



## **Broadening the horizon of Analytical Chemistry in India: Report of the 3<sup>rd</sup> Annual Conference, India Section of the AOAC INTERNATIONAL**

*19-20 November 2015, Pune, India*

### ***Introduction***

The 3<sup>rd</sup> Annual Conference, convened by the India Section of the AOAC INTERNATIONAL, was a quest - a quest for a new bridge between analytical science and society, built on collaboration and mutual harmony among analytical chemists, regulatory authorities, industry consultants and university students.

Held at Hotel Four Points by Sheraton in Pune, India during 19-20 November 2015, this event attracted over 140 delegates, representing governmental regulatory bodies (BIS, NABL, APEDA, EIC), national laboratories (e.g. National Chemical Laboratory, National Referral Laboratory, ICAR-NRC Grapes), leading commercial food testing laboratories, educational institutes, scientific and industrial organisations along with the representatives from the technical partners, viz. Waters India Pvt. Ltd., ThermoFisher Scientific, Shimadzu Analytical (India) Pvt. Ltd., PerkinElmer, Sciex, Agilent Technologies, Sigma Aldrich Chemicals Pvt. Ltd. and R-Biopharm).

This year's Conference primary objectives were to: (1) discuss how to reach a consensus on what should be required to validate and harmonise analytical methods; (2) determine the processes of application of the validation procedures in food analysis and (3) discuss on the capacity building of various laboratories within the country that may be referred to in developing future formal guidelines. Keeping the broad goals of the Conference in mind, the organisers strove to present a mélange of eminent speakers (from India, USA and Europe) who enlightened the delegates about various facets of food analysis, food authenticity, global food safety requirements and analytical quality control regulations.

Overall, this two-day Conference provided a unique opportunity to review the two-way commitment of analytical sciences to society as well as the commitment of a safe society to the field of analytical chemistry.

### ***Inauguration Session***

Inaugurated by Professor Emeritus of chemistry M.S. Wadia (University of Pune), this Conference created a momentum among all stakeholders for engaging them with the immediate advancement and challenges in the domain of analytical sciences. Other prominent dignitaries

who graced the inaugural lamp lighting ceremony were Dr Vasireddi (Executive Chairman, Vimta Labs Ltd.), Ms Parna Dasgupta (Director, Regulatory Affairs, Kellogg India), Dr Kaushik Banerjee (President, AOAC-India Section of AOAC INTERNATIONAL and Principal Scientist, ICAR-NRC Grapes), and Dr Sumit Sen (US-FDA and the mentor of this section). While addressing the audience, Dr Wadia appreciated the earnest effort of the AOAC-India Section to educate people about the significance of analytical chemistry, which is relatively a less talked discipline of chemistry in the country. He further added: “We want such initiatives should last for long”.

Along with a formal greeting, Dr Banerjee’s presidential address set the tone and the context for the Conference. In this address, he included information about the relevance, evolution and mandates of the AOAC’s Indian Section since its establishment in 2011. He further stressed on the achievements of the new Executive Committee (EC) that was formed in November, 2014, including launching of the AOAC-India website with institutionalised e-mail addresses of its EC members, initiation of the collaborative study on Vitamin B12 and holding numerous workshops on analytical methodologies.

### *Technical Sessions*

The Conference had four technical sessions on the following broad themes: “Food Safety”, “Capacity Building”, “Infant Formula and Adult Nutritionals” and “Food Authenticity”.

#### *Day 1 (November 19, 2015)*

##### *Technical Session 1*

Chaired by Dr Banerjee, the morning technical session, entitled “Food Safety”, featured a panel of prominent speakers and provided interesting insights into challenges in the field of analytical sciences as well as into an evaluation of approaches that have allowed collaborations between researchers in industry and academia.

As a representative of the Board of the AOAC INTERNATIONAL, Dr Murali Reddy (Abbott, USA) gave an overview and rationale of the recently proposed AOAC SPIFAN Nutritional Ingredients program along with safety and quality framework of nutritional ingredients for infant formula. Drawing from various real life instances, Dr Reddy enlightened the delegates on various types of food contaminants (e.g., mercury, arsenic, high level of nitrite, dicyandiamide, organochlorine pesticides, etc.) that might be found in dairy products.

