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**Technical requirement for low-volatile-organic-
compound-content coatings product**

低挥发性有机化合物含量涂料产品技术要求

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Foreword

This Standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard was proposed by China Petroleum and Chemical Industry Federation.

This Standard shall be under the jurisdiction of National Technical Committee on Coatings and Pigments of Standardization Administration of China (SAC/TC 5).

The drafting organizations of this Standard: Environmental Planning Institute, Ministry of Ecology and Environment, China Coatings Industry Association, China Petroleum and Chemical Industry Federation, CNOOC Changzhou Coating Chemical Research Institute Co., Ltd.

Main drafters of this Standard: Wang Ning, Ji Junhong, Li Li, Yang Jianhai, Xue Yan, Tang Ying, Su Chunhai, Ning Miao, Wang Zhen.

Technical requirement for low-volatile-organic-compound-content coatings product

1 Scope

This Standard specifies requirements, test methods, rules for determination, packaging marks, implementation of standard for low-volatile-organic-compound-content coatings product.

This Standard is applicable to the determination of low-volatile-organic-compound-content coatings product.

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/T 1725-2007, *Paints varnishes and plastics - Determination of non-volatile-matter content*

GB/T 3186, *Paints varnishes and raw materials for paints and varnishes - Sampling*

GB/T 5206-2015, *Paints and varnishes - Terms and definitions*

GB/T 6682-2008, *Water for analytical laboratory use - Specification and test methods*

GB/T 6750-2007, *Paints and varnishes - Determination of density - Pycnometer method*

GB/T 8170-2008, *Rules of rounding off for numerical values & expression and judgement of limiting values*

GB/T 9750, *Marks for package of coating products*

GB/T 23985-2009, *Paints and varnishes - Determination of volatile organic compound (VOC) content - Difference method*

GB/T 23986-2009, *Paints and varnishes - Determination of volatile organic*

compound (VOC) content - Gas-chromatographic method

GB/T 34675-2017, Determination of volatile organic compound (VOC) content in radiation curable coatings

GB/T 34682-2017, Determination of volatile organic compound (VOC) content in reactive diluent containing coatings

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 5206-2015 as well as the followings apply. For ease of use, some terms and definitions in GB/T 5206-2015 are listed repeatedly below.

3.1 low-volatile-organic-compound-content coatings product

The coating product that under application condition, the quality of the volatile organic compounds present in the coating products meets the volatile organic compound content limit requirements of the corresponding products in this Standard.

3.2 coating material

Liquid, paste or powder product. When it is applied to the substrate, it can form a coating with protection, decoration and/or other special functions.

[GB/T 5206-2015, definition 2.51]

3.3 volatile organic compound; VOC

The organic compound participating in atmospheric photochemical reactions, or organic compound determined according to relevant regulations.

3.4 volatile organic compound content; VOC content

The mass of the volatile organic compounds presents in the paint measured under the specified conditions.

[GB/T 5206-2015, definition 2.271]

3.5 application condition

The state that when the construction method and construction conditions meet the requirements in the corresponding product technical specification, after all the components of the product are mixed, construction can be carried out.

5.2.2.2 VOC content in water-based coating

5.2.2.2.1 VOC content in architectural wall coatings, wood coatings, floor coatings, waterproof coatings, and road marking coatings

Carry out according to the regulations of GB/T 23986-2009. The chromatographic column adopts a medium-polarity column (6% is cyanopropyl phenyl / 94% is polydimethylsiloxane capillary column). The marked substance is diethyl adipate. Weigh about 1g of sample. The moisture content is determined in accordance with the provisions of Annex A. The VOC content is calculated according to 10.4 in GB/T 23986-2009.

5.2.2.2.2 VOC content in other water-based coatings

First, determine the moisture content in the water-based coating according to the provisions of Annex A.

If the moisture content in the coating is greater than or equal to 70% (mass fraction), it shall be carried out in accordance with the provisions of GB/T 23986-2009. The chromatographic column adopts a medium-polarity column (6% is cyanopropyl phenyl / 94% is polydimethylsiloxane capillary column). The marked substance is diethyl adipate. Weigh about 1g of sample. The VOC content is calculated according to 10.4 in GB/T 23986-2009.

If the moisture content in the coating is less than 70% (mass fraction), it shall be carried out according to the regulations of GB/T 23985-2009. The non-volatile content shall be carried out in accordance with the regulations of GB/T 1725-2007. Weigh about 1g of sample. Bake at $(105\pm 2)^{\circ}\text{C}$ for 1h. The VOC content is calculated according to 8.4 in GB/T 23985-2009.

5.2.2.3 VOC content in solvent-based coatings

Solvent-based coatings without reactive diluents and water shall be carried out in accordance with the provisions of GB/T 23985-2009. The non-volatile content shall be carried out in accordance with the regulations of GB/T 1725-2007. Weigh about 1g of sample. Bake at $(105\pm 2)^{\circ}\text{C}$ for 1h. Do not measure moisture content. Set the moisture content as zero. The calculation of VOC content in solvent-based coatings without reactive diluent and water is carried out according to 8.3 of GB/T 23985-2009.

Solvent-based coatings containing reactive diluents shall be carried out in accordance with 5.2.2.4.

