

National Bureau of Standards
Certificate of Analysis
Standard Reference Material 1573
Tomato Leaves

This Standard Reference Material is intended primarily for calibrating instrumentation and evaluating the reliability of analytical methods for the determination of major, minor, and trace elements in botanical materials and other agricultural products.

Certified Values of Constituent Elements: The certified values for the constituent elements are shown in Table 1. They are based on results obtained either by reference methods of known accuracy or by two or more independent, reliable analytical methods. Non-certified values, which are given for information only, appear in Table 2. All values are based on a minimum sample size of 500 mg of the material dried as indicated under "Instructions for Drying."

Notice and Warnings to Users:

Expiration of Certification: This certification will be invalid 5 years after the shipping date. Should it be invalidated before then, purchasers will be notified by NBS.

Stability: The material should be kept in its original bottle and stored at temperatures between 10-30 °C. It should not be exposed to intense sources of radiation, including ultraviolet lamps or sunlight. Ideally, the bottle should be kept in a desiccator in the dark at the temperature indicated.

Use: The bottle should be shaken well before each use. A minimum sample of 500 mg of the *dried* material (see Instructions for Drying) should be used for any analytical determination to be related to the certified values of this certificate.

The overall direction and coordination of the technical measurements leading to this certificate were performed under the chairmanship of H. L. Rook. The overall coordination of the cooperative work performed by the Commission of European Communities, Joint Research Center, Ispra Establishment, Italy, was by G. Rossi of the Chemistry Division.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by T. W. Mears and R. Alvarez.

Washington, D.C. 20234
October 18, 1976

J. Paul Cali, Chief
Office of Standard Reference Materials

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Instructions for Drying: Samples of this Standard Reference Material *must* be dried before weighing by either of the following procedures:

1. Drying in air in an oven at 85 °C for 2 hours.
2. Lyophilization using a cold trap at or below -50 °C at a pressure *not greater* than 30 Pa (0.2 mm Hg) for 24 hours.

NOTE: Drying either in an oven at 105 °C or in a vacuum oven at 75 °C causes large losses of volatiles other than water and should *not* be used.

Additional Information on Analyses: This Standard Reference Material contains siliceous material, which is an integral part of the sample. The analyses reported in Tables 1 and 2 were performed on the entire sample. Therefore, dissolution procedures should be capable of complete dissolution of the sample, but should not result in losses of volatile elements, such as arsenic and mercury.

Source and Preparation of Material: The plant material for this SRM was collected and prepared under the direction of A. L. Kenworthy of Michigan State University, East Lansing, Mich. Its source was a field plot of direct seeded tomatoes that had been established at the Horticultural Research Center of the University. For the preparation of the SRM, the terminal portions of the plants were clipped, air-dried, and ground in a comminuting machine. After grinding, the material was dried at 85 °C, thoroughly mixed in a feed blender, packaged in polyethylene-lined fiber drums, and sterilized in situ with cobalt-60 radiation. The sterilization procedure was carried out at the U.S. Army Research and Development Command, Natick, Mass. under the direction of A. Brynjolfsson. At NBS, a preliminary evaluation of the material homogeneity indicated that its improvement would be required to establish more reliable certified values. Therefore, the material was resieved and the portion that had passed a polypropylene sieve having openings of 0.25 mm (equivalent to a U.S. series 60 standard sieve) was retained for the SRM.

Homogeneity Assessment: Material homogeneity was evaluated by determining nine of the certified elements, P, Fe, Mn, Zn, Rb, Cu, Cr, As, and U on samples of 500 mg or less taken at various locations of the freeze-dried bulk material. The other certified elements, K, Ca, Sr, Pb, and Th were determined using sample weights not exceeding one gram. The uncertainties of the concentrations given in Table 1 include these results.

Analytical Methods Used and Analysts

Analytical Methods

- A. Atomic absorption spectroscopy
- B. Isotope dilution mass spectrometry
- C. Isotope dilution spark source mass spectrometry
- D. Kjeldahl method for nitrogen
- E. Neutron activation
- F. Nuclear track technique
- G. Optical emission spectroscopy
- H. Spectrophotometry
- I. Polarography

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Table 1. Certified Values of Constituent Elements^a

Major and Minor Constituents

<u>Element</u>	<u>Content Wt. Percent</u>
Potassium	4.46 ± 0.03
Calcium	3.00 ± 0.03
Phosphorus	0.34 ± 0.02

Trace Constituents

<u>Element</u>	<u>Content µg/g</u>	<u>Element</u>	<u>Content µg/g</u>
Iron	690 ± 25	Lead	6.3 ± 0.3
Manganese	238 ± 7	Chromium	4.5 ± 0.5
Zinc	62 ± 6	Arsenic	0.27 ± 0.05
Strontium	44.9 ± 0.3	Thorium	0.17 ± 0.03
Rubidium	16.5 ± 0.1	Uranium	0.061 ± 0.003
Copper	11 ± 1		

^aAnalytical values are based on the "dry-weight" of material (See Instructions for Drying).

The uncertainties of the values shown in Table 1 include allowances for inhomogeneity, method imprecision, and an estimate of possible biases of the analytical methods used.

Table 2. Non-certified Values for Constituent Elements^a

NOTE: The following values are not certified because they are not based on the results of either a reference method of known accuracy or two or more independent methods. These values are included for information only.

Major and Minor Constituents

<u>Element</u>	<u>Content Wt. Percent</u>
Nitrogen	(5.0)
Magnesium	(0.7)
Aluminum	(0.12)

Trace Constituents

<u>Element</u>	<u>Content µg/g</u>	<u>Element</u>	<u>Content µg/g</u>
Boron	(30)	Cobalt	(0.6)
Bromine	(26)	Scandium	(0.13)
Cadmium ^b	(3)	Mercury	(0.1)
Cerium	(1.6)	Thallium	(0.05)
Lanthanum	(0.9)	Europium	(0.04)

^aAnalytical values are based on the "dry weight" of material (See Instructions for Drying).

^bCadmium was not sufficiently homogeneous for certification.

Analysts

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|-----------------------|---------------------|
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