Next, Dr Paul Young (Waters Corporation, USA) in his talk “Global Food Safety Regulations and Challenges for Trade Related Analytical Compliance” addressed the issue of diverse food standards across different countries. He explained the significance of analytical testing in demonstrating quality compliance with production controls. Whilst Dr Young focussed on some of the demands imposed by international regulations and highlighted the role that technology can play in minimising the load, Dr Simon Hird (Waters, UK) explored the rationale, merits and operational constraints implementing multi-residue methodologies in the context of the requirements of different residue monitoring schemes.

The finale of this session was a talk by Nick Mitchell, titled as “Advances in Analytical Technologies for Food Safety & Quality Testing”, in which he showed how using target, suspect

and non-target screening analytical approaches has led towards the successful identification of chemicals in Ayurvedic products, dietary supplements and other herbal drugs. The session came to an end with a panel question and answer session.

Following the lunch break, the session began with a talk entitled “Quantitative Analysis of Pesticides using High Throughput and High Resolution Mass Spectrometry” by Dr Venkateswarlu Panchagnula (NCL, Pune). This presentation featured certain novel approaches involving the applications of MALDI in analysing a large volume of samples with high throughput capabilities using high resolution mass spectrometry.

Underlining the food safety theme, Dr Nimish Shah (Hindustan Unilever) in his lecture, “Science behind food safety - pillars of a modern food safety agenda”, elaborated on the importance of analyses and tools implemented to regulate food safety. He reinstated the need to embed risk-based approaches for food safety surveillance and tracking diseases caused by the lack of regulations.

In his closing remarks of the session, Dr Banerjee summed up the principal concerns with regards to food safety and quality control, and also highlighted how each speaker efficiently addressed the theme.

### *Sponsored Talk*

The issues related to mycotoxins have affected humankind globally. The public health concerns in all animals resulting from the mycotoxin consumption have paved the way for the development of new analytical methods. Aligned with the Conference’s broad theme on food safety, the audience heard an afternoon sponsored talk by Dr B J Desai (R-Biopharm) on “New approaches to Mycotoxin analysis”. In his lecture he outlined some of the major food contaminants. He held that although method development and evaluation for mycotoxins could be quite subtle and a challenging task, however its analysis is extremely important for reducing the consumption of contaminated food and feed.

### *Technical Session 2*

This technical session titled as “Capacity Building & Challenges for Analytical Laboratories in India” was convened by Mr. Vishal Arora (Secretary, AOAC-India section) and Dr Saurabh Arora (Member-at-Large, AOAC-India Section). Mr. (Vishal) Arora introduced the speakers to the audience members, while focusing on the accelerated importance of capacity building in the country.

This session started with Mr. S.G. Dwivedi’s (Export Inspection Agency) lecture, “India’s national residue control programs and compliance requirements of the food testing laboratories for facilitation of national and international trade”, where he stressed on how the residue control programmes can be synchronised with the analytical methods mandate for export.

This session also contained a presentation - “Capacity Building for Laboratories” - by Mr. Devendra Prasad (APEDA) who informed the audience members about the problems involved in

Proficiency Testing (PT) programmes in the nation. He laid emphasis on the need of development of the nation's analytical infrastructure by enhancing the growth of trained manpower to secure food safety in all sectors. Furthermore, he called attention to the fact that increasing the number of microbial testing laboratories are the growing need of the hour.

Mr. N. Venkateswaran from the NABL presented "Current capacities and the way forward for accreditation of food laboratories" in which he outlined views on various accreditation organisations and the functioning of various accredited food testing laboratories in India. He also touched upon the role of the accrediting authority and highlighted how a proficiency testing (PT) provider can function as a referral harbour.

Fairly recent, there has been an emphasis laid on the importance of trace level elements in biological systems. Multiple trace metals occur naturally in food materials; whilst some are nutrients, others are toxic. For example, metals such as iron, copper, zinc, cobalt and manganese are essential metals since they play an important role in biological systems; but metals such as mercury, lead, cadmium, etc. can be toxic even in trace amounts. Thus, there are legislative limits on the specific trace metal content for different food commodities.

