Certification Report – Certified Reference Material

Certipur® Secondary buffer substances

Manufacturer:

Merck KGaA, Frankfurter Str. 250, 64293 Darmstadt, Germany, Tel. +49(0)6151 720

Accreditation:

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

Introduction:

This certification report contains additional information about certified values and uncertainties, homogeneity, stability, traceability and other relevant details of Certipur® secondary buffer substances.

The scope of the ISO 17034 accreditation is documented in the annex to the accreditation certificate D-RM-15185-01-00. The pH standards are produced, characterized and certified by the legal entity Merck KGaA, Darmstadt, Germany.

Preparation and packaging of CRMs:

Certipur® buffer substances are produced from homogeneous high purity salts.

Certipur® secondary buffer substances are delivered in 50 ml brown glass bottles. The label on the products is in accordance with ISO Guide 31 and covers ordering number, article description, lot number, expiry date and safety data information. Packaging material is subject to comprehensive stability studies according to ISO Guide 35.

Homogeneity:

Homogeneity studies were conducted in accordance with ISO Guide 35.

A representative number of samples packaged in their final form was chosen systematically (stratified over the whole batch) for assessment of the between-bottle (between-unit) homogeneity. Measurements have been carried out according to DIN EN ISO/IEC 17025. Results from multiple samples of the chosen bottles were evaluated.

Typically, there is no contribution u_{hom} to uncertainty through between-bottle (between-unit) homogeneity.

An evaluation of within-bottle (within-unit) homogeneity was conducted for assessment of the minimum sample volume (30ml) and does therefore not contribute to the uncertainty budget of this certified reference material. The weigh-in quantity depends on the buffer substance and has to be calculated.

Stability:

Stability studies were conducted in accordance to ISO Guide 35.

Stability comprises long-term stability, which is associated with the storage behavior of the CRMs under recommended storage conditions as well as short-term (transportation) stability that takes any extra effects due to transport of the products into account (quantification of transport effects that result from temperature variations during shipment).

Long-term stability:
Long-term stability of the products was evaluated in close collaboration with Physikalisch Technische Bundesanstalt (PTB), Germany using the classical experimental layout. Samples were stored at the recommended storage conditions before measurement. Measurements were conducted by PTB according to DIN EN ISO/IEC 17025. Results were evaluated using a linear regression model and the calculated uncertainty included into the uncertainty budget as long-term stability contribution u_{lts}.

Typical long-term stability contributions to uncertainty u_{lts} are in the range of pH 0.003.

Short-term (transportation) stability:
Short-term (transportation) stability was evaluated using the isochronous experimental layout. Samples were stored at elevated temperatures that may arise during shipment of the products before measurement. Results were evaluated using a linear regression model and the calculated uncertainty included into the uncertainty budget as short-term (transportation) stability contribution u_{sts}.

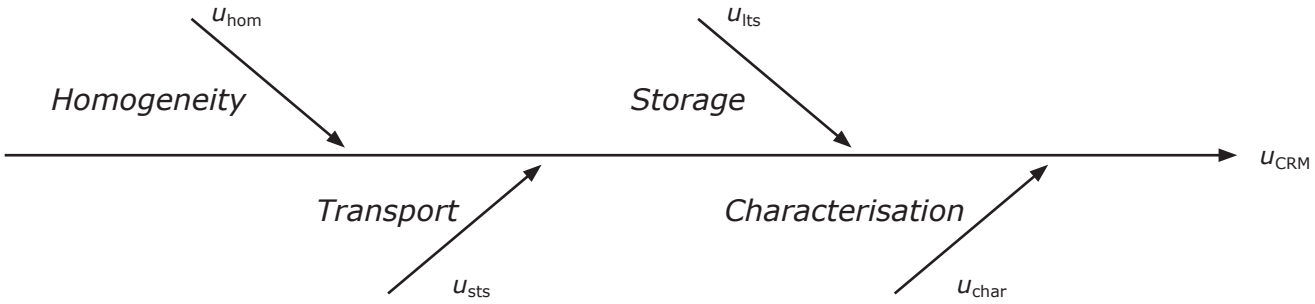
Typically, there is no contribution u_{sts} to uncertainty through transportation stability.

Stability monitoring:
Merck KGaA, Darmstadt, Germany will monitor all Certipur® secondary buffer substances over the period of their certification (minimum shelf life). If substantive technical changes occur that affect the validity of certification, the customer will be notified.

Characterisation:
Characterisation of Certipur® secondary buffer substances is carried out by the accredited quality control (QC) laboratory at Merck KGaA, Darmstadt, Germany according to DIN EN ISO / IEC 17025 by differential potentiometry. Typical characterisation contributions to uncertainty u_{char} are in the range of pH 0.004.

Traceability:
All certified values of Certipur® secondary buffer substances are directly traceable to the corresponding primary certified reference material (of Merck KGaA, Darmstadt, Germany, characterized by PTB) and verified by SRM´s from NIST (National Institute of Standards and Technology).

Uncertainty evaluation:
The expanded uncertainty U_{CRM} reported with the certified values is calculated in accordance to GUM and EA-4/02, with k=2 as the coverage factor for a 95% coverage probability. Uncertainty contributions to the certified expanded uncertainty are illustrated by the following cause-and-effect-diagram (Ishikawa-Diagram):



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The expanded uncertainty u_{CRM} is obtained from the standard uncertainties of characterisation, homogeneity and stability:

$$\boldsymbol{U}_{CRM} = k \cdot \boldsymbol{u}_{CRM}$$

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

$$\boldsymbol{u}^2\text{Stability} = \boldsymbol{u}^2\text{sts} + \boldsymbol{u}^2\text{lts}$$

Quality management system:
Certipur® Secondary buffer substances have been prepared and certified under an ISO 9001 quality management system in accordance to
ISO 17034: General requirements for the competence of reference material producers
ISO Guide 35: Reference materials – General and statistical principles for certification
ISO Guide 31: Reference materials – Contents of certificates and labels
Eurachem / CITAC Guide: Quantifying uncertainty in analytical measurement
Guide to the Expression of Uncertainty in measurement (GUM)
DIN EN ISO / IEC 17025: General requirements for the competence of testing and calibration laboratories

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