

U-[¹³C₁₇]-AFLATOXIN B1 IN ACETONITRILE

1. General information

This document is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31 [1] and Eurachem / CITAC Guides [2,3].

2. Description of the Reference Material (RM)

Name:	U-[¹³ C ₁₇]-Aflatoxin B1 in acetonitrile
CAS number:	1162-65-8
Catalog number:	B-MYC0210-1.2
Lot #:	I14311S
Expiry date:	28.07.2015
Starting material:	U-[¹³ C ₁₇]-Aflatoxin B1, Lot #S08224Z, Romer Labs Diagnostic GmbH
Physical description of RM:	Solution of U-[¹³ C ₁₇]-Aflatoxin B1 in acetonitrile
Packaging and amount of RM:	Amber Certan [®] glass ampoules, solution of 1.2 mL
Name and address of the manufacturer:	Romer Labs Diagnostic GmbH Technopark 1, 3430 Tulln, Austria www.romerlabs.com
Name and address of the supplier:	LGC Standards GmbH Mercatorstraße 51, 46485 Wesel, Germany Tel +49(0)2 81 98 87 0, Fax +49(0)2 81/98 87 199 www.lgcstandards.com

2.1 Intended use of the RM

- for laboratory use only
- internal standard [4, 5]

2.2 Instruction for the correct use of the RM

The ampoules should be stored at -20°C in a dark place. Before usage of the RM, the ampoules should be allowed to warm to room temperature. The recommended minimum sub-sample amount for all kinds of application is 100 µL. The expiry date of this RM is based on the current knowledge and holds only for proper storage conditions in the originally closed flasks/packages.

2.3 Hazardous situation

The normal laboratory safety precautions should be observed when working with this RM. Further details for the handling of this RM are available as safety data sheet.

Hazardous Ingredients	Concentration in %	Pictograms	Signal word	Hazard statement(s)
Acetonitrile	> 99.9	 	Danger	H225, H302, H312, H319, H332

3. Certified values and their uncertainties

U-[¹³ C ₁₇]-Aflatoxin B1 in acetonitrile		
Compound	Mass concentration ^a	
	Certified value ^b	Uncertainty ^c
U-[¹³ C ₁₇]-Aflatoxin B1, 99.3 atom % ¹³ C	0.500 µg/mL	± 0.026 µg/mL

^a Values are based on preparation data and confirmed experimentally by HPLC-UV
^b Mass concentration based on weighed amount, purity and dilution step
^c Expanded uncertainty U (k = 2) of the value u_c according to GUM [6]

3.1 Calculation of uncertainty

After the concentration of the gravimetric prepared solution was confirmed by HPLC-UV, the uncertainty of the calibrant solution was calculated on the basis of preparation [7].

Uncertainty components	Description	Standard uncertainty (u)	
Purity (P) of solid U-[¹³ C ₁₇]-Aflatoxin B1, 99.3 atom % ¹³ C	P = 99 ± 1 %	u (P) = 0.58 %	a
Weighing procedure weighted sample: m _{ws} = 1.262 mg	repeatability: 0.03 mg linearity: 0.012 mg	u (m) = 0.03 mg	b
Dilution procedure volumetric flask 1: V _{f1} = 250 mL volumetric flask 2: V _{f2} = 250 mL one-mark glass pipette: V _p = 25 mL	calibration flask 1: 250 mL ± 0.15 mL repeatability flask 1: 0.03 mL volume expansion solvent flask 1 calibration flask 2: 250 mL ± 0.15 mL repeatability flask 2: 0.03 mL volume expansion solvent flask 2 calibration pipette: 25 mL ± 0.03 mL volume expansion solvent pipette	u (cal1) = 0.06 mL u (rep1) = 0.03 mL u (Vol. exp.1) = 0.59 mL u (V1) = 0.59 mL u (cal2) = 0.06 mL u (rep2) = 0.03 mL u (Vol. exp.2) = 0.59 mL u (V2) = 0.59 mL u (cal3) = 0.01 mL u (Vol. exp.3) = 0.06 mL u (V3) = 0.06 mL	c d e f g h i j k l m

^a Maximum tolerance of purity was divided by $\sqrt{3}$

^b Estimation of this u-value is based upon the values for repeatability and linearity described in the user manual of the microbalance

^{c,g,k} A triangular distribution (division by $\sqrt{6}$) was chosen for the calculation of u (cal)

^{d,h} Based on a series of ten fill and weigh experiments on a typical 250 mL flask; the value was used directly as a standard deviation

^{e,l} Based on the density of 0.7857 g/cm³ at temperature T = 20°C and a maximum temperature variation of ± 3°C, of volume expansion, relative volume expansion coefficient of acetonitrile is 1370 * 10⁻⁶/°C [8], volume expansion term (rectangular distribution) was divided by $\sqrt{3}$

^{t,i,m} All contributions are combined to give the u (V) = $\sqrt{u(cal)^2 + u(rep)^2 + u(Vol. exp.)^2}$

