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(பெனயீபிலை ஒபி ඇත. திருத்தத்திற்குட்படக்கூடியது. Liable to alteration)

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2025-05-30

econd பிப்பது ஏரியான ஹேல் அபிப்பிராயங்களை தெவிப்பதற்கான இறுதித்திகதி Latest Date for Receipt of Comments

2025-07-30



Draft Sri Lanka Standard SPECIFICATION FOR SODIUM HYPOCHLORITE FOR DOMESTIC AND INDUSTRIAL USE (DSLS :)

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(ශීලංපු :)

මෙම කෙටුම්පත ශී ලංකා පුම්තියක් ලෙස තොසැලකිය යුතු මෙන් ම භාවිතා නොකළ යුතු ද වේ. இவ்வரைவு இலங்கைக் கட்டளையெனக் கருதப்படவோ அன்றிப் பிரயோகிக்கப்படவோ கூடாது This draft should not be regarded or used as a Sri Lanka Standard.

අදහස් එචිය යුත්තේ : ශුී ලංකා පුමිති ආයතනය, 17, චික්ටෝරියා පෙදෙස, ඇල්ව්ටිගල මාචත, කොළඹ 08.

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

හැඳින්වීම

මෙම ශ්‍රී ලංකා පුමති කෙටුම්පත , ශ්‍රී ලංකා පුමිති ආයතනය විසින් සකසන ලදුව, සියලුම උදොග්ගී අංශ වලට තාකෘණික විවේචනය සඳහා යවතු ලැබේ.

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

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ධෝකෂ ජනරාල් ශ්‍රී ලංකා පුමිති ආයතනය, 17, වික්ටෝරියා පෙදෙස, ඇල්ඩ්ටිගල මාවත, කොළඹ 08.

Introduction

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 SODIUM HYPOCHLORITE FOR DOMESTIC AND **INDUSTRIAL USE**

st Colombo 08 Sri Lanka

Draft Sri Lanka Standard SPECIFICATION FOR SODIUM HYPOCHLORITE FOR DOMESTIC AND INDUSTRIAL USE

FOREWORD

This Sri Lanka Standard was approved by the Sectoral Committee on Chemical and Polymer Technology and was authorized for adoption and publication as a Sri Lanka Standard by the Council of Sri Lanka Standards Institution on

Sodium hypochlorite is a chemical compound, and it is commonly known as liquid bleach, soda bleach or Sodium oxychloride. The product is supplied as an aqueous solution.

Sodium hypochlorite solution is used in textile and paper bleaching, laundry trade, sterilization of swimming pools, treatment of Cyanide wastes of electroplating industry and treatment of sewage effluent. It is also used as a sanitizer and deodorizer for floors, sinks and toilets, as a therapeutic adjunct in the treatment of certain skin diseases and as a safe antiseptic.

Commercial Sodium hypochlorite solution prepared by chemical process usually contains 10 to 15 per cent of available Chlorine at ambient temperature. The stability of Sodium hypochlorite solution is greatly affected by heat, light, pH and presence of heavy metals (which may be present in caustic soda). The optimum stability is attained at a pH close to 11. Storage temperature should not exceed 32 °C, above which the rate of decomposition becomes too high, and the available Chlorine content is rapidly depleted. At temperatures above 38 °C, Sodium chlorate formation becomes appreciable resulting in loss of Sodium hypochlorite.

All standard values given in this Specification are in SI units.

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 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.

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

IS 11673 : Part 1: 2019	Sodium hypochlorite solution- Specification Part 1 Household
$\mathbf{O}^{\mathbf{Y}}$	and industrial use (Second Revision)
VC FAC 205 . 2021	Sodium humashlarita solutions for domestic and industrial use

KS EAS 295 : 2021 Sodium hypochlorite solutions for domestic and industrial use-Specification

1 SCOPE

1.1 This Specification prescribes the requirements and methods of sampling and tests for Sodium hypochlorite solution intended for domestic and industrial use.

1.2 This Specification does not cover Sodium hypochlorite solution used for treatment of water intended for human consumption.

