CDC 7 (207) CD 2

DRAFT TANZANIA STANDARD

Sodium carbonate (Soda ash) – Specification

TANZANIA BUREAU OF STANDARDS

First Edition 2020

Introduction

Sodium carbonate, anhydrous (Na_2CO_3) is commonly named as soda ash. It is a white, finely crystalline, water soluble material produced in several commercial forms, which differ only in their physical characteristics, that is, with respect to size, shape of particles, and bulk density. The standard forms are light, medium and dense soda ash, graded according to the bulk density. Dense soda ash is further classified with reference to particle size and is generally used for glass, silicate and chromate industries.

Soda ash is one of the most important industrial chemicals and the most widely used fixed alkali for the manufacture of other alkali products, sodium salts, glass, soap, pulp and paper, iron and steel, cellulose and rayon, cleaning compounds, water softening chemicals, textiles, drugs, etc. There are few industries, indeed which do not consume soda ash in their own operations or do not employ materials which were made partly with soda ash.

Foreword

This Draft Tanzania Standard is being developed by the Industrial and Laboratory Chemicals Technical Committee under supervision of the Chemical Division Standards Committee and it is in accordance with the procedures of the Bureau.

In the preparation of this Tanzania Standard assistance has been drawn from:

> IS 251:1998 (Reaffirmed 2019) *Soda ash, technical - Specification*, published by the Bureau of Indian Standards

Acknowledgement is hereby made for the assistance derived from this source.

In reporting the result of a test or analysis made in accordance with this Tanzania Standard, if the final value, observed or calculated is to be rounded off, it shall be done in accordance with TZS 4 *rounding off numerical values.*

Sodium carbonate (Soda ash) – Specification

1 Scope

This Draft Tanzania Standard prescribes the requirements, sampling and test methods for sodium carbonate (soda ash). This standard does not cover Sodium Carbonate for food application.

2 Normative references

The following referenced documents are indispensable for the application of this document. The latest edition of the referenced document (including any amendments) applies;

TZS 59 *Water for analytical laboratory use – Specification and test method*

TZS 505 *Specification for hydrochloric acid*

3. Terms and definitions

<<<<<Not applicable>>>>>

4. Requirements

4.1 General requirements

4.1.1 Grades

The material shall be of three grades, namely, dense, medium and light depending upon the bulk density described in 4.1.2 below; all having the same chemical composition as given in Table 1.

4.1.2 Bulk Density

When determined as prescribed in Annex A the bulk density of the material shall be as given below:

a) Dense Grade - 951 to 1 250 kg/m^3
b) Medium Grade- 751 to 950 kg/m^3
c) Light Grade 500 to 750 kg/m^3

4.1.3 Appearance

The material shall be a white, uniform textured, free from dirt and other foreign matter.

4.2 Specific requirements

The material, when tested according to the methods prescribed in Annex C, shall comply with the specific requirements given in Table 1.

Table 1 Specific requirements for Sodium carbonate (Soda ash).

S/N	Characteristic	Requirement (on dry basis)	Method of test
1.	Total alkalinity (as Na_2CO_3), percent by mass, Min	98.5	C-3
2.	Matter insoluble in water. percent by mass, Max	0.15	C-4
3.	Volatile matter content, percent by mass, Max	2	Annex B
4.	Sulphate (Na_2SO_4), percent by mass, Max	0.08[1]	C-5
5.	Chloride (as NaCl), percent by mass, Max	1.0[2]	C-6
6.	Iron (as Fe_2O_3) percent by mass, Max	0.007	C-7
[1]when produced by the modified Solvay process, the sulphate content shall be 0.5 percent, Max.			
[2]For sodium dichromate industry, chlorides (as NaCl), percent by mass. Max, shall be 0.4.			

5 Packing and Marking

5.1 Packing

The material shall be supplied in clean, dry and tight containers, without faults, made of material which do not affect the contents.

5.2 Marking

Each package shall be securely closed and marked with the following information in English and/or Kiswahili:

a) Name of material and grade
b) Manufacturer's name and address
c) Recognized trade-mark, if any
d) Country of origin
e) Net content
f) Lot or batch number
g) Manufacturing date

6 Sampling

Representative samples of the material shall be drawn as prescribed in Annex D.

