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NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA

GB 31604.7-2023

**National food safety standard - Food contact materials and
products - Decolorization test**

食品安全国家标准 食品接触材料及制品 脱色试验

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National food safety standard - Food contact materials and products - Decolorization test

1 Scope

This standard specifies the test methods for discoloration of plastic materials and products used in food contact.

This standard is applicable to the determination of soak solution coloring and wipe decolorization of food-contact plastic materials and products with colorants.

2 Principle

The decolorization test is divided into two parts: soak solution coloring and wipe decolorization. The soak solution coloring uses food simulants or chemical alternative solvents obtained from the migration test. The grey scale or 9-step chromatic transference scale for assessing staining is used to evaluate the grade of soak solution coloring. For wipe decolorization, absorbent cotton moistened and saturated with food simulants is used to wipe the food contact surface of the sample, and the coloring grade of the absorbent cotton after wipe is evaluated by using the grey scale or 9-step chromatic transference scale for assessing staining.

3 Reagents and materials

Unless otherwise stated, the reagents used in this method are of analytical grade and the water is second-grade water specified in GB/T 6682.

3.1 Reagents

3.1.1 Glacial acetic acid ($C_2H_4O_2$).

3.1.2 Absolute ethanol (C_2H_6O).

3.1.3 Isooctane (C_8H_{18}).

3.1.4 95% ethanol.

3.1.5 Vegetable oil (olive oil, corn oil): It shall comply with the requirements of GB 5009.156.

5.1.2 Blank test

Process food simulants or chemical alternative solvents that are not in contact with the sample to be tested according to 5.1.1, and the soak solution obtained is the blank soak solution.

5.1.3 Coloring grade assessment

Experimenters shall have no color vision impairment. If laboratory personnel wear corrective glasses, their lenses must have uniform spectral transmittance throughout the visible spectrum. If an experimenter performs continuous colorimetry, the person shall rest for a few minutes at certain intervals to ensure the quality of visual colorimetry.

Take colorimetric tubes with stoppers, add 50 mL of the soak solution that has been cooled to room temperature and the blank soak solution respectively, and place them on the colorimetric tube rack in the color assessment booth. Place the colorimetric tube rack and grey scale or 9-step chromatic transference scale for assessing staining on the same plane in the color assessment booth, and the experimenter shall observe it in the horizontal direction. Visually evaluate the grey scale or 9-step chromatic transference scale grade to which the color difference between the soaking solution and the blank soaking solution belongs. The corresponding number is the coloring grade of the soak solution.

When there is a difference in the coloring grade of the soak solutions between two parallel samples and it affects the presentation of the results of the decolorization test, additional assessors need to participate in the evaluation. If it is determined that the difference in the results of parallel samples is caused by the visual difference of the assessors, there shall be at least three people who give a consistent grade before the results can be reported. If it is determined that the difference in the results of parallel samples is not caused by the visual difference of the assessors, the samples need to be prepared again to evaluate the coloring grade of the migration test soak solution.

When comparing multiple batches of sample soak solutions at the same time, the soak solutions that are prepared with the same food simulant and assessed as the same coloring grade need to be compared together to ensure the accuracy of the assessment of each batch of sample soak solutions. When the color difference between a certain batch of sample soak solution and the blank soak solution is inconsistent with other batches evaluated at the same time, the coloring grade of the soak solution shall be re-evaluated.

5.2 Wipe decolorization

5.2.1 Sample preparation

The samples shall be pretreated in accordance with GB 5009.156, and 2 wipe

decolorization samples shall be prepared for each food simulant. Experimenters are required to wear disposable nitrile gloves for the wipe test, and ensure that the nitrile gloves worn do not discolor during the entire test process.

5.2.2 Preparation of food simulants for moistening absorbent cotton

The food simulant used for moistening absorbent cotton is selected according to the total migration test provisions in the corresponding product standards, GB 31604.1, and GB 5009.156. When vegetable oil is selected as the food simulant, liquid coconut oil is used for the wipe test. If coconut oil solidifies, it can be melted by heating at a constant temperature of 30 °C.