2 **REFERENCES**

- **ISO 8288** Water quality- Determination of Cobolt, Nickel, Copper, Zinc, Cadmium and Lead- Flame atomic absorption spectrometric methods
- **SLS** 102 Rules for rounding off numerical values
- **SLS 428** Random sampling methods

3 DEFINITION

3.1 available Chlorine: The measure of the oxidizing power of chlorine present as hypochlorite.

4 **GRADES**

Sodium hydroxide covered under this Specification shall be of the following grades:

- a) Domestic use; and
- b) Industrial use.

5 **REQUIREMENTS**

5.1 General requirements

5.1.1 Sodium hypochlorite solution shall be a pale yellowish green, clear liquid with a faint chlorinous odour and shall not produce any sediment or turbidity when mixed with water.

5.1.2 Industrial grade Sodium hypochlorite solution shall comply with the available chlorine content as given in Table 1 within the period of 30 days from the date of packing. Beyond this period (more than 30 days), the available chlorine content shall be as agreed to between the purchaser and the supplier. Domestic grade sodium hypochlorite solution shall comply with the available chlorine content as given in Table 1 throughout its stated shelf life.

5.2 Other requirements

Sodium hypochlorite solution shall also conform to the requirements given in Table 1 when tested in accordance with the relevant methods given in Column (5) of the table.

	1			1
No.	Characteristic	Requirement		Method of test
(1)	(2)	Domestic (3)	Industrial (4)	(5)
i)	Available Chlorine (as Cl ₂), per cent, mass by volume	4.0 to 6.0	12.5 to 15.0	Appendix B
ii)	pH at (27±2) °C, min.	12	12	Appendix C
iii)	Free alkali (as NaOH), g/ L, min.	1.0	5.0	Appendix D
iv)	Free Sodium carbonate (as Na ₂ CO ₃), g/ L, max.	0.5	0.5	Appendix E
v)	Iron (as Fe), mg/ kg, max.	0.4	2.0	Appendix F
vi)	Sodium chlorate (as NaClO ₃), g/ L, max.	0.2	3.0	Appendix G
vii)	Cadmium (as Cd) mg/L, max.	2.5	2.5	Appendix H
viii)	Lead (as Pb) mg/L, max.	10	10	Appendix H
ix)	Chromium (as Cr). mg/L, max.	2.5	2.5	Appendix H
x)	Arsenic (as As) mg/L, max.	1	1	Appendix H
xi)	Mercury (as Hg) mg/L, max.	1	1	Appendix \mathbf{J}

TABLE 1- Requirements for Sodium hypochlorite solution

6 PACKAGING

The material shall be packed in air-tight plastic containers or as agreed between the purchaser and the supplier. The containers shall be capable of withstanding normal handling and transportation and shall prevent leakage and contamination of the product. Products manufactured for domestic consumption shall be packed in opaque bottles. The containers used shall be dry and free from grease, dirt or other foreign matter that could cause the material to decompose. Spray bottles shall not be permitted for packaging.

7 MARKING

Each package shall be marked legibly and indelibly with the following information:

- a) Name and grade of the product;
- b) The manufacturer's and supplier's or distributor's name and address including country of origin;
- c) Registered trade mark, if any;
- d) Date of manufacture and best before;
- e) Available Chlorine content;
- f) Net content, in kilograms (kg) or litres (L);
- g) Batch or code number;
- h) Instructions for use;
- j) Statement to include "NOT SUITABLE FOR TREATMENT OF WATER INTENDED FOR HUMAN CONSUMPTION".
- k) Storage instructions with words ("store in a cool and dark place" and "keep away from direct sunlight and heat)";
- m) Warning statement as 'avoid contact with eyes and skin'; and
- n) Any other warning statements relevant to safety

8 METHODS OF TEST

8.1 Tests shall be carried out as prescribed in Appendices **B** to **J** of this Specification.

8.2 During the analysis, unless otherwise stated, use only reagents of analytical grade and distilled water. For metal analysis, deionized water shall be used.

9 SAMPLING

Representative samples of the product for ascertaining conformity to the requirements of this Specification shall be drawn as prescribed in Appendix A.

