IMEKO JOINT CONFERENCE
TC8-TC11-TC24
PHILIPPINES 2026

“Leveraging INNOVATION for Future-Ready MEASUREMENTS for Industry, Health and Environment”

BOOK OF ABSTRACTS

DOST-ITDI
INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE
OneDOST4U: Solutions & Opportunities for All

27th to 29th AUGUST 2026

ACACIA HOTEL MANILA, Alabang, Muntinlupa City, Metro Manila, PHILIPPINES

IMEKO WORLD CONGRESS

PALACONGRESSI DI RIMINI, ITALY

30 AUGUST - 3 SEPTEMBER, 2027

IMEKO XXV World Congress will be held in **Rimini**, certainly among the most welcoming Italian places, from **30 August to 3 September 2027**.

We have lined up an exciting programme that will include industry-based workshops, distinguished plenary and keynote speakers, industry led concurrent sessions, applied research presentations and a plethora of networking opportunities. The congress aims to outline the new challenges that the metrology will face and for these reason the multi- and interdisciplinary meeting of all the scientific communities will be welcome.

Stay tuned and save the dates….see you in Rimini!

SAVE THE DATE

www.imeko2027.org

FOLLOW US

We warmly welcome you to the **2026 IMEKO TC8-TC11-TC24 Joint Conference** in **Metro Manila, PHILIPPINES**. Hosted by the **Industrial Technology Development Institute, Department of Science and Technology** (DOST-ITDI), this event brings together IMEKO Technical Committees TC8, TC11, and TC24 to advance critical standards in metrological traceability, analytical testing, inspection, certification, and chemical measurements. We are honored to host such a distinguished community of innovators and invite you to exchange transformative ideas, forge lasting international collaborations, and experience the vibrant spirit of the Philippines. We thank our organizers, partners, sponsors, exhibitors, and participants for making this landmark gathering possible.

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Updated copy of the IMEKO TC8-TC11-TC24 Joint Conference Metro Manila, PHILIPPINES 2026 **CONFERENCE PROGRAM BOOK** is made available at the conference website: **https://imekomanila2026.org/**

Technical Briefing

Please put your phone on vibration mode and use the area outside the ballroom for urgent calls.

Q&A sessions will be at the end of each presentation and are approximately 2 minutes long.

Please be mindful of time and return to the conference area on time.

We hope you have a great time networking and finding collaboration opportunities with the community.

In case of emergency, we need to follow the emergency protocol as briefed by the hotel staff and gather at the nearest emergency exit.

Conference Feedback

Please respond to the feedback form and let us know our best practices and areas for improvement.

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MESSAGE

MICHELA SEGA, PhD
Senior Researcher,
Istituto Nazionale di Ricerca Metrologica – INRiM (Italy)
CHAIRPERSON, IMEKO TC8

On behalf of the IMEKO TC8 “Traceability in Metrology”, it is my great pleasure and honor to welcome you to the 2026 IMEKO TC8, TC11 and TC24 Joint Conference, held in the beautiful city of Manila, Philippines, from 26th to 29th August 2026.

The conference represents a further step in the close collaboration among the three IMEKO Technical Committees, that share common transversal topics and interests. In a rapidly evolving landscape, this event serves as a premier platform to discuss cutting-edge trends, address pressing challenges, and spark new ideas and will provide networking opportunities. We have lined up an exciting program featuring outstanding keynote speakers and technical sessions to explore the latest developments in traceability, measurement standards and metrological infrastructure.

We would like to express our sincere appreciation to all the authors who submitted their work, and to the reviewers whose insights maintained the high standard of this event. A special thank to our local organizers and sponsors for making this conference a reality. Please take full advantage of the sessions, connect with old colleagues, meet new ones, and enjoy everything that Manila has to offer.

Have a wonderful and inspiring conference!

MESSAGE

ÁLVARO SILVA RIBEIRO, PhD
Head of Metrology Division and Quality Manager
National Laboratory for Civil Engineering (Portugal)
CHAIRPERSON, IMEKO TC11

On behalf of IMEKO Technical Committee 11 – Measurement in Testing, Inspection and Certification (TC11), it is my pleasure to welcome you to the IMEKO Joint Conference of TC8,TC11 and TC24, held in Manila, Philippines, in 2026.

This conference highlights the scientific and technical importance of IMEKO as a forum for advancing measurement science through international and interdisciplinary collaboration. The longstanding cooperation among TC8, TC11 and TC24, together with the valuable contributions of EUROLAB and other stakeholders, continues to strengthen the links between research, industry and conformity assessment. Holding this event in the Asia-Pacific region further reinforces IMEKO's global commitment to knowledge exchange and international cooperation. Testing, inspection and certification are essential for ensuring safety, quality and confidence in products and services. Reliable conformity assessment depends on accurate measurements, validated methods, advanced technologies and competent personnel, supporting laboratories, inspection bodies, certification organizations and industry while generating significant economic and societal benefits.

I sincerely hope that this conference will inspire stimulating discussions, foster new scientific collaborations, strengthen existing partnerships and provide valuable opportunities for networking among all participants. May the presentations, technical sessions and informal exchanges contribute to new ideas, future joint initiatives and lasting friendships. I would also like to express my sincere appreciation to the Local Organizing Committee, the sponsors, and all supporting organizations for their dedication, commitment, and invaluable contributions to the successful organization of this conference. I wish you all a productive, successful and enjoyable conference, a rewarding stay in Manila, and every success in your future scientific and professional endeavors.

Welcome to the IMEKO Joint Conference TC8, TC11 and TC24!

MESSAGE

TATJANA TOMIĆ, PhD
R&D Laboratory Senior Expert Coordinator,
INA Oil Industry (Croatia)
CHAIRPERSON, IMEKO TC24

On behalf of the IMEKO TC24 dedicate to Chemical Measurements, I welcome you to the IMEKO TC8, TC11 and TC24 Joint Conference, which is held from 26th to 29th August 2026, in Manila, Philippines.

IMEKO is an organization that promotes cooperation of the scientists in the different field of measurements. In TC24, we encourage connection of experts in the field of chemistry and chemical metrology as well as international exchange of expert's work, results, problems and solutions. Chemical metrology is a field that plays a crucial role in science, industry and everyday life. Without reliable chemical measurements, there is no scientific progress, no fair exchange of goods, no protection of health and the environment. Conference brings together experts from different areas and all participants have an opportunity to exchange knowledge, experiences but also their challenges – from the method development and validations, through the role of reference materials in chemical measurements, to the application of international standards and impact on everyday quality assurance issues.

This conference represents a continuation of the excellent cooperation between the three IMEKO technical committees but also it is a major step forward. We are honored to have colleagues from the Philippine scientific community in our committees; they represent a great contribution to metrology, and they are the driving force of this conference. I would like to thank the organizers for their hard work and sponsors for their support.

Also, I would like to thank the authors for their willingness to share papers, results and knowledge, to the reviewers who significantly contributed to the conference high quality and all the participants for interest and contribution.
I wish all participants successful work, enjoying new experiences and a pleasant stay in Manila.

MESSAGE

ADMER REY C. DABLIO, RCh, CCPQM
Supervising Science Research Specialist
DOST-Industrial Technology Development Institute
CHAIRPERSON, Local Organizing Committee

Warmest greetings to all delegates, distinguished guests, speakers, and participants!
Maligayang pagdating sa Pilipinas at malugod na pagtanggap sa inyong lahat!
*(*A warm welcome to the Philippines and a heartfelt welcome to you all!)

On behalf of the Local Organizing Committee and the Department of Science and Technology – Industrial Technology Development Institute (DOST-ITDI), it is my absolute privilege to welcome you to Metro Manila for the 2026 IMEKO Joint Conference, bringing together TC8 (Traceability in Metrology), TC11 (Measurement in Testing, Inspection and Certification), and TC24 (Chemical Measurements).

This gathering unites key pillars of the global measurement infrastructure. Over the next three (3) days, we will address emerging challenges and opportunities—from digital traceability and certified reference materials to quality management, chemical sensing, and environmental sustainability. Beyond the technical exchange, we invite you to experience the rich heritage and genuine warmth of Filipino hospitality. Our sincere thanks go to the IMEKO leadership, TC officers, partners, and sponsors whose dedication made this event possible.

Nawa'y maging makabuluhan at matagumpay ang ating pagsasama-sama para sa ikauunlad ng agham at teknolohiya.
(May our gathering be meaningful and successful for the advancement of science and technology.)

Maraming salamat at mabuhay! (Thank you very much and welcome!)

ANNABELLE V. BRIONES, PhD, CESO III
Director IV / Scientist I
DOST-Industrial Technology Development Institute
Head of Host Member Organization

MESSAGE

To our distinguished guests, renowned keynote and plenary speakers, local and international delegates, and colleagues in the scientific community,

On behalf of the Industrial Technology Development Institute of the Department of Science and Technology (DOST-ITDI), it is my distinct honor and great pleasure to welcome all of you to the IMEKO TC8-TC11-TC24 Joint Conference 2026.

To our international participants who have traveled from around the world, a warm welcome to the beautiful shores of the Philippines! We are excited to host you not only amid our rich cultural heritage and legendary hospitality but also in a thriving environment of scientific discovery and forward-thinking collaboration.

This joint conference marks a significant, historic milestone for our country. By bringing together the world's leading experts in measurement science, this event strongly positions the Philippines within the global scientific community. It highlights our nation's rapidly growing capabilities and unwavering dedication to precise measurements, scientific metrology, and advanced analytical testing—disciplines that form the unseen foundation of international trade, industrial quality, safety, and sustainable technological progress.

This gathering holds a deeply meaningful connection for us at DOST-ITDI. As an institute, our main goal is to conduct multidisciplinary research and development, provide specialized technical services, and oversee the country's national metrology infrastructure to promote industrial growth and economic advancement. Every aspect of this conference—from traceability in testing to environmental and food analysis—directly reflects our mission to establish the fundamental measurement systems that help local industries stay competitive and scientifically reliable.

As you browse through this Program Book, you will find an agenda carefully designed to challenge assumptions, inspire innovative discussion, and promote international collaborations. I encourage each of you to actively participate, share groundbreaking ideas, and create networks that will go beyond geographic boundaries long after our stay in Manila ends.

Thank you for sharing your expertise and passion at this historic event. I hope you all have a deeply fulfilling, productive, and inspiring conference.

Mabuhay and welcome to the Philippines!

IMEKO TC Chairpersons

MICHELA SEGA, PhD
Instituto Nazionale di Ricerca Metrologica (INRiM), Italy
IMEKO TC8

ÁLVARO SILVA RIBEIRO, PhD
National Laboratory for Civil Engineering, Portugal
IMEKO TC11

TATJANA TOMIC, PhD
INA Industrija nafte d.d., Croatia
IMEKO TC24

IMEKO TC Officers
(involved in the preparation of the conference)

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EUROLAB – a strategic approach for the lab of tomorrow

Plenary Lecture 1
Thursday, **27 August 2026**
10:30-10:55 AM Philippine Standard Time

Ms. LAURA MARTIN
Secretary General,
eurolab

BACKGROUND

Laura Martin has been elected as EUROLAB Secretary General during the EUROLAB General Assembly 2022. Previously to this position, she has undergone various responsibilities, taking the first role in EUROLAB back in September 2013. Before, she has worked for DG CONNECT at the European Commission, as well as for other international organizations based in Brussels, taking on various roles such as Communications Manag-er and International Affairs Manager.

She holds a diploma in Journalism, a master's degree in Communications Studies, and a bachelor's in Mod-ern Languages and Translation.

