

**DRAFT TANZANIA STANDARD**

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**TBS/CDC-2(5223) P3 Surface active agents - Methods for performance tests –  
Part 4: Relative detergency (Revision of TZS 224-4: 1984)**

**TANZANIA BUREAU OF STANDARDS**

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## Foreword

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

This Draft Tanzania Standard is the first revision of TZS 224: 1984 Surface active agents – Methods for performance tests - Part 3: Relative detergency. This edition maintains the first approved methods.

Test for relative dispersing power, emulsifying power and foaming power are covered in Part 1 Par 2 and Part 3 respectively of this Tanzania Standard.

IS 5785 (Part 5):2016 *Methods for performance tests for surface active agents. Part 5. Relative Detergency*; published by the Indian Standards Institutions.

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

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**Surface active agents - Methods for performance tests- Part 4: Relative detergency****1. Scope**

Tanzania part of Draft Tanzania Standard prescribes method for determining the relative detergency of surface active agents used for the purpose of cleaning cotton and other textile fabrics. The method is also applicable to surface active agents containing optical brightening agents (see Note 1).

NOTE 1 - The search unit of the photoelectric reflection meter is fitted with a 3-mm methyl methacrylate sheet placed between the light source and the cloth which absorbs the ultraviolet light required to excite fluorescence and hence prevents it from reaching the cloth.

**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 35 Soaps – Sampling and test methods*

**3. Terminology**

For the purpose of this Tanzania Standard, the definition given in TZS 35 (See Clause 2) shall apply:

**4. Outline of the method**

Cloth is artificially soiled and the soil is removed by washing the soiled swatches of cloth with a solution of the surface active agent to be evaluated under standard conditions, such as concentration of wash liquor, ratio of cloth to wash liquor, temperature of washing, hardness of water employed for the washing tests, and mode and period of agitation. The degree of whiteness of the unsoiled, soiled and washed swatches is measured instrumentally using a standard photoelectric meter. The detergency is expressed as percentage of soil removed.

## 5. Apparatus

### Photoelectric reflection meter

With built – in galvanometer and tungsten lamp as an illuminant.

#### 5.1 Search unit

Fitted with photoelectric cell (large are preferred)

**5.2 White enamel standard plate** of approximately 75% reflectance, calibrated for the tristimulus light blue filter.

#### 5.3 Washing appliance

#### 5.4 Cloth soiling machine

Electrically operated mangle with variable pressure arrangements which can be recorded and variable speed drive, with attached air-drying chamber fitted with exhaust. Batching arrangement would be convenient.

## 6. Reagents

### 6.1 Quality of reagents

Unless specified otherwise, analytical chemicals shall be used in tests.

### 6.2 Quality of water

Water used in tests shall be of the desired hardness. A stock solution of hard water of hardness equivalent to 2 000 mg/kg (as  $\text{CaCO}_3$ ) in which the ratio calcium: magnesium is 60;40, shall be prepared as given below:

Weigh 76.4g of calcium chloride ( $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ ), and 29.6 g of magnesium sulphate ( $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ ). Dissolve these separately in distilled water. Mix the two solutions and make the volume to 15 litres. This stock solution may be diluted with distilled water complying with TZS 59 (See Clause 2) in the desired hardness (See Note 2).

NOTE 2- The recommended water hardness values are 40mg/kg, 150mg/kg and 300mg/kg.

## 7. Preparation of standard soiled cloth test specimens

**7.1** The cloth shall be bleached, mercerized shrink proof cotton cloth of suitable dimensions and as specified in **Annex A** (see Note 3).

NOTE 3- The cloth specified in Clause 7.1 is generally available as a finished grade of cloth and hence is required to be pretreated for removal of the finishing agents before use. However, if the unfinished variety of this cloth is obtained the pre-treatment operation is not necessary.

**7.1.1 Pretreatment of cloth**

If necessary pretreatment of the cloth shall be carried out as prescribed in **Annex B**.