Keeping in line with the AOAC's strategic goals to preserve environmental and food safety, Ms. Laura Thompson (PerkinElmer Inc. USA) in her lecture, "Application Note - Trace Metal Analysis in Food" explained the various nuances of trace metal analysis in various food items (diary, meat, etc.). She argued that continuous monitoring of the trace metal levels in food matrices utilising advanced, accurate and precise analytical tools is the pressing need of the hour to regulate the food value.

Following her, Dr Jitendra Kelkar (Shimadzu Analytical, India) discussed various methods on multi-pesticide residue analysis in food items in his lecture, "Application Note - Important check points for successful Multi-Pesticide Residue Analysis using GC-MS/MS". His speech featured some new mass spectrometric technologies and advanced software attributes that can be utilised to bring forth improved analytical outcomes.

Dr (Saurabh) Arora presented the closing remarks of the session in which he acknowledged the contributions of all the speakers for sharing their expertise with the august gathering.

## *Day 2 (November 20, 2015)*

### *Sponsored Talks*

For the first time in the AOAC-India annual Conference, the delegates had an opportunity to attend two sponsored talks over the breakfast: "Global food fraud and its detection: implications for key Indian food categories" by Dr Robert Packer, (PerkinElmer Inc. USA) and "High Resolution Mass Spectrometry for Pesticide Residue Analysis" by Dr Manoj Pillai, (Sciex, India). At first, Dr Packer efficiently highlighted the problems associated with food fraud and appraised the attendees about how to detect adulteration in food. He also briefly covered areas such as methodologies for detecting food adulterants in oils, cereals (rice), spices, beverages, etc.

Following that, Dr Pillai introduced high resolution mass spectrometry (HRMS) coupled with liquid chromatography as an essential tool for targeted and untargeted screening of contaminant residues, metabolite identification and quantitation, identification of adulterants and cross sample comparison, retrospective analysis and high sensitivity quantitation. He also presented an overview of various workflows that can be used for herbal formulations and herbal (or Ayurvedic) medicines.

### *Technical Session 3*

Day 2 Technical Session 3 was titled as “Infant Formula and Adult Nutrition”. Dr Ranjan Mitra (President-Elect, India Section of the AOAC INTERNATIONAL and NPD Scientist-Analytical, GSK) welcomed all the speakers of the session. In this panel, Dr R. K. Bajaj (Bureau of Indian Standards) discussed India’s Standards Development Process, especially in infant formula and adult nutritionals. He highlighted how India’s stakeholders relate and participate in various international regulatory bodies, for example, the International Organization for Standardisation (ISO), Codex Alimentarius Commission (Codex), International Dairy Federation (IDF) and also the AOAC SPIFAN. His lecture also threw light on how ISO/Codex/IDF/AOAC methods are appropriated and implemented as Indian standards.

Next the attendees listened to Dr. A. Laxmaiah’s (National Institute of Nutrition, ICMR) talk - “Nutritional status in India cutting across socioeconomic status with emphasis on infant & child nutrition”, in which he discussed a multidisciplinary approach to food safety research related to child nutrition. He centred his discussion on how various socio-economic factors influence food choices and simultaneously, drew attention to the increasing health issues related to dietary habits, lifestyle, etc.

In his talk “Movement towards global harmonisation with standardised laboratory test methods”, Dr. Alok Kumar Srivastava (CFTRI, Mysore) provided a general overview of India’s technical perspective including the available nutrient analysis methods - its lacunas and challenges. He incorporated several serious concerns: artificial ripening of fruits, excessive use of pesticides, heavy metal toxicity, veterinary drugs in fish/meat, unpermitted colours/additives in food, lack of hygiene in the handling of food (e.g., mid-day meals served in Indian schools) and the use of dye in synthetic milk, etc.

In addition, there was a sponsored talk from Agilent Technologies over the tea break, in which Mr. Chandrasekar Kandaswamy presented “Dioxin, Furans & PCBs’ Quantification by GC-MS/MS in Food and Feeds”. He drew attention of the delegates by presenting certain interesting applications in this regard in compliance to the recent regulatory changes (EU regulation 589/2014) in Europe approving GC-MS/MS triple quadrupole system for the analysis of dioxins, furans and PCBs in food and feed.

