Chemical metrology at the BIPM

Organic Metrology Programme

The BIPM Organic Metrology Programme focuses on the international equivalence of primary reference materials and calibrators, the basis of SI traceability in chemical analyses. Outputs from the current programme include:

Technical Coordination

- 98 NMI participations in 6 Comparisons coordinated by the BIPM in the 2016-2019 programme to date in support of CCQM strategy
- 21 visiting scientists working on organic metrology projects in BIPM laboratories for a total of 114 person-months
- 3 key comparison final reports published in *Metrologia*
- 3 Reference data documents published for application of qNMR

Science

- 6 papers published in peer reviewed journals
- 1 review article on Small and Large Molecule Organic Standards published
- Methodology for impurity identification and quantification in straight-chain peptide standards developed
- Ensemble of internal standards for qNMR characterized and cross-validated for development of reference data

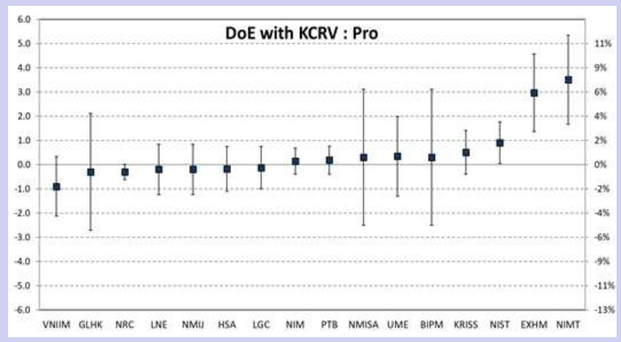
Representation

- Represented chemical metrology at WADA, Codex, ISO TC 212, ISO REMCO, IUPAC, JCTLM
- Contributed to guidelines on organic purity developed within IUPAC
- Supported regional activities on capacity building on standards for food analysis in Asia, South America and Africa

Reference Measurement Systems in Laboratory Medicine

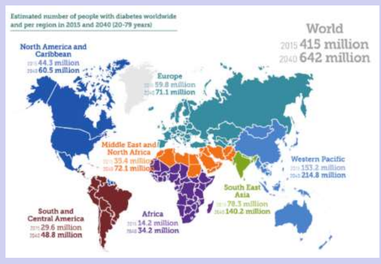
Reducing false positives in Newborn Blood Screening

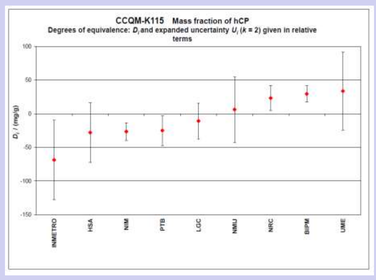
BIPM coordinated comparison on amino acids (CCQM-K78.a) supports NMI contribution to Newborn Blood Spot Screening Programme



- 775,000 babies born in the UK each year
- tests for rare and serious conditions
- minimize false positive rate
- Example provided by: LGC and NHS England

Diabetes diagnostics: standardizing measurements world-wide



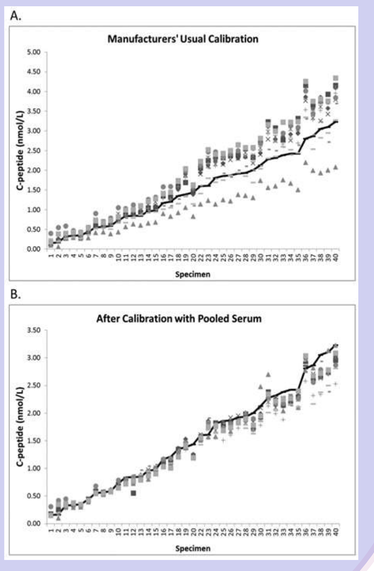


C-peptide is a biomarker for insulin secretion and the body's ability to regulate blood sugar levels

BIPM comparison on C-peptide PRM (CCQM-K115) supports NMI CRM production activities for the *in vitro* Diagnostics (IVD) industry

The impact on measurement compatibility of IVD kits for C-peptide measurement after implementing an SI traceable calibration hierarchy

Little R.R., Wielgosz R.I., et al. "Implementing a Reference Measurement System for C-peptide: Successes and Lessons Learned." *Clin. Chem.*, 2016, 63(9), 1447-1456.



