BIPM
Bureau international
des poids et mesures

CCQM and BIPM programmes supporting accurate measurements on food and feed

R. Wielgosz (BIPM)

Overview

1. NMI Services supporting the Food Sector
2. CCQM activities for the Food Sector (CCQM Strategy 2021-2030)
3. BIPM Headquarters' activities supporting the CCQM Strategy
    a) Comparisons of calibration CRMs
    b) Mycotoxins, Vetinary Drugs, Pesticides CBKT
    c) eLearning and qNMR Summer School
4. CCQM Task Group on Food Measurement

NMI Measurements Services supporting the Food Sector

Metrology Tools to support accurate, traceable, validated measurement results

Calibration Standard

Matrix Reference Material

Sample

Laboratory
+ Validated Method

Measurement Result

Above safe level?

+ Proficiency Testing Schemes and sample value assignment

CCQM: Support for the Food Analysis Sector (2021-2030)

Sector	CCQM OAWG	CCQM PAWG	CCQM NAWG	CCQM CAWG	CCQM SAWG	CCQM EAWG	CCQM IAWG	CCQM IRWG	CCQM GAWG
Climate & Environment	POPs Contaminants Microplastics Water/Soil		Species/ microbial surveillance			Seawater pH and salinity	Heavy Metal Contaminants Speciation Water/Soil	GHGs	GHGs Air Quality Emissions Particles
Health & Life Sciences	Diagnostic biomarkers Forensics Anti-doping	Diagnostic biomarkers Therapeutics	Diagnostic biomarkers Gene Therapy	Diagnostic biomarkers	Imaging diagnostics Biocompatibility In-vitro diagnostic devices	Diagnostic biomarkers	Diagnostic biomarkers Toxic Elements	Diagnostic biomarkers Forensics Anti-doping	Breath diagnostics
Food Safety	Toxins Contaminants Residues Authentication	Allergens Authentication	GMO-Foods Pathogens	Pathogens	Packaging materials		Heavy metal Contaminants Speciation	Food authentication	
Energy					Batteries Fuel/Solar cells Catalysts	Batteries Fuel Cells	Fuel Contaminants		Natural Gas LPG/LNG Hydrogen Biofuels
Advanced Manufacturing		Advanced Therapy Development	Biotechnology	Advanced Therapy Development	Nanotechnology Semiconductors Quantum devices	Nanotechnology	Nanotechnology		Trace Gases
Digitialization				Digital Pathology				Isotope Ratio Scale defining RMs Database	GHG Scales Database & Management

JCTLM
Accurate results for patient care

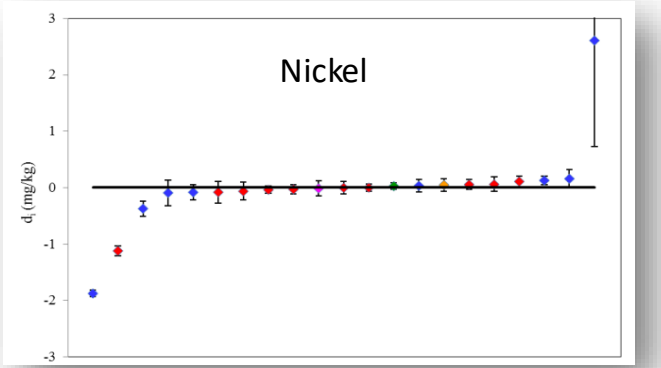
Inorganic Measurements in Food (CCQM-IAWG)

Maximum levels of metallic contaminants in food

Elements in Rice Flour (CCQM-K158)

Rice is consumed as the main foodstuff for about half of the world's population

Toxic and essential elements in bovine liver (CCQM-K145)