What followed next was Dr (Murali) Reddy’s talk where he gave an outline of the “Stakeholder Panel on Infant Formula Adult Nutritionals (SPIFAN) project” including the vision of the AOAC directed stakeholder initiatives to establish reference analytical methods for infant formula and adult nutritionals. He also talked on the requirement of guidance protocols on single laboratory validations and collaborative studies on related matrices.

After the tea break, Dr Ranjan Mitra, along with Dr Priti Amritkar (Envirocare Labs Pvt. Ltd.), presented an update on the first collaborative study of the AOAC-India Section on Vitamin B12. Dr Mitra mentioned that one of the primary goals of the India Section is to apply the global methods (e.g., AOAC methods) for priority nutrients to Indian food/food product matrices of infant formula and adult nutritionals so as to build a scientific justification to persuade FSSAI/BIS and other national regulatory bodies to replace the current conventional methodologies. Further to this, while addressing the issue of lack of availability of analytical methodologies for infant formula and adult nutritionals in the country, Dr Mitra also talked about the possible contribution of the section on validating dispute resolution methods. Dr Amritkar mentioned about the role that Vitamin B12 plays in our lives. She also presented an update on the current status of the single laboratory validation on Vitamin B12 in selected matrices, mutually agreed upon by the collaborative organisations (Nestle, Abbott and GSK) with the support of Agilent Technologies and Sigma Aldrich.

Following that, Ms. Sonam Bansal and Mr. Shivdev Chhina (both from Nestlé Quality Assurance Centre) deliberated on collaborative studies to be initiated on Pantothenic Acid (LC-MS/MS) and Fatty Acids (GC) in India. They touched upon the appropriateness of methodologies, selected (technical information, regulatory requirements and fitness for purpose) and plan for the validation studies on Indian food/food product matrices of infant formula and adult nutritionals.

In the same session, Mr. S. Dave (Former Director, APEDA, Ex-Advisor-FSSAI, Ex-Chair-Codex Alimentarius Commission) shared his insightful experience with the attendees on various aspects of the capacity building of food testing laboratories across the nation. His lecture “Essential Elements for a National Food Safety System” informed the delegates about various processes for harmonisation of Indian standards through the e-Working Groups formed by the FSSAI. He put emphasis on the need of establishment of a comprehensive food safety system within the nation, and further urged that Indian system should upgrade laboratory infrastructure, modernise laboratory settings, set up a network of Referral Labs and also conduct training of Inspectors and laboratory analysts. He concluded his talk by giving an overview of various regulations related to trade, product approvals, etc.

Finally, Dr Sen summarised the contents of the session and also, shared his wide expertise and experience as the President of the AOAC-Southern California Section.

#### *Technical Session 4*

Today, more than ever before, consumers are pondering on food authenticity - for example, from where it is produced and what its content is, and where they can eat it. Food Safety has thus become a critical priority for the manufacturers whose success depends on the public's confidence in the safety of the nation's food supply and the products they consume. Protecting consumer rights and preventing deceptive practices are challenging issues faced by both the regulatory agencies and the food industry. Food analysis gets complicated due to its diversity in matrices as well as in terms of contaminants and additives, from pesticides to mycotoxins and veterinary drugs to trace metals. To cope with these problems, scientific technologies (for example, DNA fingerprinting techniques, isotopes, chromatography and mass spectrometry) are

being profusely developed to test the food authenticity. Accordingly, the final technical session was named as “Food Authenticity and Traceability”. It was chaired by Dr Nilesh S Amritkar, Member-at-Large, AOAC-India Section. To begin it, Dr Amritkar welcomed the speakers and gave a brief layout of the session.

In this session, the audience members listened to Dr. Lalitha R. Gowda (Former Chief Scientist, CFTRI) and learned how various analytical approaches such as DNA analysis and ‘omics’ technologies including metabolomics and proteomics in addition to the chromatography and mass spectrometric techniques are utilised for detecting the food authenticity. She further talked about how DNA based techniques allow to authenticate raw and processed foods and identify genotypes in different food matrices.

Stable isotopes of carbon ( $^{13}\text{C}$  and  $^{12}\text{C}$ ) and oxygen ( $^{16}\text{O}$  and  $^{18}\text{O}$ ) have been very effective in tracing food sources and food authenticity. Dr. Rengaswamy Ramesh, (Physical Research Laboratory, Ahmedabad) in his lecture “Using Stable Carbon and Oxygen Isotopes to trace food sources and authenticity” argued how isotope ratio measurements can be used to determine the origin of foods (for example, wine) and therefore, can establish the authenticity and the accuracy of labelling. He further demonstrated how authenticity in honey can be traced on the basis of stable isotope ratio of carbon.