ABSTRACT OF PLENARY LECTURE

The presentation will focus on key EUROLAB identified pillars in supporting the laboratories in building smart and sustainable strategies. Various insights will be provided on challenges and opportunities faced by the sector given current digital trends and regulatory developments. It will provide insights on the specific activities, including key technical outputs and actions in supporting best practices and capacity building, to enable laboratories in their digital transitions. The presentation will also include the EUROLAB projects around the key topics: sustainability and digitalization, European Quality Infrastructure as well as roadmaps of the EUROLAB Technical Working Groups and the added value brought to the laboratory community.

Global ACI - The Heart of a Changing Assurance World

Plenary Lecture 2
Thursday, **27 August 2026**
11:00-11:50 AM Philippine Standard Time

Mr. MARCUS LONG
Chief Executive, IIOA;
Chairperson, Stakeholder Committee,
Global Accreditation Cooperation
Incorporated (Global ACI)

BACKGROUND

Marcus was appointed IIOA Chief Executive in 2011. Prior to joining IIOA Marcus was Head of External Affairs at BSI, building relationships with key international and national organizations. Before BSI, Marcus was Head of Customer Service for Network Rail, owner and operator of the UK rail infrastructure. Marcus has also worked in the telecoms, retail and automotive sectors for BT, Marks & Spencer, Next and Land Rover in customer service and procurement roles.

Marcus is also a member of the Global ACI Executive Committee as the Chair of the Stakeholder Committee. Marcus has an MBA and a BSc in Economics.

ABSTRACT OF PLENARY LECTURE

Society, business and governments are seeing an unprecedented amount and pace of change, the volume and speed of which will only accelerate further. The accredited conformity assessment community needs to ensure it continues to not simply be relevant, but needs to ensure that it is at the forefront of change to support global trade, economic development, safety, sustainability, etc.

On 01 January 2026 Global ACI, the merger of IAF and ILAC created the new global accreditation organization. This is a significant moment and Global ACI will provide a central pillar to the future of accredited conformity assessment. What does Global ACI and all the members of the quality infrastructure prioritize? What actions do we need to take to effectively benefit society, business and governments. Vital issues at a critical time.

Quality and Trust Through Metrology: Advancing Natural Products in Healthcare and Industrial Sectors in Thailand

Plenary Lecture 3
Friday, **28 August 2026**
09:00-09:50 AM Philippine Standard Time

SORNKRIT MARBUMRUNG, PhD
Chemical Metrologist and Senior Professional,
National Institute of Metrology (Thailand) (NIMT)

BACKGROUND

Dr. Sornkrit Marbumrung is a Chemical Metrologist and Senior Professional at the National Institute of Metrology (Thailand). She earned a B.Sc. in Chemistry in 2004, followed by an M.Sc. and a Ph.D. in Inorganic Chemistry in 2007 and 2012, respectively. Her research focused on developing a metrological approach for purity assessment of high-purity organic compounds and standard solution. Since joining the institute in October 2012, she has been responsible for assessing the purity of organic compounds using various analytical techniques, participating in international laboratory comparisons, and producing certified reference materials (CRMs).

ABSTRACT OF PLENARY LECTURE

Metrology, the science of measurement, is fundamental to ensuring the quality, safety, and trust in natural products, which is essential for their integration into healthcare and industrial sectors. In Thailand, where natural products play a vital role in both domains, robust metrological systems provide the foundation for standardization, certification, and international recognition. The National Institute of Metrology (Thailand) (NIMT) strengthens the country's National Quality Infrastructure for herbal products by providing crucial metrological support. NIMT has successfully developed various high-purity certified reference materials (CRMs) and, recognizing the importance of regulatory adherence, has also created matrix-matched CRMs. These resources facilitate the validation of analytical methods and ensure measurement accuracy. Through these efforts, Thailand enhances consumer confidence, promotes innovation, and supports sustainable growth in healthcare and industrial sectors. The integration of among government agencies, research institutions, and industry stakeholders further advances metrology-driven practices. Ultimately, precise measurement systems not only safeguard public health but also position Thailand as a leader in the sustainable development and commercialization of natural products across diverse sectors.

Boosting National Quality Infrastructure: Insights from the World Development Report 2025

Plenary Lecture 4
Friday, **28 August 2026**
01:00-01:50 PM Philippine Standard Time

Mr. PHILIP GRINSTED
Private Sector Specialist and Co-Author of the
World Development Report 2025, World Bank

WORLD BANK GROUP

BACKGROUND

Philip Grinsted is a Private Sector Specialist in the Trade, Business and Competition team at the World Bank. He focuses on the intersection of private sector development and sustainability, with expertise in green competitiveness, firm-level technology adoption, and sustainable value chains. Philip also specializes in national quality infrastructure, advising clients on standardization and quality assurance—such as testing and certification—to strengthen market access and regulatory effectiveness. Additionally, he has experience in improving policy environments for digital businesses. Before joining the World Bank, Philip worked at the German Agency for International Cooperation (GIZ), primarily in India and China, advising the German Federal Ministry for Economic Affairs on fostering trade with emerging markets through national quality infrastructure. He holds a dual Master of Public Policy (MPP) and Master of Public Administration (MPA) from the London School of Economics and Political Science (LSE) and the Hertie School in Berlin.

ABSTRACT OF PLENARY LECTURE

Standards are the hidden infrastructure of modern economies—and they have never been more important. Developing countries today must contend with a thicket of increasingly stringent international standards, a product of globalization and rapid technological change. Using standards—and shaping them—is now a prerequisite for export growth, technology diffusion, and the efficient delivery of public services. Yet standards are too often overlooked by policy makers, especially in developing countries. World Development Report 2025 provides the most comprehensive assessment of the global landscape of standards today and how they can be used to accelerate economic development. It offers a practical framework for countries at all stages of development. Countries at the earliest stage should adapt international standards to suit local conditions when needed, whereas at more advanced stages, they should aim to align domestic markets with international standards. Meanwhile, all countries should author international standards in priority areas.

Trustworthy AI in Medicine – Data Quality as a Metrological Challenge

Plenary Lecture 5
Saturday, **29 August 2026**
09:00-09:50 AM Philippine Standard Time

DANIEL SCHWABE, PhD
Coordinator for Digital Medicine, Division 8:
Medical Physics and Metrological Information Technology,
Physikalisch-Technische Bundesanstalt (PTB), Germany

PTB
Physikalisch-Technische Bundesanstalt
National Metrology Institute

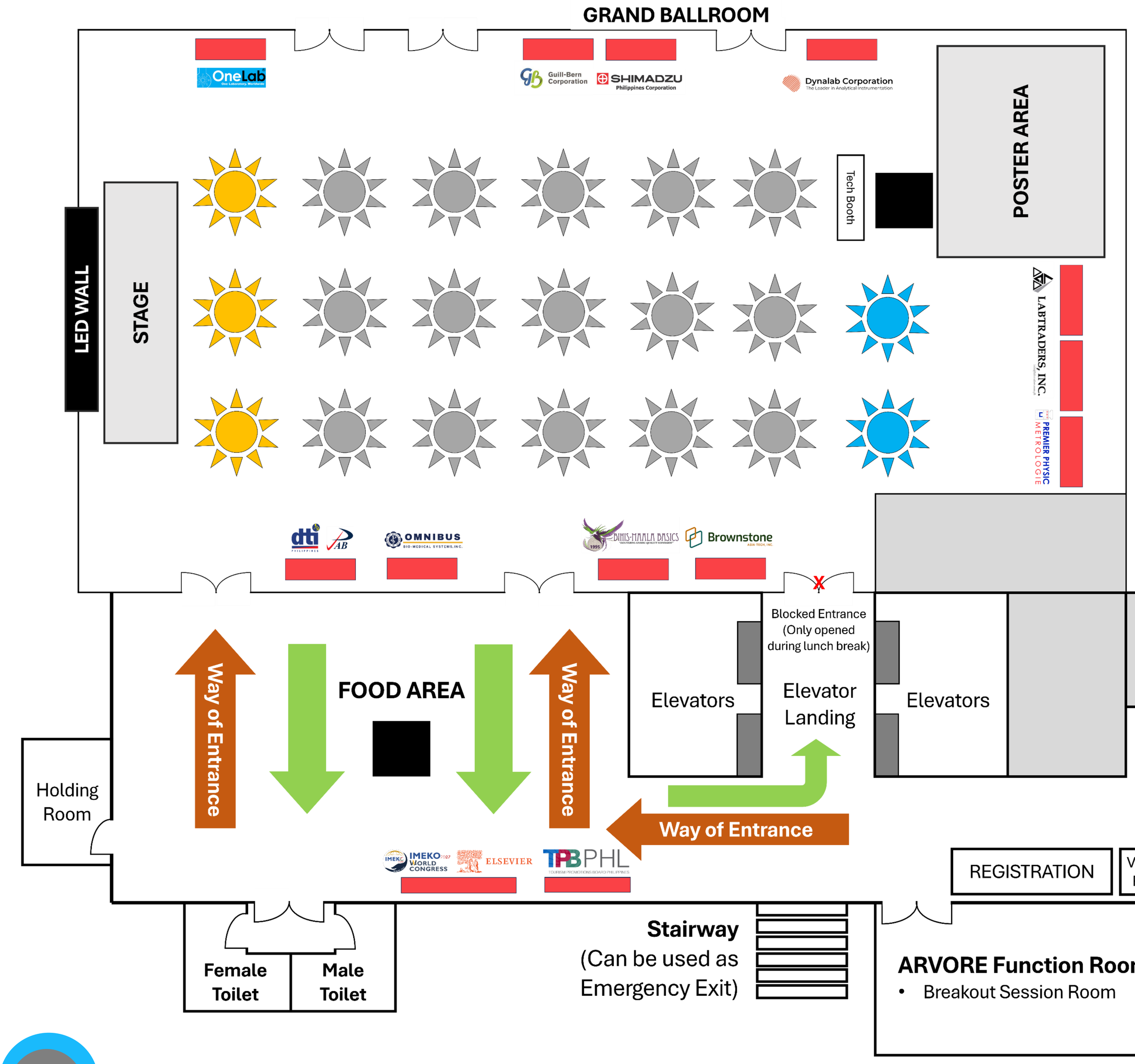
BACKGROUND

Daniel Schwabe holds an MSc in Mathematics from Humboldt University in Berlin and earned his PhD in Theoretical Biophysics at the Max Delbrück Center for Molecular Medicine. Since September 2021, he has served as the Coordinator for Digital Medicine at the Physikalisch-Technische Bundesanstalt (PTB). He is involved in the TEF-Health project, a major EU-funded initiative with a budget of €60 million aimed at testing and validating AI solutions in healthcare. Daniel's research focuses on quantitative quality assurance of AI in medicine, with a particular interest in the quality of data used in machine learning applications. To this end, his team published the METRIC-framework for systematically assessing the quality of machine learning data and the Metric Hub providing a collection of metrics.

ABSTRACT OF PLENARY LECTURE

Artificial intelligence has become one of the defining technologies of our time, reshaping nearly every domain. In medicine its promise is especially profound, but so are the stakes, because the consequences fall directly on people's health. Much of an AI's trustworthiness is decided by the data: a model can only ever be as good as what it was trained and tested on. Yet medical data quality is still judged largely by intuition rather than rigorous, quantitative measurement.

This talk reframes data quality as a measurement problem and therefore a natural task for metrology. It shows how quality can be broken into well-defined dimensions and how it can be measured. This makes quantitative testing of data a practical part of quality assurance of medical AI.