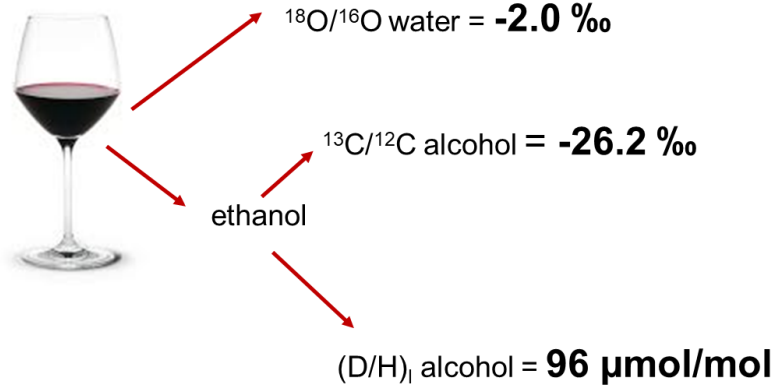
Arsenic in Seafood (CCQM-P215)

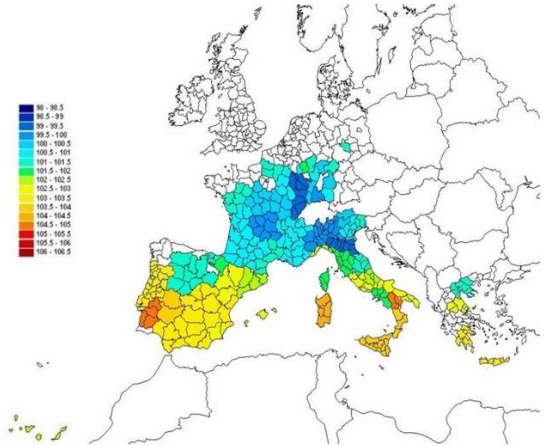
CODEX sets maximum levels of metallic contaminants in seafood to protect public health

- Cadmium 2 mg/kg in bivalve molluscs and cephalopods
- Lead 0.3 mg/kg in fish
- Mercury 1.2 mg/kg in fish
- Arsenic 0.1 mg/kg in fish

Isotope Ratio Measurements in Food (CCQM-IRWG)

Food Authenticity





Year	Method	product	Method	Isotope Ratio	Fraud
2001	OIV 17/2001	wine, must	IRMS	$^{13}C/^{12}C$	sugar addition (cane)
2003	EU Reg. 2676/90, 440/03	wine, must	IRMS	$^{13}C/^{12}C$	sugar addition (cane)
2003	OIV MA-F-AS314-03	wine	IRMS	$^{13}C/^{12}C$	technogenic CO_2

Measurements of GMOs (CCQM-NAWG)

Identification/Quantification of presence of GMO food products

– in support of regulatory environment across the world

Metrologia

Final report for CCQM-K86.b relative quantification of Bt63 in GM rice matrix sample

Lianhua Dong[1], Zhiwei Sui[1], Jing Wang[1], Vincent H M Tang[2], Winnie W Y Chum[2], Foo–wing Lee[2], Della W M Sin[2], Melina Pérez–Urquiza[3], Malcolm Burns[4], Stephen L R Ellison[4] + Show full author list

Metrologia, Volume 55, Number 1A

Citation Lianhua Dong *et al* 2018 *Metrologia* **55** 08017

DOI 10.1088/0026-1394/55/1A/08017

Metrologia

Final report of CCQM-K86.c. Relative quantification of genomic DNA fragments extracted from a biological tissue

Zoltan Mester[1], Philippe Corbisier[2], Stephen L R Ellison[3], Yunhua Gao[4], Chunyan Niu[4], Vincent Tang[5], Foo-wing Lee[5], Melina Pérez-Urquiza[6], Angel Ramirez Suárez[6], Malcolm Burns[3] + Show full author list

Metrologia, Volume 57, Number 1A

Citation Zoltan Mester *et al* 2020 *Metrologia* **57** 08004

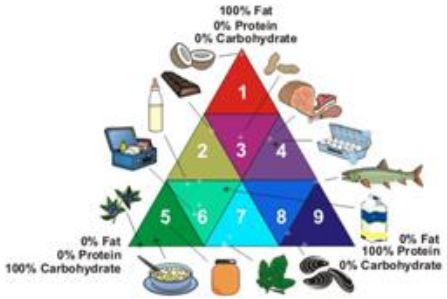
DOI 10.1088/0026-1394/57/1A/08004

Organic Measurements in Food (CCQM-OAWG)

