Glass filter crucible sintered disk of pore size between 5 μm and 15 μm.

### H.3 PROCEDURE

Weigh, to the nearest 0.001 g, about 10 g of the dried sample (see Appendix **E**). Dissolve it in 100 ml of water and add Hydrochloric acid to make the solution slightly acidic. Boil well to decompose the Carbonates. Cool, filter through a folded filter paper and wash the filter paper thoroughly, collecting the filtrate and washings in a 500 ml beaker. Dilute the combined filtrate and washings to about 250 ml, boil and add 10 ml of hot barium chloride solution **(H.1.2)** to the boiling solution. Boil again for 2 minutes, stand for 4 hours and filter through the tarred filter crucible **(H.2).** Wash the precipitate until free from chlorides.

Dry at 105 ± 2 °C and weigh. Repeat drying and weighing procedures until the difference in mass, between two successive weightings does not exceed 5 mg.

## H.4 CALCULATION

Sulfate content ( as $Na_2S0_4$) mg/kg =

$$\frac{m_1}{m_o} \text{ x } 0.6086 \text{ x}100\text{x}10^5$$

where,

$m_o$ is the mass, in g, of the dried sample taken for the test; and
$m_1$ is the mass, in g, of the precipitate.

## APPENDIX J
## DETERMINATION OF CHLORIDE

## J.1 REAGENTS

**J.1.1** Nitric acid , concentrated, relative density = 1.42.

**J.1.2** Silver nitrate, 0.1 mol/1, standard solution.

**J. 1.3** Nitrobenzene

**J.1.4** Ammonium thiocyanate, standard volumetric solution, C($NH_4CNS$) = 0.1 mo1/1.

**J.1.5** Ferric ammonium sulfate indicator**,** saturated solution.

## J.2 PROCEDURE

Weigh, to the nearest 0.01 g, about 2 g of the dried sample (see Appendix **E**) and transfer to a conical flask. Neutralize to litmus paper with Nitric acid **(J.1.1)** and add 5 ml of the acid in excess. Add 20 ml of standard Silver nitrate **(J.1.2)**. Add 3 ml of nitrobenzene **(J.1.3)** and shake vigorously. Titrate with standard Ammonium thiocyanate solution **(J.1.4)** using Ferric ammonium sulfate **(J.1.5)** as the indicator.

## J.3 CALCULATION

Chloride content, as NaCl, on dry basis, per cent by mass =

$$\frac{5.845\ (20\ C_1 - C_2\ V)}{m}$$

where,

$C_1$ is the concentration, in mol/I, of silver nit rate solution **(J.1.2)**;
$C_2$ is the concentration,. in mol/1, of the ammonium thiocyanate solution **(J.1.4)**;
$V$ is the volume, in ml, of the ammonium thiocyanate solution used; and
$m$ is the mass, in g, of the dried sample taken for the test.

# APPENDIX K
# DETERMINATION OF IRON

## K.1 APPARATUS

**K.1.1** Photometer**,** spectrophotometer or photoelectric absorption meter fitted with filters providing a maximum transmission at a wavelength of about 510 nm.

**K.1.2** Optical cells, having 5 cm optical path length.

**NOTE**

*Cells of other dimensions may be used providing suitable adjustments to the amounts of samples and reagents used.*

## K.2 REAGENTS AND MATERIALS

**K.2.1** Iron, standard stock solution corresponding to 0.1 g of iron per litre.
Dissolve 0.7022 g of iron (*11*) ammonium sulfate hexahydrate ($FeS0_4$. $(NH_4)_2S0_4.6H_2O$) in 500 ml of water containing 20 ml of concentrated sulfuric acid (relative density = 1.84), in a 1000 ml volumetric flask . Dilute to the mark and mix.

**K. 2.1.1** Iron, standard working solution corresponding to 0.01 mg of iron per milliliter.
Dilute 100 ml of the stock solution **(K.2.1)** to 1000 ml in a volumetric flask and mix. Prepare this solution immediately before use.

**K.2.2** Hydroxylamine hydrochloride, 100 g/1 solution.

**K.2.3** Ammonium hydroxide, 50 per cent (V/V) solution prepared by using concentrated ammonium hydroxide (relative density = 0.90).