ACACIA HOTEL MANILA

- Exhibitors
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- Flow Path during Lunch Break

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Abstract ID No. 02

Audit-Ready and Explainable Machine Learning for Chemical Measurements: A Case Study on Ceramic Oxide Profiles

Author: David Jaucian Alcarde Jr.[1]

[1]*Department of Science and Technology, Industrial Technology Development Institute (DOST-ITDI), Packaging Safety & Testing Laboratory*

Chemical composition measurements underpin materials characterization and conformity assessment in industrial and laboratory contexts; however, interpretation of high-dimensional oxide datasets remains analytically intensive and frequently dependent on expert judgment. This study presents an audit-ready and explainable machine learning (ML) workflow for systematic interpretation of ceramic oxide composition measurements using a publicly available dataset from the UCI Machine Learning Repository comprising 88 samples (44 ceramic bodies and 44 glazes) characterized by seven-teen measured oxide components. Interpretable linear classifiers and nonlinear ensemble ML models were implemented within a reproducible digital pipeline. Under stratified five-fold cross-validation, both model classes achieved error-free classification performance, with accuracy and ROC-AUC values of 1.00 across all folds, demonstrating complete separability between body and glaze oxide profiles. Decision robustness was evaluated using Monte Carlo perturbation to simulate analytical variability in oxide concentration measurements at relative levels up to ±5%. Classification stability remained at 100% across all perturbation scenarios, indicating high tolerance of the ML decision boundary to plausible measurement fluctuations. Explainability analysis based on ensemble feature importance identified chemically plausible drivers of classification dominated by alumina (Al_2O_3; importance = 0.247), calcium oxide (CaO; 0.215), and strontium oxide (SrO; 0.216), followed by network modifiers including phosphorus pentoxide (P_2O_5; 0.150) and manganese oxide (MnO; 0.076). These drivers align with established compositional distinctions between ceramic body matrices and glaze formulations. The results demonstrate that explainable and robustness-tested ML can function as an audit-ready digital interpretation layer for chemical measurement data, enabling transparent, reproducible, and highly reliable classification of multivariate oxide compositions. The presented workflow highlights the potential of digitalized analytical methodologies to strengthen decision confidence in chemical metrology and testing applications.

Abstract ID No. 03

Elemental Fingerprinting of Reinforcing Steel Bars Using Portable EDXRF and Chemometric Analysis for Origin Classification

Author: Mary Joy Bautista[1]

Co-authors: George Catague[2]; Gina Catalan[1]; Jo Marie Venus Agad[1]; Morris Pioquinto[1]

[1]Department of Science and Technology, Metals Industry Research and Development Center (DOST-MIRDC)
[2]QES Technology Philippines Inc.

Elemental fingerprinting offers a powerful approach for distinguishing the origin of reinforcing steel bars and strengthening quality control in construction materials, particularly through the assessment of both alloying and trace elements. In this study, Energy Dispersive X-ray Fluorescence (EDXRF) combined with multivariate chemometric techniques was applied to characterize the elemental composition of reinforcing steel bars produced locally and imported from various countries. Principal Component Analysis (PCA) was employed to reduce the dimensionality of the elemental dataset and identify the variables contributing most significantly to sample differentiation, while Hierarchical Cluster Analysis (HCA) was used to assess compositional similarity and grouping behavior. The PCA results revealed a clear separation between locally manufactured and imported steel bars, with alloying and trace elements such as Cr, Cu, Mn, Mo, Ni, Pb, and Sn acting as key discriminating markers. HCA produced clustering patterns consistent with the PCA groupings, confirming the robustness of the elemental classification. The agreement between the two independent chemometric techniques demonstrates the reliability of elemental fingerprinting for origin identification. These findings highlight the potential of EDXRF-based chemometric analysis as an effective tool for traceability, regulatory monitoring, and quality assurance of reinforcing steel bars in the construction industry.

Abstract ID No. 04

Chemometric Evaluation of FDA-required Migration Parameters in Commercial Polyethylene Food Packaging using Aqueous Simulant

Authors:

Winnie Alejandro[1]; Elyson Keith Encarnacion[1]; Anne Alcantara[1]; Agaseve Del Rosario[1]; David Alcarde[1]; Rizel Marie Ting[1] ; Josefino Antonio Mendoza[1]; Darylle Jerome Ortiz[1]; Alliyah Gahle Enriquez[2]; Maria Jelo Mantile[3]

[1]Department of Science and Technology, Industrial Technology Development Institute (DOST-ITDI), Packaging Safety & Testing Laboratory

[2]Pamantasan ng Lungsod ng Maynila

[3]Adamson University

In the Philippines, the Food and Drug Administration mandates voluntary testing of Total Residual Contaminants (TRC), Total Oxidizable Contaminants (TOCs), and Total UV-Absorbing Contaminants (TACs) as screening parameters for plastic food-contact materials. These indices represent complementary domains of potential migrant species and provide a comprehensive assessment of contamination behavior. However, it remains unclear whether these parameters reflect interconnected contamination pathways or independent measurement domains across commercially avail-able polyethylene (PE) brands. Understanding the statistical relationship among TRC, TOCs, and TACs is essential to determine whether they provide overlapping or distinct information in regulatory migration testing. This study evaluates fourteen PE packaging materials using an aqueous food simulant and applies inferential and chemometric tools to assess compliance, distributional characteristics, inter-parameter relationships, and multivariate brand differentiation. One-sample t-tests demonstrated that mean TRC (5.264 mg/L), TOCs (0.336 mg/L), and TACs (0.0095 AU) were significantly lower than their respective regulatory limits ($p < 0.05$). Shapiro–Wilk analysis indicated approximate normality for TRC and TOCs, while TACs exhibited non-normal distribution. Spear-man correlation analysis revealed no statistically significant associations among TRC, TOCs, and TACs ($\rho \leq 0.123$, $p > 0.05$), indicating independent contaminant behavior under aqueous migration conditions. Principal Component Analysis further supported this independence, with the first two components explaining 83% of total variance and demonstrating multidimensional contamination structure rather than a single dominant correlated pathway. The findings confirm regulatory compliance and clarify that TRC, TOCs, and TACs function as statistically independent and complementary indicators in PE migration assessment.

Abstract ID No. 05

PFOA and PFOS migration from commercially-used food-contact materials (FCMs) using LC-MS/MS

Authors: Agaseve Del Rosario[1]; Elyson Keith Encarnacion[1]; Johnree Omar Delos Santos[2]; Rizel Marie Ting[1]; Aaron Dacuya[3]; Harold Armario[1]; Anne Alcantara[1]; David Jr Alcarde[1]; Josefino Antonio Mendoza[1]; Winnie Alejandro[1]; Jeric Bañadera[1]

[1]Department of Science and Technology, Industrial Technology Development Institute (DOST-ITDI), Packaging Safety & Testing Laboratory
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Perfluoroalkyl Substances (PFAS) are synthetic chemicals used to resist oil and water in food con-tact materials (FCMs). These compounds migrate to food and bioaccumulate in the body, causing cancer, immunotoxicity, developmental toxicity, vaccine suppression, and obesity among others. To investigate the extent of migration, this study modified and optimized a previously validated method to screen 10 Philippine-based FCMs. Samples were immersed in 95% ethanol as oily food simulant for 2 hours, evaporated, and reconstituted with 96:4 methanol for instrumental analysis using an ultrahigh performance liquid chromatography (UHPLC) coupled with a Tandem Mass Spectrometer (MS/MS). The modified method did not exhibit loss from the additional heating and cleanup steps. Limit of detections (LODs) for both Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS) (0.20 ng/g and 0.05 ng/g, respectively), and repeatability at low and high levels ($\%RSD_{low}$ and $\%RSD_{high}$, respectively) were within acceptable limits. PFOA concentrations ranged from Not Detected (ND) to 90.87 ng/g, while PFOS was not detected. One sample exceeded the European Union (EU) specific migration limit for PFOA (25 ng/g), implying unsuitability for contact with oily food products. PFOA migration was higher with the printed section compared to the non-printed part of the representative sample, suggesting potential contamination from inks. Assessment using other food simulants and exposure assessment are recommended in future studies.

Keywords: PFAS, PFOA, PFOS, migration, FCMs, UHPLC-MS/MS, oily-food simulant, 95% ethanol

Abstract ID No. 06

Homogeneity Assessment of Nylon/LDPE Flexible Packaging Films Based on Oxygen Transmission Rate Measurements

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Consistency of barrier performance is critical in quality assurance of multilayer flexible packaging materials to prevent oxidative deterioration and maintain shelf-life stability of selected food products. This study investigates the homogeneity of nylon/LDPE flexible packaging films using oxygen transmission rate (OTR) measurements. From a single production batch of 100 bags, twenty units were randomly chosen and measured in duplicate under repeatability conditions to enable separation of measurement variability from intrinsic unit-to-unit differences. Nylon/LDPE composition was confirmed by FTIR analysis. Measured OTR values ranged from 51.5 to 59.7 $cm^3 \cdot m^{-2} \cdot day^{-1}$, with an overall mean of 56.8 $cm^3 \cdot m^{-2} \cdot day^{-1}$. One-way analysis of variance revealed significant bag-to-bag differences ($F(19,20) = 183$, $p < 0.001$). Variance component analysis was applied to quantify intrinsic between-unit variability, yielding a standard deviation (s_{bb}) of 2.46 $cm^3 \cdot m^{-2} \cdot day^{-1}$ (4.3% relative variation). The 95% confidence interval ranged from 1.55 to 3.90 $cm^3 \cdot m^{-2} \cdot day^{-1}$ (2.7–6.9% relative to the mean), while repeatability standard deviation was substantially smaller (0.258 $cm^3 \cdot m^{-2} \cdot day^{-1}$). When duplicate measurements were averaged, homogeneity contributed the dominant portion of the combined standard uncertainty (≈3.1% relative to the mean). Although statistically detectable differences were observed, magnitude-based evaluation indicated moderate intrinsic variability consistent with typical manufacturing variation. The study demonstrates that statistical significance should be interpreted alongside magnitude of variation in homogeneity assessment. The proposed variance component framework provides a quantitative basis for evaluating barrier consistency and supports process control and specification development in multilayer packaging manufacturing. Further investigation is warranted to evaluate larger production batches and additional barrier properties to strengthen industrial decision-making.

Keywords: Homogeneity assessment, Oxygen transmission rate, Variance component analysis, Measurement uncertainty, Flexible packaging films.

Abstract ID No. 07

Accreditation and Best Practices in Meteorological Instrument Calibration: Insights from the PAGASA Instrument Calibration Laboratory

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The PAGASA Instrument Calibration Laboratory (PICL) plays a critical role in ensuring the accuracy, traceability, and reliability of meteorological instruments that underpin weather forecasting, climate monitoring, and disaster risk reduction in the Philippines. Designated in 1996 by the World Meteorological Organization (WMO) as a Regional Instrument Center for the Southwest Pacific region, PICL maintains the national reference standards for basic meteorological instruments. This paper details the laboratory's systematic transition toward nationally recognized quality infrastructure, with emphasis on its implementation of ISO/IEC 17025:2017 requirements for competence in calibration laboratories. The compliance phase commenced in 2018, followed by internal audits in 2021, culminating in successful accreditation by the Philippine Accreditation Bureau (PAB) in Au-gust 2023. At present, PICL is the sole accredited laboratory in the country for atmospheric pressure calibration, providing a critical link in the national traceability chain. Central to its best practices is the continuous sustainment of service quality through strict adherence to ISO standards, equipment characterization, proficiency testing, measurement uncertainty evaluation, and continuous personnel competency development. This paper highlights how accreditation and quality management strengthens national measurement systems essential for climate resilience, disaster risk reduction, and public safety.

