Draft Tanzania Standard

Solid Fertilizers – Determination of Moisture Content

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0 FOREWORD

Moisture is found in three forms in solid fertilizers. These include water of crystallization, adsorbed/absorbed moisture and free moisture. Water of crystallization is the integral part of a compound whereas the other forms are interchangeable depending upon the degree of moisture saturation and temperature.

Determination of moisture content in solid fertilizers is very crucial as it is among the quality control parameters for the fertilizers and it has to be measured for it to comply with the recommended levels provided by the manufacturer as well as labeling requirements as per standard. It is important as a means of satisfaction to customers, manufacturers, regulatory officials, formulators and farmers for a maintained quality of the fertilizers.

In reporting the results of a test or analysis made in accordance with this standard, if the final value observed or calculated, is to be rounded off, it shall be done in accordance with TZS 4.

For the purpose of this standard only analytical grade reagents and distilled water shall be used.

1 SCOPE

This Tanzania standard prescribes the methods for determination of moisture content in solid fertilizers.

2 REFERENCE

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

TZS 4 *Rounding off Numerical Values*

TBS/AFDC 10 (4589) P3 *Fertilizer and Soil Conditioners – Vocabulary*

TZS 159 *Fertilizer - Methods of Sampling*

TBS/AFDC 10(4580) P3 *Solid Fertilizers and Soil Conditioners - Test Sieving*

TBS/AFDC 10 (4579) P3 *Solid fertilizers – Preparation of samples for chemical and physical analysis*

3 SAMPLING AND SAMPLE PREPARATION

3.1 Sampling

The sample shall be drawn in accordance with TZS 159.

3.2 Sample Preparation

Samples shall be prepared according to TZS 1013.

4 DETERMINATION OF MOISTURE – OVEN DRY METHOD

The method does not apply to fertilizers that yield volatile substances other than water at drying temperature.

4.1 PROCEDURE

a) Weigh accurately 2 g of the prepared sample in a pre-weighed, clean and dry weighing bottle or petridish.

b) Heat in an oven for about 5 hours at 105 $\pm$ 2°C to constant weight. Cool in a desiccator and weigh. For urea, heat at 70 $\pm$ 5 °C for five hours to constant weight.

4.2 CALCULATION

$$\text{Moisture per cent by weight (\%)} = 100 \times \frac{B - C}{B - A}$$

Where,

A = Weight in gram of the empty bottle.
B = Weight of the bottle plus the material in gram, before drying
C **=** Weight of the bottle plus the material in gram, after drying

5.0 DETERMINATION OF MOISTURE – VACUUM DESICCATOR METHOD

The method is applicable to Ammonium Chloride, Calcium Ammonium Nitrate (CAN), Di-Ammonium Phosphate (DAP) and all types of complex and mixtures of NPK fertilizers.

5.1 PROCEDURE

Weigh accurately in duplicate 5g of prepared sample in a weighed shallow porcelain dish. Put the sample in a dessicator over concentrated sulphuric acid, close and introduce vacuum for about 10 minutes, then stop the vacuum pump and leave the sample for 24 hours, then release vacuum, remove the sample from the dessicator and weigh.

5.2 CALCULATION

$$\text{Moisture per cent by weight} = 100 \times \frac{(W2 - W3)}{(W2 - W1)}$$

Where,

W1= Weight in gram of empty porcelain dish
W2=Weight in gram of porcelain dish with sample before putting the sample for 24 hours in the dessicator
W3 **=** Weight in gram of porcelain dish with sample after putting the sample for 24 hours in the dessicator

6.0 DETERMINATION OF MOISTURE – KARL FISCHER METHOD

This method is applicable to fertilizers like CAN, Urea and urea based complexes. This method is not suitable for phosphate rock based fertilizers and fertilizers containing monocalcium phosphate, calcium sulphate, alkali carbonates as well as aldehydes and ketone groups.

6.1 APPARATUS

Karl Fischer titrator

6.2 REAGENTS

6.2.1 Karl Fischer reagent(KF) – Karl Fischer solution (pyridine free) (single solution)
6.2.2 Di-sodium tartarate dihydrate ($Na_2C_4O_62H_2O$) analytical grade
6.2.3 Methanol-KF grade/spectroscopy grade containing less than 0.05 % water

6.3 PROCEDURE

6.3.1. Standardization of KF reagent.

i) Set up the instrument as per manufacturer's manual.
ii) Add methanol to the titration vessel until the electrodes are dipped and titrate with Karl-Fischer reagent to a pre-set end point persists for 30 seconds.
iii) Add 100mg of the disodium tartarate dehydrate to the titration vessel carefully and titrate with Karl Fischer reagent to a pre-set end point (the pre-set end point should persist for 30 seconds). Note the volume of KF reagent used as V_1 mL.

6.3.2 Determination of moisture of sample

a) Weigh accurately 1 g of the prepared sample and transfer to the titration vessel carefully and stir until dispersed.

b) Titrate with KF reagent to the same pre-set end point as above and note the volume of KF reagent used as V_2 mL.

6.4 CALCULATION

$$\text{Factor (F)}(\text{mg}H_2O/1\text{ ml of KF reagent}) = \frac{0.1566 \times \text{mg of sodium tartarate dihydrate added}}{V_1}$$

$$\text{Moisture per cent by weight} = \frac{F \times V_2 \times 100}{\text{Weight of sample (gram)} \times 1000}$$