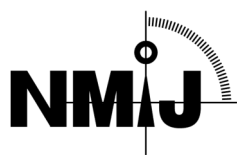


National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 4055-a

No. +++

Styrene



This certified reference material (CRM) is produced in accordance with the NMIJ's management system and is in compliance with ISO 17034 and ISO/IEC 17025. This CRM is intended for use in the calibration of analytical instruments, quality control of analytical instruments, and validation of analytical techniques and instruments.

Certified Value

The certified value of this CRM is the purity (mass fraction) of styrene given in the table below. The uncertainty of the certified value is the half-width of the expanded uncertainty interval calculated using a coverage factor (k) of 2, which gives a level of confidence of approximately 95 %.

	CAS No.	Certified value Mass fraction (kg/kg)	Expanded uncertainty Mass fraction (kg/kg)
Styrene	100-42-5	0.998	0.003

Analysis

Amounts of impurities were determined by the gas chromatograph with a flame ionization detector (GC-FID), the Karl Fischer titrator, the differential scanning calorimeter (DSC), and weighing of the residue after evaporation. The purity (amount of substance fraction) was obtained by the freezing point depression method using the DSC, and a unit of the purity determined by the DSC was converted to the mass fraction by using the estimated average molecular weight of impurities. The certified value is the weighted mean of the purities determined by the subtracting method and by the DSC.

Metrological Traceability

The GC-FID was calibrated using NMIJ's primary reference solutions prepared by the gravimetric blending method. The concentration of water, which is one of the impurities, was determined by Karl Fischer titration. The calibrations of temperature and enthalpy of the DSC were performed with NIST SRM 2225 (mercury) and NIST SRM 2232 (indium). The certified value is traceable to the International System of Units (SI).

Mutual Recognition Arrangement under Meter Convention

This certificate is consistent with the calibration and measurement capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (as for Appendix C of MRA, see <https://kcdb.bipm.org/AppendixC/default.asp>).

Expiration of Certification

This certificate is valid for one year from the date of shipment, provided that the CRM is stored in accordance with the instructions given in this certificate.

Sample Form

This CRM is in the form of a colorless liquid at room temperature and contains tert-butylcatechol as a stabilizer. This CRM of

ca. 10 mL in net volume is kept in an amber glass crimp top vial. The vial is sealed in an aluminum-layered bag. This CRM contains *tert*-butylcatechol as a stabilizer.

Homogeneity

The homogeneity of this CRM was determined by measuring the ten samples using the GC-FID and the Karl Fischer titrator. The homogeneity is reflected in the uncertainty of the certified value.

Instructions for Storage

This CRM should be stored cool (about 5 °C) and shielded from light.

Instructions for Use

The vial of the CRM should be allowed to warm to room temperature before opening. Attention should be paid so as to avoid contamination with water from air. This CRM should be used promptly once the vial is opened.

Precautions for Handling

Refer to the safety data sheet (SDS) on this CRM before use.

Preparation

Each 10 mL of commercial high-purity styrene was sealed in an amber vial at room temperature by Wako Pure Chemical Industries, Ltd. All procedures were done in an argon atmosphere.

Technical Information

On March 2009, the concentrations of ethylbenzene, *p*-xylene, *m*-xylene, and *o*-xylene were 290 mg/kg, 3.1 mg/kg, 15 mg/kg, and 11 mg/kg, respectively. These concentrations of the impurities were determined by the GC-FID.

NMIJ Analysts

The technical manager for this CRM is KATO K. The production manager is KATO K. The analysts are KITAMAKI Y., SHIMIZU Y., WATANABE T., OHTE Y., KATO K., SUGAI Y. and BAO X.

Information

If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customers. Customer registration on the NMIJ Website (given below) will facilitate notification. Technical reports regarding this CRM can be obtained from the contact details given below.

Reproduction of Certificate

In reproducing this certificate, it should be clearly indicated that the document is a copy.

April 1, 2020

ISHIMURA Kazuhiko
President

National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:
National Institute of Advanced Industrial Science and Technology,
National Metrology Institute of Japan,
Center for Quality Management of Metrology, Reference Materials Office,

1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan

Phone: +81-29-861-4059; Fax: +81-29-861-4009, <https://unit.aist.go.jp/nmij/english/refmate/>

Revision history

March 21, 2013: The expiration of this certificate was extended from “March 31, 2014” to “March 31, 2017.”

April 1, 2015: “Metrology Management Center” was renamed to “Center for Quality Management of Metrology.”

June 15, 2016: The indicative values for *o*-xylene and *p*-xylene were corrected and the description in “Indicative Values” was changed to “Technical Information.”

The description in “Expiration of Certification” was changed to “one year from the date of shipment.”

October 17, 2019: The description on “Mutual Recognition Arrangement under Meter Convention” was added.

Sample