Abstract ID No. 08

Unsupervised Anomaly Detection in Perfluorooctane Sulfonate (PFOS) and Perfluorooctanesulfonic Acid (PFOA) Migration Measurements for Laboratory Quality Assurance and Conformity Assessment

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Per- and polyfluoroalkyl substances (PFAS), including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), are subject to increasing regulatory scrutiny due to their persistence and potential health risks. Migration testing of Per- and polyfluoroalkyl substances (PFAS) from food-contact and packaging materials therefore plays a critical role in laboratory quality assurance and conformity assessment. Conventional evaluation of migration data, however, often relies on mean values and repeatability metrics that may obscure atypical measurement behavior relevant to compliance decisions. In this study, unsupervised anomaly detection was applied to PFOS and PFOA migration measurement data to support laboratory quality assurance without reliance on predefined labels or exclusion thresholds. A dataset comprising 48 replicated surface migration measurements, obtained across three analysts, two PFAS analytes, and three concentration regimes (low, medium, high), was analyzed using Isolation Forest–based statistical learning. Measurement concentration, analyte identity, analyst, and concentration regime were jointly considered following feature standardization. The analysis identified 5 measurements (10.4%) exhibiting anomalous behavior relative to the overall measurement structure. Anomalies were observed for both PFOA (3 cases) and PFOS (2 cases), indicating no systematic compound-specific bias. Notably, four of the five anomalous measurements were associated with a single analyst, highlighting the contribution of analyst-dependent variability. Furthermore, 83% of detected anomalies occurred in the high concentration regime, suggesting increased measurement sensitivity at elevated migration levels. Rather than serving as a basis for data exclusion, the detected anomalies are interpreted as diagnostic indicators warranting further metrological review. The results demonstrate that unsupervised anomaly detection can complement established measurement science practices by enhancing transparency, supporting traceability-aware conformity assessment, and reducing the risk of false compliance or false non-compliance in PFAS migration testing laboratories.

Keywords: PFAS, PFOA, PFOS, anomaly detection, laboratory quality assurance, conformity assessment, statistical learning

Abstract ID No. 09

Temporal studies on polyethylene's total UV-absorbing contaminants migrating to fatty and oily foods at refrigeration and ambient temperatures

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Domestic households subject food and its packaging to diverse conditions, resulting in variable time-temperature exposures that differ markedly from controlled laboratory settings. Because product-packaging surface interactions permit chemical migration, this study explores the effects of varying extraction times on a previously characterized polyethylene (PE) sample made in contact with a fatty and oily food simulant at both ambient (22-28 ^{0}C) and refrigeration (0-5 ^{0}C) temperatures. Sample PE-0009, categorized through Fourier Transform Infrared Spectroscopy (FTIR) as HDPE, was exposed to the intended product type and temperature conditions from 0.50 to 24 hours. Pearson correlation analysis revealed distinct associations between the correlation coefficient ( ) of time and absorbance units (AU) for both temperatures. At ambient temperature, (AU, time) = -0.35 exhibited a weak-to-moderate inverse relationship, indicating AU decrease with increasing time. In contrast, (AU, temperature) = 0.011 implies no linear relationship, depicting temporal stability at refrigeration. While changes in AU were observed through linear modeling (AU, time with temperature interaction), sample, simulant, and condition expansions are recommended to further strengthen claims and generate conclusions for different product-packaging combinations. This underscores that the Philippines' food safety regulations on food contact materials and articles (FCMs and FCAs) must be reinforced for consumer protection.

Abstract ID No. 10

Modeling Laboratory Workflows for Efficiency: Throughput, Delays, and Operational Variability

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Laboratory 4.0 initiatives demand a quantitative understanding of variability and efficiency in testing operations to ensure traceable, reproducible, and timely measurements. Using historical laboratory information management system (LIMS) data spanning 2016-2023, this study models sample processing dynamics across multiple laboratories from a Philippine national S&T institution. A discrete-event simulation (DES) informed by empirical distributions of sample arrivals, queue times, and processing durations quantifies stochastic variability in turnaround and delay times, capturing operational constraints such as reduced staffing and scheduling changes. The simulation framework highlights potential bottlenecks and evaluates system performance under alternative staffing and scheduling scenarios. Metrics such as throughput, queue lengths, and delays are analyzed to provide insight into operational efficiency and resource utilization. By integrating LIMS-derived empirical data with DES modeling, the study offers a reproducible methodology for laboratories to anticipate workflow constraints, optimize processes, and support data-driven decision-making while maintaining adherence to traceable measurement practices.

Abstract ID No. 11

Single-Laboratory Validation of a Spectrophotometric Method for the Quantitative Determination of Total UV-Absorbing Contaminants (as Bisphenol A) Migrating from Polyethylene Packaging to 8% Ethanol Food Simulant

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Bisphenol A (BPA) is an industrial monomer widely used in polymer production to impart rigidity, transparency, and chemical resistance. The qualitative method developed by Alcantara was modified by converting TACs absorbance values into BPA concentrations through external calibration. Validation demonstrated a linear working range (R^2 = 0.9994), with an LOD of 0.0279 mg/kg and LOQ of 0.0931 mg/kg. Repeatability and trueness were satisfactory, with %RSD values ranging from 1.15% to 2.91% and mean recoveries between 97.437% and 104.528%, meeting performance criteria established by AOAC International. Ruggedness testing using polypropylene (PP) produced a mean recovery of 97.989% (%RSD = 1.42). Statistical analysis showed significant difference (p = 1.46 x 10-9) between the two polymers, indicating matrix-dependent effects and non-applicability of the method to PP. Although the method did not achieve the 0.001 mg/kg LOD for BPA referenced in European Commission Regulation (EU) 2024/3190, no criterion is currently established in the Philippine setting, supporting its use for PE films with BPA concentrations greater than 0.0279 mg/kg. Given this sensitivity limitations, higher order techniques such as GC–MS/MS or LC–MS/MS are recommended for trace-level determination and regulatory harmonization. Furthermore, interlaboratory studies are proposed to evaluate reproducibility and strengthen method reliability.

Abstract ID No. 12

Empirical Validation of Wringing Uncertainty Using Long-Service Gauge Blocks: Evidence-Based Replacement of Conservative Estimates in Calibration Budgets

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Accurate uncertainty quantification is vital for metrological traceability. This will provide a basis for empirically determined wringing errors in industrial steel gauge blocks that have been in use (i.e., 25-30 years), with an established empirical base to replace the traditional arbitrary values (0.20-0.50 microns) used today, and thereby enable calibration and measurement capability (CMC) claims that are inflated as much as 6.3 times when using conservatively determined values. The results of this study indicate that the average error per interface is 0.08 microns and therefore suggest that a 38-47 % reduction in CMC can be achieved for calibrations that serve the automotive, semiconductor, and metal fabrication industries. This methodology offers laboratories a validated approach to optimize uncertainty budgets, ensuring more competitive measurement capabilities while strictly adhering to ISO/IEC 17025 requirements and international standards.

Abstract ID No. 13

Chemical Insights into the Degradation Mechanisms of Cultural Metal Artefacts

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Understanding corrosion mechanisms in metallic cultural artefacts is essential for defining effective and sustainable conservation strategies. Burial conditions, environmental exposure, and post-excavation processes alter the original composition and microstructure of metals, potentially com-promising their stability. In this framework, reliable and traceable chemical measurements play a central role in assessing degradation phenomena and supporting evidence-based preservation decisions.

This work presents a multi-analytical measurement approach applied to artefacts of different typologies, including archaeological iron, copper-based alloys, and silver objects, ranging from ancient materials recovered from Italian archaeological sites to modern works belonging to contemporary collections. Case studies from Italian archaeological contexts and modern outdoor collections are presented to illustrate the versatility of the proposed methodology.

The analytical strategy integrates minimally invasive and non-destructive techniques to characterize corrosion products, stratigraphy, and surface morphology. Raman spectroscopy enables phase identification of alteration compounds, while SEM-EDS, optical microscopy, and X-ray diffraction provide complementary microstructural and compositional information.

For outdoor and museum-displayed artefacts, in-situ monitoring was performed using Electrochemical Impedance Spectroscopy (EIS), X-ray fluorescence (XRF), and portable Raman spectroscopy to evaluate corrosion kinetics, patina stability, and protective coating performance. Microclimatic parameters were continuously monitored through smart sensors, and 3D photogrammetry allowed integration of analytical data into digital models for documentation and data sharing.

The results demonstrate how measurement-driven approaches enhance risk assessment, enable early detection of active corrosion, and support the development of tailored safeguard strategies for metallic cultural heritage.

Abstract ID No. 14

Development of an In-House LC-MS/MS Method for the Detection of Selected Food Allergens in Philippine Cookies

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Food allergies affect people globally, posing a significant public health concern. Food avoidance is essential for mitigating food allergies, and safe food consumption would depend on accurate and clear food labelling. For food labels to accurately identify the allergenic ingredients, strict food regulations must be enforced, supported by reliable analytical methods for testing. Analytical method development is fundamental and crucial in food allergen testing by liquid chromatography-tandem mass spectrometry (LC-MS/MS) because it ensures accurate, sensitive, and reproducible determination of the allergenic proteins in complex food matrices such as cookies. This study focused on the optimization of the protein extraction method, as it directly affects the recovery of the allergenic proteins that are subjected to trypsin digestion before LC-MS/MS detection of the unique marker peptides. Among the key parameters that were optimized are extraction buffer pH, extraction temperature and incubation time, and reduction and alkylation conditions. The protein extraction efficiency was evaluated by determining the protein concentration through Bradford Assay (working range: 0.125-2 mg/mL; repeatability %RSD = 13.42; intermediate precision %RSD= 25.01). Using customized peptide standards, the mass spectrometer parameters were also optimized to determine the precise ion source settings and collision energies and to establish selective MRM transitions for reliable peptide detection. Different sample clean-up approaches were also compared, including molecular weight cut-off (MWCO) filtration and desalting through C18 spin column. Each method was assessed based on its effect on peptide recovery and the detection sensitivity of egg, peanut, and milk allergens in the LC-MS/MS. Through method optimization, the laboratory has successfully developed an in-house LC-MS/MS method that is sensitive, selective, and reproducible, ensuring reliable detection of food allergens at concentrations below 10 mg/kg. This method development initiative strengthens the country's capacity for food allergen testing, contributing to improved monitoring and regulatory compliance.

Abstract ID No. 15

Evaluating Competence of Philippine Laboratories in Testing Water Activity of Biscuit Sample through Conduct of Interlaboratory Comparison

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Water activity (a_w) is a critical parameter that describes the availability of water for biological reactions and directly influences the growth of microorganisms in food products. Control of a_w is therefore essential to ensure food safety, stability, and quality. This study describes the preparation, characterization, and application of a biscuit candidate material for a local interlaboratory comparison (ILC) in the Philippines. Commercially available biscuit samples were pulverized using a food processor and mortar and pestle, followed by sieving through mesh number 40 (0.425 mm) to obtain a uniform particle size distribution. The homogenized material was bottled and evaluated for bulk and between-bottle homogeneity using a portable water activity meter. Statistical assessment included Cochran's test for outliers, linear regression (t-test) for trend analysis, and analysis of variance (F-test). Results from 11 stratified randomly selected bottles demonstrated satisfactory homogeneity ($t_{calc} = 1.42 < t_{crit} = 2.31$; $F_{calc} = 3.11 < F_{crit} = 3.32$). Short-term stability testing conducted at 30 ℃ and 40 ℃ over one month showed no significant change in a_w, confirming the material's stability under normal laboratory conditions. The validated candidate material was subsequently used to conduct a local ILC in accordance with PNS ISO/IEC 17043:2023. The ILC protocol was reviewed and approved by the Philippine Accreditation Bureau of the Department of Trade and Industry (DTI-PAB), complying to the Supplementary Requirements for Proficiency Testing (LA/SR01). Participant performance was evaluated using a consensus value approach and z-score statistics. After application of Grubbs' test to identify and remove two outliers, the assigned consensus value was established at 0.4040 a_w. Except for the identified outliers, all participating laboratories achieved satisfactory z-scores ($|z| \leq 2$), indicating good agreement with the consensus value and demonstrating acceptable analytical performance. The results highlight the technical competence of Philippine testing laboratories in water activity measurement and reinforce confidence in the reliability and comparability of a_w data generated nationwide. Furthermore, participation in this ILC supports compliance with Clause 7.7.2 of PNS ISO/IEC 17025:2017, strengthening the national quality infrastructure and promoting harmonization of food testing practices across accredited laboratories.

