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Determination of emission rate of volatile organic compounds from wooden furniture - Concentration history method

木家具中挥发性有机化合物释放速率检测 逐时浓度法

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1 Scope

This Standard specifies the principle, terms and definitions, test methods and result calculation for concentration history testing method of emission rate of formaldehyde, benzene, toluene, xylene, total volatile organic compounds (TVOC) in wooden furniture.

This Standard is applicable to testing of emission rate of formaldehyde, benzene, toluene, xylene, total volatile organic compounds (TVOC) in wooden furniture. The testing of emission rate of other volatile organic compounds may refer to this Standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB 18584, *Indoor decorating and refurbishing materials - Limit of harmful substances of wood based furniture*

GB/T 18801-2015, *Air Cleaner*

GB/T 31106-2014, *Determination of volatile organic compounds in furniture*

GB/T 31107, *Environmental chamber for the determination of volatile organic compounds of furniture - General technical requirements*

GB/T 35607, *Green product assessment - Furniture*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB18584, GB/T 31106-2014, GB/T 31107, GB/T35607 as well as the followings

5.1.1 Climate chamber

It shall meet the requirements of GB/T 31107. The number of air changes when the climate chamber is closed shall be less than $0.03h^{-1}$. See A.2 of GB/T 18801-2015 for the test method.

5.1.2 Sampling instruments and equipment

It shall meet the requirements of Clause 4 and Clause 5 in GB/T 31106-2014.

5.2 Test conditions

During the test, the test conditions in the climate chamber shall meet:

- Temperature of (23±2)°C;

- Relative humidity of (45±5)%;

- Air velocity of 0.1m/s~0.3m/s.

5.3 Sample

5.3.1 Measurement and calculation of emittable area

Use measuring equipment to measure the size of each wooden part of the wooden furniture sample. Calculate the emittable area of the sample. Those with carved patterns on the surface are treated with planes. If a steel ruler or tape measure is used, the accuracy is not less than 1mm. If an area tester is used, the accuracy shall not be less than $1mm^2$.

5.3.2 Pretreatment

Assembled products, folding products, and adjustable products shall be assembled, opened, and adjusted according to the style that is most conducive to emit harmful substances. Generally, conduct pretreatment according to the whole product. The surface of all parts of the product shall be exposed to the pretreatment environment.

Pretreatment time is (120±2)h.

The pretreatment environmental conditions are:

- Temperature is (23±2)°C;

- Relative humidity is (45±10)%;

- The distance between samples is not less than 300mm; the placement and direction shall try to avoid mutual interference between samples due to airflow;

formaldehyde sampling flow rate shall be 0.5L/min~1.0L/min. The sampling flow of benzene series and TVOC shall be 200mL/min. During the test, the total sample volume shall not exceed 10% of the volume of climate chamber.

5.4.4 Determination and analysis of volatile organic compound samples

According to the provisions of Clause 4 and Clause 5 in GB/T 31106-2014, analyze the collected samples of volatile organic compounds.

6 Result representation

According to the results of the concentration of volatile organic compounds obtained by determination and analysis, according to formula (1), the concentration and time of each target volatile organic compound in the chamber are respectively linearly fitted. The slope is a_0 ($R^2 \geq 0.90$). If R^2 is less than 0.90, and the concentration at the initial moment of the closed phase is lower than the 0.5th hour concentration result, sequentially obtain the slope between the target volatile organic compound concentration at each time and the concentration at the initial time of the closed phase. Take the maximum value as a_1. If R^2 is less than 0.90, and the initial concentration of the closed phase is higher than the 0.5th hour concentration result, then sequentially obtain the slope between the concentration at each time after the 0.5th hour and the concentration at the 0.5th hour. Take the maximum value as a_2. See Annex A for R^2 calculation method and fitting example. The calculation result keeps three decimal places.

$$a_0 = \frac{\rho_t - b}{t} \qquad \cdots\cdots (1)$$

Where,

a_0 - Linear fit slope, in milligrams per cubic meter hour [mg/(m^3·h)];

ρ_t - Target volatile organic compound concentration in the climate chamber, in milligrams per cubic meter (mg/m^3);

t - Time the sample is placed in the climate chamber, in hours (h);

b - Linear fit intercept, in milligrams per cubic meter (mg/m^3).

The emission rate per area of target volatile organic compound of wood furniture samples is calculated according to formula (2):

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