Annex A

(Normative)

Determination of Bulk Density

A-1 Apparatus

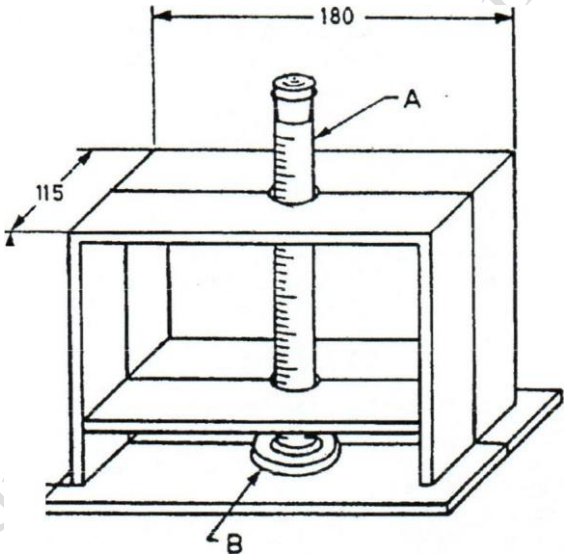
A-1.1 Assemble the apparatus as shown in Fig. 1. The base of the measuring cylinder *A* shall be ground flat and the empty measuring cylinder together with the rubber bung shall weigh 250 ± 5 g. It shall be accurately calibrated to 250 mL with an error, if any, of less than 1 mL. The distance between zero and 250 mL graduation mark on the measuring cylinder *A* shall not be less than 220 mm and not more than 240 mm. The distance between the flat-ground part of the base of measuring cylinder *A* and the rubber base pad *B,* when the measuring cylinder *A* is raised to the full height, shall be 50 ± 2 mm.

A-1.1.1 *Rubber Base Pad*

The rubber base pad *B* shall have a share hardness of 42 to 50.

A-1.1.2 *Funnel*

Made of glass, with an angle of 60°C.



All dimensions in millimeters.

Fig. 1 APPARATUS FOR DETERMINATION OF BULK DENSITY

A-2 Procedure

Take a sufficient quantity of the material on a glazed paper and slip it gently and smoothly through the funnel into the measuring cylinder *A* up to 100 mL mark without knocking. With the thumb and fingers of one hand, gently grasp the upper portion of the cylinder and lift it as far as 50 mm height. Release the cylinder on the table. Repeat this knocking a second time. Again, slip more of the material into the cylinder gently and smoothly as before up to 200 mL mark and give two knocks as before by lifting the cylinder to 50 mm height. Finally, slip more of the material into the cylinder as before up to 250 mL mark and give two further knocks of 50 mm height. Level the cylinder with the material without any further knocking. Empty out the material from the cylinder and weigh the material to the nearest 0.1 g.

A-3 Calculation

Bulk density, $kg/m^3 = 4\ M$

where
M = massing of the material in the cylinder

Annex B

(Normative)

Determination of volatile matter content

B.1 Apparatus

B.A.1 weighing scale
B.A.2 weighing bottle with glass stopper
B.A.3 Heater (capacity of 350°C)

B-2 Procedure

Place about 2 g of the material in a weighing bottle provided with a glass stopper and weigh accurately. Remove the stopper and heat for about one hour at a temperature of 250°C to 300°C. Cool in a desiccator, and replace the stopper and weigh. Repeat until mass remains constant.

B-2 Calculation

Volatile matter content, percent by mass = $\frac{100\ (M_1 - M_2)}{M_1}$

where
M_1= mass in g of the material before heating, and
M_2= mass in g of the material after heating.

Annex C

(Normative)

Methods of test for sodium carbonate (soda ash)

C-1 Quality of reagents

Unless specified otherwise, water for analytical laboratory use (see clause 2) shall be used in tests.

C-2 Preparation of the material

Dry about 25 g of the material as prescribed in Annex B and keep in a desiccator. Use this prepared sample for analysis.

C-3 Determination of total alkalinity

C-3.1 Reagents

C-3.1.1 *Standard Sulfuric Acid* – 1N

C-3.1.2 *Methyl Orange Indicator Solution*

Dissolve 0.01 g of methyl orange in 100 mL of water.

C-3.2 Procedure

Weigh about 1 g of the prepared sample *(see* **C-2).** Transfer it completely to a 500 mL conical flask and dissolve it in a 100 mL of water. Add 4 drops of methyl orange indicator solution and titrate with standard sulfuric acid. The colour changes from yellow to pale red orange at the end point.

C-3.3 Calculation

Total alkalinity (as Na_2CO_3), percent by mass = $\frac{5.3\ A\ N}{M}$

Where,

A = volume in mL of standard sulfuric acid used in the titration,
N = normality of standard sulfuric acid, and
M = mass in g of the prepared sample *(see* **C-2)** taken for the test.