Abstract ID No. 16

Carbon Dioxide Exposure and Emission Assessment in Environ-mental Laboratory Settings

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Carbon dioxide (CO_2), an important greenhouse gas, is produced through human respiration. Chronic exposure to CO_2 levels in the workplace and indoor air can pose health risks. At elevated levels, it can cause headaches, dizziness, confusion, and loss of consciousness. CO_2 monitoring in an environmental laboratory started when the Philippine Department of Labor and Employment (DOLE) released guidelines on ventilation for workplaces during the Covid-19 pandemic. Data collected from 2022 to March 2026 for CO_2 monitoring covered forty-five (45) departments and sections. CO_2 direct readings were measured using a portable CO_2 meter for short term approach. Results of CO_2 levels in the laboratory can be influenced by the occupancy (no. of workers), nature, type, and level of activity, and workload intensity. Other air parameters measured were temperature and humidity. Selected sections in the laboratory exceeded the local guidelines of 1130 ppm. CO_2 emissions (tCO_2e) from equipment were quantified based on analytical testing in the laboratory. The results of CO_2 concentrations helped the management in decision-making on improvement, appropriate engineering controls, and adoption of climate change mitigation strategies, including the use of selected plants for air purification and carbon sequestration. Continuous workplace monitoring is necessary to safeguard worker health and enhance workplace sustainability.

Abstract ID No. 17

Establishing Metrological Traceability in Elemental Analysis: Development of a Candidate Reference Material for Cd, Hg, and Pb in Mussels

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The Metrology in Chemistry Section of the National Metrology Laboratory of the Philippines developed a candidate reference material (RM) for toxic elements in mussels to support food safety monitoring, ensure the reliability of analytical measurements, and establish metrological traceability. This initiative addresses concerns regarding the potential contamination of mussels with hazardous elements such as cadmium (Cd), mercury (Hg), and lead (Pb). The candidate RM was produced by spiking lyophilized mussel tissues with known concentrations of Cd, Hg, and Pb, followed by thorough homogenization and bottling to obtain uniform test units. The homogeneity and stability were assessed. Statistical assessment using one-way ANOVA showed that the calculated F-values for Cd (F_{calc} = 0.27). Hg (F_{calc} = 0.47), and Pb (F_{calc} = 2.06) were lower than the critical F-value (F_{calc} = 2.30), demonstrating adequate homogeneity of the prepared material. Short-term stability (STS) was investigated through an isochronous approach. Bottled samples were stored at 4 ℃ and 50 ℃ for three weeks to simulate transport and non-ambient storage conditions. The concentration trends were assessed using linear regression analysis. The results confirm that the candidate RM is sufficiently homogeneous and stable under the tested conditions, demonstrating its suitability for use in method validation, quality control, and proficiency testing in food safety laboratories.

Keywords: toxic elements; homogeneity; short-term stability; food safety; metrological traceability

Abstract ID No. 22

Performance Trends of Philippine Laboratories in Heavy Metal Analysis in Seafood Matrices via Accuracy-Based Proficiency Testing with Metrological Traceable Reference Values

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Continuous proficiency testing (PT) is a cornerstone for ensuring the reliability and comparability of toxic element measurements in food. This study presents the evaluation of Philippine laboratories analyzing heavy metals in seafood such as milkfish, mussels, and tuna across multiple PT rounds. Test materials were prepared with certified reference values to ensure metrological traceability, and laboratories applied their routine analytical methods. Laboratory performance was assessed using z-scores and z'-scores, and measurement uncertainty following ISO/IEC 17043:2023 and ISO 13528:2022. Results indicate progressive improvement for Cd, reflecting enhanced analytical reliability over time. Conversely, Hg performance showed a declining trend, while Pb results remained stable at an average of 65 % satisfactory, highlighting persistent analytical challenges. These element- and matrix-specific trends demonstrate the value of repeated PT participation in promoting accuracy and consistency in laboratory measurements. Overall, the longitudinal PT data underscore that systematic engagement in proficiency testing strengthens the comparability, accuracy, and reliability of toxic element determinations, supporting food safety monitoring and regulatory compliance in the Philippines.

Keywords: toxic elements; contaminants; food safety; metrological traceability, seafood

Abstract ID No. 23

Interlaboratory Comparison in Nutritional Measurements: Results of 2023 APFAN Proficiency Testing Program

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Proficiency testing (PT) is widely used to assess the competence of analytical laboratories and verify the comparability of their measurement results. In collaboration with the Asia-Pacific Food Analysis Network (APFAN), a regional PT program was conducted to assess the capability of participating laboratories in measuring selected nutritional parameters in different food matrices.

Three PT rounds were organized covering processed meat, wheat flour, and biscuit matrices. The parameters evaluated included proximate components (moisture, protein, fat, and ash), selected minerals, total dietary fiber (TDF), cholesterol, and saturated fatty acids. Participants consisted of regula-tory agencies, testing and quality assurance laboratories from government and food manufacturing industries across APFAN member countries. Laboratory performance was evaluated using assigned values derived from participant results, and interpreted using z or z' scores, where $|z/z'| \leq 2.00$ indicated satisfactory performance.

Upon statistical evaluation of results from 57 laboratories, majority of the participants obtained “Satisfactory”(S) performance ($|z$ or z' score$| \leq 2.00$) in three PT Rounds: (a) processed meat –moisture (95%), fat (52%), protein (81%), ash (86%), calcium (54%), sodium (75%), potassium (68%), saturated fatty acids (55%) and cholesterol (62%); (b) wheat flour –moisture (92%), fat (76%), protein (73%), ash (76%), calcium (62%), iron (77%), zinc (78%) and total dietary fiber (80%); and (c) Biscuit –moisture (88%), fat (91%), protein (69%), ash (64%), calcium (74%), iron (69%), sodium (82%), potassium (77%), zinc (85%), total dietary fiber (54%) and saturated fatty acids (78%). Participants who did not obtain “Satisfactory” performance were encouraged to conduct self-investigation and corrective actions to improve their laboratory performance.

Abstract ID No. 24

Optimization and Validation of a Test Method for the Quantification of Total Mercury in Fish Tissue through Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry

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Mercury (Hg) contamination in fish represents an ongoing public health concern that requires continuous monitoring. In the Philippines, fish is an important source of dietary protein and aquaculture contributes to local livelihoods. The Bureau of Fisheries and Aquatic Resources (BFAR) of the Department of Agriculture (DA) in the Philippines, through its Administrative Order No. 210-01, has set a permissible limit of 0.5 mg/kg Total Hg in fish intended for export. Currently, limited information is available on the application of a direct mercury analyzer (DMA) for mercury determination in freshwater fish within the Philippine setting. Commonly used is the conventional method of Cold Vapor Technique –Atomic Absorption Spectrophotometry (AAS), which uses a lot of reagents and exposes analysts to a number of chemical hazards. This study aimed to optimize analytical parameters for the quantification of Total Hg in fresh fish tissue using DMA based on the US EPA Method 7473 (SW-846). This method involves thermal decomposition, amalgamation, and atomic absorption spectrophotometry for liquid and solid samples, providing enhanced operational efficiency and reduced hazardous waste generation compared to conventional methods. Method validation was performed based on Eurachem guide to establish the fitness-for-purpose of the method prior to the analytical testing of fish samples from the local market. Method performance characteristics evaluated included linearity, instrument detection limit (IDL), method detection limit (MDL), method quantification limit (MQL), repeatability, intermediate precision, and trueness by spiking recovery. Statistical assessment of the validation results demonstrated that the method is fit for the intended determination of Total Hg in fish tissue. The validated method was applied to actual tissue samples from fish randomly selected from local markets in Metro Manila, Philippines.

Abstract ID No. 25

Application of Multivariate Analysis in the Investigation of Microparticles Present in Philippine Milkfish, Feeds, and Marine Water

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This study investigated the characterization and distribution of microplastic contamination in cage-cultured milkfish, commercial feeds, and surrounding waters in an open-water aquaculture system. The proliferation of microplastics in the aquaculture environment threatens marine environment species and poses potential risks to human health. Selected fingerlings, juveniles, and adult milkfish, along with water and feed samples, were collected in Southern Mindanao, Philippines. Samples were digested with H_2O_2 and KOH. Polypropylene (PP), polyethylene terephthalate (PET), polyamide (PA), polyethylene (PE), and cellulose fibers were detected using a vibrational spectroscopy technique. Principal component analysis was performed to aid in classifying the microplastic particles according to source, showing distinct separation between cellulose fibers and polymers across all sample sources. The first two principal components for fish, water, and feeds account for 88.76%, 83.89%, and 91.52% of the corresponding data set variance, respectively. Findings suggest that environmental exposure and contaminated feeds are possible pathways and factors for microplastic ingestion in milkfish.

Abstract ID No. 26

Design and early deployment of a distributed digital environmental conditions monitoring system supporting traceability in a triple-accredited laboratory

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Environmental conditions such as thermodynamic temperature, relative humidity, and barometric pressure significantly influence calibration results and associated measurement uncertainties. In many ISO/IEC 17025:2017 accredited laboratories, environmental conditions monitoring relies on manual recording at discrete intervals, limiting temporal resolution, weakening record continuity, and introducing transcription errors that may compromise documented information integrity.

This paper presents the design, implementation, preliminary operational assessment, and on-going architectural refinement of a distributed digital environmental conditions monitoring system developed entirely in-house by a privately operated organization holding simultaneous accreditation under ISO/IEC 17025:2017, ISO/IEC 17043:2023, and ISO/IEC 17020:2010. The system acquires thermodynamic temperature, relative humidity, and barometric pressure at one-second intervals via low-cost sensor modules and microcontroller-based acquisition units. Structured data payloads are validated and NTP-synchronized at client workstations before transmission to a centralized base server, which aggregates multi-node data streams and relays them to a web-based computerized management system built on a Django and React architecture. Correction factors from calibration certificates are applied to generate traceable environmental values, stored as encrypted, time-stamped digital records. Communication security enhancements are currently being implemented as part of on-going system refinement.

A preliminary comparative assessment across five deployed nodes evaluates recording frequency, data completeness, record continuity, and administrative workload relative to manual practices. Initial findings indicate improved temporal resolution, elimination of transcription errors, and reduced documentation workload. Operational experience revealed performance constraints associated with high-frequency data acquisition using file-based storage, motivating on-going migration toward a database-based persistence architecture and more efficient communication protocols currently under evaluation.

The study demonstrates the viability of iteratively developed, laboratory-built monitoring infrastructure as an alternative to commercial solutions, offering a replicable reference for accredited laboratories pursuing in-house digitalization of traceability-supporting processes.

Abstract ID No. 27

Validation of AOAC Official Method 995.11 for Total Phosphorus Determination in Fish Products

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Phosphorus is an essential nutrient necessary for skeletal integrity, cellular membrane structure, energy metabolism, and acid–base balance. However, excessive phosphorus intake has been linked to vascular calcification, impaired kidney function, and increased cardiovascular risk, particularly in individuals with chronic kidney disease. Phosphorus occurs naturally in organically-bound forms or is intentionally added as inorganic phosphate additives, the latter being more bioavailable and potentially posing greater health risks.

This study applied AOAC 995.11 to determine total phosphorus in fish, a widely consumed dietary source of phosphorus. Although this method is established for various food matrices, its extension to fish products requires specific validation to account for the unique organic and mineral profiles of aquatic species and their processed derivatives. While the method does not distinguish between natural and added phosphorus, it quantifies total phosphorus which provides preliminary information on potential overexposure.

