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ZIMBABWE STANDARD TEST METHOD FOR

CLEANING EFFICIENCY OF HIGH-FOAM LAUNDRY DETERGENTS

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All comments should be sent to the Committee Secretary **Ms E Pindura** at the address shown below.

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AMENDMENTS

No.	MD No.	Date of Issue	Text affected

Zimbabwe Standards are revised, when necessary, by issuing either amendments or revised editions. Suggestions for improvements will be welcome at all times.

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Foreword

This Zimbabwe Standard Test Method ZWS1107:2023: Cleaning efficiency of high-foam laundry detergents, is identical to SANS 5782:2018. Referenced South African standards are replaced with Zimbabwe equivalent standards where relevant.

This Zimbabwe Standard was prepared by TC CH001 – Chemicals, which falls under the Chemicals Standards Sector. The standard was approved by the Standards Approval Committee.

ZIMBABWE STANDARD TEST METHOD

FOR

CLEANING EFFICIENCY OF HIGH-FOAM LAUNDRY DETERGENTS

1. Scope

This test method specifies a method for the determination of the cleaning efficiency of high-foam laundry detergents.

2. Materials and Reagents

2.1 **Indelible Marking Ink**

2.2 **Standard Soiled Cotton Swatches**, as follows:
Twenty standard soiled cotton swatches of size 65 mm × 75 mm, designated C-12, impregnated with pigments, groundnut oil, stabilisers and a low concentration of skimmed milk-powder.

2.3 **Standard Detergent** of composition as in table 1

Table 1 — Composition of the standard detergent

Composition	Mass fraction %
Linear sodium alkylbenzenesulfonate (mean length of alkane chain C 11,5) ...	8,0 ± 0,02
Ethoxylated tallow alcohol (14 EO)	2,9 ± 0,02
Sodium soap (chain length C_{12-22})	3,5 ± 0,02
Sodium tripolyphosphate	43,7 ± 0,02
Sodium silicate (SiO_2/Na_2O = 3,3/1)	7,5 ± 0,02
Magnesium silicate	1,9 ± 0,02
Carboxymethylcellulose (CMC)	1,2 ± 0,02
Ethylenediaminetetraacetic acid (EDTA), tetrasodium salt	0,2 ± 0,02
Sodium sulfate (anhydrous)	21,0 ± 0,02
Optical brightener of cotton (dimorpholinostilbene type)	0,2 ± 0,02
Moisture	9,9 ± 0,02
	100,0

2.4 **Standard Hard Water**
Prepared as follows:

Dissolve in separate 1 ℓ volumes of distilled water 3,520 g of chemically pure calcium chloride ($CaCl_2 \cdot 2H_2O$) and 3,947 g of chemically pure magnesium sulfate ($MgSO_4 \cdot 7H_2O$). Mix both of the solutions together and dilute to 20 ℓ with distilled water. (This standard has a hardness of approximately 200 mg/ℓ, expressed as calcium carbonate.)

2.5 **Pieces of blotting paper**, of size approximately 110 mm x 120 mm.

3 Apparatus

3.1 Photo-electric reflectance meter fitted with a search unit and so designated that the light strikes the test surface in the normal direction and the reflected light is measured at an angle of approximately 45° from normal. The search unit is fitted with a filter that provides a spectral response equivalent to observation by the human eye in average daylight.

Standardize the reflectance meter by means of a calibrated white enamel working standard that has a reflectance of 79,7 % of that of magnesium oxide.

3.2 Mechanical washing device that has individual containers, and that is capable of maintaining the temperature of their contents at 40 °C ± 1 °C and of causing oscillating agitation of the contents of each container at a speed of (100 ± 2) cycles per minute.

3.3 **Analytical Balance**, with a resolution of 0,001 g or better.

3.4 **Laboratory-Grade Glass Beaker**, with a capacity of at least 5 ℓ

3.5 **Means of heatin**g, such as a hot plate or water bath.

3.6 **Measuring Cylinder** with a capacity of at least 1 ℓ.

3.7 **Steam-iron** of the hand- or power-operated type, that is suitable for pressing and drying cotton fabrics.

4. Sampling

Take a laboratory sample as specified in the relevant product standard. Where no standard exists, take the laboratory sample as agreed upon between the test laboratory and the manufacturer to ensure a reasonable and acceptable reliability at a reasonable and acceptable confidence level.

5. Procedure

5.1 With indelible marking ink (see 2.1), uniquely identify each standard soiled cotton swatch (see 2.2).

Note. It is preferable to finish the raw edges of the swatches with stitching to prevent unravelling during testing

5.2 Using the photo-electric reflectance meter (see 3.1), take three reflectance readings on each side of each standard soiled cotton swatch in turn. Take the readings with the swatch under test superimposed on three unwashed swatches placed on a black enamel standard. Calculate both the mean reflectance of each swatch from the relevant 6 readings and the standard deviation (σ) of the 20 swatches. If the standard deviation does not exceed 2,0, proceed as in 5.4.