5.2.3 Preparation of absorbent cotton

Take absorbent cotton, cut it into a size of 2 cm×2 cm in an area of uniform thickness, with a mass of 0.25 g~0.30 g, and completely wet it with the food simulant selected in 5.2.2.

5.2.4 Experimenter's practice and confirmation of wiping force value

Take a plate or sheet of the same material as the sample to be tested, and place it on an electronic balance (or other equivalent device that can display the wiping force value); the experimenter presses the moistened absorbent cotton with the pulp of two fingers (index finger and middle finger) to wipe back and forth 100 times in an area of about 4 cm×2 cm at a speed of about 1 time/s (wipe the absorbent cotton back and forth for one round in the direction of the sample test, counting as 1 time). When wiping, apply force evenly along the test surface, and observe the mass display on the electronic balance throughout the process to ensure that the mass display during the entire wiping process is stable within the range of 1.0 kg±0.2 kg.

After three consecutive wiping exercises, if the mass display of the electronic balance in the whole process of wiping is stable in the range of 1.0 kg±0.2 kg, it is indicated that the wiping force value of the experimenter met the requirements.

5.2.5 Wipe decolorization test

Within an area of approximately 4 cm×2 cm on the food contact surface of the sample, press the moistened absorbent cotton with the pulp of two fingers (index finger and middle finger), and apply a wiping force that meets the requirements of 5.2.4 along the sample surface to wipe back and forth 100 times at a speed of 1 time/s, to obtain absorbent cotton after wiping. If an experimenter performs a continuous wipe decolorization test, the person shall rest for a few minutes at certain intervals to ensure the stability of the wiping force value.

5.2.6 Blank test

Use the sample of the same material that was confirmed not to be decolorized by wipe decolorization test as the blank sample, and prepare blank absorbent cotton according to 5.2.1~5.2.5.

5.2.7 Coloring grade assessment [Translator's note: here should be *Wipe decolorization grade assessment*]

Place the wiping absorbent cotton, blank absorbent cotton, and grey scale or 9-step chromatic transference scale for assessing staining on the same plane of the color assessment booth. The incident light is at an angle of about 45° to the surface of the absorbent cotton, and the observation direction is roughly perpendicular to the surface of the absorbent cotton. Visually evaluate the grey scale or 9-step chromatic transference scale grade to which the color difference between the absorbent cotton after wiping and the blank absorbent cotton belongs. The corresponding number is the wipe decolorization grade.

When there is a difference in the wipe decolorization grade of two parallel samples and it affects the presentation of the results of the wipe decolorization test, more assessors need to participate in the evaluation. If it is determined that the difference in the results of parallel samples is caused by the visual difference of the assessors, there shall be at least three people who give a consistent grade before the results can be reported. If it is determined that the difference in the results of parallel samples is not caused by the visual difference of the assessors, the samples need to be prepared again to assess the grade of wipe decolorization.

When conducting wipe decolorization tests on multiple batches of samples at the same time, it is necessary to compare the wiping absorbent cotton that is used for the same food simulant and assessed as the same grade together to ensure the accuracy of the wipe decolorization test assessment for each batch of samples. When the color difference between the wiping absorbent cotton and the blank absorbent cotton of a certain batch of samples is inconsistent with other batches of samples evaluated at the same time, the wipe decolorization grade of this batch of samples shall be re-evaluated.

6 Result presentation

When the assessed grade of the soak solution coloring test result is grade 5, 4-5, or 4.5, the soak solution coloring test result is represented as negative; when the assessed grade of the soak solution coloring test result is grade 1~4, the soak solution coloring test result is represented as positive.

When the assessed grade of the wipe decolorization test result is grade 5, 4-5, or 4.5, the wipe decolorization test result is represented as negative; when the assessed grade of the wipe decolorization test result is grade 1~4, the wipe decolorization test result is represented as positive.

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