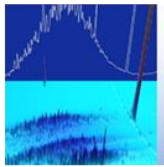
Maximum levels of organic contaminants in food

Pesticide Residues: Current State-of-the-Art and Emerging Issues

Veterinary drug residues and drug metabolites in food



Mycotoxin analysis, current state-of-the art and emerging issues



Packing contaminants in food:

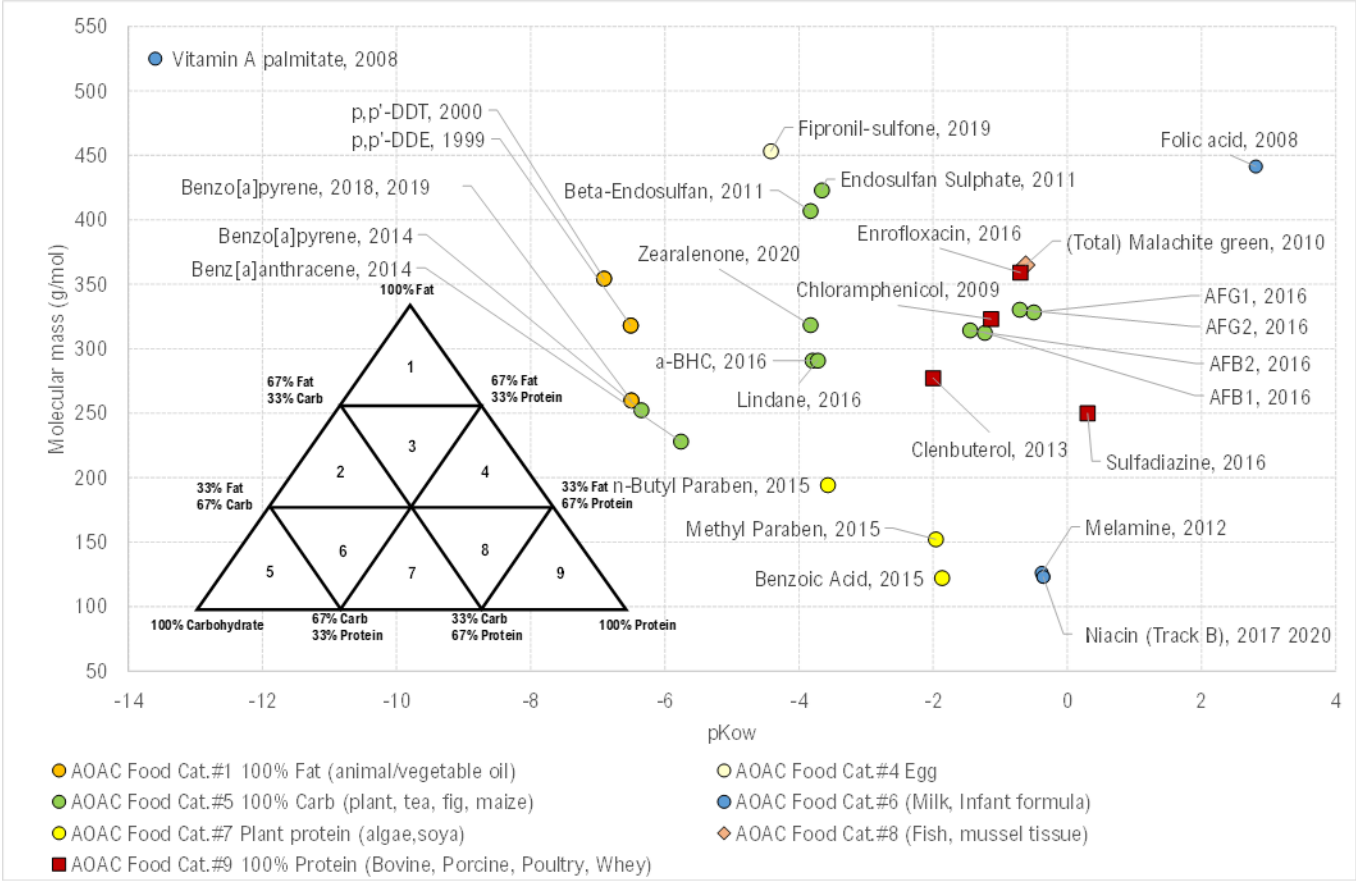
The analysis of *mineral oil saturated hydrocarbons* (MOSH) and *mineral oil aromatic hydrocarbons* (MOAH) as an example