5.3 If, however, the standard deviation exceeds 2,0, remove and discard the swatches which have the highest or lowest (or both, as appropriate) reflectance readings and replace with new swatches. Determine, as in 5.2, the mean reflectance of each replacement and calculate the new standard deviation. Repeat this procedure until the standard deviation of the 20 swatches does not exceed 2,0

5.4 Start the mechanical washing device (see 3.2) and set it to a wash temperature of 40 °C ± 1 °C.

5.5 Weigh out (see 3.3) 6,00 g of the standard detergent (see 2.3) into a 5 L beaker (see 3.4) and add 3 L of the standard hard water (see 2.4).

5.6 Weigh out 6,00 g of the test specimen detergent into a 5 L beaker and add 3 L of the standard hard water.

It is recommended that the solutions be prepared sufficiently early to allow the standard and test specimen to be completely dissolved when the test is started.

5.7 Place both of the solutions on a warm hotplate or in a water bath (see 3.5) 1 h before use and, stirring occasionally, bring their temperatures to 40 °C ± 1 °C, and then maintain them at this temperature until the test is started.

5.8 Mix the standard solution thoroughly and immediately thereafter, using a measuring cylinder (see 3.6), transfer 1 000 mL of the solution to a container of the washing device.

5.9 Repeat the procedure given in 5.8 but use the test specimen solution.

5.10 Bring the temperature of the solutions in the containers back to 40 °C ± 1 °C, and then, by sliding each swatch down the side of the container until it is below the surface of the solution, add 10 swatches to each container of both the standard solution and the test specimen solution. Wash the swatches at a speed of (100 ± 2) cycles per minute for exactly 10 min, then stop the machine, examine the swatches in each container and separate any that have become entangled. Wash for a further 20 min.

5.11 After washing, remove the swatches from the wash solutions and without squeezing, blot each swatch separately between pieces of the dry blotting paper (see 2.5); then rinse, for 1 min, all the swatches together in approximately 4 ℓ

of the standard hard water at a temperature 25 °C ± 3 °C, stirring with a glass rod during the rinsing. Remove the swatches from the water and, without squeezing, blot each swatch separately between pieces of the dry blotting paper.

5.12 Steam-iron (see 3.7) the blotted swatches and condition them at ambient temperature for at least 1 h.

5.13 Determine the mean reflectance of each of the washed swatches as in 5.2 but, instead of three unwashed swatches, place three washed swatches on the black enamel standard. It is recommended that swatches washed in the standard solution be superimposed on three swatches washed in the standard solution; and swatches washed in the test specimen solution be superimposed on three swatches washed in the test specimen solution.

6. Calculations

6.1 Calculate the comparative cleaning efficacy CE, expressed as a percentage soil removal, of the test specimen as follows:

$$CE = \frac{R_2 - R_1}{R_3 - R_1} \text{ X } 100$$

where

R_1 is the mean reflectance of the standard soiled cotton swatches before washing (see 5.2 or 5.3, as relevant);

R_2 is the mean reflectance of the standard soiled cotton swatches after washing with the test specimen;

R_3 is the mean reflectance of the standard soiled cotton swatches after washing with the standard detergent.

Note. The reflectance reading indicates the amount of soil in the swatches. The increase in the reflectance units after washing indicates the amount of soil removed.

6.2 Use the following formula to determine the standard deviation, σ_{n-1}, of the difference in the reflectance units between the washed and unwashed swatches for the standard detergent and for the test specimen:

$$\sigma_{n-1} = \sqrt{\frac{\sum(d - \bar{d})^2}{n-1}}$$

where

d is the individual ($R_2 - R_1$) difference or individual ($R_3 - R_1$) difference (see 6.1);

$\bar{d}$ is the mean of the ($R_2 - R_1$) difference or the mean of the ($R_3 - R_1$) difference (see 6.1);

n is the number of readings.

NOTE When determining the standard deviation, take into account the sign (+ or –) of each individual difference value (d) and the sign of the mean difference value ($\bar{d}$).

6.3 Use a standard deviation of 2,0 from the mean (see 6. 2) for acceptance of results to be used in the calculation of CE (see 6. 1).

6.4 If 3 out of 10 results are outside the acceptance limit, repeat the test.

7. Test Report

Report the following information:

a) all the data needed to identify the laboratory sample tested;

b) confirmation that the test was carried out in accordance with this standard;

c) any deviation from this standard; and

d) the comparative cleaning efficiency, expressed as a percentage soil removal, of the detergent under test.

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