



BSI Standards Publication

Plastics — Determination of residual styrene monomer in polystyrene (PS) and impact-resistant polystyrene (PS-I) by gas chromatography

National foreword

This British Standard is the UK implementation of ISO 2561:2012. It supersedes BS ISO 2561:2006 which is withdrawn.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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**Plastics — Determination of residual
styrene monomer in polystyrene (PS)
and impact-resistant polystyrene (PS-
I) by gas chromatography**

*Plastiques — Détermination du styrène monomère résiduel dans
le polystyrène (PS) et le polystyrène résistant au choc (PS-I) par
chromatographie en phase gazeuse*





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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 2561 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This third edition cancels and replaces the second edition (ISO 2561:2006), which has been technically revised. A second analytical condition (for a chromatograph with an open tubular column) using the solvent tetrahydrofuran has been added.

Plastics — Determination of residual styrene monomer in polystyrene (PS) and impact-resistant polystyrene (PS-I) by gas chromatography

1 Scope

This International Standard specifies a method for the determination of the residual styrene monomer in polystyrene (PS) and impact-resistant polystyrene (PS-I) by gas chromatography. It may also be used for the simultaneous determination of other volatile aromatic hydrocarbons in PS and PS-I.

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.

ISO 472, *Plastics — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 apply.

4 Principle

The polymer sample is dissolved in solvent, which for polystyrene contains an internal standard. Either a small volume of the polymer solution is injected directly into a gas chromatograph (method A) or a small volume of the supernatant solution remaining after precipitation of polymer by addition of a precipitator is injected (method B), in order to obtain separation of styrene and other volatile materials. Method A is simple and has much the same accuracy as method B. However, there is a possibility that contamination of the injector with polymer and oligomers will occur over time, leading to erroneous results.

5 Reagents and materials

5.1 Internal standard

The internal standard shall be selected based on consideration of the retention times of the materials contained in the polymer sample and solvent. Recommended candidates are *n*-butylbenzene, cyclopentanol, 1,2,4-trimethylbenzene and 1,4-diethylbenzene of sufficient purity for analytical use.

5.2 Solvent

Use analytical-grade dimethylformamide, butanone, dichloromethane or tetrahydrofuran. Tetrahydrofuran is used for only method A.

5.3 Precipitator

Use analytical-grade 2,2,4-trimethylpentane or ethanol.

5.4 Aromatic hydrocarbons

Use analytical-grade styrene and (if required) other aromatic hydrocarbons such as ethylbenzene, cumene or α -methylstyrene. Styrene shall give a clear mixture when mixed with an equal volume of ethanol.

5.5 Carrier gases and fuel gases for gas chromatograph

Use helium or nitrogen as carrier gas. Use hydrogen and air as fuel gases.

6 Apparatus

6.1 General

Normal laboratory equipment and the following apparatus are required. Typical operating conditions are described in Annex A.

6.2 Gas chromatograph

6.2.1 Injection port: Use an injection port for liquid samples. When using an open tubular column (hereafter called an OT column), an injection port with splitter may be applicable.

6.2.2 Column: The column diameter and length, as well as the packing material and liquid phase, shall be selected based on consideration of column resolution and calibration curve linearity. Both packed columns and OT columns are acceptable. OT columns are recommended in the light of accuracy.

6.2.3 Detector: Use a hydrogen flame ionization detector (FID).

6.3 Data processor

Use a recorder or microcomputer to record the signals from the detector.

6.4 Sample injection syringe

Use a micro-syringe of the 1 μ l to 50 μ l type. A micro-syringe forming part of the auto-injector may also be used.

6.5 Analytical balance

A balance capable of measuring to 0,1 mg is required.

6.6 Volumetric flasks

Volumetric flasks are standardized in ISO 1042.

7 Preparation of sample

The sample can be taken from material in the form of powder, pellets or moulded parts. In order to ensure the desired accuracy of the sample mass, large pieces of sample shall be reduced to smaller fragments.

8 Procedure

8.1 General

During the dilution processes described below, the temperature of each solution shall remain under 25 $^{\circ}$ C.