CCQM

CCQM OAWG Food Sector – Workshop 24 January 2022

Organic Measurements in Food (CCQM-OAWG)

Food sector CCQM OAWG comparisons



BIPM Headquarters' support for CCQM Food Activities

Liaison /Coordination

The Inter-Agency Meeting (IAM)

Food and Agriculture Organization of the United Nations

World Health Organization

CCQM

World Metrology Day 2023: 'Measurements supporting the global food system'

CCQM Task Group on Food Measurement (2023)

Specific activities to be undertaken by the Task Group:

To develop a document describing the CCQM strategy and work programme of 2021-2030 within the field of food safety

Comparisons

Contaminants in Food:

- Toxins
- Drugs
- Pesticides

Calibrants:

Knowledge Transfer

BIPM qNMR Summer School (2024)

A qNMR Summer School at the BIPM Headquarters is provisionally planned for 24-28 June 2024 for NMR practitioners in NMIs to enhance their knowledge and skills in qNMR as a robust methodology for the value assignment of organic reference materials. The onsite course will provide a hands-on training opportunity and accompanies the online knowledge transfer modules that will be available on BIPM's eLearning platform in 2024.

The course is suitable for scientists at NMIs that already have practical experience in the use of NMR and access to a spectrometer within their home institute. There is no charge for the course, but travel and accommodation costs will need to be met by participants.
Potential participants can register their interest by completing the following form before 31 August 2023.
Registration for the course is planned to open at the end of 2023. Space is limited to 12 participants.

qNMR Summer School

When and where
- Summer 2024 (1 week duration)
- BIPM Headquarters (Sèvres, France)

Participant requirements
- Practical and theoretical knowledge of NMR
- Acces to an NMR spectrometer in their home institution

Key topics
- Sample preparation
- qNMR experiment set-up
- Data analysis and uncertainty evaluation

Organization
- Experianced instructors from NMIs and the BIPM
- 12 places available
- Networking opportunities

Description of course:
- Led by experienced external instructors from National Metrology Institutes and the BIPM
- qNMR sample preparation
- NMR spectrometer set-up for qNMR
- Use of MNova software for data processing and analysis
- qNMR of different types of samples and nuclei (^{1}H, ^{19}F and ^{31}P)
- Choice of suitable internal standards
- Measurement uncertainty
- Alternative calibration methods
- 2D NMR for impurity confirmation
- Use of orthogonal techniques to correct qNMR results

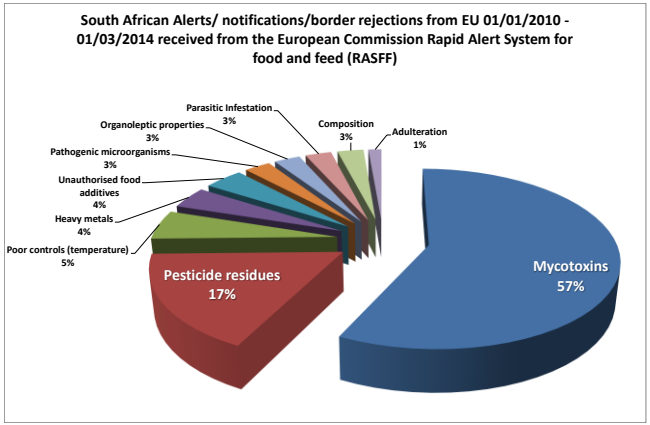
Mycotoxins prioritized based on RMO needs

CBKT

Developing Economy Needs Expressed by AFRIMETS (2014)

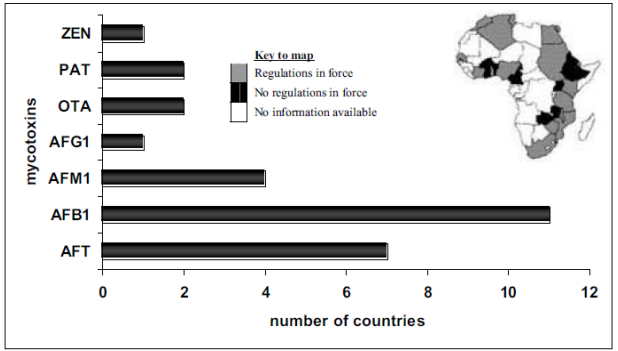
Food and Agriculture Organisation (FAO) estimates in Asia and Africa, 8–18 % of cereals are lost during postharvest handling and storage, the majority due to fungal growth and contamination with mycotoxins.

