

DRAFT TANZANIA STANDARD

**TBS/CDC-2(5222) P3 Surface active agents – Methods for performance tests -
Part 3: Foaming power (Revision of TZS 224-3: 1984)**

TANZANIA BUREAU OF STANDARDS

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: Foaming power. This edition maintains the first approved methods.

Tests for relative dispersing power, emulsifying power and relative detergency of surface active agents are covered in Part 1, Part 2 and part 4 respectively of this standard.

In the preparation of this standard, assistance has been derived from IS 5785 (Part 3) – 2016 *Methods for performance tests for surface active agents – Part 3 Forming power*; published by the Bureau Indian Standard Institution

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

Surface active agents – Methods for performance tests – Part 3: Foaming power

1 Scope

1.1 This Part of Draft Tanzania Standard prescribes two methods for the measurement of the foaming power of a surface active agent. The methods are applicable to all surface active agents. Method A, known as the Ross-Miles method, shall be the referee method and shall be used in case of any dispute. Method B shall be the alternative method.

1.2 The methods are not applicable for measurement of the foaming power of very dilute solutions of surface active agents, such as river water containing surface active agents.

1.3 Measurement of the foaming power of solutions of readily hydrolysable surface active agents by these methods does not give reliable results, as the hydrolysis products collect in the films of liquid and agent the persistence of the foam.

NOTE 1– the persistence of liquid films is very sensitive to the presence of insoluble matter. This method or measurement of foaming power should be used only with the greatest of care, for measuring the foaming power of compositions based on surface active agents of which the solubility is rarely complete. Forming power is also very sensitive to small variations in composition. Consequently, the results obtained on formulated products should be interpreted with caution.

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*

3 Terminology

For the purpose of this standard, the following definitions shall apply.

3.1 Foam

mass of small gas cells, separated by thin films of liquid and formed by the juxtaposition of bubbles, giving a gas dispersed in a liquid

3.2 Foaming power

ability to produce foam

Note 2: In this standard, foaming power is characterized by the volume of foam obtained under specific experimental conditions. The decay of this volume of foam during the five minutes following its formation is also relevant.

4 Method A (Ross – Miles method)

4.1 Apparatus

4.1.1 Pipette

The pipette shown in figure. 1 shall be constructed from standard-wall chemically resistant glass tubing having the following dimensions:

- a) For the bulb, 45.0 mm \pm 1.5 mm outside diameter; and
- b) For the lower stem, 7.0 mm \pm 0.5 mm outside diameter

The upper stem shall be constructed to contain a solid stopper, straight bore, No. 2, standard-taper stopcock having a 2 mm bore and stems 8 mm in outside diameter. Both the upper and lower seals of the bulb to the stems shall be hemispherical in shape. The lower stem shall be hemispherical in shape. The lower stem shall be 60 mm \pm 2 mm in length from the point of attachment to the bulb and shall contain an orifice sealed into the lower end. The orifice shall be constructed from precision bore tubing having an inside diameter of 2.90 mm \pm 0.02 mm and length of 10.00 mm \pm 0.05 mm, with both ground square. The orifice shall have an outside diameter so as to fit snugly into the lower stem and form a secure seal to the stem when heated with a sharp pointed flame in the blow torch. The pipette shall be calibrated to contain 200.0 mL \pm 0.2 mL at 20°C. the calibration mark shall be on the upper stem at least 15 mm below the barrel of the stopcock and shall completely encircle the stem.

4.1.2 Receiver

The receiver shown in Fig. 2 shall be constructed from standard-wall, chemically resistant glass tubing having an internal diameter of 50.0 mm \pm 0.8 mm, with one end constructed and sealed to a straight-bore, solid-plug, standard-taper No. 6 stopcock having a 6 mm bore and 12 mm stems.