C-4 Determination of matter insoluble in water

C-4.1 Procedure

Weigh about 10 g of the prepared sample *(see* **C-2).** Transfer it to a 400 mL beaker, add about 200 mL of freshly boiled distilled water and boil the solution for about 10 min. Filter through a weighed sintered glass crucible (G No. 4). Wash thoroughly with hot water and dry to constant mass at 110 ± 2°C.

C-4.2 Calculation

Matter insoluble in water, percent by mass= $\frac{100\ M_1}{M_2}$

where

M_1 = mass in g of the residue, and
M_2 = mass in g of the prepared sample taken for the test.

C-5 Determination of sulphates

C-5.1 Reagents

C-5.1.1*Concentrated hydrochloric acid (See* TZS 505)
C-5.1.2 *Barium chloride solution* - 10 percent.

C-5.2 Procedure

Dissolve about 10 g of the prepared sample *(see* **C-2),** in 100 mL of water and add hydrochloric acid to make the solution slightly acidic. Boil to decompose the carbonates. Cool the contents, filter through a folded filter paper and wash the filter paper thoroughly, collect 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 to the boiling solution. Boil again for 2 min, let it stand for 4 hrs and filter through a tared sintered crucible. Wash the precipitate and dry to constant mass at 105 ± 2°C.

C-5.3 Calculation

Sulphates (as Na_2SO_4), percent by mass = $\frac{60.86\ C}{M}$

where

C = mass in g of the precipitate, and
M = massing of the prepared sample *(see* **C-2)** taken for the test.

C-6 Determination of chlorides

C-6.1 Reagents

C-6.1.1 *Concentrated Nitric Acid,*

C-6.1.2 *Standard Silver Nitrate Solution,* 0.1 N.

C-6.1.3 *Nitrobenzene*

C-6.1.4 *Standard Ammonium Thiocyanate Solution,* 0.1 N.
C-6.1.5 *Ferric Alum Indicator,* saturated solution.

C-6.2 Procedure

Transfer about 2 g of the prepared sample *(see* **C-2)** to a conical flask, neutralize with nitric acid and then add 5 mL of the acid in excess. Add 20 mL of standard silver nitrate solution followed by 3 mL of nitrobenzene and shake vigorously. Titrate with standard ammonium thiocyanate solution using ferric alum indicator, until the colour of indicator changes from colourless to faint distinct reddish brown colour.

C-6.3 Calculation

Chlorides (as NaCl) percent by mass = $\frac{5.845\ (20\ N_1 - V\ N_2}{M}$

Where,

N_1 = normality of standard silver nitrate solution,
V = volume in ml of standard ammonium thiocyanate solution used in **C-6.2,**
N_2 = normality of standard ammonium thiocyanate solution, and
M = mass in g of the prepared sample *(see* **C-2)** taken for the test.

C-7 Determination of Iron

C.7.1 *Method A.*

C-7.1.1 Apparatus

Nessler cylinders, 100 mL capacity

C-7.1.2 Reagents

C-7.1.2.1 *Dilute hydrochloric acid,* approximately 15 percent *(m/v),* free from iron.
C-7.1.2.2 *Ammonium persulfate*
C-7.1.2.3 *Potassium thiocyanate solution,* 5 percent.
C-7.1.2.4 *Dilute sulfuric acid,* 10 percent *(m/v).*
C-7.1.2.5 *Standard iron solution* - Dissolve 0.490 g of ferrous ammonium sulphate [$FeSO_4.(NH_4)_2\ SO_4.6H_2O$] in 10 mL of dilute sulfuric acid and dilute with water to 1000 mL. 1 mL of the dilute solution is equivalent to 0.1 mg of iron (as Fe_2O_3).

C-7.1.3 Procedure

Weigh accurately 1.00 g of the prepared sample *(see* **C-2)** and dissolve it in about 20 mL of water. Add about 5 mL of hydrochloric acid to make it acidic and 30 mg of ammonium persulfate and boil to oxidize the iron. Cool and transfer the contents to a Nessler cylinder, add 5 mL of potassium thiocyanate solution, dilute to the mark with water, and stir thoroughly. Into a second Nessler cylinder, add 5 ml of hydrochloric acid, about 30 mg of ammonium persulfate, 5 mL of potassium thiocyanate solution and 0.7 mL of standard iron solution. Dilute to the mark with water. Compare the colour of the solution in the two cylinders.