Solvent-based coatings intentionally added with water shall be carried out in accordance with the provisions of GB/T 23985-2009. The non-volatile content shall be carried out in accordance with the regulations of GB/T 1725-2007. Weigh about 1g of sample. Bake at $(105\pm 2)^{\circ}\text{C}$ for 1h. The moisture content is

determined in accordance with the provisions of Annex A. The calculation of VOC content is carried out according to 8.4 of GB/T 23985-2009.

5.2.2.4 VOC content in solvent-free paint

Carry out according to GB/T 34682-2017. The storage time when determining the non-volatile content is the standard test environment [temperature is $(23\pm 2)^{\circ}\text{C}$ and the relative humidity is $(50\pm 5)\%$]. Place for 24h or the time required by the product manual. But the storage time is not more than 7d. Do not measure moisture content. Set the moisture content as zero.

The calculation of VOC content is carried out in accordance with 8.3 in GB/T 34682-2017.

5.2.2.5 VOC content in radiation curing coatings

In accordance with GB/T 34675-2017.

The calculation of VOC content in water-based radiation curable coatings is carried out according to 8.4 in GB/T 34675-2017. The moisture content is determined in accordance with the provisions of Annex A.

The calculation of VOC content in non-aqueous radiation curable coatings is carried out in accordance with 8.3 in GB/T 34675-2017. Do not measure moisture content. Set the moisture content as zero.

6 Rules for determination

6.1 The test result is determined according to the rounding-off comparison method in GB/T 8170-2008.

6.2 When the VOC content in the application condition is indicated in the inspection report, the application condition shall be determined according to the provisions of 5.2.1.

6.3 When the application condition determination and VOC content meet the requirements of this Standard, the product shall meet the requirements of this Standard.

7 Packaging marks

7.1 In addition to the product packaging mark shall meet the requirements of GB/T 9750, products that have passed the inspection according to this Standard can be clearly indicated on the packaging mark.

Annex A

(normative)

Determination of moisture content - Gas chromatography

A.1 Reagents and materials

A.1.1 Distilled water: meet the requirements of Grade 3 water in GB/T 6682-2008.

A.1.2 Dilution solvent: organic solvent used to dilute the sample and dried by molecular sieve, does not contain any substances that interfere with the test. The purity is at least 99% (mass fraction), or the purity is known. For example: dimethyl formamide.

A.1.3 Internal standard substance: a compound that does not exist in the sample and is dried by molecular sieve, and the compound can be completely separated from other components on the chromatogram. The purity is at least 99% (mass fraction), or the purity is known. For example: isopropanol.

A.1.4 Molecular sieve: pore size is 2Å~3Å; particle size is 1.7mm~5.0mm. Molecular sieve shall be used after regeneration.

A.1.5 Carrier gas: hydrogen or helium; purity is ≥99.995%.

A.2 Equipment

A.2.1 Gas chromatograph: equipped with thermal conductivity detector and temperature program controller.

A.2.2 Chromatographic column: capillary column of styrene-divinylbenzene porous polymer.

NOTE: Other chromatographic columns meeting the inspection requirements can also be used.

A.2.3 Injector: micro syringe, 10μL.

A.2.4 Sampling bottle: about 10mL glass bottle with a sealable cap.

A.2.5 Balance: actual graduation value d=0.1mg.

A.3 GC test conditions

A.3.1 Chromatographic column: capillary column of styrene-divinylbenzene

solvent (mixture solution). But do not add water as a blank sample. Record the peak area of water in the blank sample, A_0 . Calculate the relative response factor R of water according to formula (A.2):

$$R = \frac{m_i \times (A_w - A_0)}{m_w \times A_i} \dots\dots\dots (A.2)$$

Where,

R - Relative response factor of water;

m_i - Mass of internal standard substance, in grams (g);

A_w - Peak area of water;

A_0 - Peak area of water in blank sample;

m_w - Mass of water, in grams (g);

A_i - Peak area of internal standard substance.

Test twice in parallel. Take the average value of two test results. The relative deviation shall be less than 5%.

A.4.2 Sample analysis

Weigh about 0.6g of the sample after stirring and the internal standard substance (A.1.3) approximately equal to the water content in the sample bottle (A.2.4), to the nearest of 0.1mg. Record the mass of the sample m_s and the mass of the internal standard substance m_i . Then add 5mL of dilution solvent (A.1.2) (the volume of the dilution solvent can be adjusted according to the sample status). Seal the sample bottle (A.2.4) and shake well. At the same time prepare a mixture of internal standard substance and dilution solvent without sample as a blank sample. Shake vigorously or ultrasonically contain the sample bottle (A.2.4) of the sample for 15min. Place for 5min. Make it precipitate [In order to make the sample precipitate as soon as possible, a few small glass beads can be added to the sample bottle (A.2.4) containing the sample, and then shake vigorously; a low-speed centrifuge can also be used to precipitate]. Use a micro syringe (A.2.3) to draw 1 μ L of supernatant from the sample bottle (A.2.4). Inject into the chromatograph. Record the chromatogram.

A.4.3 Calculation

Calculate the moisture content w_w in the sample according to formula (A.3):

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