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Evaluation Guide of Detergence, Water Costing and Saving for Laundry Detergents - Simulated Household Washing Test Method

衣料用洗涤剂去污性能、耗水量与节水性能评估指南

模拟家庭洗涤试验法

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Evaluation Guide of Detergence, Water Costing and Saving for Laundry Detergents - Simulated Household Washing Test Method

1 Scope

This Standard provides basic principles, basis and modes, as well as conditions that need to be determined for the establishment of evaluation methods for the detergency, whiteness preserved, level of using water and water-saving performance of test laundry detergents through the simulated household washing mode under laboratory conditions.

This Standard is applicable to all types of laundry detergents (excluding soap products) with water as the wash solution.

2 Normative References

The following documents are indispensable to the application of this document. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 13173-2008 Surface Active Agents - Detergents - Testing Methods

GB/T 13174 Determination of Detergency and Cycle of Washing Property for Laundry Detergents

3 Terms and Definitions

The following terms and definitions are applicable to this Standard.

3.1 Wash

Wash refers to the process of removing stains adhering to clothes with an aqueous solution containing detergent.

NOTE: the aqueous solution containing detergent used in washing is known as wash solution.

3.2 Rinse

Rinse refers to the process of adding water to rinse clothes after washing.

number (in the calculation, the level of using water is calculated by the sum of water used for rinsing).

3.9 Saving Water

Saving water refers to the degree of reduction in the level of using water of the sample detergent relative to the reference detergent after the completion of washing under determined washing comparison conditions.

4 Basic Principles

4.1 Under laboratory conditions, the determined washing and rinsing methods shall be able to reflect the consumers' actual washing habits.

4.2 The determined evaluation indexes shall be suitable for the washing characteristics of the type of detergent.

4.3 The test result of the evaluation shall manifest a certain degree of reproducibility.

5 Sample Preparation

The test samples may come from organizations or individuals that have test demands, such as: manufacturers, markets and consumers, etc. In order to make the sample test results comparable and reproducible, some reference detergents with fixed formulas may be used for comparison, for example, the standard detergent specified in GB/T 13174 may be considered as the basis for determining the washing performance and the level of using water of the sample.

The sample treatment and application shall comply with the stipulations of Chapter 4 in GB/T 13173-2008.

6 Selection of Washing Materials and Stains

6.1 Washing Lining (companion washing fabric)

The selection of washing fabrics for tests needs to consider the suitability with the determination of the evaluation results of the level of using water of the detergent. It shall also be close to the ratio of the mainstream fabrics in the market. Since different fabrics have different adsorption of laundry detergents, it is relatively reasonable to use a combination of fabrics with various typical materials for the washing tests. This combination may refer to the ratio of various fabrics worn by consumers daily. In addition, in accordance with the washing requirements, determine the quality of the fabrics to be washed at an appropriate quality. In the evaluation of the mode of washing by washing machines, use a set of washing lining fabrics with a net weight of 1,300 g

In real life, the temperature of water used for washing significantly varies in different regions and seasons. The common washing temperature is the natural water temperature. In the test, the temperature of water used for washing is also a condition that needs to be controlled by the test personnel. Just like the water quality, within the range of 10 °C ~ 30 °C, selecting different temperature points for the washing test can reflect the performance of the detergent in a more comprehensive way. The typical test temperature is 25 °C ± 2 °C.

8 Modes of Washing

There are three modes of washing: washing by washing machines (machine washing), manual washing (hand washing) and manual and machine washing. The third mode is mainly used as a supplement to the first mode, and the level of using water in actual washing is the same as that of the first mode, which depends on the set program of the washing machine. Therefore, the design of washing test may be carried out through the mode of machine washing or hand washing. Starting from the fundamental purpose of the test to explore the performance of the detergents, the determined washing mode shall have a certain degree of reproducibility based on the simulated washing mode in real life. For this reason, adopting the mode of machine washing makes it easier for the reproductivity of the test results.

For the mode of machine washing, the soaking, washing, drying and rinsing links, and the level of using water may be determined in accordance with the program set by the machine. In addition, they shall remain unchanged throughout the test, so as to obtain stable, comparable and reproducible test results. During the washing test, in order to monitor the water quality changes of the wash solution at any time, the two-cylinder washing machine may be more convenient than the fully automatic washing machine. The test result of washing by washing machine has a high degree of consistency with the actual washing result, but it is not easy to control the test error and cost. Another alternative is to use the mode of simulating the laboratory detergency test machine for evaluation. This method has advantages in the repeatability control of the test results and the test cost, but its conformity with the reality may be relatively low.

For the mode of hand washing, the implementer of this Standard needs to further specify the details of washing, wringing and rinsing, including the size of the washtub and the amount of water added each time, etc. In addition, the operating personnel shall receive uniform trainings, so as to ensure that the difference in the results obtained by different operators are within the acceptable range.

9 Process of Washing

9.1 Detergency

After determining the test conditions of washing, enter the actual washing. Whether it

standards and literature, select the method that complies with the requirements of the detection limit and precision. Appendix B lists some commonly used detection methods for selection.

10.3 Application of Determination Indexes

For the determination of the rinsing effect, appropriate indexes shall be selected from the indexes listed in Table 1 to determine each rinse solution. The indexes selected for the tests should be involved in all three categories; they are also related to the formula of the detergent (for example, if an anionic surfactant is not added, then, it is unnecessary to test the indexes related to anionic surfactants) and can objectively reflect the rinsing effect.