C-7.1.4 Conformity criteria
The limit prescribed in Table 1 shall be taken as not having been exceeded if the intensity of colour produced with the prepared sample *(see* **C-2)** is not greater than that produced by the standard iron solution.

Alternative Method

C.7.2 *Method B*

C.7.2.1 Reagents:

C.7.2.1.1 *Conc. Hydrochloric acid*

C.7.2.1.2 *Sodium hydroxide solution* 1 M

C.7.2.1.3 *Citric acid* 20% w/v

C.7.2.1.3 *Thioglycolic acid (mercaptoacetic acid)*

C.7.2.1.3 *Ammonia* 10 M

C.7.2.1.3 *Iron standard solution*, 0.7 ppm

C.7.2.1.3 Procedure

i) Solution S: Dissolve 1 g of sodium carbonate in portions in a mixture of 5 mL Hydrochloric acid and 25 mL distilled water. Heat the solution to boiling, then cool. Add dilute sodium hydroxide solution until the solution is neutral and dilute to 50 mL with distilled water

ii) Dilute 5 mL of solution S to 10 mL with water in a Nessler cylinder. Add 2 mL of 20% w/v solution ofcitric acid and 0.1 mL of thioglycolic acid, mix, then make alkaline with 10 M ammonia, dilute to 20 mL with water and allow to stand for 5 min. Treat 10 mL of iron standard solution (0.7 ppm) in the same manner as sample. The sample is considered to not having more than 0.007% m/m if the pink

colour produced is not more intense than that produced by the standard solution.

Alternatively: To quantify the exact amount of Iron, solution S can be subjected to any elemental analyzer

Annex D

(Normative)

Sampling of Sodium carbonate (Soda ash)

D-1 General requirements of sampling

D-1.0 While drawing samples the following precautions and directions shall be observed.

D-1.1 Samples shall not be taken in an exposed place.

D-1.2 The sampling instrument shall be clean and dry.

D-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from the adventitious contamination.

D-1.4 Samples shall be placed in suitable, clean, dry and air-tight glass containers,

D-1.5 The sample containers shall be of such a size that they are almost completely filled by the sample.

D-1.6 Each sample container shall be sealed air-tight after filling and marked with full details of sampling, the date of sampling and the year of manufacture of the material.

D-2 Scale of sampling

D-2.1 Lot

In any consignment of one grade of soda ash, all the containers of the same size and drawn from a single batch of manufacture shall constitute a lot. If a consignment of one grade of soda ash is known to consist of different batches of manufacture or of different sizes of containers, then the containers belonging to the same batch and size shall be grouped together and each such group shall constitute a separate lot.

D-2.2 For ascertaining the conformity of the lot to the requirements of the specification, tests shall be carried out for each lot separately. The number of containers *(n)* to be selected for this purpose shall depend on the size of the lot *(N)* and shall be in accordance with Table 2.

D-2.3 The container shall be selected at random from the lot and in order to ensure randomness of selection, the following procedure is recommended for use.

Arrange all the containers in the lot in a systematic manner and starting from any container, count them as 1, 2, 3,....., etc, up *to r* and so on, where *r* is the integral part of *N/n.* Every *r*th container thus counted shall be withdrawn to give sample for tests.

Table 2 Scale of Sampling

Lot size	No. of containers to be selected
N	*n*
Up to 15	3
16 to 40	4
41 to 65	5
66 to 110	7
111 and above	10

D-3 Preparation of test samples

D-3.1 In taking out samples from a container of soda ash, care shall be taken to exclude portions where caking is noticeable (due to absorption of moisture and carbon dioxide). This may be done by removing from the top about 20 cm of the material in the container and then taking out the sample from the centre of the remaining portion. The total quantity of the material so collected from a

container shall be not less than 300 g. The material drawn from different containers shall be mixed together and by the process of coning and quartering an ultimate sample of about 750 g shall be obtained. This test sample shall be divided into three equal parts, one for the purchaser, another for the supplier and the third shall be used as a reference sample.

D-3.2 AII the test samples shall be transferred to separate containers and shall be sealed and labelled with full identification particulars. The referee test sample, bearing the seal of both the purchaser and the supplier, shall be kept at a place agreed to between the two and shall be used in case of any dispute.

D-4 Number of tests and criteria for conformity

D-4.1 Tests for the determination of all the requirements given in **3** shall be performed on the test sample as obtained in **D-3.1.**

D-4.2 The lot shall be declared as conforming to the requirements of this specification if all the test results as obtained under **D-4.1** are found satisfactory.