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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 46510-2025

**Determination of free formaldehyde in water-based material of
toys - High performance liquid chromatography**

玩具水基材料中游离甲醛的测定 高效液相色谱法

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1 Scope

GB/T 46510-2025 is the Chinese national standard covering free formaldehyde in finger paints, bubble solutions and modelling compounds - the extraction, the derivatisation that makes formaldehyde detectable by HPLC, the calibration, and the limit of quantification against the regulatory limit. First edition, already in force. Issued on 5 October 2025, it has been in force since 5 October 2025.

This document describes the high-performance liquid chromatography (HPLC) method for the determination of free formaldehyde in water-based materials of toys. This document applies to the determination of free formaldehyde in water-based materials of toys such as bubble solution, finger paint, ink, and water-based gels. Other materials of toys can also be tested using this method after validation. NOTE. Toys made of water-based gel materials, such as slime and artificial water.

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 6682 Water for analytical laboratory use - Specification and test methods

3 Terms and definitions

This document does not contain any terms or definitions that need to be defined.

4 Method summary

Weigh an appropriate amount of sample and extract by vortexing with an aqueous phosphoric acid solution. Free formaldehyde in the extract is separated by high-performance liquid chromatography (HPLC), derivatized post-column, detected at a specific wavelength, and quantified using the external standard method. NOTE. Other validated methods (such as pre-column derivatization-HPLC) can also be used to determine free formaldehyde in the extract.

5 Reagents and materials

Unless otherwise specified, use only analytical grade reagents.

5.1 Water, GB/T 6682, grade 1.

5.2 Formaldehyde. Standard solution, CAS No.. 50-00-0.

5.3 Phosphoric acid, 85 % by mass.

5.4 Ammonium acetate.

5.5 Glacial acetic acid.

5.6 Acetylacetone.

5.7 Aqueous phosphoric acid solution. Take 2 mL of phosphoric acid (5.3), slowly add it to 998 mL of water, mix well, and adjust the pH to 2.0 ± 0.1 .

5.8 Post-column derivatization solution. Weigh

62.5 g of ammonium acetate (5.4), add

7.5 mL of glacial acetic acid (5.5), 5 mL of acetylacetone (5.6), add water to 1000 mL, and shake well. This solution is effective for 3 days.

5.9 Formaldehyde series standard solutions. Accurately transfer an appropriate amount of formaldehyde standard solution (5.2) into 10 mL volumetric flasks, and dilute with phosphoric acid aqueous solution (5.7) to prepare a series of standard solutions of

0.05 mg/L,

0.1 mg/L,

0.2 mg/L,

0.5 mg/L,

10.0 mg/L. Prepare before use. The concentration range of the standard solutions can be adjusted according to the sample content level during actual testing.

5.10 Filter membrane. 0.45 μm , aqueous phase.

6 Instruments and equipment

6.1 High-performance liquid chromatograph with diode array detector.

6.2 Post-column derivatization apparatus.

6.3 Vortex mixer.

6.4 Analytical balance. Accuracy

0.1 mg.

6.5 Stoppered colorimetric tubes.

6.6 Pipettes. Capacity 10 μL ~ 100 μL , capacity 100 μL ~ 1000 μL , and capacity 1 mL ~ 5 mL.

6.7 Volumetric flasks.

7 Sample extraction

0.2 g (accurate to

0.1 mg) of sample into a 10 mL stoppered colorimetric tube (6.5), shake well, add phosphoric acid aqueous solution (5.7) to the mark, and vortex for 1 min. If necessary, purify the extract using a suitable purification method. Filter the extract through a 0.45 μm microporous membrane; the filtrate is used as the test solution. The test solution shall be tested within 12 h.

8.2 Qualitative and quantitative analysis

8.2.1 Qualitative analysis Analyze the standard solution and sample solution according to the above analytical conditions (8.1). Qualitative analysis is performed using the retention time and spectrum of the chromatographic peaks. The chromatogram and retention time of formaldehyde derivatives are shown in Annex B.