APPENDIX A COMPLIANCE OF A LOT

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

Where compliance with this Specification 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

A.1.1 All the packages and containers containing material belonging to a single batch of manufacture or supply and having the same grade and size shall constitute a lot.

A.2 GENERAL REQUIREMENTS OF SAMPLING

In drawing, handling, and preparing samples, the following precautions shall be observed.

A.2.1 Sampling shall be carried out by a trained and experienced person as it is essential that the sample should be representative of the lot to be examined.

A.2.2 The sampling equipment/s shall be clean and dry when used.

A.2.3 The samples shall not be taken from broken or opened packages.

A.2.4 The samples shall be placed in clean, dry and air-tight glass or suitable containers while drawing and handling the samples.

A.2.5 The samples shall be drawn from a protected place not exposed to air, light or heat.

A.2.6 The sample containers shall be air-tight after filling and marked with necessary details of sampling.

A.2.7 The sample containers shall be need to be filled only up to 80% of the full volume leaving provision for gas exchange.

A.2.8 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contamination.

A.3 SAMPLING EQUIPMENTS

A.3.1 Sampling tube, liquid sampler or other effective liquid sampling device shall be used for sampling liquids in drums and cans. Sampling equipment shall be made of either stainless steel or other suitable material.

A.3.2 The appropriate equipment shall be designed so that it will reach to within about 3 mm of the bottom of the container and have a capacity of approximately 0.5 litre or 1.0 litre.

A.4 SCALE OF SAMPLING

A.4.1 The samples shall be inspected and tested from each lot for ascertaining conformity of the lot to the requirements of this Specification.

A.4.2 The number of packages to be selected as the sample from a lot shall be in accordance with Table 2.

TIDLE 2 Seale of Sumpling					
Number of packages	Number of packages to be				
in the lot	selected				
(1)	(2)				
Up to 150	3				
151 to 1 200	5				
1 201 to 35 000	8				
35 001 and Above	13				

TABLE 2 – Scale of sampling

NOTE

Minimum total sample volume shall be 1 000 mL.

A.4.3 The packages shall be selected at random. In order to ensure randomness of selection, random number tables as given in SLS 428 shall be used.

A.4.4 The sample obtained from each package shall be thoroughly mixed to make the composite sample and reduced to obtain a test sample.

A.5 NUMBER OF TESTS

A.5.1 Each package selected as in A.4.2 shall be examined for packaging and marking requirements specified in Clause 6 and 7. This shall be done at the place of sampling.

A.5.2 Composite sample prepared as in A.4.4 shall be tested for the requirements given in Clause 5.2 of this Specification.

A.6 CRITERIA FOR CONFORMITY

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

A.6.1 Each package examined as in A.5.1 shall satisfy the packaging and marking requirements.

A.6.2 The test results on the composite sample tested as in A.5.2 shall satisfy the relevant requirements.

APPENDIX B DETERMINATION OF AVAILABLE CHLORINE CONTENT

B.1 PRINCIPLE

The sample is added to an acidified solution of Potassium iodide and the liberated iodine is titrated with standard Sodium thiosulphate solution to the usual starch end point.

B.2 REAGENTS

B.2.1 Glacial Acetic acid

B.2.2 Standard Potassium iodate solution, 0.1 M

B.2.3 Starch indicator solution, 0.5 per cent

Mix 0.5 g of soluble starch with 5 mL of cold water and add 95 mL of boiling water. Mix, cool and store in a glass bottle. Replace frequently or add 0.1 per cent Salicylic acid to the starch solution to minimize deterioration.

B.2.4 Potassium iodide, iodate-free

B.2.5 Standard Sodium thiosulphate solution, 0.1 M

Dissolve approximately 25 g of Sodium thiosulphate ($Na_2S_2O_3.5H_2O$) crystals in freshly boiled and cooled water, and dilute to 1 000 mL.

NOTE

The solution is more stable if the glassware is cleaned with Sulphuric acid and thoroughly rinsed with water.

