Isotope Ratio Measurements by IRMS Instrument in TUBITAK UME

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**EA-IRMS (δ^{13}C and δ^{15}N Measurements)**

**δ^{13}C Measurements:**
Bulk honey, molasses, juice, sugar and sugary products, biofuels, biodiesel, vegetarian oil, seed samples

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Allows the precise measurements of mixture of stable isotopes

Thermofinnigan MAT 253 IRMS

Elemental Analyzer (EA)

Continuous flow III
EA-IRMS ($\delta^{13}$C and $\delta^{15}$N Measurements)

$\delta^{15}$N Measurements:
Fish muscle, wheat, leaf samples

Allows the precise measurements of mixture of stable isotopes.

Thermofinnigan MAT 253 IRMS  Elementatal Analyzer (EA)  Continuous flow III
δ¹⁸O Measurements:
Underground water, biofuels, vegetarian oil, seeds, clay, juice samples

Thermo Finnigan MAT 253 IRMS
Temperature Conversion Elemental Analyzer (TC/EA)
Solid / liquid autosampler units for TCEA

Solid autosampler unit
**TCEA-IRMS (δ¹⁸O and δ²H Measurements)**

**δ²H Measurements:**
Underground water, biofuels, vegetarian oil, seeds, clay samples

We have solid and liquid autosampler units for TCEA.
**GC-IRMS ($\delta^{13}C$, $\delta^{18}O$ and $\delta^2H$ Measurements)**

**$\delta^{13}C$ Measurements:**

Methyl mercury in fish samples, pure and 400 ppm CO$_2$ and CH$_4$ gas samples

Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253

Sample chromatogram for pure CO$_2$ by GC-IRMS
GC-IRMS (δ¹³C, δ¹⁸O and δ²H Measurements)

δ¹⁸O Measurements:
Pure and 400 ppm CO₂ gas samples

Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253
GC-IRMS ($\delta^{13}$C, $\delta^{18}$O and $\delta^2$H Measurements)

$\delta^2$H Measurements:
CH$_4$ gas samples

Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253
Gas Mixture Preparation

- Turbomolecular vacuum pump system
- Gas filling station
- Cylinder weighing system
- Cylinder roller (for homogenization)
Infrastructure of Gas Metrology Laboratory

Gas Mixture Preparation (diluting system)

MF (mass flow controller)  PC (pressure controller)
Molbloc-L flow element  PC

Molbox Units

CRDS
Gas Analysis

**CRDS:** Picarro G2401 CO/CO$_2$/CH$_4$/H$_2$O Analyzer equipped with 16-Port Distribution Manifold
ENG09-Metrology for Biofuels Project (2010-2013)

$\delta^{13}C$, $\delta^{18}O$ and $\delta^2H$ Measurements (TCEA-IRMS):
Biofuels, biodiesel, oil and seed samples
Projects and Comparisons

ENV51-Traceability for Mercury Measurements (Metra project, 2014-2017)

$\delta^{13}C$ Measurements (GC-IRMS): Fish samples

$\delta^{13}C$ and $\delta^{18}O$ Measurements (GC-IRMS):

Pure and 400 ppm CO$_2$ gas samples

Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253

Sample chromatogram for 400 ppm CO$_2$ in air measured by GC-IRMS
ENG54-Metrology for Biogas (biogas project, 2014-2017)

$\delta^{13}C$ and $\delta^2H$ Measurements (GC-IRMS): CH$_4$ gas samples

Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253
16ENV06-Stable isotope reference standards (SIRS project)

$\delta^{13}C$ and $\delta^{18}O$ Measurements (GC-IRMS): pure and 400 ppm CO$_2$ gas samples

Preperation of pure and 400 ppm CO$_2$ gas mixtures
Key Comparison: Carbon stable isotope ratio delta values in honey (CCQM-K140)

δ¹³C Measurements (EA-IRMS): Honey CRM 1312

KEY COMPARISON
CCQM-K140: carbon stable isotope ratio delta values in honey
P J H Dunn¹, H Goenaga-Infante¹, A C Goren², A Şimşek², M Bilsel², N Ogrinc³, P Armishaw⁴ and L Hai⁵

Metrologia, Volume 54, Technical Supplement

Participants to CCQM-K140
- IJS
- LGC
- NIM
- NMIA
- UME
Key Comparison: (CCQM-K140)

K140 Results

![Graph showing comparison results]

Mean $= -24.09 \pm 0.08$

Standart uncertainties, $k=1$
Key Comparison CCQM-P204

Key Comparison: CO$_2$ Isotope Ratios ($\delta^{13}$C and $\delta^{18}$O) in pure CO$_2$ CCQM-P204

We purchased the cylinders and valves for the comparison of CCQM-P204

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
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| Part No.: SS-600-P  
Description: 316 Stainless Steel Plug for 3/8 in. Swagelok Tube Fitting | 10 |
| Part No.: SS-4CS-TW-50  
Description: 316 Stainless Steel Single Ended Miniature Sample Cylinder, 50 cm$^3$, 1000 psig (68.9bar) | 10 |
| Part No.: SS-6BW  
Description: Stainless Steel Bellows Sealed Valve, Welded, Spherical Stem Tip, 3/8 in. Swagelok Tube Fitting | 10 |
Thank you for your attention