The method demonstrated acceptable analytical performance, characterized by good linearity ($r \geq 0.995$) across the range of 0.05–1.20 mg/L P. Method detection and quantitation limits were established at 1.60 and 5.35 mg/kg P, respectively. Precision was confirmed by Horwitz ratios (HorRat) of <1 for repeatability and <2 for intermediate precision. Trueness was verified through spike recoveries (95.0-103.3%) and the analysis of NIST SRM 1546a (Meat Homogenate), which yielded recoveries of 90-95%. Overall, the method is fit for purpose for the determination of total phosphorus in fish matrix.

Abstract ID No. 28

Bracketing or exact matching: two different approaches for delta13C-CO2 value assignment to isotopic reference gas mixtures

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The production of gas mixtures of carbon dioxide (CO_2) in air at ambient level, certified for both CO_2 amount fraction and the isotopic composition of the ratio 13C/12C (δ13C-CO_2), is a promising activity to obtain valid references for comparable and reliable measurement results to support climate change studies. Different analytical approaches can be used to assign the δ13C-CO_2 values to these mixtures. Among these, bracketing and exact matching are two valuable strategies. In the bracketing approach, two certified reference mixtures with similar CO_2 amount fraction but different δ13C-CO_2 values, are used as calibration standards to assign the δ13C-CO_2 to a mixture under test. Specifically, the amount fraction needs to be close to that of the mixture under test, while the δ13C-CO_2 values must bracket the expected δ13C-CO_2 of the mixture under test. In the exact matching approach, instead, a single certified reference mixture with both CO_2 amount fraction and δ13C-CO_2 values closely matching those of the mixture under test, is used as calibration standard. The present contribution describes both approaches, including their pros and cons, as applied to δ13C-CO_2 determination via Cavity Ring-Down Spectroscopy. Examples of uncertainty budgets obtained with both methods are also provided.

Abstract ID No. 29

23RPT03 Project GrainMET: Updates on reference water content determinations in plant-origin materials

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In the agri-food sector, the availability of reliable reference measurements and Certified Reference Materials (CRMs) is paramount to ensure the accuracy of analytical results. These results are essential for facilitating international trade and protecting human health.

The 23RPT03 GrainMET project (Metrology for standardised moisture/water content measurements in plant-origin bulk materials) primarily aims to develop two good practice guides and two CRMs characterised for water content produced in line with ISO 17034 requirements. Once finalised, these CRMs will enable the robust and express calibration of instrumentation used to monitor moisture/water content in grain during commercial transportation and storage.

Currently, a pre-comparison is being carried out to benchmark candidate reference methods. The investigated methods include volumetric and coulometric Karl Fischer titration, and Loss-on-Drying approaches, including ISO 712-1. The methods are applied to centrally distributed samples (barley, wheat and rapeseed). The work will address the comparison design and key metrological aspects such as method selectivity, extraction completeness, bias and uncertainty. Based on these discussions, two CRM candidates will be selected: a wheat matrix (as a representative of the agri-food material) and a wheat-simulant matrix intended to increase long-term stability. This will lead to a subsequent Pilot Study to be organised at EURAMET TC-MC or CCQM level.

Abstract ID No. 32

Effects of Varying Food Types and Physical Properties of Film on the Total Residual Contaminants Migrating from Monolayer Polyethylene Packaging

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Residual contaminants consist of non-volatile chemical substances that may migrate from packaging to food during contact. This study employed a gravimetric method, modified from the Japan External Trade Organization (JETRO), to quantify Total Residual Contaminants (TRCs) from monolayer polyethylene (PE) plastic bags collected across Metro Manila. Film samples were cut into 50 cm^2 and immersed into water, 20% ethanol and 4% acetic acid food simulants. Average results showed the highest TRC levels in 20% ethanol (5.31 mg/L), followed by 4% acetic acid (4.92 mg/L) and water (3.69 mg/L), suggesting that the semi-polar nature of ethanol enhances extraction of both polar and nonpolar residual contaminants. However, one-way ANOVA revealed no statistically significant difference among the simulants ($p = 0.200$, > 0.05). Principal Component Analysis was applied to explore relationships among TRCs, film thickness, and density. The results indicated contrasting migration behavior between water and acetic acid, as evidenced by opposite loading signs in the first Rotated Component (RC1) (RC14% acetic acid= -0.814; RC1water = 0.759). The second RC showed a strong association with TRC levels in 20% ethanol and film thickness (RC2film thickness= -0.814; RC220% ethanol = 0.876). Spearman correlation further confirmed these two observed patterns. In contrast, density behaved independently of the other variables (uniqueness = 0.735, > 0.60). The results provide an insight into possible factors affecting chemical migration behavior and warrant further studies into applying a more comprehensive chemometric approaches to better understand the underlying relationships.

Abstract ID No. 33

Re critical role of research and industry partnerships in establishing food packaging safety in the Philippines

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A strong national quality infrastructure, supported by competent testing laboratories, plays a crucial role in ensuring contact article safety, while strengthening the competitiveness of locally manufactured products in domestic and international markets. However, the absence of mandatory certification schemes in the Philippines limits systematic monitoring of contact articles accessible to consumers. In this study, the Packaging Safety Laboratory partnered with two local manufacturers that provided samples for subsidized analytical testing. Paper food packaging from Manufacturer X was analyzed for perfluoroalkyl substances (PFAS) using validated liquid chromatography tandem mass spectrometry. Highly bioaccumulative PFAS were detected including PFDA (3.04 ug/kg), PFUnA (0.46 ug/kg), PFTriA (0.22 ug/kg), and PFTA (0.51 ug/kg). Regulated and more mobile PFAS such as PFOS and PFHxS were not detected. However, their carboxylic acid counterparts, PFOA (5.65 ug/kg) and PFHxA (103 ug/kg) respectively were measured with PFHxA exceeding the 25 ug/kg in-dividually targeted non-polymeric PFAS limit specified in the EU Packaging and Packaging Waste Regulation. Plastic food bags produced by Manufacturer Y were evaluated using a modified 21 CFR Part 177 migration approach with n-heptane as fatty food simulant and UV-Vis spectrophotometry. After extraction at 25 +/- 3 degrees Celsius for 30 minutes, replicates of pure low-density and high-density polyethylene films showed average absorbance values of 1.060 AU and 0.795 AU respectively, exceeding the 0.1 AU maximum allowable limit adopted by the FDA Philippines. Both manufacturers initiated corrective actions to reduce contaminant levels. Retesting and follow-up investigations are essential to systematically evaluate the effectiveness of manufacturer-initiated interventions and ultimately, research-industry collaborations.

Abstract ID No. 35

Chemometric Evaluation of Total Reflection X-Ray Fluorescence (TXRF) Elemental Profiles of Milkfish (*Chanos chanos*) Tissue for Geographic Differentiation

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The traceability of aquaculture products has become increasingly important due to concerns regarding food authenticity, environmental monitoring, and supply chain transparency. Milkfish (*Chanos chanos*), one of the most widely consumed fish species in the Philippines, is distributed through numerous fish landing sites across the Luzon region, making verification of its geographic origin challenging. Elemental profiling of biological tissues offers a potential analytical approach for identifying environmental signatures associated with different production or harvesting locations.

In this study, the elemental composition of milkfish tissue samples collected from multiple fish landing sites in Luzon was investigated using Total Reflection X-Ray Fluorescence (TXRF) spectrometry. TXRF provides rapid multi-element detection with minimal sample preparation, making it suitable for screening trace elements in biological matrices.

The resulting elemental datasets were evaluated using chemometric techniques to investigate relationships among samples. Principal Component Analysis (PCA) was applied to reduce data dimensionality and identify dominant sources of variation in the elemental profiles, while cluster analysis was used to explore possible sample groupings.

Preliminary multivariate analysis revealed distinct patterns within the dataset, with the first few principal components explaining a substantial portion of the total variance. PCA projections and clustering results suggested variability in elemental composition among samples, with several groupings and outliers observed. These findings demonstrate the potential of combining TXRF elemental fingerprinting with chemometric analysis as a rapid screening approach for investigating geographic variability and supporting seafood traceability studies.

Abstract ID No. 36

Evaluating Arsenic Removal from Natural Ore: A Treatability Study in Central Luzon, Philippines

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Arsenic is a naturally occurring metal. One source is the pyroclastic materials brought about by the volcanic eruption in Mount Pinatubo. Several research studies on arsenic removal technologies were done. The adsorption method is one of the most effective and low-cost processes in removing arsenic from water. The ore samples used in this study were collected in Bulacan and Zambales. Zambales ore samples contain chromium, iron, and nickel at 0.4%, 31.4%, and 0.477%, respectively. Arsenic is not present in the sample investigated. On the other hand, Bulacan ore samples contain arsenic, chromium, iron, and nickel at 0.00077%, 0.00083%, 11.10%, and 0.00047%, respectively. Leaching contact time started from 24 hours to 48 hours to 72 hours at a ratio of 1:1, 1:2, and 1:3 for both ore samples. Based on the results of the analysis for Zambales ore, arsenic results were undetected at 1:1 from 24 to 72 hours of contact with the ore. In a 1:2 ratio, 24 hours showed traces of arsenic at 0.02 mg/L, while 48 to 72 hours of contact showed no detection. Bulacan ore, arsenic leached out in 48 to 72 hours of contact using a 1:2 ratio. The Lagergren pseudo-first-order model using a 1:3 ratio showed a strong correlation. An R^2 of 0.75 suggests a reasonable but not perfect description of arsenic adsorption kinetics in a 1:2 ratio. A 1:1 ratio showed no correlation. The results suggest a potential use of the adsorption method in environmental remediation efforts to immobilize metal contaminants.

Abstract ID No. 37

Method Validation of Total Reflection X-ray Fluorescence (TXRF) for Arsenic Screening in Milkfish (*Chanos chanos*)

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Milkfish (*Chanos chanos*) is recognized by the Bureau of Fisheries and Aquatic Resources (BFAR) as one of the most important aquaculture species in the Philippines, being widely cultivated in fresh-water, brackish, and marine environments due to its adaptability to diverse cultivation conditions. However, the species may be susceptible to contamination by toxic elements such as arsenic (As), which can originate from anthropogenic activities, industrial discharges, and naturally occurring sources in sediments and water. The bioaccumulation of As in milkfish poses potential health risks, as one of the most widely consumed fish in the country. In this study, a method for As determination in milkfish using Total Reflection X-ray Fluorescence (TXRF) was validated using Philippine Reference Material (PRM) 2002-As, Cd, Hg & Pb in milkfish produced by the DOST-ITDI National Metrology Division. Method validation yielded recovery values ranging from 92–106% and a relative standard deviation (RSD) below 10%, indicating acceptable accuracy and precision. The expanded uncertainty, estimated using the Nordtest approach, was 0.42 ppm. Analytical performance was further evaluated using a Levey–Jennings chart and Westgard rules to assess data reliability. The results demonstrate that TXRF provides a rapid and cost-effective alternative for arsenic determination in milkfish, supporting routine monitoring of contamination and ensuring seafood safety.

Abstract ID No. 38

Comparative Evaluation of Drinking Water Supply Options in a Makati Office Using pH and Turbidity Measurement Uncertainty in Cost-Based Decision-Making

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In urban office settings, drinking water is commonly provided either through externally supplied filtered water or through point-of-use filtration systems installed within the workplace. Although both options are generally regarded as suitable for routine use, their evaluation is often based on simple screening measurements whose uncertainty may affect interpretation and cost-based decision-making. This study proposes a comparative evaluation of these two drinking water supply options in a Makati office by examining how uncertainty in pH and turbidity measurements may influence practical workplace decisions.

Measurements will be conducted during regular workdays over a one-month period using a multiparameter water quality meter. Water from externally supplied filtered drinking water and from a small office filtration machine will be assessed through repeated pH and turbidity measurements under routine operating conditions. Measurement variability and expanded uncertainty will be estimated for each supply option, with particular attention to observations near predefined internal acceptability thresholds.