**7.1.2** Pretreatment of cloth is cut lengthwise into strips of suitable width depending on the size of the soiling machine rollers. Several such lengths may be stitched together and made into a roll for convenience of handling. The cloth is conditioned under standard atmosphere conditions of  $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and  $65 \pm 2\%$  relative humidity.

**7.2 Standard soiling mixture**

**7.2.1** The soil shall have the following composition

- (a) Coconut soil (refined and bleached) 9.0g
- (b) Coconut oil fatty acids (distilled) 4.5g
- (c) Refined mineral oil (viscosity 86 to 98mm<sup>2</sup>/s at 60°C) 1.87%
- (d) Lanolin (anhydrous) 0.90g
- (e) A homogeneous stable colloidal suspension 3.5g of graphite (approximately 10% graphite mass) in refined mineral oil, having viscosity of 86 mm<sup>2</sup>/s to 98 mm<sup>2</sup>/s at 60°C (see Note 3)
- (f) Carbon tetrachloride commercial grade) To make 1 000 mL

**7.2.2 Preparation of soiling mixture**

Weigh ingredients as given in 7.2.1 a) to c) into a suitable container. Add a portion of carbon tetrachloride and mix the contents into a homogenous liquid: Then add the rest of the solvent to make up the volume to 1 litre. Shake the mixture well and store in a suitable airtight container.

**7.3 Soiling procedure**

**7.3.1** Wind a leader of fabric of suitable length on both spools of the soiling machine. Stitch or tack one end of the test fabric to the leader from the spool next to the soiling trough, and wind completely. Stitch the free end of the wound cloth to the other leader after passing the latter through the guide-rod of the soiling trough.

**7.3.2** Shake the soiling mixture well and transfer to the sling trough so that the guide-rod is completely submerged. Then start the machine so that the cloth passes through the soiling mixture at a uniform speed of 18m/min and is squeezed through the rollers at a constant pressure. Then pass the soiled cloth through the air-drying chamber and rewind to the other spool at the other end of the machine.

**7.3.3** Make four such passes through the soiling solution for the roll of fabric. Before each pass take care to ensure that the cloth is completely dry from solvent. Turn the fabric each time after passage so that side first down is up on the second pass and so on. Store the fabric thus soiled in a suitable moisture-proof sealed container under standard atmospheric conditions ( $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and  $65\% \pm 2\%$  relative humidity), and allow to age under these conditions for a period of at least one week before use. Adjust the pressure between the squeezing rollers of the soiling machine so that the final dried soiled cloth after completion of four passes through the soiling mixture has a reflectance value of  $34 \pm 1$ .

## **8. Evaluation of soil removal**

### **8.1 Measurements of reflectance of unsoiled fabric**

**8.1.1** Fold the pretreated, unsoiled cloth into a single fold so as to minimize the effect of the colour of the background, and spread uniformly on to a smooth table.

**8.1.2** Connect the photoelectric reflection meter to the flexible lead of the search unit and then to the mains or battery. Place the search unit on the surface of the standard enamel white plate. After making the zero adjustments on the galvanometer, adjust the galvanometer so as to read 75 on the scale. Thus, having made the necessary adjustments place the search unit on other surface of the unsoiled cloth and record the reflectance reading. Take at least 20 such readings at different places on each side of the cloth. The reflectance value of the original cloth is a mean of at least 40 reflectance readings.

**8.2.1** Cut the soiled cloth into swatches of size 10cm x 10 cm. Make each swatch for identification with indelible marking ink. Place the swatches on a gray background strip of the same cloth having a reflectance value of  $30 \pm 2$ . Take reflectance measurements one on each side of each swatch in the manner described under 8.1.2. Reject swatches which do not show average reflectance value of  $34 \pm 1$  (See 7.3.3). **8.2.2**

#### **8.2.2 Number of cloth test specimens**

For each surface active agent to be evaluated take 15 soiled swatches when a Terg-o-tometer is employed, and 16 soiled swatches when a Launder-o-tometer is employed as the washing device. Thus, the detergency or percentage soil removed shall be a mean of 15 values in the case of a Terg-o-tometer and 16 values in the case of a Launder-o-meter for each surface active agent.