CCQM-K115 coordinated by the BIPM and NIM (China)

Metrology for safe food: knowledge transfer to NMIs

- Training of NMI scientists on mycotoxin standard preparation and value assignment and demonstration of competence in follow up comparisons in response to request from AFRIMETS
- Sponsorship of CBKT programme by NIM, NMISA, UME and PTB

Growing number of NMI participants with regional events in Asia (2017), Africa (2018) and South America (2018)

2nd meeting 21 April 2017 joined by:

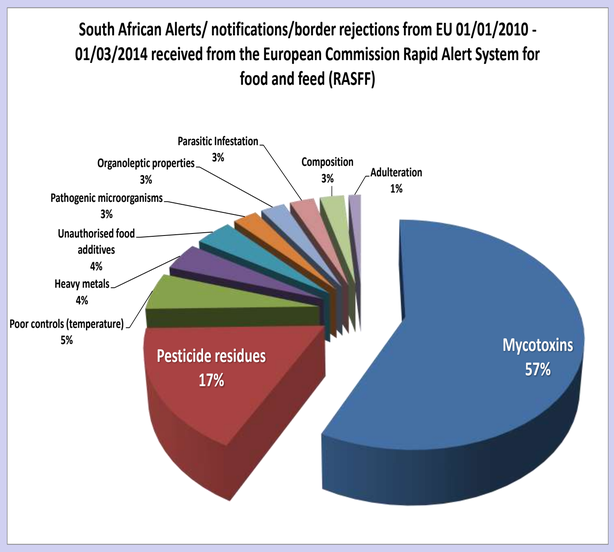
CENAM · LATU · Institut National de Recherche et d'Analyse Physico-chimique

1st meeting 15 April 2016

NIM · nmisa · UME · Bureau International des Poids et Mesures · UNIDO · INMETRO · INTI · KEBS Kenya Bureau of Standards · PTB

3rd meeting 13 April 2018 joined by:

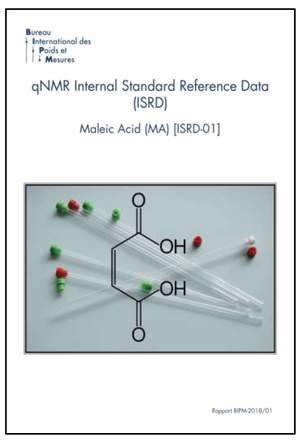
CODEX ALIMENTARIUS International Food Standards · LIPI · NRC·CNRC · INM

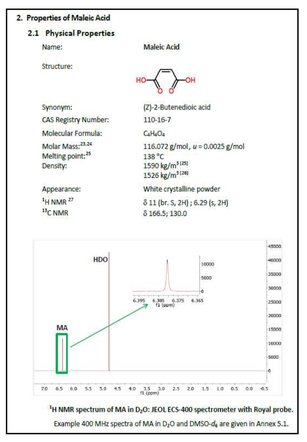


Supporting the establishment of metrological traceability for chemical measurements

BIPM and NMIJ collaborative project on Quantitative Nuclear Magnetic Resonance (qNMR)

- Increased uptake of qNMR as method used by NMIs for organic purity characterization
- Reference data for seven 'universal' internal standards produced
- Impact: increasing number of organic calibration materials available world-wide for SI traceable measurements





ISRM ⇨	KHP	BTFMBA	DMTP	MA	$DMSO_2$	BTMSB	DSS-d_6
Structure							
δ (ppm)	8.3-7.0 (4H)	8.4-8.5 (2H) 8.2-8.4 (1H)	8.1 (4H) 3.9 (6H)	6.3 (2H)	3.0 (6H)	[7.5 (4H, R=H)] 0.2 (18H)	0.1 (9H)
Solvent ⇩	ISRM Solubility by Solvent (mg.mL^{-1})						
D_2O	> 10	< 1	< 1	5-10	> 10	< 1	5-10
DMSO-d_6	< 2.5	> 10	< 2.5	> 10	5 - 10	< 5	5-10
CD_3OD	< 2.5	> 10	*	*	5 - 10	< 5	5-10
$CDCl_3$	< 1	5-10	> 10	< 1	> 10	5-10	< 1