A scenario-based analysis will then be applied to examine how uncertainty in measured values may influence comparative decisions, including continued use, retesting, preventive maintenance, filter replacement, or continuation of outsourced supply. The related cost implications of these actions will also be considered.

The study is expected to provide an applied framework for incorporating measurement uncertainty into the routine evaluation of office drinking water arrangements. More broadly, it aims to show how metrological reliability may support more consistent cost-based decisions in workplace water management.

Abstract ID No. 39

Multicriteria Selection of Candidate Substances for Density Certified Reference Materials Using the Analytic Hierarchy Process

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The selection of suitable candidate substances for the development of certified reference materials (CRMs) for density measurements is critical to ensuring metrological traceability and reliable calibration of density measurement systems. This process involves evaluating multiple physico-chemical, practical, and safety-related criteria, which often leads to complex decision-making scenarios. In this study, the Analytic Hierarchy Process (AHP) is employed as a structured multicriteria decision-making methodology to support the systematic evaluation and prioritization of potential candidate substances for density CRMs. Relevant selection criteria were identified based on metro-logical requirements, practical laboratory considerations, and safety aspects associated with hydro-static weighing procedures and the production of CRMs in accordance with ISO 17034 guidelines. The criteria considered include density value, toxicity, viscosity, corrosivity, vapor pressure, surface tension, hygroscopicity, flammability, ignition point, thermal expansion and compressibility coefficients, purity, ease of acquisition, and chemical reactivity. A set of candidate substances, including tetrachloroethylene, dodecane, ethylene glycol, FC-40, saline solutions, water–glycerin mixtures, dichlorotoluene, bromobenzene, and dimethyl phthalate, was evaluated through pairwise comparisons within the AHP framework. This approach allowed the determination of relative weights for each criterion and the derivation of an overall ranking of the candidate substances. The results demonstrate that AHP provides a transparent and systematic decision-support tool for CRM selection, enabling the balanced consideration of metrological performance, safety, environmental impact, and practical implementation. The proposed methodology contributes to strengthening the development of density CRMs at density standards laboratories and may be extended to other reference-material development processes.

Abstract ID No. 42

A Traceable Smart Meteorological Research Station for High-Accuracy Monitoring: Edge Computing, M2M Communication and Dynamic Data Science Models

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High-quality meteorological observations are essential for advancing climate science, especially with growing climate variability and extreme weather events. This paper presents the development and management of a traceable smart meteorological research station operated as part of the research infrastructure of LNEC – National Laboratory for Civil Engineering in Lisbon, Portugal. The initiative addresses key research and development and innovation (R&DI) management challenges associated with ensuring long-term measurement accuracy, metrological traceability, high-frequency data acquisition, and reliable data integration for climate research.

The infrastructure was designed to address the growing need for robust environmental monitoring platforms that support multidisciplinary climate research. A major challenge in managing such R&DI infrastructures is ensuring the quality, comparability, and sustainability of long-term datasets while enabling technological innovation. To address these challenges, the station integrates high-precision sensors supported by a traceability-oriented calibration framework aligned with Testing, Inspection and Certification (TIC) principles.

The system incorporates a smart communication architecture based on Machine-to-Machine (M2M) technologies and edge computing techniques, enabling autonomous operation, continuous monitoring, and efficient data transmission. In parallel, a dedicated data science framework processes high-frequency meteorological data using dynamic modelling. Edge computing techniques support data validation, anomaly detection, and adaptive quality control, improving the reliability and usability of the generated datasets, while M2M communications enables the processing of high volumes of data and metadata with minimal human interaction throughout the process.

From an R&DI management perspective, the infrastructure provides a scalable platform for experimentation, methodological development, and integration with emerging environmental observation networks. Its implementation strengthens the capacity of LNEC to generate high-quality climate and autonomous data systems, supporting research on atmospheric processes and improving scientific understanding of extreme climatic phenomena.

The proposed approach demonstrates how combining metrological rigor, intelligent digital infrastructures, and advanced data analytics can significantly bring added value to the data sets and enhance the scientific impact and operational value of meteorological research infrastructures.

Abstract ID No. 43

Prioritization of Packaging Safety Testing Services through Stake-holder Demand Analysis in the Philippine Packaging Industry

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The strategic development of testing laboratories to strengthen packaging industry competitiveness requires alignment with stakeholder demands to ensure relevance and sustainability. This study assessed the priorities of 75 stakeholders for local technical services related to food contact article safety. Participants, including packaging manufacturers and food and beverage brand owners, completed a structured survey to identify priority testing needs in the packaging sector. Descriptive statistical analysis and demand ranking were performed to determine utilization patterns and ser-vice gaps. Results indicate that plastic packaging is the most frequently handled material, reported by 73.3% of respondents, followed by other packaging materials (38.7%). Despite broad recognition of the importance of contact article safety testing, routine laboratory engagement remains limited. About 51% of respondents reported conducting chemical testing only once per year, suggesting that testing is performed intermittently rather than as part of systematic quality monitoring programs. When testing is undertaken, it is primarily driven by internal quality assurance and control (69.3%), customer requirements (54.7%), and regulatory compliance (41.3%). Respondents identified migration testing (32.0%), heavy metal determination (22.7%), and barrier property evaluation (16.0%) as priority analytical services. These priorities may reflect increasing industry awareness influenced by FDA AO No. 2022-011 on voluntary certification and labeling requirements for food contact articles. Overall, the findings reveal a gap between the recognized importance of packaging safety testing and current laboratory utilization, highlighting the need for expanded laboratory capacity, stakeholder engagement, and targeted capability development to strengthen the packaging safety testing ecosystem and national quality infrastructure in the Philippines.

Abstract ID No. 45

Bridging Competency Gaps: A Training Needs Assessment for ISO/IEC 17025:2017 in Laboratory Settings in the Asia Pacific

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Strengthening competencies for ISO/IEC 17025:2017 implementation is essential for ensuring laboratory quality and accreditation readiness. This study assessed training needs, priorities, and delivery preferences among laboratory professionals. A cross-sectional survey of 79 respondents from diverse laboratory settings was conducted. The instrument captured familiarity with the standard, priority training topics, and preferences for course design and delivery. Descriptive statistics were used to analyze responses. Most respondents reported moderate to advanced familiarity with ISO/IEC 17025:2017 (81%). Online training was highly valued (mean = 4.52/5), reflecting strong acceptance of digital formats. Key course design features were consistently rated as highly important (mean range: 4.44–4.80), with top priorities including certification (4.80), clear instructor presentation (4.77), and well-structured delivery (4.75). Instructor expertise, responsiveness, and alignment of content with current standards and organizational goals were also emphasized (≥4.72). While still important, quizzes and assessments received relatively lower ratings (4.44). Respondents expressed strong demand for practical, implementation-focused training supported by real-world applications. There is a clear need for structured, expert-led, and application-oriented ISO/IEC 17025:2017 training, with a strong preference for online delivery. Programs should emphasize clarity, relevance, and certification while aligning with evolving laboratory requirements. These findings provide a basis for designing targeted capacity-building initiatives to enhance laboratory competence and accreditation outcomes.

Abstract ID No. 46

Assessment of Methods for Analytical Testing of Soluble Sulfates in Construction Materials: Integrating Measurement Uncertainty and Proficiency Testing

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Accurate soluble sulfate quantification in construction materials is essential for verifying compliance with relevant standards for structural integrity and safety. This study presents a comprehensive method performance assessment for acid- and water-soluble sulfates in construction materials through method validation, measurement uncertainty evaluation, and proficiency testing (PT) participation.

Measurement uncertainty was evaluated using a hybrid bottom-up/top-down approach, following ISO/IEC Guide 98-3:2008 (GUM) and EURACHEM/CITAC Guide CG 4. The uncertainty budget revealed that calibration curves (43.42% and 24.36%), method precision (25.77% and 11.93%), and method trueness (15.41% and 53.88%) were the primary contributors for both methods. Conversely, gravimetric and volumetric operations contributed minimally. This indicates that targeted improvements in calibration procedures and method performance would yield the greatest reduction in over-all measurement uncertainty, enhancing measurement quality.

To externally validate analytical performance, the laboratory participated in DRRR GmbH organized PT schemes: RVEP 240916 (Aggregate) and RVEP 240909 (Cement) in 2025. The laboratory obtained satisfactory z'-scores in both schemes, confirming method accuracy and laboratory technical competence.

These findings demonstrate that combination of method validation, measurement uncertainty evaluation, and PT participation provides a strong framework for quality assurance. This comprehensive approach ensures that validated methods for soluble sulfates quantification are fit for intended purpose, delivering the accurate, reliable, and metrologically traceable test results essential for the construction industry.

Abstract ID No. 47

Application of Statistical Process Control (SPC) for Monitoring Stability and Variability in Perfluorooctane Sulfonate (PFOS) and Perfluorooctanesulfonic Acid (PFOA) Migration Measurements

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Reliable quantification of per- and polyfluoroalkyl substances (PFAS) in food-contact materials re-quires not only analytical sensitivity but also stable and consistent measurement performance. This study applies statistical process control (SPC) techniques to monitor the stability and variability of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) migration measurements generated from multi-analyst replicate datasets across low, medium, and high concentration levels. X-bar and range (R) control charts were constructed to evaluate subgroup means and within-group variability. For PFOS, the overall mean concentration ($\bar{\bar{X}}$) was 270.77 ng/100 cm^2 with an average range ($\bar{R}$) of 32.34 ng/100 cm^2, yielding X-bar control limits of 237.69–303.85 ng/100 cm^2 and an R-chart upper control limit (UCL) of 83.24 ng/100 cm^2. For PFOA, $\bar{\bar{X}}$ and $\bar{R}$ were 299.94 ng/100 cm^2 and 45.43 ng/100 cm^2, corresponding to X-bar control limits of 253.46–346.41 ng/100 cm^2 and an R-chart UCL of 116.94 ng/100 cm^2. Seven subgroups for each analyte exceeded X-bar control limits, primarily reflecting systematic variation across concentration levels rather than instability of the measurement process. In contrast, R charts demonstrated stable within-subgroup variability for PFOS, while PFOA exhibited one out-of-control subgroup exceeding the R-chart UCL, indicating localized variability. Increased variability at lower concentration levels was observed for both analytes. These findings demonstrate that SPC is an effective tool for monitoring measurement stability and variability in PFAS migration analysis. Integration of control chart techniques into routine lab-oratory workflows can enhance quality assurance, support ISO/IEC 17025 compliance, and improve confidence in analytical results.

Abstract ID No. 48

Measurement Capability of TXRF for Trace Heavy Metal Detection in Epoxy-Based Die Attach Adhesives

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The detection and quantification of hazardous substances in electronic materials are essential for compliance with the Restriction on Hazardous Substances (RoHS) directive and for minimizing environmental and health risks associated with electronic waste. In the semiconductor and electronics (S&E) industry, reliable analytical techniques are required to accurately screen raw materials for trace heavy metal contamination. This study presents the development of a measurement method for trace heavy metals in epoxy-based die attach adhesives using Total Reflection X-Ray Fluorescence (TXRF) spectroscopy.

Method development focused on calibration, sample preparation, and measurement optimization to support reliable quantification. Dissolution experiments were conducted to determine a suitable solvent for sample preparation, with acetone selected for its effective dilution capability and lower safety risks compared with other tested solvents. Element-specific sensitivity factors were deter-mined for bromine (Br), chromium (Cr), mercury (Hg), lead (Pb), and cadmium (Cd) using reference concentrations of 30 ppm and 100 ppm.

The resulting calibration produced measured concentrations closely matching the expected values, demonstrating acceptable measurement accuracy within the targeted regulatory range. Measurement conditions were further optimized by evaluating the analysis time required for stable signal intensity, with peak stabilization observed at approximately 1200 seconds.