B.2.5.1 Standardization of Sodium thiosulphate solution

Weigh accurately 21.4 g of dry Potassium iodate (KIO₃) and transfer to a 1 000 mL volumetric flask. Dissolve in water, mix thoroughly and make up to the mark. This solution will be exactly 0.1 M. To standardize the Sodium thiosulphate solution, carefully pipette out a 50 mL aliquot of the Potassium iodate solution into a 250-mL stoppered conical flask and dilute to 100 mL with water. Add 1 g of Potassium iodide crystals. When it is dissolved, add 15 mL of 0.1 M Hydrochloric acid and titrate immediately with the Sodium thiosulphate solution. When the solution becomes pale yellow colour, add 1 mL of starch indicator solution and complete the titration to the disappearance of the blue colour. Standardize at least monthly. Calculate the molarity of the Sodium thiosulphate solution as follows:

$$Molarity = \underbrace{6 \times 50 \times 0.1}_{A}$$

where,

A is the volume, in milliliters, of standard Sodium thiosulphate solution required for titration.

B.3 PROCEDURE

B.3.1 Preparation of sample solution

B.3.1.1 Strong solutions of Sodium hypochlorite sample shall be accurately diluted with distilled water and aliquots taken for determination of available Chlorine, free Sodium carbonate and Sodium chlorate. The size of aliquots shall be such that approximately 40 mL of the 0.1 M reagent (**B.2.5**) is required.

B.3.1.2 Dissolve 2 to 3 g of Potassium iodide crystals in 50 mL of water in a 250 mL stoppered conical flask. Add 10 mL of glacial Acetic acid, then pipette out the aliquot of sample into the solution, keeping the tip of the pipette beneath the surface of the solution until drained. Titrate at once with 0.1 M standard Sodium thiosulphate solution until the iodine colour becomes pale yellow, then add 1 mL of starch indicator solution and complete the titration to the disappearance of the blue colour.

B.4 CALCULATION

B.4.1 Available Chlorine (as Cl₂), per cent by volume = $(V_1 \times M \times 0.03546) \times 100$ V_2

where,

 V_1 is the volume, in milliliters, of standard Sodium thiosulphate solution required for titration of the sample;

M is the molarity, of the standard Sodium thiosulphate solution; and

 V_2 is the volume, in milliliters, of original sample in aliquot used.

APPENDIX C DETERMINATION OF pH

C.1 **PROCEDURE**

Weigh 2.0 ± 0.1 g of the liquid material of Sodium hypochlorite and dissolve in 100 mL of freshly boiled and cooled distilled water. Measure the pH of the solution at (27 ± 2) °C by a suitable pH meter, using a glass electrode.

APPENDIX D DETERMINATION OF FREE ALKALI

D.1 PRINCIPLE

The sample is added to a neutralized, mixed solution of Barium chloride and Hydrogen peroxide, which precipitates any Carbonate and reduces the Hypochlorite to Chloride. The free alkali is then titrated with standard Hydrochloric acid using Phenolphthalein indicator.

D.2 REAGENTS

D.2.1 Barium chloride solution, 10 per cent (m/v)

Dissolve 100 g of Barium chloride (BaCl₂.2H₂O) in water and dilute to 1 000 mL. Filter, quantitatively through whatman No. 41 filter paper (or equivalent) if the solution is turbid.

D.2.2 Standard Hydrochloric acid, 0.1 M

D.2.3 Hydrogen peroxide solution, 3 per cent (v/v)

D.2.4 Phenolphthalein indicator solution, 0.5 per cent (m/ v)

Dissolve 0.5 g of phenolphthalein in 60 mL of 95 per cent Ethyl alcohol and dilute to 100 mL with water.

D.2.5 Sodium hydroxide solution, 0.4 per cent (m/v)

D.3 PROCEDURE

Place 50 mL of Barium chloride solution and 30 mL of Hydrogen peroxide solution in a 250 mL conical flask, add 10 drops of Phenolphthalein indicator solution and neutralize with Sodium hydroxide solution. Introduce into this neutral mixture 10 mL of the liquid sample solution

(see **B.3.11**), shake or stir vigorously for 1 min, and titrate solution with 0.1 M Hydrochloric acid until the pink colour disappears.

