# Certificate of Analysis – Certified Reference Material

## di-Sodium tetraborate decahydrate

**Certified secondary standard reference material pH(S)=9.18$_0$ (25°C)**

**Producer:** Merck KGaA, Frankfurter Str. 250, 64293 Darmstadt, Germany
**Product no.:** 1.01964.0025
**Lot no.:** 241964A
**Description of CRM:** di-Sodium tetraborate decahydrate Certipur®
certified secondary standard reference material for pH measurement
directly traceable to primary SRM from NIST/PTB pH(S)=9.18$_0$ (25°C)
**Expiry date:** 2028/02/29
**Storage:** +15°C to +25°C tightly closed in the original container
**Composition:** di-Sodium tetraborate decahydrate
Formulation in compliance with DIN 19266, IUPAC, NIST, EP (Ph. Eur.) and USP

| T [°C] | Certified value as pH ($Na_2B_4O_7$*10 $H_2O$ 0.01 mol/kg) | Associated uncertainty $U_{CRM}=k\cdot u_{CRM}$ ($k$=2) as pH |
|---|---|---|
| 5.0 | 9.387 | ± 0.010 |
| 10.0 | 9.327 | ± 0.010 |
| 15.0 | 9.274 | ± 0.010 |
| 20.0 | 9.226 | ± 0.010 |
| **25.0** | **9.182** | **± 0.010** |
| 30.0 | 9.142 | ± 0.010 |
| 37.0 | 9.093 | ± 0.010 |
| 40.0 | 9.073 | ± 0.011 |
| 45.0 | 9.043 | ± 0.011 |
| 50.0 | 9.015 | ± 0.011 |

**Metrological traceability:** This certified secondary standard reference material is directly traceable to primary certified reference material di-sodium tetraborate decahydrate characterised by PTB-BO-580/30510/23 and NIST 187f.
*PTB: Physikalisch Technische Bundesanstalt, Braunschweig, Germany*
*NIST: National Institute of Standards and Technology, Gaithersburg, USA.*

**Accreditation:** Merck KGaA, Darmstadt, Germany is accredited by the German accreditation authority DAkkS as registered reference material producer D-RM-15185-01-00 in accordance with ISO 17034.

**Certificate issue date:** 2024/11/07

ilac-MRA

DAkkS Deutsche Akkreditierungsstelle D-RM-15185-01-00

**ISO 17034**

CRM released by Approving Officer
or delegate of Quality Control

A. Yildirim

Dipl.-Ing. Ayfer Yildirim
Responsible Laboratory Manager

| | |
|---|---|
| **Method of analysis:** | The pH value is directly measured by differential potentiometry with the aid of two platinum hydrogen electrodes "quasi without transference" according to IUPAC[1] recommendations against solutions prepared from primary reference materials characterised by PTB and NIST. |
| **Intended use:** | This reference material is intended for use as a calibration standard for pH instruments or pH electrodes or as a control sample for measuring the pH value. |
| **Instructions for handling and correct use:** | The formulation is compliant to DIN 19266, IUPAC[1], NIST[2] and Ph. Eur. chapter 2.2.3 and USP chapter<791>. |
| **Health and safety information:** | Please refer to the Safety Data Sheet for detailed information about the nature of any hazard and appropriate precautions to be taken. |

**Details on correct use:**

**Preparation of di-sodium tetraborate decahydrate 0.01 mol/kg (pH(S)=9.18$_0$):**
Dissolve 3.814 g di-sodium tetraborate decahydrate in 800 ml of water and make up to 1000 ml at 25°C. This solution is stable for approximately 6 weeks. Do not use any solution that shows signs of fungal contamination within this period.

Through within-bottle homogeneity a minimum sample volume of 30 ml was determined. The weigh-in quantity depends on the buffer substance and has to be calculated.

This reference material is intended for use as a calibration standard for pH instruments and pH electrodes. The pH value strongly depends on the temperature. Therefore it is necessary to keep the temperature constant during the measurement. Details concerning the nature of any hazard and appropriate precautions are provided in the material safety data sheet.

**Associated uncertainty:**
The associated uncertainty $U_{CRM}$ reported with the certified values is calculated as combined expanded uncertainty $U_{CRM}=k \cdot u_{CRM}$ in accordance with GUM and EA-4/02, with $k=2$ as the coverage factor for a 95% coverage probability.

The combined uncertainty $u_{CRM}$ is derived from combination of the squared uncertainty contributions:

$$u_{CRM} = \sqrt{u^2_{Characterisation} + u^2_{Homogeneity} + u^2_{Stability}}$$

| | |
|---|---|
| $u_{characterisation}$: | is the uncertainty in accordance with DIN EN ISO/IEC 17025 which includes the contributions of the primary reference material and the measuring system. The characterisation measurements have been conducted by our DAkkS accredited calibration laboratory. |
| $u_{homogeneity}$: | is the between-bottle variation in accordance with ISO 17034. The assessment of homogeneity is performed by analysis of a representative number of systematically chosen sample units. |
| $u_{stability}$: | is the uncertainty obtained from short-term and long-term stability in accordance with ISO 17034. The stability studies are the basis for the quantification of the expiry date of this reference material for the unopened bottle. |

**For more detailed information please read the certification report on our website.**


[1] R.P. Buck, et al.: The Measurement of pH – Definition, Standards and Procedures (IUPAC Recommendations 2002), Pure Appl. Chem, Vol 74, No. 11, pp. 2169-2200, 2002

[2] Y. Ch. Wu, W. F. Koch, R. A. Durst: Standardization of pH Measurements, NBS Special Publication 260-53, 1988


**Certificate of analysis revision history:**

| Certificate version | Date | Reason for version |
|---|---|---|
| 01 | 2024/11/07 | Initial version |


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