CDC 6 (960) DTZS
ICS 71.100.80

DRAFT TANZANIA STANDARD

Chemicals used for treatment of water intended for human consumption - Aluminium Sulfate.

TANZANIA BUREAU OF STANDARDS

1st Edition

Foreword

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

This Tanzania Standard has been prepared with assistance drawn from:

> BS EN 878:2016 *Chemicals used for treatment of water intended for human consumption - Aluminium Sulfate,* published by British Standards Institution.
>
> RS 353-1:2017 *Chemicals used for treatment of water intended for human consumption - Aluminium Sulfate,* published by Rwanda Standards Board.
>
> ANSI/AWWA B403-09 *Aluminum Sulfate - Liquid, Ground, or Lump,* published by American Water Works Association (AWWA)

In reporting the result of a test or analysis made in accordance with this Tanzania Standard, if the final value, calculated or observed is to be rounded off, it shall be done in accordance with TZS 4 (see clause 2).

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Chemicals used for treatment of water intended for human consumption - Aluminium Sulfate.

1 Scope

This Draft Tanzania Standard specifies requirements, sampling, and tests method for Aluminium Sulfate used in coagulation of water intended for human consumption.

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 4 *Rounding off numerical values*
TZS 59 / ISO 3696 Water *for analytical laboratory use - Specification and test methods*.
TZS 1445, *Sampling of chemical products for industrial use - Safety in sampling*
TZS 1444, *Chemical products for industrial use - Sampling - Vocabulary*

3 Terms and definitions

For the purposes of this document terms and definitions given in TZS 1444/ ISO 6206 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

water intended for human consumption
water either in its original state or after treatment, intended for drinking, cooking, food preparation or other domestic purposes, regardless of its origin and whether it is supplied from a distribution network, from a tanker, or in bottles or containers

4 Requirements

4.1 General requirements

4.1.1 Descriptions

4.1.1.1 *Chemical name***;** Aluminium Sulfate.
4.1.1.2 Relative *molecular mass***;** 342.14
4.1.1.3 Empirical *formula***;** $Al_2(SO4)_3$.
4.1.1.4 Chemical formula**;** $Al_2(SO4)_3 \cdot n\ H_2O$

4.1.2 Physical properties

4.1.2.1 The product is a white solid or colourless to yellow clear liquid.
4.1.2.2

4.2 Specific requirements

4.2.1 The material, when tested according to the methods prescribed in Annexes A, B, and C shall comply with the specific requirements given in Table 1.

Table 1 Specific requirements for Aluminium Sulfate

S/N	Characteristic	Requirement		Method of test
		Solid	Solution	
i.	Aluminium content (as Al_2O_3), percent by mass, min	16	8	Annex A
ii.	Iron (as Fe), percent by mass, max	0.004		Annex B
iii.	Insoluble matter, percent by mass, max	0.5	0.2	Annex C
iv.	pH (of 5 percent solution), min	3		Annex D

4.2.3 Toxic substances

The content of toxic substances shall comply with the requirements specified in Table 2.

Table 2 — Toxic substances

Element	Maximum limit mg/kg of product
Arsenic (As)	14
Cadmium (Cd)	3
Chromium (Cr)	30
Mercury (Hg)	4
Nickel (Ni)	20
Lead (Pb)	40
Antimony (Sb)	20
Selenium (Se)	20
NOTE Cyanide (CN^-) is usually not relevant because of the acidity of the product. Pesticides and polycyclic aromatic hydrocarbons are not relevant since the raw materials used in the manufacturing process are free of them. For maximum impact of these products on trace metal content in drinking water see A.2.	

5 Packing and marking

5.1 Packaging

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

In order that purity of the product is not affected, the means of delivery shall not have been used previously for any different product or it shall have been specially cleaned and prepared before use.

5.2 Marking

The following information shall be marked legibly and indelibly on the container;

a) name and formula of the product as ‘ALUMINIUM SULFATE’ ($Al_2(SO4)_3 \cdot n\ H_2O$ or $Al_2(SO4)_3$)
b) the name and address of manufacturer.
c) net content.
d) batch or code number.
e) available Aluminium content.
f) dates of manufacture and best before.
g) instruction for handling, storage and use,
h) first aid instructions.
i) the words ‘STORE IN COOL AND DRY PLACE AWAY FROM DIRECT SUNLIGHT’
j) hazard warning in symbol or words

6 Sampling

Sampling of Aluminium Sulfate shall be done as per TZS 1443/ISO 8213 while observing the general recommendations as given in TZS 1445/ISO 3165 and TZS 1444/ISO 6206

7 Testing

Methods of tests for Aluminium Sulfate shall be as prescribed in the Annexes.

Annex A

(Normative)

Determination of Aluminium content.

A-1 General

Two methods are prescribed, namely (a) gravimetric method and (b) titration with EDTA solution. Gravimetric method shall be used, as referee method in case of dispute.

A-2 Method A (Gravimetric Method)

A-2.1 Reagents

A-2.1.1 *Ammonium Chloride Solid*

A-2.1.2 *Concentrated Nitric Acid.*

A-2.1.3 *Dilute Ammonium Hydroxide*-Approximately 4 N.