**K.2.4** Congo red indicator paper

**K.2.5** Ammonium acetate - acetic acid buffer solution

Dissolve 100 g of ammonium acetate in about 600 ml of water and filter. Add 200 ml of glacial acetic acid to the filtrate and dilute to 1 litre.

**K.2.6** 1, 10 Phenanthroline, 3 g/l solution .

**K.2.7** Hydrochloric acid**,** concentrated, relative density = 1.19.

**K.2.8** Nitric acid, concentrated, relative density =1.42.

## K.3 PROCEDURE

### K.3.1 Preparation of the calibration curve

**K.3.1.1** *Calibration solutions*

Transfer 0.5 ml, 1.0 ml, 2.0 ml, 3.0 ml and 5.0 ml of the iron working solution **(K.2.1.1)** into a series of 100 ml volumetric flasks. Dilute each flask to about 50 ml with water. Proceed in accordance with **K.3.1.3**.

**K.3.1.2** *Reference solution*

Transfer 50 ml of water to 100 ml volumetric flask and proceed in accordance with **K.3.1.3.**

**K.3.1.3** *Colour development*

To each flask add 5 ml of hydroxylamine hydrochloride solution **(K.2.2)**, ammonium hydroxide solution **(K.2.3)** in order, with mixing after each addition as required to make the solution just alkaline to congo red paper **(K.2.4)** used as an external indicator, 5 ml of the acetate buffer solution **(K.2.5)** and 5 ml of the phenanthroline solution **(K.2.6).** Dilute to volume with water and mix thoroughly. Allow to stand for 15 minutes for complete colour development.

**K.3.1.4** *Photometric measurement*

Carry out the photometric measurements either with a spectrophotometer at a wavelength of about 510 nm or with the photoelectric absorptiometer fitted with suitable filters **(K.1.1)**, after having adjusted the instrument to zero absorbance against the reference solution **(K.3.1.2).**

**K.3.1.5** *Calibration curve*

Plot absorbances of the calibration solutions against milligrams of iron per 100 ml of solution.

### K.3.2 Determination

**K.3.2.1** *Preparation of the test solution*

Weigh, to the nearest 0.01 g, about 50 g of the dried sample (see Appendix **E**) and transfer to a 600 ml beaker. Add 100 ml of water and stir to dissolve. Acidify with concentrated hydrochloric acid **(K.2.7)** in increments until 100 ml have been added. Cover with a watch glass and boil for 1 minute. Remove from the heat and examine the bottom of the beaker for the presence of insoluble particles. If present, decant the clear solution to a 500 ml volumetric flask. To the residue in the beaker add 5 ml of hydrochloric acid **(K.2.7)** and 2 ml of nitric acid **(K.2.8),** heat to boiling in a fume cupboard and evaporate nearly to dryness. Cool and transfer the residual solution to the 500 ml volumetric flask, carefully rinsing the beaker. Cool the solution in the flask and make up to the mark with water and mix thoroughly. Pipette an aliquot containing 0.005 mg to 0.05 mg of iron into a 100 ml volumetric flask.

### **K.3.2.2** *Reference solution*

Transfer 50 ml of water to a 100 ml volumetric flask and add 1 ml of hydrochloric acid.

### **K.3.2.3** *Colour development*

Develop the colour of the test solution **(K.3.2.1)** and the reference solution **(K.3.2.2)** as prescribed in **K.3.1.3.**

### **K.3.2.4** *Photometric measurement*

Carry out the photometric measurements of the test solution and the reference solution **(K.3.2.2)** as prescribed in **K.3.1.4**.

## K.4 CALCULATION

Convert the photometric measurements of the test solution and the reference solution, to milligrams of iron by means of the calibration curve.

$$\text{Iron, as mg/kg} = \frac{m_1 - m_2}{m_o} \times 1000$$

where,

$m_o$ is the mass, in g, of the sample represented in the aliquot taken;
$m_1$ is the mass, in mg, of iron found in 100 ml of final solution; and
$m_2$ is the mass, in mg, of iron found in 100 ml of reference solution **(K.3.2.2).**

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