### **8.3 Measurement of reflectance of washed swatches**

Place the washed swatches on an off-white background strip of the same cloth having a reflectance value of  $60 \pm 2$ . Take reflectance measurements one on each side of each swatch in the manner prescribed in 8.1.2.

## **9. Cloth to solution ration**

The ratio of cloth in g to solution in mL shall be 1:100 when a Terg-o-tometer is used, and 1:25 when a Launder-o-meter is used.

## **10. Washing**

For washing, two methods are being prescribed and anyone of them may be used. The method prescribed here is based on the use of:

- a) Terg-o-tometer, and
- b) Launder-o-meter

### **10.1 Terg-o-tometer method**

#### **10.1.1 Terg-o-tometer**

With a battery of four or six agitator washers in 2-litre stainless steel beakers. The angle through which the agitators are oscillated is 350°. The speed of rotation is adjustable and set at 100 strokes per minutes, each back and forth movement representing one stroke. The breakers are fully immersed in an electrically controlled water-bath. The agitators and beakers are removable.

**10.1.2.1** Prepare 1 litre each of a stock solution of the surface active agent of concentrations 0.20, 0.40, 0.60, 0.80, 1.00, 1.20 and 1.60% on anhydrous matter basis by heating on a steam bath. Cool to room temperature.

NOTE 4- The stock solution shall be further diluted to 0.05, 0.10, 0.15, 0.20, 0.25, 0.30 and 0.40% respectively as described under 10.1.2.2 at which concentrations the washing shall be carried out.

**10.1.2.2** Measure out 250 mL of the stock solution of the desired concentration by means of a measuring cylinder and pour it into one of the Terg-o-tometer beaker. Dilute the contents to 1 litre by adding 750 mL water so as to obtain the desired wash aliquot concentration. Switch on the water-bath heater. Allow the temperature of the wash aliquot to reach 50°C or any other specified temperature and maintain it at this temperature throughout the washing operation. Introduce, as quickly as possible 5 soiled swatches into the Terg-o-tometer beaker and start the agitators.

**10.1.2.3** Wash the cloth specimen for exactly 5 min at 50°C or any other specified temperature noting the time with the help of a stop-watch.

**10.1.2.4** Remove the beaker from the water-bath and decant the solution. Squeeze lightly the swatches by hand to remove the excess of solution. Rinse the beaker with water and refit into the water-bath. Reintroduce the swatches into the beaker and rinse for 1 min by agitation in 500 mL water of the hardness in use. Decant the rinse water and give a second rinse in the same manner. Squeeze the washed and rinsed swatches through a wringer of a domestic washing machine and iron dry. Alternatively, allow the swatches to dry at room temperature in the shade.

**10.1.2.5** Repeat twice more the procedure prescribed in 10.1.2.2 to 10.1.2.4 using the stock solutions mentioned in 10.1.1.2.1. Thus, in all three wash loads are taken involving a total of 15 swatches for each surface active agent.

NOTE 5 - The procedure as prescribed in 10.1.2.1 to 10.1.2.4 enable surface active agents to be tested at one time in one wash load provided a Terg-o-tometer with 6 beakers is used. Three such wash loads are to be taken so that the detergency value is a mean of 15 values for each surface active agent.

## **10.2** Launder-o-meter method

### **10.2.1** Launder-o-meter

With attached preheating loading table, capable of tumbling 20 jars at one time. The jars shall be fitted with glass lids and rubber gaskets. A sufficient number of stainless steel balls shall be provided to impart a beating action to the cloth. Rubber balls may also be used. The machine shall have an electrically heated water-bath with an automatic temperature controller and a water circulating pump to circulate water from the batch to the preheating table and back. The speed of rotation shall be 40 rev/min  $\pm$  2 rev/min at full load.