Calculation of the combined uncertainty u_c and the expanded standard uncertainty U

$$c_{Toxin} = \frac{10 \times m_{ws} \times P \times V_p}{V_{f1} \times V_{f2}} = \frac{10 \times 1.262 \times 99 \times 25}{250 \times 250} = 0.500 \text{ mg / L}$$

$$\frac{u_c(c_{Toxin})}{c_{Toxin}} = \sqrt{\left[\frac{u(P)}{P}\right]^2 + \left[\frac{u(m)}{m_{ws}}\right]^2 + \left[\frac{u(V1)}{V_{f1}}\right]^2 + \left[\frac{u(V2)}{V_{f2}}\right]^2 + \left[\frac{u(V3)}{V_p}\right]^2} = \sqrt{\left[\frac{0.58}{99}\right]^2 + \left[\frac{0.03}{1.262}\right]^2 + \left[\frac{0.59}{250}\right]^2 + \left[\frac{0.59}{250}\right]^2 + \left[\frac{0.06}{25}\right]^2} = 0.025$$

$$u_c(c_{Toxin}) = c_{Toxin} \times 0.025 = 0.500 \times 0.025 = 0.013 \text{ mg / L}$$

Calculation of expanded standard uncertainty U using a coverage factor k = 2

$$U(c_{Toxin}) = u_c(c_{Toxin}) \times 2 = 0.013 \times 2 = 0.026 \text{ mg / L} = 0.026 \text{ µg / mL}$$

4. Isotopic enrichment and isotope pattern

Isotope pattern ^a	
Compound	Isotopic distribution
[¹³ C ₁₇]-Aflatoxin B1	88.4 %
[¹³ C ₁₆]-Aflatoxin B1	10.6 %
[¹³ C ₁₅]-Aflatoxin B1	1.0 %
Calculated isotopic enrichment level ^a : 99.3 atom % ¹³C	
^a Approximation based on LC-MS/MS data	

5. Discussion of traceability

This calibrant is certified on the basis of gravimetric preparation [7]. Thus the certified value (mass concentration of U-[¹³C₁₇]-Aflatoxin B1, 99.3 atom % ¹³C) is based on the weighed amount of the starting material and is therefore traceable to the stated purity of the solid mycotoxin. High purity material represents a practical realization of concentration units, through conversion of mass to molar quantity.

6. Confirmation of certified value by HPLC-UV

The certified concentration of U-[¹³C₁₇]-Aflatoxin B1, 99.3 atom % ¹³C of the gravimetric prepared solution was confirmed by HPLC-UV against an independently prepared reference batch of unlabeled Aflatoxin B1 calibrant Lot# L14163C.

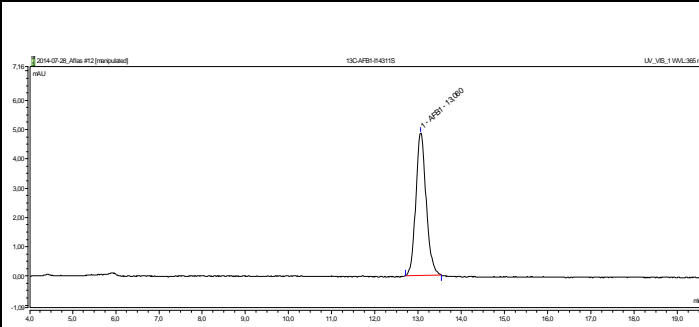
column	Phenomenex Luna C18(2), 250 x 3.0 mm, 5µ			
injection volume	100 µL sample			
solvent A	Water / Acetonitrile / Methanol 57/17/26			
oven	30°C			
flow rate	0.5 mL / min			
DAD settings	365 nm			
sample dilution	1:5 with water			
	time [min]	area	concentration ^a [µg/mL]	
U-[¹³ C ₁₇]-Aflatoxin B1	13.060	1.351	0.507 ± 0.03	
^a Mean of 7 replicate measurements against reference batch, confidence interval with P = 95 %				

Figure 1: HPLC-UV chromatogram of U-[¹³C₁₇]-Aflatoxin B1 Lot # 114311S

7. Further information

The purchaser must determine the suitability of this product for its particular use. LGC Standards GmbH makes no warranty of any kind, express or implied, other than its products meet all quality control standards set by LGC Standards GmbH. We do not guarantee that the product can be used for a special application.

approved for release by: Dipl. Chem. Ulrich Berger

date: 28.07.2014

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References:

- [1] ISO Guide **31**, 1-7, (2000), "Reference Materials – Contents of Certificates and Labels"
- [2] Eurachem / CITAC Guide, 1-37, (2003), "Traceability in Chemical Measurement"
- [3] Eurachem / CITAC Guide CG-4, 1-133, (2012), "Quantifying Uncertainty in Analytical Measurement"
- [4] G. Häubl, F. Berthiller, R. Krska, R. Schuhmacher, "Suitability of a fully ^{13}C isotope labelled internal standard for the determination of the mycotoxin deoxynivalenol by LC-MS/MS without clean-up", Anal. Bioanal. Chem. **384** (3), (2006), 692-696
- [5] G. Häubl, F. Berthiller, J. Rechthaler, G. Jaunecker, E.M. Binder, R. Krska, R. Schuhmacher, (2006), "Characterization and application of isotope-substituted ($^{13}\text{C}_{15}$)-deoxynivalenol (DON) as an internal standard for the determination of DON", Food Addit Contam. **23**, (2006), 1187-1193
- [6] International Organization for Standardization (ISO), (1995), "Guide to the Expression of Uncertainty in Measurement", 1st Ed. Geneva, Switzerland
- [7] R.D. Josephs, R. Krska, S. MacDonald, P. Wilson, H. Pettersson, J. AOAC Int. **86**, 50-60, (2003), "Preparation of a Calibrant as Certified Reference Material for Determination of the Fusarium Mycotoxin Aflatoxin B1"
- [8] E.W. Flick, (1996), "Industrial Solvents Handbook", 3rd Ed., Noyes Data Corp. Westwood NJ