A-2.1.4 *Methyl Red Indicator* - Dissolve 0.1 g of methyl red in 100ml of rectified spirit.

A-2.1.5 *Ammonium Nitrate Solution* — Approximately 2%.

A-2.2 Procedure

Weigh accurately about 1 g of the prepared sample and dissolve it in 100 ml of water. Filter to remove the undissolved matter and wash the filter paper thoroughly. Add 5 g of ammonium chloride and 2 drops of concentrated nitric acid to the filtrate "and washings;

heat to boiling and add dilute ammonium hydroxide, drop by drop, until the solution smells faintly of ammonia and shows distinct yellow colour on the addition of two drops of methyl red indicator. Boil for 2 rein, filter immediately through filter paper (Whatman No. 40 or equivalent) and wash the residue with hot ammonium nitrate solution till the filtrate is free from chlorides. Dry the residue and ignite to constant weight at 1100 to 1 200^{0}C in tared porcelain or a silica crucible.

A-2.3 Calculation

Aluminium (as Al_2O_3), percent by mass=$100 * \left(\frac{m}{m1}\right) - A * 1.4297$

where

m = mass, in g, of the ignited residue.

A = percent by mass of iron as determined in Annex B; and

m_1= mass in g of the prepared sample taken for the test.

A-3 Method B (Titration with EDTA

A-3. 1 Reagents

A-3. 1.1 *Disodium Ethylenediamine Tetra Acetate (EDTA) Solution* — 0.05M.

Dissolve 18.6125 g of disodium ethylenediamine tetra acetate dihydrate in water and make the volume to one litre in a volumetric flask.

A-3. 1.2 *Concentrated Sulfuric Acid*

A-3. 1.3 *Hexamine (Hexamethylene Tetramine)* - Analar

A-3.1.4 *Xylenol Orange Indicator* (Prepare 0.5 percent in water and add 1 to 2 drops of dilute sodium hydroxide solution)

A-3.1.5 Standard Lead Nitrate Solution 0.05 N

A-3.2 Procedure

Dissolve 5 g of prepared sample in water. Acidify it by adding 1to 2 ml of concentrated sulphuric acid and make up the volume to 500 ml in a volumetric flask.Take an aliquot of 50 ml into a conical flask. Add 50 ml of 0.05 M EDTA solution and heat to just boiling. Cool it and add hexamine powder to adjust the pH to 5. Add few drops of xylenol orange indicator. Titrate the excess EDTA solution with standard Lead nitrate solution until the colour changes from yellow to pink.

A-3.3 Calculation

Calculate the Aluminium content of the material on the assumption that one millilitre of 0.05 M EDTA solution is equivalent to 0.002 55 g of Aluminium (as Al_2O_3).

Annex B

(Normative)

Determination of Iron

B.1 Apparatus.

B.1.1 *Nessler Cylinders* — 50 ml capacity.

B.2 Reagents

B.2.1 Ammonium Persulphate

B.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.

B.2.3 Standard Iron Solution A

Dissolve 0.702 2 g of ferrous ammonium sulphate $[FeSO_4 \cdot (NH_4)_2 SO_4 \cdot 6H_2O]$ in 100 ml of water (as per TZS 59), add 5 ml of 1: 5 (*v*/*v*) sulphuric acid and add dilute solution of potassium permanganate (0.2 percent, *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.

B.2.4 Standard Iron Solution B

Take 100 ml of the standard iron Solution A (*see* **B-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).

B.3 PROCEDURE

B.3.1

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. Compare the intensity of the colour produced in the butanol layers in the two cylinders.

B-3.2 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.

Annex C

(Normative)

Determination of water-insoluble matter

C.1 Principle

A representative sample of Aluminium Sulfate is dissolved in water. The insoluble matter is separated by filtration then dried and weighed.

C.2 Apparatus

Ordinary laboratory apparatus and glassware together with the following:

C.2.1 Sintered glass crucible of porosity P40 (pores size between 16 µm to 40 µm).

C.2.2 Oven capable of being controlled at (105 ± 3) °C.

C.3 Procedure

Weigh approximately 10 g of the representative sample (m_4) to the nearest ± 0.01 g and dissolve in 1000 ml of water by stirring for 30 min. Then filter the solution under vacuum through a dried and weighed glass filter. After the filtration, wash the residue with 20 ml of water and remove excess water by filtering under vacuum. Dry the residue at (105 ± 3)°C in the oven until the mass remains constant and weigh it (m_5) after cooling in a dessicator.

C.4 Expression of results

The insoluble matter expressed as percentage by mass (% (m/m)), C_5 in the product is given by the following equation:

$$C_5 = \frac{m_5}{m_4} X\ 100$$

where

m_5 is the mass, in grams, of the residue;
m_4 is the mass, in grams, of the test portion.

ANNEX D

(Normative)

Determination of pH

D-1 Procedure

Take 5 g of the material and dissolve in 100 ml of freshly boiled and cooled water. Determine pH of the solution by means of a suitable pH meter.