D.4 CALCULATION

Free alkali as (NaOH), g/ L = $V_1 \times M \times 40$ V₂

where,

- V_1 is the volume, in milliliters, of standard Hydrochloric acid solution required for titration of sample;
- *M* is the molarity, of standard Hydrochloric acid; and
- V_2 is the volume, in milliliters, of original sample solution in aliquot used.

APPENDIX E DETERMINATION OF FREE SODIUM CARBONATE

E.1 PRINCIPLE

For determining free Sodium carbonate, total alkalinity, free Sodium hydroxide and Sodium bicarbonate are required. Finally, free Sodium carbonate is estimated from the data obtained.

E.2 TOTAL ALKALINITY (AS SODIUM MONOXIDE)

E.2.1 Reagents

E.2.1.1 Standard Hydrochloric acid, 0.1 M

E.2.1.2 *Hydrogen peroxide solution*, 10 per cent (v/ v)

E.2.1.3 Standard Sodium hydroxide solution, 0.1 M

E.2.1.4 *Mixed indicator*, Mixture of 3 parts of 2 per cent of Methyl red in alcohol and 1 part of 0.1 per cent of Bromocresol green in alcohol.

E.2.2 Procedure

Use a volume of sample solution (see **B.3.1.1**) to require at least 10 mL of 0.1 M standard Hydrochloric acid for titration. Add the sample to three times its volume of Hydrogen peroxide solution, previously neutralized with 0.1 M Sodium hydroxide solution, using methyl red-

bromocresol green mixed indicator solution. Add a few drops more of the indicator solution and titrate to the end point with 0.1 M Hydrochloric acid.

E.2.3 Calculation

Total alkalinity (as Sodium monoxide), g/ L = $V_1 \times M \times 31$ V_2

where,

- V_1 is the volume, in milliliters, of standard Hydrochloric acid;
- *M* is the molarity of Hydrochloric acid; and
- V_2 is the volume, in milliliters, of original sample solution aliquot used.

E.3 FREE SODIUM HYDROXIDE

E.3.1 Reagents

E.3.1.1 *Dilute Barium chloride solution*, 10 per cent (m/v)

E.3.1.2 Hydrogen peroxide solution, 10 per cent (v/

E.3.2 Apparatus

E.3.2.1 *pH Meter*

E.3.3 Procedure

Place 50 mL of Barium chloride solution and 30 mL of Hydrogen peroxide solution in a 250 mL beaker and, using a pH meter, titrate the solution with 0.1 M Sodium hydroxide to bring the pH to 7.5. Introduce into this solution 10 mL of the sample solution (see **B.3.1.1**), stir vigorously for 1 min, and titrate with 0.1 M Hydrochloric acid to a pH of 7.5 with continuous stirring.

E.3.4 Calculation

Sodium hydroxide (as NaOH), g/ L = $V_1 \times M \times 40$

 V_2

where,

- V_1 is the volume, in milliliters, of standard Hydrochloric acid consumed in titration;
- *M* is the molarity of Hydrochloric acid; and
- V_2 is the volume, in milliliters, of original sample solution aliquot used.

E.4 SODIUM BICARBONATE

If free Sodium hydroxide is not found, Sodium bicarbonate may be present and can be determined as follows.

E.4.1 Pipette out volume of 0.1 M Sodium hydroxide solution equal to the volume of 0.1 M Hydrochloric acid required for the determination of total alkalinity (see **E.2.2** and **E.3.3**), in a 250 mL conical flask and add the same volume of sample solution as used for determination of total alkalinity (see **E.2.2**). In a 250-mL beaker, place 50 mL of Barium chloride solution, 30 mL of Hydrogen peroxide, and 10 drops of Phenolphthalein indicator solution, neutralize with 0.1 M Sodium hydroxide solution. Add this neutralized solution to the prepared sample solution and shake vigorously for 1 min. Titrate the excess Sodium hydroxide with 0.1 M Hydrochloric acid to the disappearance of the pink colour.

