

National Institute for Environmental Studies

Certified Reference Material No. 23 Tea Leaves II

This environmental certified reference material (CRM) was developed and certified by the National Institute for Environmental Studies (NIES) for the determination of multi-elements in tea leaves and materials of similar matrix. This CRM supersedes NIES CRM No. 7 Tea Leaves.

Certified and Reference Values

The property values of the material were statistically determined based on chemical analyses by 12 organizations (including 16 laboratories) using a wide range of methods. A property value satisfying the following conditions was accepted as a certified value (Table 1): 1) the relative standard deviation associated with the mean of the laboratory means was 5% or less; 2) the number of laboratories contributing to the mean of the laboratory means was at least eight; 3) the number of methods contributing to the mean of the laboratory means was at least two. The uncertainty attached to the certified values is the expanded uncertainty using a coverage factor $k = 2$, corresponding to a confidence interval of approximately 95%. A property value failing to satisfy the NIES criteria for certification but supplying valuable additional information about the material is given as a reference value (Table 2). All certified and reference values were determined based on dry mass.

Description of the Material

The material consists of powdered tea leaves (35 g) stabilized by ^{60}Co irradiation (2.5 Mrad) in an amber glass bottle.

Instructions for Use

1. This CRM should be kept tightly closed in its original bottle and stored in a desiccator at room temperature ($\leq 30^\circ\text{C}$).
2. Prior to weighing aliquots for analysis, the contents of the bottle should be shaken gently.
3. For convenience of handling a minimum sample intake of 0.1 g is recommended.
4. Precautions should be taken to avoid inhalation of the material.
5. This CRM should not be used for purposes other than research. When disposing of the material, local laws concerning processing and disposal of waste materials should be strictly adhered to.
6. The mass fractions of elements in this CRM are reported on a dry mass basis. This CRM, as received, contains 2-4% water. Correction to dry mass should be determined by drying a separate sub-sample for 4 hours at 85°C .

7. This CRM contains 50% carbon, 5.1% nitrogen, 98 mg/kg iron, and 17 mg/kg rubidium, although these values are neither certified nor reference values. An appropriate analytical method should be selected.

Expiration Date of Certification

The expiration date for the certified values of this CRM is July 2019 assuming that the recommended storage conditions are adhered to. NIES will notify via its website if any changes in the contents are recognized within the term of validity.

Collaborating Laboratories in Analysis

The certified and reference values for this CRM were based on the analytical values from the following participating organizations:

National Institute for Environmental Studies; Chuo University; Geo-Science Laboratory, Inc.; Green Blue Corporation; Japan Chemical Analysis Center; Japan Environment Sanitation Center; Murata Measuring Instrument Service Ltd.; Nagoya Institute of Technology; Nittech Research Corporation; Shimadzu Techno-Research, Inc.; Sumitomo Metal Mining Co., Ltd.; Tokyo City University.

Organization Responsible for Preparation, Certification, and Distribution

The Environmental Analytical Chemistry Research Laboratory within the Laboratory of Intellectual Fundamentals for Environmental Studies, NIES, takes entire responsibility for this CRM. Technical information and the latest research reports regarding this material can be obtained from the following address.

Table 1 Certified values of NIES CRM No. 23 Tea Leaves II

<i>Element</i>	<i>Unit</i>	<i>Mass fraction</i>			<i>Analytical method</i>
<i>Mg</i>	%	0.169	±	0.012	ICP-AES, ICP-MS, INAA
<i>P</i>	%	0.472	±	0.032	ICP-AES, ICP-MS
<i>K</i>	%	2.03	±	0.11	AAS, ICP-AES, ICP-MS, INAA, XRF
<i>Ca</i>	%	0.249	±	0.021	ICP-AES, ICP-MS, INAA, XRF
<i>Mn</i>	mg/kg	704	±	52	ICP-AES, ICP-MS, INAA
<i>Ni</i>	mg/kg	7.89	±	0.57	HR-ICP-MS, ICP-AES, ICP-MS
<i>Cu</i>	mg/kg	9.48	±	0.76	HR-ICP-MS, ICP-AES, ICP-MS, XRF
<i>Zn</i>	mg/kg	31.9	±	2.2	ICP-AES, ICP-MS, INAA
<i>Sr</i>	mg/kg	3.93	±	0.25	HR-ICP-MS, ICP-AES, ICP-MS

AAS, atomic absorption spectroscopy; HR-ICP-MS, high resolution inductively coupled plasma – mass spectrometry; ICP-AES, inductively coupled plasma – atomic emission spectrometry; ICP-MS, inductively coupled plasma – mass spectrometry; INAA, instrumental neutron activation analysis; XRF, X-ray fluorescence spectroscopy.

The uncertainty attached to the certified values is the expanded uncertainty using a coverage factor $k = 2$, corresponding to a confidence interval of approximately 95%.

All certified values were determined based on dry mass.

Table 2 Reference values of NIES CRM No. 23 Tea Leaves II

<i>Element</i>	<i>Unit</i>	<i>Mass fraction</i>	<i>Analytical method</i>
<i>S</i>	%	0.266	ICP-AES
<i>Na</i>	mg/kg	21.6	AAS, ICP-AES, ICP-MS, INAA
<i>Al</i>	mg/kg	540	ICP-AES, INAA
<i>Cs</i>	mg/kg	0.0932	ICP-MS, INAA
<i>Ba</i>	mg/kg	5.43	HR-ICP-MS, ICP-AES, ICP-MS

AAS, atomic absorption spectroscopy; HR-ICP-MS, high resolution inductively coupled plasma – mass spectrometry; ICP-AES, inductively coupled plasma – atomic emission spectrometry; ICP-MS, inductively coupled plasma – mass spectrometry; INAA, instrumental neutron activation analysis; XRF, X-ray fluorescence spectroscopy.

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