AFRIMETS has identified the regional need for certified reference materials to support its mycotoxin in food analysis requirements.



Children under 15 at huge risk of aflatoxicosis in Kenya—study

SATURDAY NOVEMBER 16 2013



Bureau International des Poids et Mesures

BIPM CBKT: Mycotoxin Metrology (started 2016)

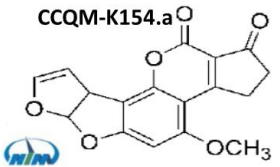
CBKT

- The CBKT project is designed to allow the BIPM and National Metrology Institutes (NMIs) to work together to:

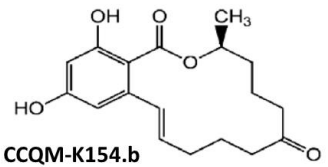
- enable NMIs to characterize selected pure mycotoxin materials, provide mycotoxin calibrants and matrix reference material and proficiency test materials to support mycotoxin testing laboratories within their countries.

Aflatoxin B_1 (AfB_1)

CCQM-K154.a

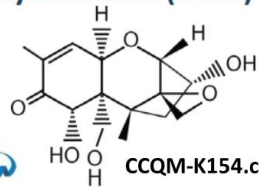


Zearalenone (ZEN)



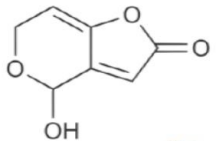
CCQM-K154.b

Deoxynivalenol (DON)



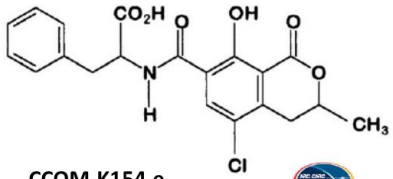
CCQM-K154.c

Patulin (PAT)



CCQM-K154.d

Ochratoxin A (OTA)



CCQM-K154.e

(2024)

Mycotoxin Primary Reference Materials and Calibrators

Higher Metrological Order Services

AfB1 in solvent,
SI-Unit: nmol/L

Definition of the measurand

Primary Reference Material (PRM)

AfB1 (Pure Material) CRM in mg/g

Produced in Compliance with ISO 17034

qNMR or Mass Balance methods* for certification of mass fraction of AfB1 in material, mg/g

Reference measurement procedure

*CCQM-K55 series of comparisons demonstrate NMI capabilities for these methods

Operated in Compliance with ISO 17025

Weighing procedure

Reference measurement procedure

Operated in Compliance with ISO 17025

Certified Reference Material

AfB1 Stock Solution CRM in nmol/L
(High Concentration)

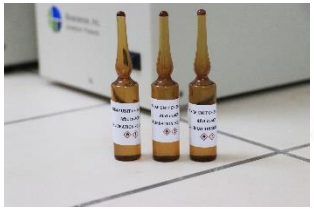
Produced in Compliance with ISO 17034

Weighing procedure

Reference measurement procedure

Operated in Compliance with ISO 17025

Primary Calibrator



AfB1 Calibration Solution CRM in nmol/L
(User level Concentration)

des

Purity evaluation guidelines for Mycotoxin Pure CRMs

Rapport BIPM-2021/01

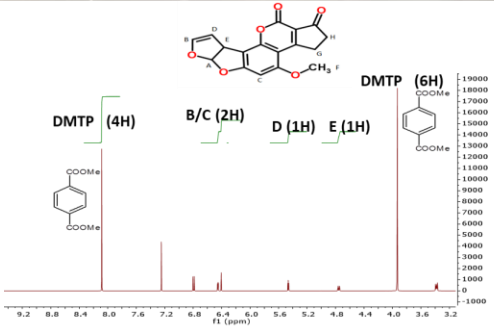
Bureau International des Poids et Mesures

