doi:10.2533/chimia.2020.64 Chimia 74 (2020) 64–66 © Swiss Chemical Society

Conference Report

Eurachem Week 2019 at Tartu (Estonia)

Ernst Halder*

*Correspondence: Dr. E. Halder, Eurachem-CH , e.halder@rhone.ch

Abstract: The Eurachem Week 2019 took place from May 20th to 24th, at Tartu, Estonia. The hanseatic city is home of the nation's oldest and most renowned university, the University of Tartu. It is often considered the intellectual centre of the country. Each year a member state of Eurachem organizes the event. The organizers propose a topic for the two-day workshop from May 20th to May 21st. The Estonian colleagues had chosen 'Validation of targeted and non-targeted methods of analysis' as the topic of the workshop. On May 22nd to May 24th the Eurachem working groups, the Executive Committee and the General Assembly of the delegates of the member countries held their meetings.

Workshop on Validation of Targeted and Non-targeted Methods of Analysis

Approximately 160 people attended the workshop. The participants came from 42 countries, mainly from the member countries of Eurachem but also from Asia, North and South America and the Middle East. The workshop was held with 13 oral presentations, 25 posters and twice three work group sessions in parallel.

Eurachem is well known for their guides covering aspects of quality and accreditation issues in analytical measurement. Particularly the well-designed and -explained validation guidelines for quantitative targeted analysis in the field of analytical chemistry are widely recognized. The non-targeted methods are becoming increasingly important for example in environmental protection, food safety and different 'omics' areas. Their validation involves specific issues and their validation is significantly less developed and defined than validation of targeted methods.

In the first presentation of the workshop 'Validation of targeted methods: where we are?' given by ***Lorens Sibbesen***, the audience learned about the history of the Eurachem method validation working group, their guideline 'The Fitness for Purpose of Analytical Methods: A Laboratory Guide to Method Validation and Related Topics', and the ongoing activities of the working group. The specific issues in the validation of non-targeted methods are at the present time not covered by the activity of the working group. The output of the workshop should give new ideas to the working group of Eurachem and their activities.

Photo: © Eurochem

Jonathan Benskin of the Stockholm University discussed in his contribution 'Intro to non-targeted analysis and time trends as a prioritization strategy in non-target analysis' the necessity of prioritization strategies which filter and isolate important features for further handling of the large quantity of data produced. The 'time trend ratio (TTR)' approach, which was based on comparison of average intensities in time points, was particularly effective at ranking spiked compounds which were only detectable in two to three of the latest time points in the time series. While this calculation is thus an efficient method to filter out substances appearing in recent years (*e.g.* emerging contaminants). Further work is needed to improve MS databases, in particular with regards to MS/MS data for environmental contaminants.

In the report of ***Georg Arju*** of the Center of Food and Fermentation Technologies, Estonia, 'Detection of a multitude of (unknown) components in complex samples: Criteria for identification', the focus was on the accurate balancing between throughput and selectivity. Samples are becoming more complex, but also a requirement to analyse more samples in a shorter span of time becomes more crucial for research success. The acquisition of sufficient amount of data in the shortest amount of time is one of the most important factors for consideration.

In the presentation of ***Ricardo Bettencourt da Silva***, University of Lisbon, he reflected on the topic of 'Traceability and uncertainty of qualitative targeted and non-targeted analysis'. His presentation discussed the reporting of qualitative analysis results and their traceability and uncertainty to make sure that no decision will be based on inadequate references and weak evidences of the determined property. This discussion is illustrated with examples of targeted and non-targeted analysis. The doping analysis by GC-MS/MS requested by the World Antidoping Agency, WADA was discussed in detail. WADA defines minimum identifiable levels and identification criteria for the analysis of doping substances or their metabolite in urine samples by GC-MS and LC-MS analysis. These criteria are strict to avoid false positive results, however, drives to high false negative result rates.

Martin Alewijn, Wageningen University & Research, presented in his contribution 'Validation of non-targeted methods in the food area', an approach for the solution of this problem. After an introduction to food fraud issues and the detection tools the speaker pointed out the issues in validation, *e.g.* the usually indirect classification mechanism, the use of a database of samples to predict future samples. The questions to be addressed are: When is a database 'sufficient' and how is the certainty of a future result quantified?

A detailed description of the approach with examples is available at M. Alewijn, H. van der Voet, S. Ruth, 'Validation of multivariate classification methods using analytical fingerprints – concept and case study on organic feed for laying hens', *J. Food Compos. Anal.* **2016**, *51*, 15–23.