“Application of HRAM MS in Food Authenticity” by Mr. Richard Fussell (ThermoFisher Scientific, UK) was another talk that dealt with the concerns related to establishing the authenticity of food samples by exploring ways by high resolution accurate mass spectrometre (HRAM) to prevent fraud and protect consumer safety. He commented that HRAM provides group separations of key compounds in food and automatic putative identifications of compounds within the samples.

India is witnessing an expansion in the restaurant segment, especially in Quick Service Restaurants (QSRs). Hygiene, consistency and quality are the basic pillars of QSR services. Dr Sudhir Tamne (Burger King) spoke on how quality systems are controlled in reputed QSRs and how each ingredient is traced as per regulatory norms to ensure food safety from an Indian perspective. It was interesting to understand how QSRs maintain the authenticity in taste and quality in Indian restaurants, irrespective of the scale of operations.

Collaborations among the various stakeholders along the food value chain, that is, ‘from farm to fork’, is more important than ever. This was the highlight of Mr. Shailesh Ghodekar’s (Marico) lecture, who delivered a talk on “Quality: Driver for Business Growth”. Drawing on his experiences in food industry, he discussed issues encompassing critical food systems across the value chain, food traceability system, tools used for food identification and problems related to food safety.

Following Mr. Ghodekar, Mr. Prashant Puranik (ThermoFisher Scientific, India) delved further into the key issues and leading practices. He offered opportunities to discuss how food authenticity of fresh and processed commodities is investigated by using IR-MS. He demonstrated case studies in honey, and various alcoholic and non-alcoholic beverages and demonstrated how isotope ratios enable to distinguish synthetic and natural products.

The closing remarks of the session were delivered by Dr (Nilesh) Amritkar who summarised all the contents of the session's lectures and hinted at the customer-driven requirements for securing human health through the establishment of reliable food authenticity and traceability testing systems.

### *Sponsored Talk*

Following the Tea Break, there was a sponsored talk by Mr. Peter Jenks from Sigma Aldrich. In his lecture, "CRMs & High Purity Solvents in Food Analysis", Mr. Jenks depicted how with the growing impositions by regulatory agencies, there is a rising need to use certified reference materials (CRMs) and ultra-pure solvents during food and beverage analyses. This talk provided a brief overview about a range of CRMs and high purity solvents which are manufactured by Sigma Aldrich.

### *Poster session and awards*

For the first time, the EC members introduced a poster session in collaboration with the Royal Society of Chemistry (RSC). Closely associated with the Conference's goals, three key threads - food safety, food authenticity and food nutrition - were chosen for the posters. The poster event was inaugurated by Dr S.D. Sawant, Director, ICAR-NRC Grapes, Pune, following the afternoon tea session of Day 1. In his brief note, Dr Sawant expressed his immense appreciation for the organisers who created an open space to several students and researchers for showcasing their interesting research works in the midst of the curious delegates. With this poster session the organising committee intended to enhance the mutual appreciation of the interdisciplinarity of analytical chemistry. A total of 31 participants, hailing from various academic institutions and industries, presented their posters. A panel comprising four judges [Dr D.G. Naik (Agharkhar Research Institute); Dr Sen; Dr Vasireddi and Dr Bala Deshmukh (Ex-Scientist from Dow Chemical Company, USA)] reviewed the content and presentation of the posters.

Among many significant contributions, the Royal Society of Chemistry (RSC) prizes for the best poster presentation were awarded to (in no particular order) (1) Zareen Khan (title: "Valuable waste from grape!- Lipid, fatty acid and anthocyanin analysis in grape seeds with High Resolution Mass Spectrometry and GC-MS"), NRL, ICAR-NRC Grapes, (2) Anas Ejaz Shaikh (title: "Anti-oxidant and anti-microbial activity of silver nanoparticles synthesized using *Phoenix dactylifera* fruit extract"), Department of Food Engineering and Technology, ICT and (3) Ahammed Shabeer T.P. (title: "Multi-residue method for target screening and quantification of pesticide residues in spices by modified QuEChERS extraction and gas chromatography tandem mass spectrometric (GC-MS/MS) analysis"), NRL, ICAR-NRC Grapes. The awards were based on the originality of the research presented, the rigour of the methodology, its novelty in practical application and overall presentation skill. The winners had the privilege to present their works before the audience members on Day 2. Finally, Dr Banerjee distributed a certificate and a book voucher from the RSC to all the winners.