Purity Evaluation Guideline: Aflatoxin B_1

BIPM PEG-02

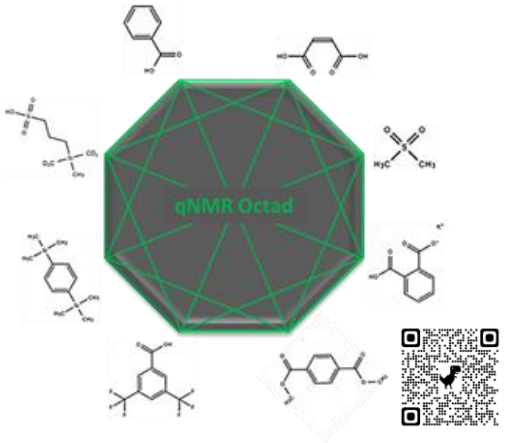
Authors: Steven Westwood (BIPM);Ralf Josephs (BIPM), Gustavo Martos (BIPM),Tiphaine Choteau (BIPM), Xiuqin Li (NIM China);Xiaomin Li (NIM China);Xhen Guo (NIM China);Xianjiang Li (NIM China);Bruno Garrido (INMETRO, Brazil);Ilker Un (TUBITAK UME, Turkey)

Version 1.0 : February 16th 2021



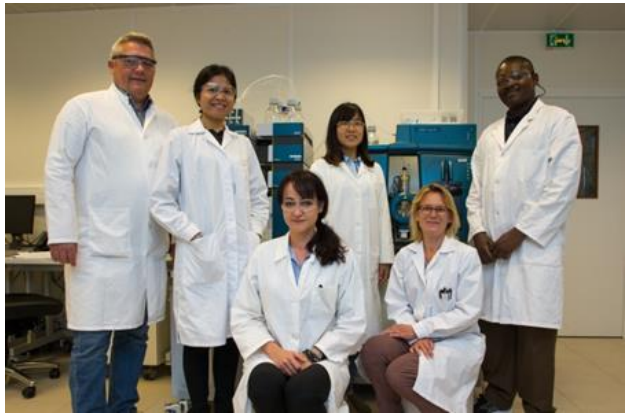
AFB_1 content: 981.3 ± 2.3 $mg.g^{-1}$

qNMR or Mass Balance methods* for certification of mass fraction of AfB1 in material, mg/g



Internal standards for qNMR (NMIJ-BIPM)

Onsite/online Knowledge Transfer by BIPM



Training Secondments at the BIPM
TS4: Calibration Solution Preparation and Value Assignment
12 week Training Secondment

PTB support for 4 visiting scientists

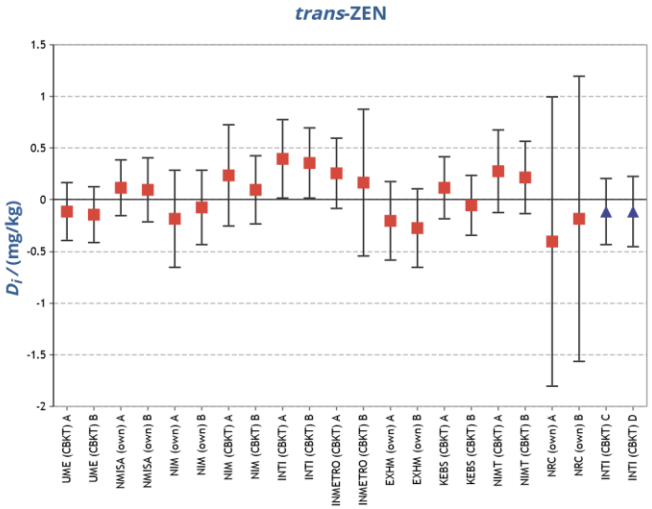
Week	Description
1	Safety and Quality documentation introduction
2-3	Accurate weighing, uncertainty calculation, ZEN ampoule solution preparation
4-5	LC-UV instrument operation and implementation of ZEN analysis method
6-7	Homogeneity testing and calculation of between ampoule variability
8-9	Stability testing and evaluation of results
10-11	Value assignment of unknown calibration solution
12	Finalisation of secondment report