The receiver shall have three calibration marks which shall completely encircle the tube. The first mark shall be at the 50 mL point, shall be measured with stopcock closed, and shall not be on any curved portion of the construction. The receiver tube shall be mounted in a standard-wall tubular water jacket, having an external diameter of not less than 70 mm, fitted inlet and outlet connections. The jacket may be attached to the receiver with rubber stoppers or may be sealed at the top and bottom. The seal at the bottom shall be as close to the barrel of the stopcock as practicable. The assembled receiver and jacket shall be mounted securely in a plumb position and the jacket connected to a source of water thermostatically placed around the receiver and having an angular displacement of 120 deg from each other. A clamp which may be securely attached to the upper part of the pipette, shall fit into the holes. The clamp shall have three leveling screws and lock nuts and when properly mounted shall exactly center the pipette in the receiver and bring the lower tip of the pipette level with the upper calibration mark on the receiver. A meter stick shall be fastened to the side or behind the receiver with the zero point level with the 250 mL calibration point on the receiver.

4.2 Preparation of sample solution

Distilled water complying to TZS 59 (see clause 2), for water of various degrees of hardness, may be used for this test. Preheat the water used for preparing the solution and add slowly, while stirring vigorously, and amount of the surface active agent that will produce the desired concentration. Continue stirring in such a manner as to avoid excessive foam formation, until solution of the surface active agent is complete. Age the solution at a temperature of 48.0 °C \pm 0.5 °C for a total period of 30 min, containing the time when the surface active agent is first added to the water.

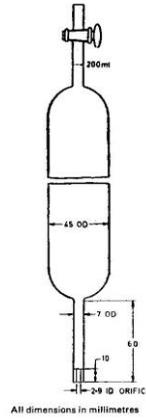


FIGURE 1 - Foam pipette.

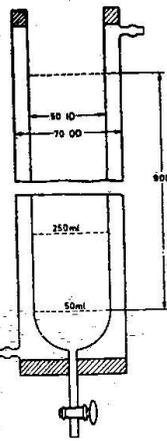


FIGURE 2 – Foam receiver

4.3 Procedure

While the surface active solution is aging, circulate water at $48.0\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$ through the water jacket of the receiver so as to bring it to the proper temperature. Rinse down the walls of the receiver with distilled water and, as an indication of cleanliness, observe whether the water drains down the walls in an unbroken film. At the completion of the aging period close the stopcock at the bottom of the receiver. Rinse the walls of the receiver with 50 mL of the solution, using a pipette, and after draining to the bottom of the receiver, adjust the stopcock so that the level of the solution in the receiver is exactly at the 50 mL mark. Fill the pipette with the solution to the 200 mL mark, using a slight suction for the purpose. Immediately place it in position at the top of the receiver and open the stopcock. When all of the solution has run out of the pipette, start a stop-watch, take a reading of the foam height and take a second reading at the end of 5 min. take the reading by measuring the foam production at the top of the foam column at the highest average height to which the rim of the foam has reached. This height is proportional to the volume of air remaining in the foam.

4.4 Reporting

In reporting results by this test, state the concentration in grams per litre, the temperature of the test, the degree of hardness of the water, and the initial foam height reading. It is desirable to conduct this test at a number of concentrations, the lowest of which shall be chosen to show a foam height which shall be no higher than 20% of the foam height shown at the highest concentration.

5 Methods B

5.1 Outline of method

The volume of foam obtained after running 500 mL of a solution of a surface active agent, from a height of 450mm, on to a liquid surface of the same solution is measured under prescribed conditions.

5.2 Apparatus

5.2.1 Assembly of apparatus

The apparatus, shown in Fig. 3, consists of the following parts:

- a) A separating funnel of 1 litre capacity, consisting of a pear-shaped bulb to the upper end of a tube about 200 mm long, having a tap at the lower end. The funnel carries a mark, 150 mm above the axis of the tap, which indicated the lower limit of discharge during the test. The lower end of the tube is cut off strictly perpendicular to its length, 40 mm below the axis of the tap. The tap is molded, not blown, the groove through the key being of sufficient diameter (not less than 3 mm) to avoid undue obstruction of the flow of the liquid.
- b) A graduated measuring cylinder of 1 litre capacity. The measuring cylinder stands in a water-bath fitted with a thermostat, the bath being sufficiently large to accommodate the measuring cylinder immersed up to half its height.
- c) A stand comprising a vertical rod, sufficiently long to allow the separating funnel and the measuring cylinder to be held in place. To ensure that the assembly is centered and so maintained during the measurement, the separating funnel is held by means of two rings, one supporting the spherical part, the other of much smaller diameter placed as low as

possible around the stem of the separating funnel, below the tap. The measuring cylinder is held in place by means of a screw clamp with one moveable jaw.

