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Limit of harmful substance of non-metallic materials and indoor air for railway locomotive and vehicle

机车车辆非金属材料及室内空气有害物质限量

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Limit of harmful substance of non-metallic materials and indoor air for railway locomotive and vehicle

1 Scope

This document specifies the limits and test methods of harmful substances in non-metallic materials, which are used in railway locomotive and vehicle, the limits and test methods of prohibited and restricted substances in non-metallic materials, which are used in railway locomotive and vehicle, as well as the limits and test methods of harmful substances in indoor air of railway locomotive and vehicle.

This document applies to the limits of harmful substances in non-metallic materials for locomotives, passenger trains, EMUs; the indoor air of driver's cabs and passenger compartments; the limits of prohibited and restricted substances of non-metallic materials for locomotives, passenger trains, EMUs.

2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

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

GB/T 2912.1 Textiles - Determination of formaldehyde - Part 1: Free and hydrolyzed formaldehyde (water extraction method)

GB/T 2918-2018 Plastics - Standard atmospheres for conditioning and testing

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

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

GB/T 17592 Textiles - Determination of the banned azo colorants

GB/T 17657-2013 Test methods of evaluating the properties of wood-based panels

mesh sieve).

c) For test of polybrominated biphenyls and polybrominated diphenyl ethers, the treatment method is to pulverize the sample to a particle size of less than 500 μm (can pass through a 35-mesh sieve).

d) For the bromine release test, the non-test area around the sample shall be wax-sealed; the area of the sample tested shall not be less than 1 cm^2.

5.3.2 Inspection methods for prohibited and restricted substances

5.3.2.1 The asbestos test shall be qualitatively analyzed, according to the provisions of GB/T 23263.

5.3.2.2 For the test of Chlorofluorocarbons (CFC), Perbromofluorocarbons (HALON), Hydrochlorofluorocarbons (HCFC), Hydrofluorocarbons (HFC), Perfluorocarbons (PFC), sulfur hexafluoride (SF6), tetrachloroethylene, they are carried out, in accordance with the provisions of Appendix D.

5.3.2.3 For the test of arsenic and its compounds, antimony and its compounds, beryllium and its compounds, cobalt and its compounds, it shall be carried out according to the provisions of GB/T 33422. For the test of antimony and its compounds, it is recommended to add an appropriate amount of hydrochloric acid to the sample digestion reagent. If the sample is glass or ceramics, use 5 mL of concentrated HNO_3 + 1.5 mL of HF + 1.5 mL of H_2O_2 as the digestion reagent; the rest of the sample digestion reagents shall be carried out, according to GB/T 33422. The test results shall be based on the content of metal elements. The detection limit of beryllium and its compounds, cobalt and its compounds are 5 mg/kg.

5.3.2.4 For the test of cadmium and its compounds, lead and its compounds, mercury and its compounds, polybrominated biphenyls and polybrominated diphenyl ethers, it shall be carried out, according to the provisions of GB/T 26125.

5.3.2.5 For the test of hexavalent chromium compounds, if the sample is leather, it shall be carried out, in accordance with the provisions of GB/T 22807; if the sample is of other materials, it shall be carried out, in accordance with the provisions of GB/T 26125.

5.3.2.6 The test of 4-nitrobiphenyl shall be carried out, according to the provisions of Appendix E.

5.3.2.7 For the test of 2-naphthylamine, p-diaminodiphenyl, 4-aminobiphenyl, if the sample is textile, it shall be carried out, according to the provisions of GB/T 17592; if the sample is leather, it shall be carried out, according to the provisions of GB/T 19942; if the sample is made of other materials, the sample processing method is as follows: Accurately weigh 1 g of the sample, accurate to 0.01 g; put it in a sample bottle; add 10 mL of methanol, to ultrasonically extract it in a 60 °C water bath, for 60 min; cool to room temperature; use a 0.22 μm filter membrane for filtering; carry out test according

to the analytical method of GB/T 17592.

5.3.2.8 For the tests of monomethyl dibromodiphenylmethane, monomethyl dichlorodiphenylmethane (Ugilec 121 or 21) and monomethyl tetra chlorodiphenylmethane (Ugilec 141), it shall be carried out, according to the provisions of Appendix F.

5.3.2.9 The test of nonylphenol and nonylphenol polyoxyethylene ether shall be carried out, according to the provisions of GB/T 23322.