'Creating reliable data – a challenge for non-target screening' was the topic of the presentation of ***Juliane Hollender***, Eawag, Swiss Federal Institute of Aquatic Science and Technology. The ability of non-target screening (NTS) to detect and identify emerging contaminants, and subsequently trigger exposure mitigation measures have been demonstrated. For efficient use in chemical

management, such as prioritising chemicals for monitoring programmes, evaluation of treatment technologies and environmental quality assessment, harmonized NTS protocols and a minimum of quality requirements are needed. First drafts of national guidelines are available for example in Germany (German Chemical Society), with a specific focus on surface water monitoring. The NORMAN network (Network of reference laboratories, research centres and related organisations for monitoring of emerging environmental substances, *www.norman-network.net*) aims to provide a more general guideline based on the experiences gained through different collaborative trials and other activities for water, indoor dust and biota (community of plants and animals that have common characteristics for the environment they exist in). In the presentation, quality assurance challenges in NTS and the related consequences for producing reliable data and for harmonization of NTS were discussed and illustrated by examples.

To conclude the first day of the meeting three workgroups met in parallel with the topics 'Traceability and uncertainty for quantitative targeted and non-targeted analysis', 'Validation of a non-target method: a practical approach' and 'Recent instrumental developments in targeted and non-targeted analysis'.

The general impression is that there are some interesting proposals for different approaches for the validation of non-targeted methods. There is still discussion necessary and probably also additional input is needed to get to a generally accepted common approach.

The first day of the workshop was concluded with the presentation of the results of the workgroups plenary session.

The second day started with the presentation 'Quality control in LC-MS based metabolomics' by ***Georgios Theodoridis***, Aristotle University of Thessaloniki. Quantitation of endogenous metabolites in biological fluids and particularly in blood-derived samples has to overcome several issues. This is due to pragmatic reasons, such as the lack of analyte-free matrix (blank samples) or Certified Reference Materials (CRMs). Comprehensive method validation that includes matrix effect and recovery is rarely described. Pre- to post- analytical aspects were discussed, with paradigms from the application of non-targeted metabolomics in the analysis of urine and quantitative analysis of human blood.

Gunda Köllensperger, University of Vienna, spoke about 'Increasing coverage and throughput in metabolomics by chromatography'. The species to be analysed cover an extremely wide range of polarity, therefore different methods are needed to cover small polar metabolites and lipids. The development of streamlined workflows in order to increase the analytical throughput while maintaining high coverage of the metabolome is a topical research theme. A 'divide and conquer' strategy is selected. This means the definition of sub-omes metabolome and lipidome based on analytical strategies, the definition of distinct analytical tasks: Targeted absolute analysis versus non-targeted analysis and the concept of merging workflows. The strategy was explained at the example of a metabolites library in Pichia pastoris.

Kapil Nichani and ***Bertrand Colson***, QuoData GmbH, reported on 'Performance characteristics and other quality control parameters for non-target methods'. The data from non-targeted workflows are typically used in connection with classification problems, *e.g.* food origin or species identification. As an example, the identification of a particular type of *Staphylococcus aureus* Type R versus Type S was selected. The method consists of two steps: full-scan spectra (*e.g.* MALDI-TOF) paired with an Artificial Intelligence (AI) algorithm for spectrum analysis. At the moment, no procedure has been set forth in an international standard or guideline for the validation of a qualitative method such as MALDI-TOF/AI. It was shown that this approach to method characterization is very responsive to relatively slight changes in the method, and thus constitutes a promising avenue for method performance assessment.

Mohamed Fathi Abdallah, Ghent University, showed in his presentation 'The use of high resolution mass spectrometric dereplication as a chemical approach for fungal identification and classification' that combining several approaches such as chemical profiling, morphological and molecular approaches provide an accurate way for classification of mycotoxins producing fungi. Thanks for the current technology represented in high resolution mass spectrometry devices that allow performing targeted and non-targeted analysis of the compounds of interest.

The workgroups of the second day discussed the topics 'Technical solutions for validation automation and planning', 'Tools for analytical quality control for non-targeted methods' and 'Estimation and use of LoD and LoQ in targeted and non-targeted analysis'. In some aspects the topics were a continuation of the workgroups of the first day. The summaries of the outcomes of the workgroups were presented at the plenary meeting. It will be interesting how some new ideas will promote the further development.

A mayor topic of non-targeted analysis was discussed by ***David Thompson***, Keele University: 'The Development of Small Molecule Profiling Technology for the Detection of Complex Food Fraud'. Food fraud costs at the global economy are estimated to be up to $40 billion per year. This makes food fraud to a interesting topic of metabonomics. That leads to non-targeted analysis creating large data sets which generate markers (RT-m/z pairs). Multivariate statistical analysis is carried out to identify the key differences between the markers for each sample set. To make the data set comparable the analysis and data must be robust, which is reached by column conditioning and the use of quality control samples. A robust approach to statistics for the generation of markers, references back to the raw data for marker confirmation and the use of analytical standards for marker identity confirmation is applied. The approach was applied to the differentiation of dead on arrival versus normally slaughtered poultry and the effect of storage time on the profiles of poultry eggs.

