

ICS 61.060



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

GB/T 33391-2026

**Footwear - Chemical tests - Determination of polycyclic
aromatic hydrocarbons(PAHs)**

鞋类 化学试验方法 多环芳烃（PAHs）的测定

(English Translation)

Issued on: April 30, 2026

Implemented on: November 1, 2026

Issued by: State Administration for Market Regulation

Table of Contents

Foreword...	3
1 Scope...	6
2 Normative References...	6
3 Terms and Definitions...	6
4 Principle...	6
5 Reagents...	6
6 Instruments and Equipment...	10
7 Sample Preparation...	11
8 Test Procedures...	11
9 Test Results...	12
10 Test Report...	13

1 Scope

This document describes a method for the determination of polycyclic aromatic hydrocarbons (PAHs) in footwear and footwear components.

This document is applicable to the determination of PAHs in footwear and footwear components.

NOTE: See Table 1 of GB/T 29292-2024 for a list of materials in footwear that may contain PAHs.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 12810 Laboratory glassware - Capacity methods testing and use of volumetric instruments (GB/T 12810-2021, ISO 4787.2010, NEQ)

3 Terms and Definitions

This document contains no terms or definitions that require clarification.

4 Principle

The specimen is extracted with toluene in an ultrasonic water bath at 60°C for 1 h and analyzed using a gas chromatograph equipped with a mass-selective detector.

5 Reagents

Warning - Toluene is flammable. Furthermore, PAHs may be carcinogenic.

Therefore, they should be handled in accordance with relevant occupational health and safety regulations.

5.1 General

Unless otherwise specified, all reagents shall be of analytical grade.

5.2 Toluene

CAS Registry Number. 108-88-3.

5.3 PAHs

Table 1 lists 24 relevant PAHs.

Table 1 -- List of Relevant PAHs

5.4 PAH Standard Solution (100 µg/mL)

The laboratory shall select the PAH species listed in Table 1 based on testing requirements and prepare a standard stock solution for each selected PAH (with a mass concentration of C=100

µg/mL for each PAH); these solutions shall be prepared using commercially available certified mixed standard samples/reference materials or certified single-component standard samples/reference materials.

5.5 PAHs - Stock Solution 1 (5 µg/mL)

Using a pipette (6.6), transfer 9 mL of toluene (5.2) into a 10 mL amber volumetric flask (6.7), add 500 µL of PAH standard solution (5.4), and dilute to the mark with toluene (5.2).

5.6 PAHs - Stock Solution 2 (0.5 µg/mL)

Using a pipette (6.6), transfer 8 mL of toluene (5.2) into a 10 mL amber volumetric flask (6.7), add 1 mL of stock solution 1 (5.5), and dilute to the mark with toluene (5.2).

5.7.1 General

5.7.1.1

The internal standards (see 5.7.1.2 to 5.7.1.8) shall be commercially available certified mixed standard samples/reference materials or certified single-component standard samples/reference materials.

5.7.1.2

Naphthalene-d8, CAS Registry Number. 1146-65-2.

5.7.1.3

Fluorene-d10, CAS Registry Number. 81103-79-9.

5.7.1.4

Pyrene-d10, CAS Registry Number. 1718-52-1.

5.7.1.5

Chrysene-d12, CAS Registry Number. 1719-03-5.

5.7.1.6

Benzo[a]pyrene-d12, CAS Registry Number. 63466-71-7.

5.7.1.7

Benzo[g,h,i]perylene-d12, CAS Registry Number. 93951-66-7.

5.7.1.8

Dibenzo[a,h]anthracene-d14, CAS Registry Number. 13250-98-1.

5.7.2 Correspondence between PAHs and internal standards

Select the appropriate internal standards for PAH determination according to Table 2. The number of internal standards may be appropriately reduced if method validation demonstrates sufficient recovery for the corresponding PAHs.

Table 2 -- List of Relevant Internal Standards

5.7.3 Internal standards - Stock solution (mass concentration of 100 µg/mL each)

The internal standard may be a commercially available certified solution or a solution prepared from a certified single compound.

To prepare the internal standard solution, weigh 10 mg of each selected internal standard (5.7.1) using an analytical balance (6.2), place it in a 100 mL amber volumetric flask, and dilute to the mark with toluene (5.2).

5.7.4 Internal standards - Working solution (5 µg/mL)

Using a pipette (6.6), transfer 0.5 mL of each internal standards - stock solution (5.7.3) into a

10 mL amber volumetric flask, and dilute to the mark with toluene (5.2).

5.8 PAHs - Calibration Solutions

Prepare at least four PAH calibration solutions (see Table 3) of different concentrations containing the internal standard, using toluene as the solvent; the concentration range shall cover the requirements of the analytical method. Using a micropipette (6.5) or pipette (6.6), transfer an appropriate amount of PAHs - stock solution 1 (5.5) or PAHs - stock solution 2 (5.6) and 100 µL of internal standards - working solution (5.7.4) into a 10 mL amber volumetric flask (6.7), and dilute to the mark with toluene (5.2).

Table 3 -- Preparation of Calibration Standard Solutions Suitable for GC-MS (Example)

5.9 Internal Standard Extraction Solution (0.050 µg/mL)

Dilute the internal standards - stock solution (5.7.3) with toluene (5.2) in a volumetric flask of appropriate capacity to prepare an extraction solution with an internal standard mass concentration of 0.050 µg/mL. This solution shall be stored in an amber flask in a dark place, avoiding exposure to direct sunlight. The shelf life of this solution is 7 d.

5.10 Storage

All PAH standard solutions (5.4, 5.5, 5.6) and internal standard solutions (5.7.3, 5.7.4) shall be stored in amber glassware in a refrigerator at approximately (5±3)°C, protected from light.

6.1 Except for the instruments listed below, the conventional laboratory apparatus and amber

laboratory glassware used shall comply with the requirements of GB/T 12810.

NOTE: Plastic equipment may contain trace amounts of PAHs.

6.2 Analytical balance, with a readability of at least 0.1 mg.

6.3 Amber glass extraction flask, with a screw cap (e.g., volume of 40 mL).

6.4 Ultrasonic water bath, equipped with a temperature control device capable of maintaining

(60±5)°C.