E.4.2 CALCULATION

Sodium bicarbonate (as NaHCO₃) g/l = $(V_1M_1 - V_2M_2) \times 84$

where,

- V_1 is the volume, in milliliters, of Sodium hydroxide solution;
- M_1 is the molarity of Sodium hydroxide solution;
- V_2 is the volume, in milliliters, of Hydrochloric acid consumed in titration;
- M_2 is the molarity of Hydrochloric acid; and
- V_3 is the volume, in milliliters, of original sample solution aliquot used.

E.5 FREE SODIUM CARBONATE

E.5.1 If Sodium hydroxide is present, calculate free Sodium carbonate as follows: Free Sodium carbonate = [Total alkalinity - 0.775 (Sodium hydroxide)] \times 1.709 (as Na₂CO₃), g/L

E.5.2 If Sodium bicarbonate is present, calculate free Sodium carbonate as follows:

Free Sodium carbonate = [Total alkalinity - 0.369 (Sodium bicarbonate)] \times 1.709 (as Na₂CO₃), g/ L

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APPENDIX F DETERMINATION OF IRON

Two methods have been prescribed for the determination of Iron. The method prescribed in **F.2** shall be the reference method and shall be carried out in case of any dispute.

F.1 METHOD 1

F.1.1 APPARATUS

F.1.1.1 Nessler Cylinders, 50 mL capacity

F.1.2 REAGENTS

F.1.2.1 Ammonium persulphate

F.1.2.2 Butanolic potassium thiocyanate solution

Dissolve 10 g of Potassium thiocyanate in 10 mL of water. Add sufficient n- butanol to make up to 100 mL and shake vigorously till the solution is clear.

F.1.2.3 Standard Iron solution A

Dissolve 0.7022 g of Ferrous ammonium sulphate $[(NH_4)_2Fe(SO_4)_2.6H_2O]$ in 100 mL of water, add 5 mL of 1:5 (v/ v) Sulphuric acid and add dilute solution of Potassium permanganate (0.2 per cent, m/ v) drop wise until a slight pink coloration remains after stirring. Dilute with water to 1 000 mL and mix thoroughly. One millilitre of this solution contains 0.1 mg of iron as Fe.

F.1.2.4 Standard Iron solution B

Take 100 mL of the standard Iron solution A (see **F.1.2.3**) and dilute to 1 000 mL with water in a 1 000 mL volumetric flask. This dilute solution should be prepared fresh. One millilitre of this solution contains 0.01 mg of Iron (as Fe).

F.1.3 PROCEDURE

F.1.3.1 For grade 1

Weigh 50.0 g of the material in a silica dish (capacity, 200 mL) and evaporate it almost to dryness over water bath. Dissolve the dry mass in 30 mL water, transfer quantitatively in a nessler cylinder of 50 mL capacity, add about 30 mg of Ammonium persulphate and 15 mL of Butanolic potassium thiocyanate solution. Make up to 50 mL, shake vigorously for about 30 s and allow the layers to separate. Carry out a control test in another Nessler cylinder using 2 mL of standard Iron solution B (see **F.1.2.4**). Compare the intensity of the colour produced in the Butanol layers in the two cylinders.

F.1.3.2 For grade 2

The limit prescribed in Table 1 shall be taken as not having been exceeded if the intensity of colour produced with the material is not greater than that produced in the control test. Carry out the test as given for grade 1 in **F.1.3.1**, using 5 mL of the standard iron solution B (see **F.1.2.4**) for the control test.

F.2 METHOD 2

Atomic Absorption Spectroscopy (AAS) methodology or Inductively Coupled Plasma Mass Spectrometry (ICP-MS) or Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES) shall be used for the determination of iron.

APPENDIX G DETERMINATION OF SODIUM CHLORATE

G.1 PRINCIPLE

Sodium chlorate is reduced with Sodium bromide in 8 M Hydrochloric acid. After dilution and addition of Potassium iodide, the released Iodine (equivalent to the Hypochlorite plus chlorate) is titrated with standard Sodium thiosulphate solution and starch indicator.