NON STRUCTURE-RELATED IMPURITY CONTENT IN ORGANIC PURE MATERIALS

The course is intended for NMI scientists working in organic analysis and wishing to further their theoretic…

Online course offered to over 100 participants

Demonstration of Measurement Capabilities



Metrologia

KEY COMPARISON

Key comparison study - organic solvent calibration solution - gravimetric preparation and value assignment of deoxynivalenol (DON) in acetonitrile (ACN)

R D Josephs[1], M Bedu[1], A Daireaux[1], Z Guo[1,2], Xianjiang Li[1,2], Y Gao[1,2], Xiuqin Li[1,2], T Choteau[1], G Martos[1], S Westwood[1] + Show full author list

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Metrologia, Volume 60, Number 1A

Citation R D Josephs *et al* 2023 *Metrologia* **60** 08002

DOI 10.1088/0026-1394/60/1A/08002

Metrologia

Key comparison study—organic solvent calibration solution—gravimetric preparation and value assignment of trans-zearalenone (trans-ZEN) in acetonitrile (ACN)

R D Josephs[1], A Daireaux[1], M Bedu[1], Xiuqin Li[1,2], Xiaomin Li[1,2], Z Guo[1,2], T Choteau[1], G Martos[1], S Westwood[1], R I Wielgosz[1] + Show full author list

Metrologia, Volume 57, Number 1A

Citation R D Josephs *et al* 2020 *Metrologia* **57** 08019

DOI 10.1088/0026-1394/57/1A/08019

Metrologia

KEY COMPARISON

Key Comparison Study - Organic Solvent Calibration Solution - Gravimetric preparation and value assignment of aflatoxin B1 (AfB1) in acetonitrile (ACN)

R D Josephs[1], M Bedu[1], A Daireaux[1], Xiuqin Li[1,2], Xiaomin Li[1,2], Z Guo[1,2], Xianjiang Li[1,2], T Choteau[1], G Martos[1], S Westwood[1] + Show full author list

Published 1 January 2022 • © 2022 BIPM & IOP Publishing Ltd

Metrologia, Volume 59, Number 1A

Citation R D Josephs *et al* 2022 *Metrologia* **59** 08002

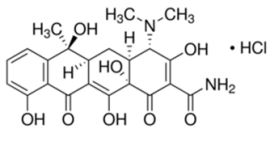
DOI 10.1088/0026-1394/59/1A/08002

Outputs: Accurate Calibrants for Food Safety testing

Extension to Drug Residue Standards (2020)

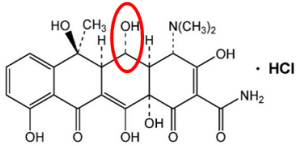
CBKT

Institutes	Summary of response
NMISA	Antibiotics in poultry: TETRACYCLINES



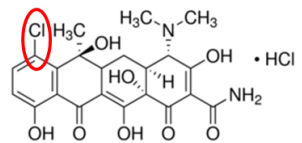
Tetracycline.HCl

1st BIPM KT Study Material (2021)

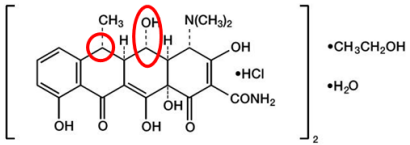


Oxytetracycline.HCl

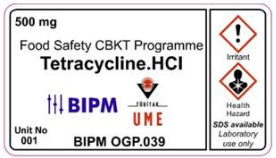
CCQM-K148.b Material (2023)



Chlortetracycline.HCl



Doxycycline.HCl



TÜBİTAK UME

Bureau International des Poids et Mesures

Extension to Pesticide Standards (2020)

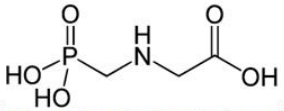
CBKT

CBKT Pesticide project includes:

- **Glyphosate** – highly regulated use in EU, concern for human and animal health, particularly impact on bee population
- **Endosulfan** – global ban since 2012 for acute toxicity, persistent in the environment and role as an endocrine system disruptor
- **Dimethoate** – neurotoxic, banned in EU 2019, recently (Sep 23) banned in Australia

In collaboration with NIM (China)

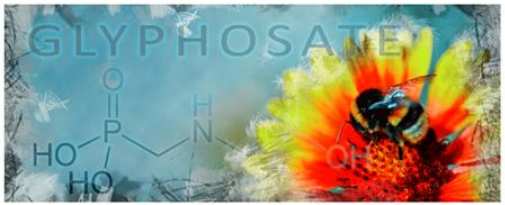
中国计量科学研究院
National Institute of Metrology, China



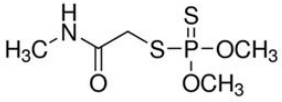
France court bans two glyphosate-based pesticides

Share

Submitted by pane on May 22, 2023 - 12:56



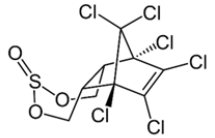
The Administrative Court of Montpellier banned two glyphosate products marketed by Syngenta. The company did not submit the mandatory risk assessment on the impacts on bees, other insects, soil and water life. For this reason, re-authorisation should not have



Dimethoate use suspended after insecticide residue found to exceed safety levels

By national regional reporter Nathan Morris

Posted Fri 22 Sep 2023 at 11:16pm, updated Tue 26 Sep 2023 at 2:03am



Endosulfan Banned Worldwide

Persistent Pollutants: Certain uses of pesticide can continue until 2017

by Cheryl Hogue

May 5, 2011 | A version of this story appeared in Volume 89, Issue 19

Countries have **agreed to a global phaseout of endosulfan**, an environmentally persistent pesticide that can cause neurological and reproductive problems in people and wildlife.

More than 120 nations struck the deal on April 29 under the **Stockholm Convention**, an international treaty for controlling persistent organic pollutants. They endorsed the endosulfan ban after five days of negotiations in Geneva.

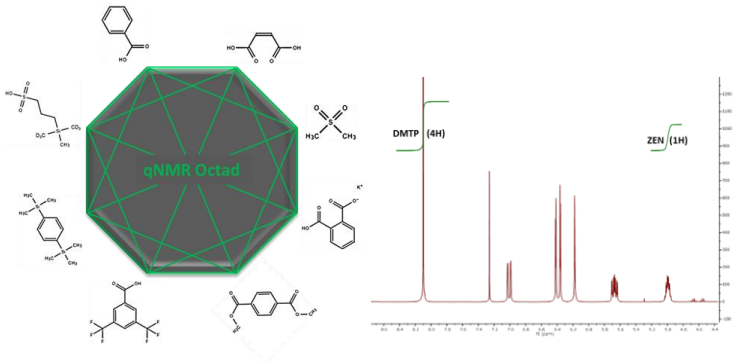
Under the deal, most uses of endosulfan will cease in 2012. However, this organochlorine insecticide may be used on certain combinations of crops and pests until

[+]Enlarge

Credit: Newscom

Protesters in the Philippines expressed their support for a global endosulfan ban while negotiations took place in Geneva.

qNMR eLearning and Summer School (2024)



- qNMR online eLearning course in development
- Pure Organic Standard Value Assignment
- Onsite practical summer school

Being established in 2023, with draft tasks:

- To develop a document describing the CCQM strategy and work programme of 2021-2030 within the field of food safety and measurement, as well as activities in the RMOs and in capacity building and knowledge transfer, based on the published CCQM 2021-2030 strategy, that can be used as publicly accessible reference to describe how the international metrology community is planning to meet measurement needs related to food and food safety;
- To identify gaps in measurements needs related to food and food safety not yet identified in the CCQM 2021-2030 strategy, and propose how the strategy could be updated to address these;
- To identify unmet stakeholder engagement opportunities and how these could be exploited to promote the benefits of metrology and NMI services or used to identify new measurement needs;
- To liaise with other CCs and identify measurements related to food and food safety covered by activities in these communities that could be incorporated into broader document covering food measurements issues and needs including those outside chemical and biological measurements.

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Thank you for your attention

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