

Certificate of Certified Reference Materials

NCS DC73347a

Human hair

Issued in 2007

Approved by China National Analysis Center for Iron and Steel

(Beijing China)

Certified values and uncertainty

Element	Certified values	Element	Certified values	Element	Certified values
Ag(10^{-9})	(50)	Ce(10^{-6})	(0.35)	Fe(10^{-6})	36 ± 5
Al(10^{-2})	(2)	Cl(10^{-2})	(0.018)	Gd(10^{-9})	20 ± 5
As(10^{-6})	0.28 ± 0.05	Co(10^{-6})	0.045 ± 0.009	Ge(10^{-9})	
B(10^{-6})	2.9 ± 0.5	Cr(10^{-6})	0.41 ± 0.12	Hf(10^{-6})	(0.6)
Ba(10^{-6})	11.4 ± 0.6	Cs(10^{-6})	(0.003)	Hg(10^{-9})	670 ± 100
Be(10^{-9})	110 ± 7	Cu(10^{-6})	14.3 ± 1.6	Ho(10^{-9})	4.6 ± 1.8
Bi(10^{-9})	21 ± 2	Dy(10^{-9})	20 ± 7	I(10^{-6})	0.8 ± 0.2
Br(10^{-6})	(1.1)	Er(10^{-9})	14 ± 5	K(10^{-2})	(0.002)
Ca(10^{-2})	0.145 ± 0.020	Eu(10^{-9})	3.7 ± 1.1	La(10^{-6})	0.16 ± 0.04
Cd(10^{-9})	0.07 ± 0.01	F(10^{-6})	(11)	Li(10^{-6})	(1.6)

Element	Certified values	Element	Certified values	Element	Certified values
Lu(10^{-9})	(2.8)	Rb(10^{-6})	(0.06)	Ti(10^{-6})	(3.3)
Mg(10^{-2})	(0.014)	S(10^{-2})	4.19 ± 0.11	Tl(10^{-9})	7.7 ± 1.1
Mn(10^{-6})	2.0 ± 0.3	Sb(10^{-6})	(0.065)	Tm(10^{-9})	$21. \pm 0.7$
Mo(10^{-6})	0.17 ± 0.03	Sc(10^{-6})	(0.018)	U(10^{-9})	99 ± 15
N(10^{-2})	13.9 ± 0.5	Se(10^{-6})	0.58 ± 0.12	V(10^{-6})	0.50 ± 0.18
Na(10^{-6})	0.0089 ± 0.0012	Si(10^{-2})	(0.06)	Y(10^{-6})	11.2 ± 1.7
Nd(10^{-6})	0.093 ± 0.020	Sm(10^{-9})	19 ± 6	Yb(10^{-9})	15 ± 6
Ni(10^{-6})	0.43 ± 0.12	Sn(10^{-6})	(0.2)	Zn(10^{-6})	137 ± 9
P(10^{-2})	0.014 ± 0.002	Sr(10^{-6})	7.7 ± 0.4	Ash(%)	(5.5)
Pb(10^{-6})	5.7 ± 0.5	Tb(10^{-9})	3.3 ± 0.9		
Pr(10^{-9})	25 ± 6	Th(10^{-6})	0.064 ± 0.011		

Note: Data behind "±" are uncertainty; Data with * means percent. Data in () is reference value.

1.The certified value is the mean of analytical results of no less than 6 independent laboratories.

2.Standard uncertainty U is got by

$$U = t_{0.05(n-1)} \bullet \sqrt{u_a^2 + u_b^2} = t_{0.05(n-1)} \bullet \sqrt{(s/\sqrt{n})^2 + [R/(2 \bullet \sqrt{3m})]^2}$$

U_a , U_b is type A and type B standard uncertainty respectively, t is t value of t distribution from 95% confidence interval and degree of freedom n-1; S is standard deviation; n is number of data; R is the max difference of the mean of analytical method; m is number of analytical methods for statistic ($n \geq 2$). If there is only one kind of method,

$3 \bullet s/\sqrt{N}$ is used to estimate the uncertainty.

3.The sample is packed in bottle with size less 80 meshes. The minimum weight for analysis is 0.2g.

The sample should be stoved at 80 °C for 4 hours before using(for elements that easy to evaporate the temperature is 60 °C).

The package is 6g/bottle.

4.The sample should be tight sealed after each use and stored in drier at dark and cool place.

5. The certification will expire in Dec.2015, although we reserve the right to make change as issue revisions.

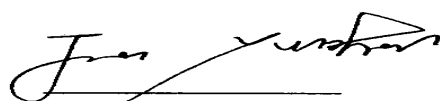
The material was provided by Institute of Geophysical and Geochemical Exploration.

Analytical Methods

Methods	Element
ICP-MS	Ag,As, B, Ba, Be, Bi, Br, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Gd, Ge, Hf, Ho, I, La, Li, Lu, Mn, Mo, Nb,Nd, Ni, Pb, Pr, Rb, Sb, Sc, Se, Sm, Sn, Sr, Tb, Th, Ti, Tl, Tm, U, V, Y, Yb, Zn
ICP-AES	Al, B, Ba, Ca, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Na, Ni, P, Pb, S, Sb, Si, Sr, Zn
INAA	Al, As, Ba, Br, Ca, Ce, Cl, Co, Cr, Cs, Cu, Eu, Fe, Hf, I, K, La, Mg, Mn, Mo, Na, Rb, S, Sb, Se, Sm, Sr,Tb, Th, U, V, Zn
XRF	Al, Br, Ca, Rb, Cu, Fe, K, Mg, Mn, Na, Rb, S, Si, Sr, Zn
AFS	As, Bi, Hg, Sb, Se
GFAAS	Cd, Pb
COL	Al, B, Cl, I, P, Si
VOL	N, S
POL	Mo
IC	Br, Cl, I
IES	F
AES	Ag, B, Sn

Note:

AES: Atomic Emission Spectrography
 AFS: Atomic Fluorescence Spectrophotometry
 COL: Colorimetry
 IC: Ion Chromatogram
 ICP-AES: Inductively Coupled Plasma- Atomic Emission Spectrography
 ICP-MS Inductively Coupled Plasma- Mass spectrometry
 ISE: Ion Selective Electrode method
 INAA: Instrumental Neutron Activation Analysis method
 GFAAS: Graphite Furnace Atomic Absorption Spectrophotometry
 POL: Polarography
 VOL: Volumetry
 XRF: X-Ray Fluorescence spectrometry



Jia Yunhai
Laboratory Director