- d) Stainless steel metering tube, 70 mm long, 1.90 ± 0.02 mm internal diameter and 0.3 mm wall thickness. The ends of the tube should be cut accurately at right angles to the axis of the tube, in a precision tool lather. The metering tube is a push fit in a steel mounting tube 5 to 10 mm long, of internal diameter equal to the external diameter of the metering tube, and of external diameter equal to that of the lower end of the glass tube of the separating funnel. The upper ends of metering tube and of mounting tube should be in the same plane. The mounting tube is fixed by means of a short length of thick rubber tube (vacuum tubing) so that the upper end of the mounting tube is in contact with the lower end of the glass tube.

5.2.2 Cleaning of apparatus

Before the test, and, possible, overnight, leave all glassware in contact with chromic- sulphuric acid mixture, prepared by slowly stirring concentrated sulphuric acid into an equal volume of a saturated solution of potassium dichromate. Rinse the apparatus first in distilled water until free from acid and then with a small quantity of the solution under test.

5.2.2.1 Keep the mounting tube and metering tube assembly for 30 min in the vapour of an azeotropic mixture of ethanol and trichlorethylene, then rinse it with a small quantity of the solution under test.

5.2.2.2 Between each measurement, of the same product, simply rinse the apparatus with the solution under test. When it is required to remove, the form remaining in the measuring cylinders, no matter what method is employed to do so, follow by a rinse with the solution under test.

NOTE 3– Perfect cleanliness of the apparatus is essential for success in the test

5.3 Preparation of solution

5.3.1 Prepare a solution of the material at the working strength. The water used for dilution may be either distilled water saturated with air by bubbling, or hard water containing 300 mg/ kg of calcium carbonate. Prepare the solution by passing and then dissolution in the chosen water, previously warmed to 50 °C. it is necessary to mix very gently to prevent the formation of foam. Keep the solution at $50 \text{ °C} \pm 2 \text{ °C}$, without stirring, until the test is made. The age of the solution at the time of the measurement, should be not less than 30 min nor greater than 2 h.

5.3.2 Other conditions than those specified above (for example, hardness of the water, temperature) may be chosen provided that they are mentioned in the test report.

5.4 Procedure

5.4.1 Assembling the apparatus

The apparatus shall be assembled in a place free from draughts. Adjust the thermostat of the water – bath to bring the temperature of the bath $50 \text{ °C} \pm 2\text{°C}$. Introduce 50 mL of the solution, prepared as described in 4.3, into the measuring cylinder, running it down the inside wall so that no foam is formed on its surface. Place the measuring cylinder in the water-bath and hold it in place by means of the screw-clamp. Mount the separating funnel with the metering tube attached to the outlet of the tap and adjust the support, so that the axes of the measuring cylinder and the metering tube are co-incident, and also that the lower end of the metering tube is 450 mm above the level of the 50 mL of solution, previously introduced into the measuring cylinder.

5.4.2 Filling the apparatus

5.4.2.1 For the first measurement, introduce part of the test solution into the separating funnel up to the 150 mm mark. To do this, immerse the lower end of the metering tube in a portion of the test solution maintained at $50\text{ }^{\circ}\text{C} \pm 2^{\circ}\text{C}$ in a beaker and aspirate the liquid by suitable means attached to the top of the bulb. This is the most certain way to avoid the formation of air-bubbles in the hole through the key of the tap. The beaker is kept below the separating funnel until the measurement is made. To complete the filling, pour 500 mL of the test solution, maintained at $50 \pm 2^{\circ}\text{C}$, into the separating funnel from the 500 mL graduated cylinder, performing this may be achieved by the used a special funnel with a curved stem, the end of which touches the interior wall of the separating funnel.

5.4.2.2 For subsequent measurements, empty the separating funnel down to a height of 1 to 2 cm above the top. Place the beaker full of the test solution, kept at $50\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, under the separating funnel with the test solution up to the 150 mm mark then pour in 500 mL of the test solution, maintained at $50\text{ }^{\circ}\text{C} \pm 2^{\circ}\text{C}$, as described above.