The judgment of the end of rinse is determined by comparing the variation trend of the same type of indexes in the adjacent rinse solution. When the index of a certain rinse (the i^{th} rinse) is significantly different from the same index of the previous rinse, while the relative change of the index of the following rinse is not obvious, then, it can be considered that the i^{th} rinse has reached the actual demands, and the rinse can be terminated. In the specific test, the index of the i^{th} rinse can be used as the base number to estimate the change ratios N_{i-1} and N_{i+1} of the indexes of the $(i - 1)^{th}$ rinse and the $(i + 1)^{th}$ rinse, so as to make the judgment of the rinsing result.

NOTE 1: the principle of determining the number (i) of rinses is that N_{i-1} larger than 1, and N_{i+1} smaller than 1 and close to 1. When N_{i-1} is much larger than 1, and N_{i+1} is much smaller than 1, it indicates that the rinse of the detergent needs to be continued, and that it needs to be re-calculated and re-evaluated in accordance with the data after the end of the next rinse.

NOTE 2: the deviation of the value of N from 1, and the difference between N_{i-1} and N_{i+1} are related to specific indexes. For different indexes, the magnitude of changes of the value of N is different. For some indexes (for example, anionic surfactant content), there may be an order of magnitude changes in the value of N; for some other indexes (for example, pH), the magnitude of changes of the value of N is relatively small; for some non-digital characterized items (such as: foam and turbidity), the value of N is based on manual estimation. The implementer of this Standard may combine the characteristics of the test samples and the indexes to determine the acceptable range of the value of N during the evaluation of rinse. For the non-digital characterized items, a mode of estimating the value of N shall also be drawn up (for example, the amount of foam on the liquid surface of the solution or the size of foam on the liquid surface may be chosen as the basis for calculation; for the turbidity of the solution, unused rinse solution may be used as a benchmark for comparison).

NOTE 3: in order to effectively apply the value of N, the standard detergent listed in GB/T 13174 should be used for confirmation tests; the reference basis for the application of the value of N of each index in the laboratory shall be established.

whiteness value F_2 of the test piece after washing.

NOTE: use whiteness meter that complies with the stipulations of JB/T 9327 and JJG 512. The whiteness meter method is applicable to the evaluation of stains mainly in black and white. For detergents added with fluorescent brighteners, different types of whiteness meters (when there is a difference in the fluorescence reaction) may have different results.

11.1.4 Scanner method

Use a scanner to read the chromaticity value (Lab) of the stained cloth pieces before and after washing. Use Formula (1) to calculate the change of chromatic aberration ΔE_i of the stained cloth pieces before and after washing, so as to evaluate the detergency. Before and after washing, read the largest effective area of the center of the front side of the cloth pieces Lab_1 and Lab_2.

The value of chromatic aberration (ΔE_i) of a certain type of stain shall be calculated in accordance with Formula (1):

$$\Delta E_i = \sqrt{(L_{1i} - L_{2i})^2 + (a_{1i} - a_{2i})^2 + (b_{1i} - b_{2i})^2} \qquad \cdots\cdots\cdots\cdots\cdots\cdots (1)$$

Where,

L_{1i}, a_{1i}, b_{1i}---the L, a and b value obtained through measurement of the i^{th} stained cloth piece before washing;

L_{2i}, a_{2i}, b_{2i}---the L, a and b value obtained through measurement of the i^{th} stained cloth piece after washing.

NOTE: adopt a tablet scanner that complies with the stipulations of GB/T 18788 and equipped with working software that reads the Lab value of the images and calculates the chromatic aberration ΔE. The scanner method is applicable to the evaluation of detergency of various colored stains. For detergents added with florescent whitening agents, the consistency between the test result by the scanner method and that of the manual visual inspection will be reduced.

11.2 Evaluation of Whiteness Preservation

In accordance with the whiteness change of the fabric material tested for whiteness preservation before and after washing by the sample detergent and the reference detergent, adopt the mode similar to the evaluation of detergency (11.1) to evaluate and calculate the whiteness preservation capability of the detergent.

Appendix A

(normative)

Selection Principles, Quality Requirements and Types of Stained Cloth Pieces Used in Detergency Test

A.1 Basic Principles for Selecting Types of Stain Used for Detergent's Performance Evaluation

Choose in accordance with the following modes:

a) Select stains that are representative and frequently appearing in people's daily lives;

b) The stain material shall be able to represent the originality of common stains in daily life and be applicable to laboratory evaluation;

c) The dyed stain material has good discrimination, as well as good stability and reproducibility;

d) Select the mainstream cloth in the market as the carrier, namely, cloth base, for the stain material preparation.

A.2 Classification of Stains

Classify stains in accordance with the following modes:

a) In accordance with the natural state of the stain source, the stains can be divided into solid stains, liquid stains and pasty stains;

b) In accordance with the representative types of stains in life, the stains can be divided into three types: food stains, household stains and environmental stains:

---Food stains mainly include: tea / coffee stains, wine stains, milk stains, edible oil stains, seasonings / sauce stains, fruits and vegetables / juice stains, grain food stains and infant food stains, etc.

---Household stains mainly include: sebum stains, blood stains, cosmetic stains, mineral oil stains, pen and ink stains, etc.

---Environmental stains mainly include: soot stains, soil stains and grass stains, etc.

A.3 Requirements for Quality

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