5.3.2.10 The test of polychlorinated phenol and its salts and esters shall be carried out, according to the provisions of GB/T 18414.1.

5.3.2.11 The test of polychlorinated terphenyls (PCT) is carried out, according to the provisions of SN/T 3918. Pre-treatment is carried out by ultrasonic extraction method. Weigh 1 g (accurate to 0.01 g) of sample into a 50 mL sample bottle. Use 10 mL of n-hexane:acetone (volume ratio 1:1), for ultrasonic extraction at 50 °C, for 60 min. After cooling to room temperature, it is filtered with 0.22 μm membrane and analyzed according to the method of SN/T 3918.

5.3.2.12 The test of short-chain chlorinated paraffins shall be carried out, according to the provisions of GB/T 33345.

5.3.2.13 The test of tris(2,3-dibromopropyl) phosphate, triacridinyl phosphorus oxide, triphenyl phosphate shall be carried out, according to the provisions of Appendix G.

5.3.2.14 The halogen test shall be carried out, according to the provisions of GB/T 34692.

5.3.2.15 The test of man-made mineral fiber (MMMF) shall be carried out, in accordance with the provisions of Appendix H.

5.3.2.16 The test of talc shall be carried out, in accordance with the provisions of Appendix I.

5.3.2.17 The test of nickel shall be carried out, according to the provisions of GB/T 19719.

5.3.2.18 The test of medium-chain chlorinated paraffin shall be carried out, in accordance with the provisions of Appendix J.

5.3.2.19 The test of diphenylmethane diisocyanate shall be carried out, according to the provisions of GB/T 18446. The pretreatment method of the sample: Take 0.5 g of the sample (accurate to 0.01 g); ultrasonically extract it in 5 mL of ethyl acetate, at room temperature for 60 min; use a 0.22 μm filter membrane to filter it; test it according to the analytical method of GB/T 18446.

Appendix A

(Normative)

Test method of weight loss after heating

A.1 Sample preparation

A.1.1 Preparation of adhesive sample

Apply the adhesive on the PTFE film or sheet. For products, which have an adhesive thickness of less than 1 mm in actual application, apply adhesive according to the actual thickness. For products, which have an actual application thickness greater than or equal to 1 mm, apply adhesive to a thickness of 2.5 mm ~ 3 mm, when preparing specimen. Place it at 23 °C ± 2 °C and humidity 50% ± 5%RH for 168 h ± 1 h, to cure the adhesive. Peel off the cured adhesive, from the polytetrafluoroethylene film or sheet, as the specimen to be tested; cut out 3 specimens, of (100 mm ± 2 mm) x (100 mm ± 2 mm).

A.1.2 Preparation of foamed material samples

Samples include seat, sleeper products.

Take 3 specimens, of (100 mm ± 2 mm) x (100 mm ± 2 mm), from foam material; the thickness is consistent with that of the actual product.

A.1.3 Preparation of regular flat plane material sample

For the sampling of materials, which have regular flat plane, take 3 specimens of (100 mm ± 2 mm) x (100 mm ± 2 mm) from the product; the thickness is consistent with that of the actual product.

A.2 Status conditioning

The specimen is subject to status conditioning, for 24 h, according to the 23/50 level 2 environmental conditions in GB/T 2918-2018.

A.3 Test method

Measure the length, width, thickness of the specimen, accurate to 0.1 mm. Weigh the conditioned product (m_0), accurate to 0.0001 g. Put the specimen into a hot air aging box, which has a temperature of 60 °C ± 2 °C. Place it horizontally, with a spacing of not less than 20 mm. Take it out after 6 h ± 10 min. The removed specimen is placed at the 23/50 level 2 environmental conditions in GB/T 2918-2018, for status conditioning for 24 h. Weigh the mass of specimen m_1.

A.4 Calculation

Appendix E

(Normative)

Detection of 4-nitrobiphenyl content

E.1 Principle

The target substance is extracted by toluene ultrasonically; analyzed by gas chromatography-mass spectrometry (GC-MS); quantified by external standard method.

E.2 Reagents

E.2.1 Toluene: Chromatographic grade.

E.2.2 Standard substance: 4-nitrobiphenyl, CAS No.: 92-93-3.

E.2.3 4-nitrobiphenyl standard stock solution: Weigh an appropriate amount of 4-nitrobiphenyl standard substance. Use toluene, to prepare a standard stock solution, which has a concentration of 1000 mg/L.