A combination of targeted and non-targeted analysis was presented by ***Myriam Guillevic***, Empa, Swiss Federal Laboratories for Materials Science and Technology, 'HALOSEARCH: Searching for Unknown Halocarbons in the Atmosphere'. The Montreal Protocol requests the monitoring of ozone depleting substances in the atmosphere to protect the ozone layer. The Vision is to identify all trace gases in the atmosphere containing halogen, sulphur or silicon which are relevant for the environment, climate and public health. The equipment installed at Jungfraujoch (3,466 Meters above sea level) consists of an advanced pre-concentration unit, a gas chromatograph and a time of flight mass spectrometer. The expected components are identified by a spectra library and quantified by calibration with certified reference materials. The spectra of unknown substances are interpreted by a combination of a modified Knapsack algorithm (mathematically possible sum formulas), calculation of the double bound equivalent (chemical reasonable sum formula) and theoretically calculated isotope patterns.

The topic 'Towards quantitative non-targeted analysis: the current status' was presented by ***Anneli Kruve***, Freie Universität Berlin, Germany. As example she selected the metabolomic study with LC/HRMS of green tea. The aim was to correlate changes in the chemical profile of a sample with a corresponding shift in macroscopic phenotype. The only possibility to still obtain quantitative information is to predict ionization efficiencies. More than 2500 ionization efficiency values in ESI positive mode and more than 1000 in ESI negative mode have been measured. These measurements have been conducted in vastly different solvents (60 combinations). Eluents with both methanol and acetonitrile content from 0 to 100% and covered pH range from 2.0 to 10.7 with all common LC/MS buffers were used. The ionization ef-

ficiency scale covers more than 7 orders of magnitude in both modes. The average prediction error was factor 1.7. The approach was demonstrated at cereal samples for pesticide and mycotoxin analysis.

After this presentation the very successful workshop was closed. Many thanks and congratulations to the organizers Ivo Leito and Riin Rebane.

The Eurachem Week 2020 will be held from May 25th to May 29th in Bucharest, Romania. The Scientific workshop 'Quality Assurance for analytical Laboratories in the University Curriculum' will be on May 25th and 26th, 2020, in connection with the Eurachem General Assembly 2020. For more information please visit *www.eurachem.org*.

35th Eurachem General Assembly

The General Assembly meeting, headed by the chairperson of Eurachem ***Marina Patriarca***, Istituto Superiore di Sanità, Roma and supported by the secretary ***Francesca Rolle***, INRIM Torino, took place from May 23rd 2019 to May 24th 2019. In addition to the usual statutory agenda items, some points of general interest are listed here.

The membership of ***The Netherlands*** was vacant. ***Fenelab***, the Association of Dutch laboratories, calibration and inspection bodies, is a no-profit organization with a secretariat domiciled in The Hague, founded on 14 April 1999 by three professional associations:

- Eurolab Netherlands,
- -VGLI (Association of Accredited Laboratories and Inspection bodies) and
- VRS (Association of Advisory Chemistry Laboratories)

applied for the full membership in Eurachem as representative of The Netherlands. The general assembly unanimously accepted the motion.

When in 1989 a network of organisations in Europe was founded (Eurachem), the establishing of a system for the international traceability of chemical measurements and the promotion of good quality practices was the objective. It was recognized that that lack of agreements in chemical measurements is a barrier to free trade and technical co-operation. At that time member countries of European Economic Community (EEC) and of European Free Trade Association (EFTA) could become full members of Eurachem. With the establishment of the EU, the political goals came to the foreground. Candidates for membership in EU could also become full members. In the last years the EU invented more categories of states (e.g. potential candidates, European Union Association Agreement). To get back to the original intention, European countries recognised by the EU and EFTA as accession states, and European countries having an Association Agreement with the European Union may become full members of Eurachem. This modification extends the list of countries to Ukraine, Georgia and Moldova. The general assembly unanimously accepted the motion.

As a consequence of the changed Memorandum of Understanding ***Ukraine*** could apply for ***full membership***. The application was accepted by the GA.

The working groups presented the state of their work on several new or modified guidelines. After being circulated to GA members for approval later in 2019 they will be published.

After the reports of stakeholder/liaison organizations and the announcement of the future Eurachem meetings, the 35th GA was closed.

The next GA will take place on May 28th and 29th in Bucharest.

Photo: © Eurochem

Received: December 22, 2019