### **10.2.2** Procedure

**10.2.2.1** Prepare 1 litre each of a solution of the surface active agent of concentration 0.05, 0.10, 0.15, 0.20, 0.25, 0.30 and 0.40% respectively on anhydrous matter basis, by heating on a steam-bath and then cooling to room temperature. Test the desired concentrations according to the steps prescribed below.

**10.2.2.2** Heat the water-bath of Launder-o-meter and maintain the temperature at 50°C or any other specified temperature running the circulating pump simultaneously. Measure out, by means of a measuring cylinder, 100 mL of the solution into each of 4 jars of the Launder-o-meter kept on the preheating table. Put 10 stainless steel balls into each jar. When the content of the jar has attained 50°C or other specified temperature, place 2 soiled test swatches into each jar, seal the jars and after ascertaining that there are no leaks, load them into the Launder-o-meter.

**10.2.2.3** Rotate the jars for washing the swatches for exactly 10 min at 50°C or any other specified temperature.

**10.2.2.4** After the washing period, open the jars and pour the contents into a strainer in the sink. Lightly squeeze the washed swatches by hand to remove the excess of solution and rinse in two portions of water of the hardness used. This may be done by dousing the swatches in the manner described in 10.1.2.4.

**10.2.2.5** Repeat the procedure as prescribed in 10.2.2.2 to 10.2.2.4 using the solutions mentioned in 10.2.2.1. Thus, in all, two wash loads are taken involving a total of 16 swatches for each surface active agents.

NOTE 6- The procedure as prescribed in 10.2.2.1 to 10.2.2.4 enables 5 surface active agents to be tested at one time in one wash load. Two such loads are to be taken so that the detergency value is mean of 16 values for each surface active agents.

## **11** Measurement of reflectance of washed swatches.

## **12** Calculation and reporting

**12.1** The detergency value expressed as percentage of soil removed is calculated from the following equation:

Percentage soil remove =  $\frac{A-B}{C-D} \times 100$

*A* is the reflectance of soiled fabric after washing,  
*B* is the reflectance of soiled fabric before washing, and  
*C* is the reflectance of white fabric before soiling.

**12.2** The concentration of the solution of the surface active agent, the hardness of water used, testing temperature, and the age of the soiled cloth used shall be reported with each result.

NOTE 7- With water of hardness 40, 150 and 300 mg/kg the recommended solution concentrations are 0.15, 0.25 to 0.30 and 0.40% respectively.

**ANNEXA**

(Normative)

**Specifications for cloth**

The specifications of the cloth required for the preparation of standard soiled cloth test specimens shall be as prescribed below:

- |                           |                          |
|---------------------------|--------------------------|
| a) Count of yarn          | 37 tex warp; 42 tex weft |
| b) Ends per dm            | 210                      |
| c) Picks per dm           | 200                      |
| d) Mass, g/m <sup>2</sup> | 171                      |
| e) Tensile strength       | Warp way: 41.5           |
| kgf/strip of 5 x 20 cm    | Weft way: 57.0           |

**Annex B**  
(Normative)

**Pretreatment of cloth**

**B. Method**

**B.1** For the purpose of removing the finishing agents from the finished cloth prior to soiling the following procedure shall be followed.

**B.2 Caustic scour** - The fabric is scoured at near boiling temperature with a 0.80% solution (m/v) of sodium hydroxide and softened water for 45 min. At the end of this period the fabric is removed from the batch. Two litres of solution are used per meter of fabric.

**B.3 Rinse**- The cloth is washed repeatedly with not water (80 °C to 90° until the washings are free from alkali (indicated by a negative phenolphalein test).

**B.4 Soap scour** - The fabric is scoured with an almost neutral soap solution of 0.30% concentration (on anhydrous basis) at 80°C to 90°C for 15 min.

**B.5 Rinse** - The fabric is finally rinsed a number of times with soft water until the risings are free from soap. This is checked by titration to methyl orange end-point with a standard solution of hydrochloric acid and comparing the results with a blank of water used. The cloth is allowed to dry room temperature.