

## National Institute for Environmental Studies

### Certificate of Analysis

#### NIES CRM No. 30 Gobi Kosa Dust

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 Asian mineral dust (kosa dust) originating from arid areas of the Gobi Desert in north-east Asia, and in materials of similar matrix.

#### Certified Values

| Element        | Mass fraction |                 |             | Analytical method *                   |
|----------------|---------------|-----------------|-------------|---------------------------------------|
|                | Unit          | Certified value | Uncertainty |                                       |
| Aluminum (Al)  | %             | 7.58            | 0.42        | ICP-MS, ICP-OES, INAA, PIXE, XRF      |
| Calcium (Ca)   | %             | 4.25            | 0.35        | ICP-MS, ICP-OES, INAA, PIXE, XRF      |
| Iron (Fe)      | %             | 3.84            | 0.35        | ICP-MS, ICP-OES, INAA, PIXE, XRF      |
| Magnesium (Mg) | %             | 1.51            | 0.13        | ICP-MS, ICP-OES, INAA, PIXE, XRF      |
| Potassium (K)  | %             | 2.13            | 0.11        | AAS, ICP-MS, ICP-OES, INAA, PIXE, XRF |
| Sodium (Na)    | %             | 0.939           | 0.071       | AAS, ICP-MS, ICP-OES, INAA, PIXE, XRF |
| Titanium (Ti)  | %             | 0.426           | 0.040       | ICP-MS, ICP-OES, INAA, PIXE, XRF      |
| Barium (Ba)    | mg/kg         | 535             | 31          | ICP-MS, ICP-OES, INAA, XRF            |
| Manganese (Mn) | mg/kg         | 768             | 83          | ICP-MS, ICP-OES, INAA, PIXE, XRF      |
| Strontium (Sr) | mg/kg         | 250             | 20          | ICP-MS, ICP-OES, PIXE, XRF            |
| Zinc (Zn)      | mg/kg         | 93.1            | 8.5         | ICP-MS, ICP-OES, INAA, PIXE, XRF      |

All certified values were determined on an “as received” basis, without drying the material. The uncertainty attached to the certified values is the expanded uncertainty using a coverage factor  $k = 2$ , corresponding to the half-width of a confidence interval of approximately 95 %.

\* AAS, atomic absorption spectroscopy

ICP-OES, inductively coupled plasma-optical emission spectrometry

ICP-MS, inductively coupled plasma-mass spectrometry

INAA, instrumental neutron activation analysis

PIXE, proton induced X-ray emission spectrometry

XRF, X-ray fluorescence spectroscopy

## Reference Values

| Element        | Mass fraction |                 | Analytical method *      |
|----------------|---------------|-----------------|--------------------------|
|                | Unit          | Reference value |                          |
| Silicon (Si)   | %             | 24.1            | Gravimetry, ICP-OES, XRF |
| Chromium (Cr)  | mg/kg         | 57.4            | ICP-OES, XRF             |
| Cobalt (Co)    | mg/kg         | 13.7            | ICP-MS, INAA             |
| Copper (Cu)    | mg/kg         | 34.1            | ICP-MS, ICP-OES          |
| Lanthanum (La) | mg/kg         | 40.4            | ICP-MS, ICP-OES, INAA    |
| Lead (Pb)      | mg/kg         | 22.4            | ICP-MS                   |
| Nickel (Ni)    | mg/kg         | 29.1            | ICP-MS, ICP-OES          |
| Phosphorus (P) | mg/kg         | 955             | ICP-OES, XRF             |
| Scandium (Sc)  | mg/kg         | 13.1            | ICP-MS, INAA             |
| Thorium (Th)   | mg/kg         | 13.0            | ICP-MS, INAA             |
| Uranium (U)    | mg/kg         | 2.62            | ICP-MS, INAA             |

All reference values were determined on an “as received” basis, without drying the material.

\* ICP-OES, inductively coupled plasma-optical emission spectrometry

ICP-MS, inductively coupled plasma-mass spectrometry

INAA, instrumental neutron activation analysis

XRF, X-ray fluorescence spectroscopy

## Characterization

The property values of the material were statistically determined based on chemical analyses by 8 organizations (including 13 laboratories) using a wide range of methods. A property value satisfying the following conditions was accepted as a certified value:

- 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, and
- 3) the number of analytical 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 the half-width of a confidence interval of approximately 95 %. A property value failing to satisfy one or two of the NIES criteria for certification but supplying valuable additional information about the material is given as a reference value. All certified and reference values were determined on an “as received” basis, that is, the values were determined without drying the material.

## Description of the Material

The CRM is supplied as fine powder in an amber glass bottle. It is pale grayish-yellow in color similar to wind-borne kosa dust has been reported from Japan, and it contains about 1 % carbonate carbon originating mainly from calcite (kosa dust characteristically contains calcite).

## Preparation of the CRM

This CRM was produced from surface soil collected at four sampling sites (around 44°N, 109°E) in the south-western Gobi Desert in May 2011. Dust and sandstorms occur frequently in this area each spring. The collected surface soil (1200 kg) was fractionated in a controlled dust generation chamber in the Sainshand Meteorological Center, Mongolia, using a cyclone-type classification apparatus and the fine dust particles (<10 µm diameter) were collected. This material (about 2 kg) was further refined and homogenized at NIES to yield 1.2 kg suitable for the CRM. The final fine dust was placed in amber glass bottles (2 g in each bottle, 500 bottles), and sterilized by <sup>60</sup>Co irradiation (25 kGy). All procedures complied with ISO Guide 34.

### **Homogeneity**

Mass fractions of multi-elements, including those for which certified values are given, were determined by XRF in material taken from 10 bottles selected from the total 500 bottles by stratified random sampling. The between-bottle variation evaluated by a one-way analysis of variance (ANOVA) showed the relative standard deviations between bottles for the analytes to be less than 1 %. The material, therefore, is sufficiently homogeneous for its intended use as a reference material.

### **Instructions for Use**

1. Care should be taken to avoid contamination when opening the bottles. It is desirable to use up the contents as quickly as possible after opening.
2. This CRM should be kept tightly closed in its original bottle and stored in a desiccator at room temperature (≤30 °C).
3. Prior to weighing portions for analysis, the contents of the bottle should be shaken gently.
4. It is recommended that a sample intake of 0.02 g is the minimum for convenient handling.
5. Precautions should be taken to avoid inhalation of the material.
6. 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.
7. The mass fractions of elements in this CRM are reported on an “as received” basis without drying. This CRM, as received, has an average moisture content of 3.2 % as measured in NIES by drying 14 separate sub-samples for 4 h at 105 °C.
8. This CRM contains approximately 2 % carbon. An appropriate analytical method should be selected.

### **Expiry Date of Certification**

The expiry date for the certified values of this CRM is September 2032 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 analytical values from the following eight participating organizations:

National Institute for Environmental Studies; China Institute of Atomic Energy; Elemental Analysis, Inc.; Green Blue Corporation; IDEA Consultants, Inc.; Murata Keisokuki Service Co., Ltd.; Nittech Research Inc.; Shimadzu Techno-Research Inc.

### Organizations Cooperating in the Preparation of the Material

The raw and secondary materials of the CRM were obtained under the international collaboration by Institute of Meteorology and Hydrology, National Agency for Meteorology and Environment Monitoring and Sainshand Meteorological Center, Mongolia.

### Technical Information

Technical information and the latest reports regarding this material can be obtained from the website.  
<http://www.nies.go.jp/labo/crm-e/index.html>

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