G.2 APPARATUS

The apparatus (see Figure 1) consists of 1 000 mL wide-mouthed reaction bottle (A), fitted with a double hole rubber stopper carrying a separating funnel B, conveniently graduated or marked at the 10, 20 and 100 mL levels, and a delivery tube leading to a 50 mL test tube gas trap C, which is fitted with rubber tubing and a glass mouth piece, D.

G.3 REAGENTS

G.3.1 Concentrated Hydrochloric acid

G.3.2 Sodium bromide solution, 10 per cent (m/v)

G.3.3 Potassium Iodide solution, 10 per cent (m/v)

Prepare a 10 per cent solution of Potassium iodide (KI). Decolourize with $Na_2S_2O_3$, when necessary.

G.3.4 Standard Sodium thiosulphate solution, 0.1 M (see B.2.5)

G.3.5 Starch indicator solution, 0.5 per cent (m/v)

G.4 PROCEDURE

G.4.1 Pipette an aliquot of the sample [same amount as used for available chlorine determination (see **B.3.1.1**)] into the reaction vessel. Assemble the apparatus and put 25 mL of Potassium iodide solution in the gas trap. Close the funnel stopcock. Pour 20 mL of Sodium bromide solution into the funnel. Open the stopcock, and with gentle suction on the mouthpiece, draw the Sodium bromide solution into the sample. Close the stopcock and pour 100 mL of Hydrochloric acid into the funnel. Open the stopcock and allow the acid to drain into the sample. Draw in the last drops with the suction. Close the stopcock. Swirl the vessel to mix the acid, and let stand exactly for 5 min (use time clock). There will be a tendency for a vacuum to form and draw Potassium iodide solution from the trap back into the sample. This must be avoided by filling the funnel with water and relieving the vacuum by opening the stopcock and adding a small amount of water.

G.4.2 After 5 min open the stopcock and allow the water to drain into the sample swirling to dilute the acid. Add water through the funnel sufficient to dilute the sample to about 700 mL. Close the stopcock, and add 10 mL of Potassium iodide solution to the funnel. Apply pressure at the mouthpiece to blow the contents of the trap back into the vessel, opening the stopcock to allow the necessary amount of gas to escape through the funnel. Rinse the trap twice with water each time blowing the contents into the vessel as above. Finally allow the contents of the funnel to drain into the vessel. Rinse down the funnel and stopper and thoroughly mix the contents of the vessel. Titrate at once with 0.1 M Sodium thiosulphate solution till the colour of the solution becomes pale yellow, add 5 mL of starch indicator solution and complete the titration to the disappearance of the blue colour.

G.5 CALCULATION

Sodium chlorate (NaClO₃), $g/1 = (V_2 - V_1) \times M \times 17.74$

where,

- V_1 is the volume, in milliliters, of Sodium thiosulphate solution required for titration for available chlorine (see **B.3.1.2**);
- V_2 is the volume, in milliliters, of Sodium thiosulphate solution required for titration for Sodium chlorate;
- M is the molality of the Sodium thiosulphate solution; and
- V_3 is the volume, in milliliters of original sample in aliquot used (see **B.3.1.1**).



Figure 1- Apparatus for determination of Sodium chlorate

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APPENDIX H DETERMINATION OF CADMIUM, LEAD, CHROMIUM AND ARSENIC CONTENT

Atomic Absorption Spectrometry (AAS) methodology or Inductively Coupled Plasma Mass Spectrometry (ICP-MS) or Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES) shall be used for the determination of Arsenic, Lead, Manganese, Cadmium and Chromium content.

APPENDIX J DETERMINATION OF MERCURY CONTENT

Two methods have been prescribed for the determination of Mercury content. The method prescribed in **J.1** shall be the reference method and shall be carried out in case of any dispute.

J.1 METHOD 1 – MERCURY ANALYZER METHOD

Mercury analyzer methodology shall be used for the determination of Mercury content.

J.2 METHOD 2

Atomic Absorption Spectrometry (flameless) methodology or Inductively Coupled Plasma Mass Spectrometry (ICP-MS) or Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES) shall be used for the determination of Mercury content.

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