National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 1657

Synthetic Refuse-Derived Fuel

Combustion Calorimetric Standard

This Standard Reference Material (SRM) consists of three components blended to resemble a sample of refuse-derived fuel. The composition of the SRM is approximately 80 wt % microcrystalline cellulose, 15 wt % silica, and 5 wt % alumina. All components have a nominal particle size of 50 micrometers. The amounts of combustible and noncombustible components (ash) are representative of the average components of municipal solid waste. SRM 1657 is intended for use as a standard for the calibration of combustion bomb calorimeters that will be used in characterizing refuse-derived fuels or other related fuels. The calorific value, residual moisture, and ash content were determined by procedures recommended in standard ASTM methods (see references). SRM 1657 is provided in a unit of 100 g.

The quantity of heat evolved by combustion of a sample of this material in an oxygen bomb calorimeter and the dry ash determined by ashing in a muffle furnace are as follows:

HHV[a] (dry)	13.87 ± 0.25 MJ/kg	(5963 ± 107 Btu/lb)
HHV (dry, ash-free)	17.40 ± 0.30 MJ/kg	(7481 ± 129 Btu/lb)
Dry Ash	20.34 ± 0.54 wt %[*]	

[*] wt % = mg/kg x 10^{-4}

[a]HHV (Higher Heating Value) is a synonym for gross calorific value and is the energy released by combustion of a unit quantity of refuse-derived fuel at constant volume or constant pressure in a suitable calorimeter under specified conditions such that all water in the products is in the liquid form.

The listed uncertainties are two times the standard deviation for the average values, and include an allowance for bottle-to-bottle variability.

The value for HHV (as-received) is 13.34 ± 0.22 MJ/kg (5735 ± 95 Btu/lb) and the observed moisture in the bottled material is 3.7 wt %. Due to differing moisture conditions that may exist in testing laboratories, the values HHV (as-received) and moisture content are not certified and are presented for information purposes only.

The statistical analysis of the data was performed by R.C. Paule of the National Measurement Laboratory.

This Certificate has undergone editorial revision to reflect program and organizational changes at NIST and at the Department of Commerce. No attempt was made to reevaluate the certificate values or any technical data presented on this certificate.

The overall direction and coordination of the technical measurements leading to certification were performed under the supervision of E.S. Domalski of the Chemical Thermodynamics Division.

Gaithersburg, MD 20899
May 14, 1993
(Revision of certificate dated 3-4-85)

Thomas E. Gills, Acting Chief
Standard Reference Materials Program

(over)

The technical and support aspects involved in the original certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by L.J. Kieffer. Revision of this certificate was coordinated through the Standard Reference Materials Program by J.C. Colbert.

Stability: Because we believe the components of the SRM to be stable indefinitely, no exhaustive stability studies have been made.

Preparation and measurements leading to certification were performed by J.C. Colbert of the Chemical Thermodynamics Division.

Use: Light shaking or riffling of the bottled material is suggested before withdrawing a test sample.

Suggested Procedures or Conditions

1) Duplicate one gram pellets should be pressed, one for the residual moisture and ash and the other for the calorific value determination. Residual moisture [1] and furnace ash [2] may be determined from a single sample. These values are necessary for the calculation of HHV (dry, ash-free). [3]

2) The volume of water placed in the bomb should be one milliliter.

3) The sample should be burned in a bomb of constant volume, filled with pure oxygen at a pressure of 30 atmospheres (3.04 MPa) measured at 25 °C. [4]

4) Nickel-chromium fuse wire (12 cm) with a heat of combustion equivalent to 5.86 MJ/kg can be used for ignition. Fuse wires composed of other substances can also be used.

5) The quantity of nitric acid produced in the combustion is determined by titration with standard alkali. The energy of decomposition of nitric acid into nitrogen (gas) and water (liquid) is 59 kj/mol.

Definitions of HHV Calculated to Different Bases [5]

HHV (as-received) - the test data calculated to the moisture condition of the sample as it arrived in the laboratory and before any processing or conditioning. (In this case, as-determined is equivalent to as-received.)

HHV (dry) - the test data calculated to a theoretical base of no moisture associated with the sample.

HHV (dry, ash free) - the test data calculated to a theoretical base of no moisture or ash associated with the sample.

REFERENCES

[1] ASTM E790-87 Standard Test Method for Residual Moisture in a Refuse-Derived Fuel Analysis Sample.
[2] ASTM E830-87 Standard Test Method for Ash in the Analysis Sample of Refuse-Derived Fuel.
[3] ASTM E791-90 Standard Method for Calculating Refuse-Derived Fuel Analysis Data from As-Determined to Different Bases.
[4] ASTM E711-81 Standard Test Method for Gross Calorific Value of Refuse-Derived Fuel by the Bomb Calorimeter.
[5] ASTM E856-88 Standard Definitions of Terms and Abbreviations Relating to Physical and Chemical Characteristics of Refuse-Derived Fuel.