NOTE 4 – Filling to the 150 mm mark may also be achieved by not allowing the separating funnel to empty completely after the previous filling with the test solution. This simpler method gives less guarantee of freedom from air bubbles.

5.4.3 Allow the solution to flow, without interruption, until the level falls to the 150 mm mark. Note the time of efflux. All measurements in which the time of efflux differs by more than 5% from the arithmetic mean of previously observed efflux times should be neglected, an abnormally long time indicating the presence of an air-bubble in the metering tube or in the tap. Measure the volume of foam (only the foam at 30 s, 3 min and 5 min after the efflux has been stopped).

5.4.3.1 If the upper level of the foam has depression in the center, record the reading as the arithmetic mean between the center and the edges (see Note 5).

NOTE 5 – It may be of assistance, in making this measurement, to use a white varnished slip carrying a longitudinal black varnished line. This slip is placed in the form generated in the receiving cylinder and the lower level of the volume of foam to be measured is taken at the point where contrast between black and white is visible.

5.4.3.2 Repeat the measurement ten times, preparing a fresh solution each time as described in 4.3.1. Take the arithmetic mean of at least 8 results.

5.5 Expression of results and reporting

5.5.1 Express the results in milliliters of foam formed 30 s, 3 min and 5 min after stopping the efflux. Then draw the corresponding curve.

5.5.2 The test report should give the method used and the results obtained. It should also mention:

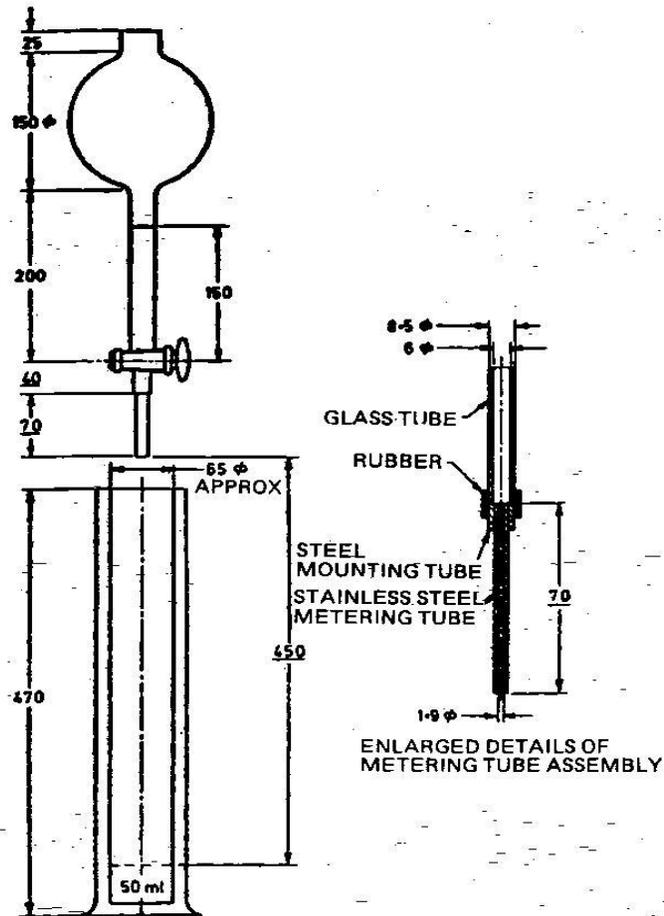
- a) the concentration of the test solution, expressed in grams of surface active agent per litre;
- b) the temperature in degrees Celsius during the test, if it is different from that recommended (see Note 6); and
- c) the hardness of the water actually used, expressed in mg/kg of calcium carbonate, if this differs from that recommended.

NOTE 6 – Curves showing the variation of foaming power as a function of temperature differ considerably, according to the products examined, in slope as well as in variety. A comparison of

several surface active agents, according to their foaming power, cannot, therefore, be carried out unless this curve is prepared or at least three points upon it are given.

5.5.3 Finally, all operational details not already given in this standard or regarded as optional, together with any other incidents which may have affected the results, should be reported.

5.5.4 The report should include all details required for complete identification of the sample.



NOTE 7- The dimensions underlined are obligatory.
All dimensions in millimeters.

FIGURE 3 – Foaming test apparatus (Method B)