E.2.4 4-nitrobiphenyl standard working solution: Use toluene, to dilute the standard stock solution into standard working solutions of 1 mg/L, 2 mg/L, 5 mg/L, 10 mg/L, 20 mg/L, as needed.

The standard solution is stored at 0 °C ~ 8 °C. The standard stock solution is valid for 12 months. The standard working solution is valid for 1 month.

E.3 Instruments and equipment

E.3.1 Gas chromatography-mass spectrometry (GC-MS);

E.3.2 Ultrasonic cleaning instrument;

E.3.3 Analytical balance: The precision is 0.1 mg.

E.4 Test steps

E.4.1 Sample preparation

Pulverize the solid samples to be not more than 1 mm x 1 mm. Shred the textile samples to be not more than 5 mm x 5 mm.

E.4.2 Sample pretreatment

Weigh 0.5 g ± 0.05 g of specimen. Put it into a 20 mL sample bottle. Add 5 mL of

Appendix F

(Normative)

Detection of halobenzylmethane content

F.1 Scope

This Appendix applies to the detection of the halobenzylmethane content (monomethyl dibromodiphenylmethane, monomethyl dichlorodiphenylmethane, monomethyl tetrachlorodiphenylmethane), in non-metallic materials for railway locomotive and vehicle.

F.2 Principle

Using ultrasonic extraction method, the halobenzylmethane in the sample is extracted by toluene, analyzed by gas chromatography-mass spectrometry (GC-MS), quantified by external standard method.

F.3 Reagents

F.3.1 Toluene: Chromatographic grade.

F.3.2 Standard substance: monomethyl tetrachlorodiphenylmethane, Ugilec 141, CAS No.: 111483-93-3, 100 mg/L.

F.3.3 Standard working solution: Use toluene to dilute the standard substance, to prepare the standard solution of 1 mg/L, 2 mg/L, 5 mg/L, 10 mg/L, 20 mg/L, respectively.

The standard working solution is stored at 0 °C ~ 8 °C AND is valid for 1 month.

F.4 Instruments and equipment

F.4.1 Gas chromatography-mass spectrometry (GC-MS).

F.4.2 Ultrasonic cleaning instrument.

F.4.3 Analytical balance, which has an accuracy of 0.1 mg.

F.5 Test procedure

F.5.1 Sample preparation

Pulverize the solid samples to be not more than 1 mm x 1 mm. Shred the textile samples to be not more than 5 mm x 5 mm.

Appendix H

(Normative)

Detection of man-made mineral fibers

H.1 Qualitative detection of man-made mineral fibers

H.1.1 Principle

Samples are ashed. A representative sample is examined microscopically, for the presence of fibers. If fibers are present, the ashing sample is placed in an immersion liquid, which has a certain refractive index; analyzed by a polarizing microscope. Using dispersive dyeing technology, qualitatively confirm whether it is a man-made mineral fiber, based on the form, anisotropy, birefringence, extinction, ductility of the fiber.

H.1.2 Reagents and materials

Immersion liquid, which has a refractive index of 1.605

H.1.3 Instruments and equipment

H.1.3.1 Electronic balance: Accuracy 0.1 mg.

H.1.3.2 Microscope: The magnification needs to cover 5 times ~ 60 times.

H.1.3.3 Polarizing microscope: Meet the requirements for polarizing microscope in GB/T 23263.

H.1.3.4 Muffle furnace.

H.1.4 Sample pretreatment

H.1.4.1 Ashing step

Weigh about 2 g of the sample. Place it in a crucible. Add the lid. Put the crucible into the muffle furnace, which has an ashing temperature of 450 ° C ± 10 ° C, for a duration of not more than 9 h; the purpose is to visually disintegrate the sample. Remove the crucible from the muffle furnace. Place it in a desiccator, to cool it.

H.1.4.2 Analysis of residual components

Examine residual components, under a microscope, for the presence of fibers. If the residual component does not contain fibers, the sample does not contain man-made mineral fibers. If there are fibers in the residual component and the average diameter is greater than 6 μm, the sample does not contain man-made mineral fibers, which have

H.1.5.2.3 Birefringence

Under the condition of orthogonal polarization, when the particle has more than one refractive index, AND the angle between the polarization plane and the polarizer is at 45°, interference color will be generated, on a black background. Man-made mineral fiber has no birefringence and will not appear interference color. Between the polarizers, man-made mineral fibers are not visible.

