Benzoic Acid Certified Reference Material

Product No: AR208, AR208C, AR208V, AR1790, AR1790C, AR1790V, AR3403

Lot No: 2431

Material and Intended Use

AR208, AR208C, AR208V, AR1790, AR1790C, AR1790V, and AR3403 are benzoic acid certified reference materials (CRM). The intended use of these CRMs is for the verification and calibration of calorimetric and other appropriate analysis methods for the determination of heat of combustion. This CRM can also be used to validate value assignment of in-house reference materials. All reference materials should be verified as fit for purpose prior to use.

Instructions for Use

The minimum sample size for analysis is dependent upon the test method and instrumentation used. A 1 g specimen was used for certification of property values. Bottles of tablets should be kept sealed tightly and stored in a cool, dry location. Property values are valid for 10 years from the initial date of certification if handling and storage instructions are followed. However, values are rendered null and void if the CRM is in any way modified or damaged.

Reported Values

Reported values indicate the heat of combustion of the overall material matrix and are metrologically traceable to the derived unit of joules per gram (J/g) and British Thermal Units per pound (BTU/lb). Certified values are reported as the mean property value with an expanded uncertainty ($U_{95\%}$). The true value of the measurand is believed to lie within the expanded uncertainty coverage interval with 95% confidence. Expanded uncertainty is calculated by application of a coverage factor (k) to the combined standard uncertainty (u_c). For laboratory uncertainty budgets, the combined standard uncertainty can be calculated as $u_c = U_{95\%}/k$, where k is approximately equal to 2. The estimation of combined standard uncertainty (u_c) includes contributions from material homogeneity, primary calibrants, characterization, and other factors. Sampling and calculation of reported values for each measurand are performed using practices consistent with ISO 17034:2016 and ISO 33405:2024. Certified values are accredited under Alpha Resources, LLC ISO/IEC 17025 and ISO 17034 certificates issued by ANSI National Accreditation Board (ANAB), AT-1200 and AR1920.

Property values were measured in isoparabolic mode (ISO 1928), operating oxygen pressure charged to 450 psi, and combustion reaction between 25-27°C. The reduction of weight in air to weight in vacuum results in a value for heat of combustion of 26434 J/g for benzoic acid where the density of benzoic acid is 1.320 g/cm^3 at 25°C, the density of dry air is 0.0012 g/cm^3 at 1 atm and 20°C, and the density of brass is 8.4 g/cm^3. Buoyancy correction can be omitted where an accuracy of no more than 0.1% is necessary.

Table 1. Certified property values for benzoic acid CRMs, Lot 2431.

Property	Value, J/g (BTU/lb)	$U_{95\%}$	Method & Detection	n
Heat of Combustion (Calorific Value)	26456 (11374)	58 (25)	Bomb Calorimetry	50

Certified values were validated using the following primary reference standards:

NIST SRM	39j

Homogeneity

This product was manufactured from chemical compounds with a high level of purity. Samples were randomly selected using practices consistent with ISO 33405:2024. Homogeneity was evaluated by replicate analysis. Within- and between-sample variance was evaluated using Analysis of Variance (ANOVA).

Methods and References

ASTM D240-19 – Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter
ISO/IEC 17025:2017 – General requirements for the competence of testing and calibration laboratories
ISO 17034:2016 – General requirements for the competence of reference material producers
ISO 33401:2024 – Reference materials – Contents of certificates, labels, and accompanying documentation
ISO 33405:2024 – Reference materials – Approaches for characterization and assessment of homogeneity and stability
ISO Guide 30:2015 – Terms and definitions used in connection with reference materials

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ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER