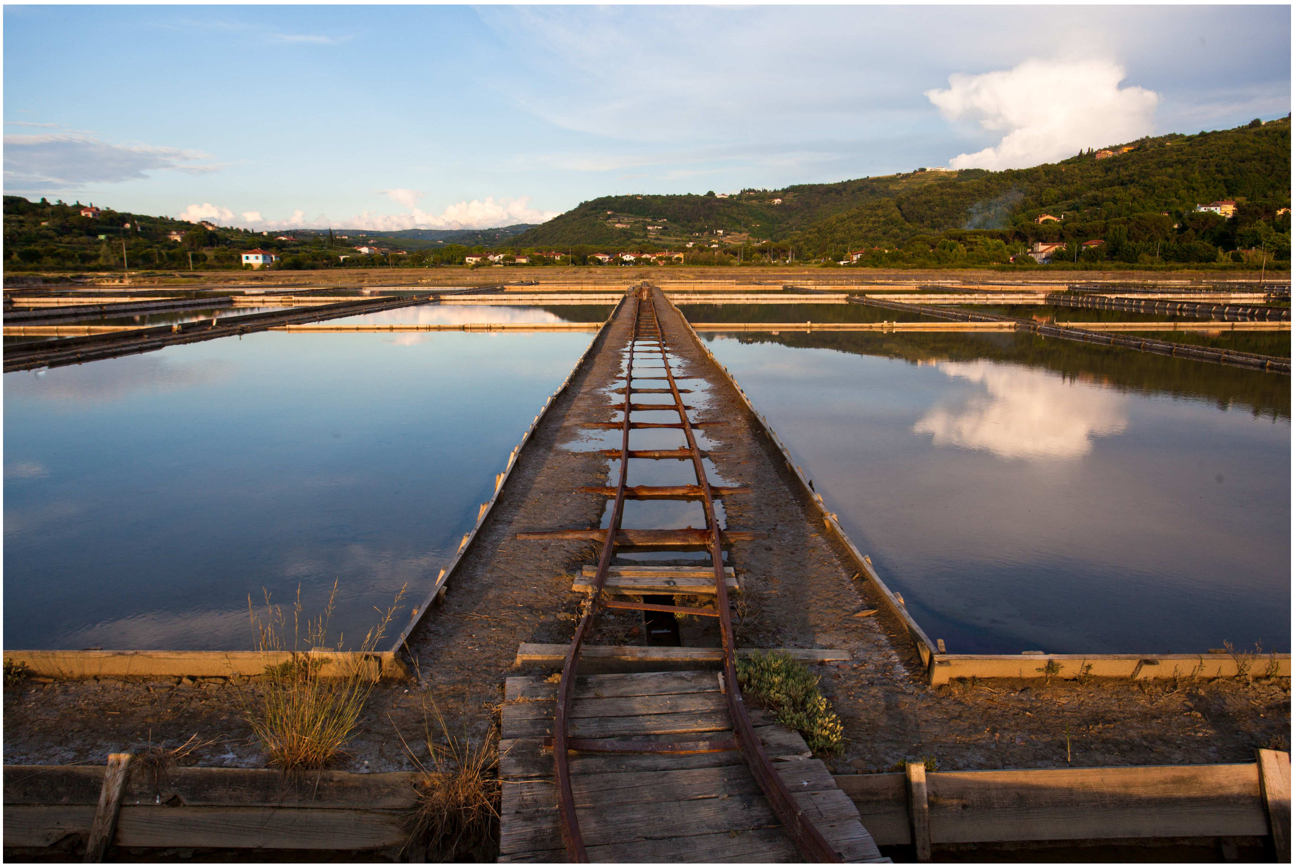
1st ISO-FOOD International Symposium on Isotopic and Other Techniques in Food Safety and Quality

Portorož, Slovenia

April 1-3, 2019



ISO Fd Food ERA Chair Safety Quality Traceability

Jožef Stefan Institute, Ljubljana, Slovenia

Organised by

ERA Chair ISO-FOOD in Isotope Techniques in Food Quality,
Safety and Traceability
Department of Environmental Sciences
Jožef Stefan Institute

Programme and Book of Abstracts

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Edited by:
David Heath, Milena Horvat, and Nives Ogrinc

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Invited Lectures

Monday Early Morning Invited Lecture

Apr 01, 9:15 - 9:45

IN-01

A new rapid method for stable isotope analysis of non-exchangeable hydrogen to detect undeclared addition of sugar and sugar syrups to food

Simon Kelly, Aiman Abrahim, Andrew Cannavan

IAEA Food and Environmental Protection Laboratory (FEPL), Austria

An improved procedure for the isotope analysis of the non-exchangeable hydrogen in mono and disaccharides has been developed to demonstrate the feasibility of detecting undeclared addition of C3 and C4 sugar products in foods and beverages susceptible to adulteration. The procedure utilizes a simple one-step reaction, with the derivatising agent N-methyl-bis-trifluoroacetamide, to substitute the exchangeable hydroxyl-hydrogen with trifluoroacetate derivatives that are sufficiently volatile to be separated and measured by gas chromatography coupled to isotope ratio mass spectrometry. The conversion of the derivatised sugars into the measuring gas is achieved using a high temperature chromium reactor that retains carbon, oxygen and fluorine whilst releasing hydrogen gas for stable isotope measurement. The new procedure has advantages over methods using nitro-sugar derivatives and degradation products, such as hexamethylenetetramine and calcium formate, in terms of ease of use, analysis time and sensitivity. The differences between the δ2H values of the non-exchangeable hydrogen in sugars from fruit juices and honey and those from beet and cane sugars/syrups permits the presence of these potential adulterants to be rapidly detected.

Invited Lectures

Monday Late Morning Invited Lecture

Apr 01, 11:15 - 11:45

IN-02

Compound specific isotope analysis in food authenticity

Nives Ogrinc, Andrija R. Ćirić, Doris Potočnik, Lidija Strojnik

Jožef Stefan Institute, Department of Environmental Sciences, Slovenia

The aim of this presentation is to provide an overview of compound-specific isotope analysis (CSIA) in food authenticity and traceability. First the theoretical background will be presented with most common analytical approaches including GC-C-IRMS and LC-IRMS followed by the review of analytical challenges associated with chromatographic separation and derivatization. Selected applications and examples will include the use of CSIA in traceability studies of olive oil, authenticity of aroma compounds and honey and discrimination between organically and conventionally produced products.
It was found that the discrimination between olive oil according to the country of origin was better when stable isotope composition of carbon in fatty acids were included in statistical evaluation of the data. The application of CSIA in authenticity of aroma compound originating from fruits and vanilla enable us to distinguish natural versus synthetic origin. Indeed, cheap, synthetic, petroleum-derived compounds usually have different isotope values than their more costly, natural counterparts. This approach is more efficient if both carbon and hydrogen stable isotopes are used. Coupling high performance liquid chromatography (HPLC) with isotope ratio mass spectrometry (LC–IRMS) has the unrivaled advantage of the simultaneous determination of δ13C values from glucose, fructose, di-, tri-, and oligo-saccharides, allowing the detection of more sophisticated honey adulteration. The last part of the presentation will show how CSIA of amino acids could be used to discriminate between conventionally and organically grown food commodities such as wheat.

Invited Lectures

Monday After-lunch Invited Lectures

Apr 01, 14:00 - 15:00

IN-03

Real time food authenticity testing with minimal need for sample preparation using the DART QDa system with LiveID software

Rainer Rozenich

Waters GmbH, Austria

DART (Direct Analysis in Real Time) is atmospheric pressure chemical ionization for direct analysis without the need for chromatographic separation. It enables a rapid, sample preparation-free solution for informed and immediate sample classification.
It is applicable for point of control quantitative testing, with reduced sample manipulation giving accurate mass spectral information in a second. There are many potential applications for the DART QDa System with LiveID within food safety, quality and research, including quality testing of raw ingredients, in-process products, and finished product quality control and authenticity.

IN-04

Traceability and authentication of premium products using stable isotope ratios analysis

Federica Camin, Matteo Perini, Luana Bontempo

Fondazione Edmund Mach (FEM), Italy

Determining the authenticity of foods means uncovering misdescription of foods not meeting the requirements for adopting a particular name, substitution with cheaper but similar ingredients, undeclared processes and/or extension of food using adulterants, incorrect origin (e.g.

geographical), species or production method (e.g. organic vs conventional). Nowadays, the objective assessment of food authenticity is of paramount importance as consumers come into daily contact with a wide variety of foods. Indeed, globalization means that more and more foods are traded around the world.

Methods for testing authenticity and providing analytical data on traceability require robust analytical techniques that can be used by the various regulatory authorities. Of the many techniques available, one of the most widely-used is isotope ratio mass spectrometry (IRMS), applied since around 1975 to detect adulteration of products like wine, honey, fruit juice, maple syrup, vinegar with cheaper extenders, such as sugar, or simply water. Those “traditional” applications in food control rely on the analysis of the stable isotope ratios of only one or two elements (13C/12C and/or 18O/16O, 13C/12C and 2H/1H) and several of these methods have been officially validated and acknowledged as AOAC, CEN, EU or OIV methods. More recently multi-isotope ratio analysis (13C/12C, 18O/16O, 2H/1H, 15N/14N, 34S/32S, sometimes combined with elemental or NMR profiling) have been successfully applied for verifying geographical origin of food (e.g. PDO cheese, olive oil, cacao). Other applications concern identification of the natural origin of flavours (e.g. vanillin) and of nutraceutical and pharmaceutical products (e.g. Red Yeast Rice, serenoa oil, squalene).

Invited Lectures

Monday Afternoon Invited Lecture

Apr 01, 16:00 - 16:30

IN-05

”A Bug Lunch” - Evaluating the chemical safety of edible insects

Giulia Poma[1], Matthias Cuykx[1], Elvio Amato[1], Chiara Calaprice[2], Francois Focant[2], *Adrian Covaci*[1]
[1]University of Antwerp, Belgium
[2]University of Liége, Belgium

Due to the rapid increase in world population, the use of alternative and more environmentally sustainable food sources is strongly encouraged. In this perspective, the opportunity for edible insects to offer a valuable alternative for the rising demand for meat or fish products is remarkable1. However, like other animal products, insects might accumulate hazardous chemicals2. The present pilot study aimed to provide a comprehensive overview of the residual levels of several classes of chemical compounds (including halogenated and phosphorous flame retardants, HFRs, PFRs; PCBs; organochlorine compounds, OCPs; dioxins and furans; metals) in four species of edible insects and four insect-based foodstuffs currently commercialized in Belgium.

Our results pointed out a generally low chemical contamination of the analyzed samples. The levels of PCBs and OCPs ranged from 27 to 2,065 pg/g and from 46 to 368 pg/g, respectively. Total HFRs were below 36 pg/g, while the total concentrations of PFRs were between 783 and 23,786 pg/g. Total dioxin and furan concentrations ranged from 0.05 to 0.3 pg WHO-TEQ/g, mostly below the regulated maximum residual levels set for beef, poultry, fish, milk and eggs. Cu (0.9-9.1 mg/kg) and Zn (6.4 to 59 mg/kg) were consistently the most abundant metals, suggesting that edible insects have the potential to provide these essential micronutrients.

Finally, the chemical concentrations measured in the analyzed samples were compared with those found in several commonly consumed food groups in Belgium3,4 and worldwide. Overall, our results support the possibility for humans to consume these insect species with no additional hazards in comparison with commonly eaten animal products and indicate that the analyzed insect food could be considered a valuable alternative to common sources of proteins.

[1] FAO. Edible insects. Future prospects for food and feed security; 2013; Vol. 171.
[2] Poma, G. et al. Food Chem. Toxicol. 2017, 100, 70–79.
[3] Poma, G. et al. Chemosphere 2018, 194, 256–265.
[4] Poma, G. et al. Environ. Sci. Technol. 2018, 52 (4), 2331–2338.

Invited Lectures

Tuesday Early Morning Invited Lectures

Apr 02, 8:30 - 9:30

IN-06

Mass spectrometry techniques for the speciation and isotopic composition of selenium in food

Joanna Szpunar
Centre for Scientific Research CNRS IPREM , France

Selenium is an element with a narrow concentration gap between the toxicity and the essentiality, often evoked in the context of antioxidant protection and cancer prevention [1]. Quantitative information on the concentrations of individual Se forms in natural and Se-enriched (functional) foodstuffs is of paramount importance for the evaluation of its bioavailability, and thus the quality and safety of commercial products. A particular importance has been attributed to the Se metabolic pathways leading to the synthesis of physiologically important selenoproteins and low (< 1000 Da) molecular weight selenometabolites. It can be the basis of the determination of the provenance of Se-enriched supplements (especially yeast) along with the Se isotopic composition.

The discrimination among the different Se chemical forms present in biological systems is a challenge for analytical chemists because - besides having several possible oxidation states in its inorganic form - selenium can be incorporated into tens of known (and probably many more not yet discovered) selenometabolites, many SeCys- and SeMet-containing proteins, selenosugars, selenolipids