During the poster session, all other participants had ample opportunities to interact with the enthusiastic judges along with the delegates. Many scholars and international visiting scientists commented that some of the posters were of high quality, which is indicative of the advancement of current analytical research and competency in India. This event remained to be a ground for

arousing intellectually stimulating conversations - something that is a rarity in larger conference settings - and this was the forte of this year's Conference.

### *Valedictory Programme*

In his concluding note, Dr Banerjee said that this Conference remained to be a profound learning space for everyone who attended it. He assured that the AOAC-India Section shall continue to co-ordinate need based training programmes involving national and international experts. It shall further facilitate understanding of the regulatory issues and guidelines in addition to transfer of technology in collaboration with the instrument manufacturers. While presenting the future roadmap, Dr Banerjee invited the stakeholders to join hands with the AOAC-India Section as technical partners and accentuated the need for conducting collaborative studies and capacity building activities within the nation. He informed the audience that immediate further collaborative studies have been planned on Pantothenic Acid (LC-MS/MS) and Fatty Acids (GC). More collaborative studies shall eventually be planned on Vitamin A, Vitamin E, Nucleotides, Ultra Trace Minerals, Inositol, Iodine. Studies shall also be undertaken on the multiresidue analysis of pesticides in matrices with high significance in India, for example, grape, okra and spices to name a few.

In the valedictory lecture, Mr. Dave concurred that it is important to integrate all food testing methods in a harmonious way. According to him, emerging contaminants should be studied to keep pace with the growing demand for the restoration of public health. Finally, he urged that the AOAC-India Section to come forward in building up the nation's analytical competence through collaboration with Indian governmental regulatory bodies and take a lead role in launching certification courses in food analysis.

Finally, all the Executive Committee (EC) members (Dr Banerjee, Dr Mitra, Mr. Vishal Arora, Mr. Viswaraja Sashikumar (Treasurer), Dr Saurabh Arora, Dr Akriti Singh (Member-At-Large), Mr. Shriram Kulkarni (Member-At-Large), Dr Nilesh S. Amritkar and Dr Sen) expressed sincere thankfulness to all the conference sponsors, speakers and delegates for their participation, contribution and heartfelt support. The EC acknowledged the financial support of their generous sponsors for making this event happen so successfully. They also extended thanks to the NRL-NRCG staff members for their wholehearted support. While insisting on the need of building a strong community of analytical professionals under the aegis of the AOAC-India section, the EC suggested that the future scope of this section can be expanded by conducting interdisciplinary studies on microbiological food safety, environmental chemistry and pharmaceuticals.

### *Conclusion*

The 3<sup>rd</sup> annual Conference (2015) of the AOAC-India Section served as a unique conversation and discussion platform for the analytical community of the country. The attendants considered the Conference as a great success that enabled the exchange of abundant valuable information through a high-level scientific programme and assisted to enlarge professional and personal networks. Ranging from analytical mass spectrometry and applied chemistry in food safety to separation science and methodologies of all kinds, the lectures and posters constructed a broad collage of the present state of the art in the field of analytical sciences. Upon hearing about such

diversified and variegated methodologies, which can be implemented in resolving common food safety issues, all the attendees left the Conference venue with amazement. Many delegates believed that this event earned an international reputation for its diligent planning and could serve as a model for other scientific communities. The EC also received several enquiries regarding the future scope of collaborations with the AOAC-India Section. They also assured by saying that the annual conference shall continue to be the venue for nurturing and developing the frontiers in analytical chemistry in India.

The AOAC India Section has planned to publish a book of abstracts, which can shortly be downloaded from the AOAC-India's website: <http://aoac-india.org/>.

The EC members keenly await the next annual AOAC-India Section Conference in November, 2016 in New Delhi, India.