H.1.5.2.4 Extinction characteristics

Advance the analyzer in the single polarizer mode, to form the orthogonal polarizing observation mode. Rotate the stage for 360°. The fiber under the microscope presents four-time bright and four-time dark characteristics. When it is completely dark, the acute angle, between the extension direction of the fiber and the longitudinal or transverse axis of the eyepiece's crosshair, is the extinction angle of the fiber. Man-made mineral fibers have no extinction characteristics.

H.1.5.2.5 Ductility notation

Advance the color filter, in the crossed polarizer mode. Rotate the stage, to turn the extension direction of the fiber to a 45° angle (NE-SW) with the eyepiece's crosshair; observe the color presented by the fiber. If the fiber is blue-green, it is positive ductility (+); if the fiber is orange or yellow, it is negative ductility (-). Although the man-made mineral fiber material is an isotropic material, due to the difference in refractive index, between it and the immersion liquid, it can be seen, when using a 530 nm optical path difference compensator or a polarizer, that does not cross slightly; BUT it has no positive and negative ductility characteristics.

H.1.6 Result judgment

Under a polarizing microscope, if the fibers are observed to have regular shapes, no divergence, no anisotropy, no birefringence, with extinction and ductility characteristics, the sample is judged to be positive.

H.2 Quantitative detection of man-made mineral fibers

H.2.1 Principle

In this method, nitric acid, hydrofluoric acid, etc. are used to digest the sample. The content of aluminum, silicon, zirconium in the test solution is determined, by inductively coupled plasma emission spectrometer. The element content is converted into aluminum silicate refractory ceramics and zirconia aluminum silicate refractory ceramic fiber content, in the specimen.

H.2.2 Reagents and materials

H.2.2.1 Grade 3 water as specified in GB/T 6682.

H.2.2.2 Nitric acid: Analytically pure, about 65% (mass fraction), with a density of about 1.40 g/mL.

H.2.2.3 Hydrofluoric acid: Analytically pure.

H.2.2.4 Hydrogen peroxide: Analytically pure.

H.2.2.5 Standard substance solution: The concentration of silicon, aluminum, zirconium standard substance is 1000 mg/L. The shelf life at room temperature is one year.

H.2.2.6 The 5% nitric acid solution: Take a 1000 mL large glass beaker. Add 950 mL of grade-3 water. Use a graduated cylinder, to measure 50 mL of concentrated nitric acid (H.2.2.2). Slowly add the concentrated nitric acid into the large beaker. Use a glass rod to stir, while adding it. Place the prepared nitric acid solution in a fume hood, to cool to room temperature. This solution is prepared before use.

H.2.2.7 Standard working solution: Use 5% nitric acid solution, to dilute the standard substance solution, to prepare the standard curve working solutions, which have a concentration of 0.1 mg/L, 0.5 mg/L, 1 mg/L, 5 mg/L, 10 mg/L.

H.2.3 Instruments and equipment

H.2.3.1 Electronic balance: Accuracy 0.1 mg.

H.2.3.2 Inductively coupled plasma atomic emission spectrometer.

H.2.3.3 Microwave digestion instrument.

H.2.4 Sample pretreatment

H.2.4.1 Sample preparation and weighing: Weigh 0.4 g of the sample. Cut it into pieces, which are not larger than 2 mm x 2 mm x 2 mm.

H.2.4.2 Digestion: Weigh 0.2 g of the cut specimen (accurate to 0.1 mg). Place it in a microwave digestion tank. Add 5 mL of nitric acid, 1.5 mL of hydrofluoric acid, 1.5 mL of hydrogen peroxide. After standing until there is no obvious reaction, cover the lid; install the outer jar; put it into the microwave digestion instrument. The recommended microwave digestion program is: Heating to 140 °C within 15 min; maintain it for 10 min; heating to 180 °C within 10 min; maintain it for 10 min; heating to 200 °C within 10 min; maintain it for 5 min. The amount of digestion solution added and the microwave digestion procedure can be adjusted appropriately, according to the sample conditions.

Note: Hydrogen peroxide shall only be added, if the active constituents of the sample are known. Hydrogen peroxide reacts rapidly and violently with oxidizable materials. Do not add hydrogen peroxide, when the sample may contain large amounts of oxidizable organic components.

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