Application of the developed method to epoxy samples from semiconductor assembly facilities showed heavy metal concentrations below the RoHS limits of 100 ppm for Cd and 1000 ppm for other elements, demonstrating that TXRF provides a rapid and reliable screening method for heavy metal detection in epoxy-based materials.

Abstract ID No. 49

Chemometric Characterization of Arsenic Speciation and Geo-chemical Drivers of Arsenic Toxicity in the Molawin-Maahas River System, Los Baños, Laguna, Philippines

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Molawin Creek, located within the Makiling Forest Reserve, serves as a domestic water source that connects to the Maahas River and eventually drains into Laguna de Bay. The volcanic geology of this area contributes to the natural occurrence of As and its toxicity. However, As toxicity depends on its chemical form, and there remains a limited understanding of the factors affecting its speciation in this river system. This study addressed this gap by investigating As occurrence across five sampling points (Upstream, Midstream 1, Midstream 2, Convergence, and Downstream) and applying chemometric analysis to identify the geochemical drivers of its toxicity.

Monitoring results indicated that total As from midstream to downstream exceeded the 10 µg/L limit set by DAO 2016-08 for Class B waters. Spearman correlation and PCA revealed that Arsenic mobility is influenced by geogenic weathering (Iron, Chlorides, and other ions), anthropogenic inputs (COD and Phosphate), and temperature. Kruskal–Wallis analysis confirmed significant spatial variability for total Arsenic (X_2 = 13.03, p = 0.011) and the As(III):As(V) ratio (X_2= 13.50, p = 0.009). These findings were supported by the Hierarchical Cluster Analysis which independently categorized the system into three groups (Upstream; Midstream-Downstream; and Convergence) based on total arsenic and speciation ratios, isolating the Convergence Site as a unique toxicity hotspot. Oxidation-reduction potential was found to be the key driver for the As(III):As(V) ratio (ρ = -0.63), suggesting that reducing conditions favor the toxic As(III) species, and stabilized by pH (ρ = -0.79). This is evident in the Convergence Site which reached a high As(III):As(V) ratio of 0.70.

These findings provide a scientific basis for ecological risk assessment and targeted arsenic mitigation and removal strategies. Continued monitoring is recommended to support sustainable environmental management and safeguard public health within the Molawin–Maahas River system.

Abstract ID No. 50

Structural Characteristics, Mechanical and Corrosion Inhibition Performance of Epoxy-Polyaniline Coating

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Epoxy-based coatings are widely used for metal protection due to their excellent chemical and corrosion resistance. Recent advances have demonstrated improved performance in epoxy-polyaniline (epoxy-Pani) systems, where Pani functions as a barrier-forming filler that promotes surface passivation. However, most studies emphasize electrochemical behavior, with limited attention to mechanical robustness, which is essential for coatings subjected to mechanical stress and damage in service.

In this work, epoxy-Pani coatings were synthesized and evaluated for their combined corrosion resistance, structural characteristics and mechanical performance. Pani fillers were prepared via oxidative polymerization of aniline using ammonium peroxydisulfate (APS) and subsequently dispersed in an epoxy matrix with N-methyl-2-pyrrolidone (NMP) as a processing aid. The coatings were de-posited on machined mild steel substrates via silk-screen printing. Structural characterization was conducted using X-ray diffraction (XRD) and scanning electron microscopy (SEM). Electrochemical performance was evaluated onto coated metal substrate using cyclic voltammetry (CV), alongside adhesion and bending tests to determine mechanical integrity.

Results confirmed the successful formation of semi-crystalline Pani and its incorporation within the predominantly amorphous epoxy matrix. SEM analysis revealed a dense, uniform, and low-porosity coating structure, indicative of effective barrier properties. The epoxy-Pani coating achieved a corrosion inhibition efficiency of 75.00%, outperforming neat epoxy coating (45.77%). Additionally, excellent adhesion (ASTM D3359) and crack-free performance under bending demonstrated superior mechanical resilience. These findings highlight epoxy-Pani coating as a promising, practical, and environmentally conscious solution for durable anticorrosion applications under mechanically demanding conditions.

Abstract ID No. 52

Matrix Uncertainty in select food items from the Philippines ac-cording to ISO 19036:2019

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Matrix Uncertainty is an independent component in the estimation of uncertainty in microbiological tests that arises from the microbial distribution of a specific food item. It was introduced in the 2019 version of ISO 19036 as a fixed value or an estimate from experiments performed in repeatability conditions. Laboratories accredited to ISO/IEC 17025:2017 are required to estimate the uncertainty of their measurements, including the influence of food matrices on test results. Although there are various published matrix uncertainty studies, most are based on international food commodities. This study aimed to determine matrix uncertainties of select Filipino food products. Direct determination of matrix uncertainties was performed by enumerating the aerobic (mesophilic) bacteria (US FDA Bacteriological Analytical Manual) and Total Coliform and *Enterobacteriaceae* Count (Petrifilm Methods). Multiple test portions (11 x 10 g) of each sample were tested and the standard deviations of repeatability (s_r) were computed. Results show that liquid samples (i.e. beverages) have the low-est matrix uncertainties while complex matrices such as meat and multi-component items reveal higher heterogeneity of microbial distribution. Further work is recommended since many local food products have distinct ingredients and processing methods that differ from those used to establish existing matrix uncertainty data, which will significantly affect microbiological test variability in the Philippines.

Abstract ID No. 53

Influence of NaOH Concentration on Magnetite Film Quality and Performance in Steel Blackening

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Alkaline blackening is widely utilized for steel components due to its process simplicity, dimensional stability, and ability to provide moderate corrosion protection. To optimize a low-concentration alkaline blackening method for safe and reliable application, it is essential to establish a clear relationship between NaOH concentration, oxide film characteristics, and the resulting corrosion performance. Hence, this study investigates the influence of NaOH concentration on magnetite (Fe_3O_4) film formation and the resulting performance of alkaline-blackened steel surfaces. Blackening treatments were conducted using 20%, 40%, and 60% NaOH solutions with sodium nitrate as the oxidizing agent under a controlled immersion time of 40 minutes.

Coating characteristics were evaluated through salt spray testing, cyclic voltammetry (CV), thick-ness and roughness measurement, scanning electron microscopy (SEM), energy-dispersive spectroscopy (EDS), and qualitative oxalic acid spot testing. All treated samples exhibited improved corrosion resistance compared with bare steel. Increasing NaOH concentration promoted thicker oxide layer formation but also resulted in increased microscale surface roughness. Although dis-tinct Fe_3O_4 peaks were not clearly resolved by X-ray diffraction (XRD) due to the coating thickness (2.17–3.57 μm), complementary microstructural and compositional analyses confirmed the formation of a Fe_3O_4-based coating. The 40% NaOH condition, on the other hand, produced a continuous and uniform iron oxide layer with minimal surface irregularities, indicating an optimal balance between coating growth and surface quality. Correspondingly, this condition exhibited superior corrosion resistance compared to the other coatings. These suggests that corrosion protection is maximized at an intermediate NaOH concentration, rather than exhibiting a linear dependence on concentration.

Abstract ID No. 54

Analytical Testing of Nicotine Levels in Commercially Available E-cigarette Liquids in the Philippines using an HPLC-PDA Method

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Accurate quantification of nicotine in electronic cigarette liquids (e-liquids) is essential for regula-tory compliance, labeling transparency, and consumer protection. This study describes the development and validation of a high-performance liquid chromatography with photodiode array detection (HPLC–PDA) method for nicotine analytical testing, and its application to 22 randomly selected commercially available e-liquid products in the Philippines. The method demonstrated satisfactory analytical performance and was deemed fit-for-purpose, with trueness evaluated using a certified reference material (ERM®-DZ002). Application of the validated method revealed notable discrepancies between labeled and measured nicotine concentrations. Measured values ranged from 1.13 to 26.8 mg/mL and were consistently lower than declared amounts, with absolute percentage differences of 13% to 84%. Bland–Altman analysis indicated a systematic negative bias, with a mean difference of approximately−9 mg/mL, suggesting widespread under-labeling discrepancies. Products labeled between 24 and 50 mg/mL exhibited significantly lower measured concentrations; for instance, products labeled at 30 mg/mL and 50 mg/mL yielded 24.5 mg/mL and 26.8 mg/mL, respectively. In accordance with Philippines Republic Act No. 11900, which permits nicotine concentrations up to 65 mg/mL, all measured values complied with regulatory limit. However, the observed discrepancies raise concerns regarding labeling accuracy and product consistency. These variations may be attributed to manufacturing variability, formulation complexity, and nicotine degradation during storage. Overall, the findings highlight inconsistencies between labeled and actual nicotine content in commercial e-liquids and underscore the need for robust analytical verification, enhanced post-market surveillance, and strengthened regulatory enforcement.

Abstract ID No. 55

Digital Transformation of LNEC Laboratories: A Smart LIMS Architecture Integrating AI, M2M Communication and Automated Data Analytics

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Laboratories operating under the requirements of ISO/IEC 17025 face increasing challenges related to data management, traceability, operational efficiency, and the integration of digital technologies. In the context of the Testing, Inspection and Certification (TIC) sector, the digital transformation of laboratory infrastructures is essential to ensure reliability, transparency, and scalability of technical activities. This paper presents the concept and development of a smart Laboratory Information Management System (LIMS) platform designed to support intelligent laboratory operations at LNEC – National Laboratory for Civil Engineering.

The proposed platform integrates key elements of the laboratory quality management system within a unified digital architecture, including client interaction and service management, method lifecycle management, and metrological control of instrumentation. A central feature of the system is the incorporation of Artificial Intelligence (AI) tools to support technical and experimental activities, including automated data validation, anomaly detection, and decision support during testing and calibration processes.

The platform will use Machine-to-Machine (M2M) communication to enable direct interaction between laboratory instruments and the LIMS environment, reducing manual data handling and improving measurement integrity. In addition, the system supports the implementation of Digital Calibration Certificates, facilitating traceability, interoperability, and secure digital exchange of calibration information. Advanced data analytics modules allow automated processing, visualization, and interpretation of experimental results.

By combining AI-driven functionalities, smart connectivity, and digital metrology concepts, the proposed LIMS architecture contributes to the development of more intelligent and efficient laboratories. The platform represents an important step toward modernizing research and testing infrastructures at LNEC, enabling improved data quality, enhanced operational management, and stronger integration within emerging digital ecosystems of the TIC sector.

Abstract ID No. 57

Characterisation of potentiometric sensors for sweat analysis

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Electrochemical wearable sensors represent an innovative and effective solution to monitor the health status of people in real-time, providing relevant information about hydration level and sweat composition. Thanks to their low cost and non-invasiveness, they can be easily deployed in telemedicine to support decentralised home-care networks and reduce hospitalisations.

The present work proposes the development of a wearable device composed of different sensors able to monitor skin hydration by impedance spectroscopy measurements and also to track ions and metabolites concentration in sweat using potentiometric and amperometric sensors, respectively. The contribution will report results on the characterisation of potentiometric sensors, using ion-selective membranes, for sodium and potassium monitoring. Potential influence of interferents commonly present in sweat will be discussed, in particular considering interfering compounds containing magnesium, calcium, and ammonium ions. Moreover, the possible sensor drifts after continuous use will be addressed, providing some quantitative parameters to assess them.

This research was funded in the framework of the project “MuSe: Multi-Sensor Wearable Device for Telemedicine”by the Italian Ministry of University and Research (MUR) under the PRIN 2022 program (project code 2022WT443M, CUP E53C24002640006).

Abstract ID No. 59

Validation of Measurement System for Testing Wetsuits Thermal Properties

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A novel and refined measurement system for testing neoprene wetsuits in accordance with CEN EN 14225-1:2017 is discussed. The system provides automated temperature measurements (using a Lab-VIEW Virtual Instrument) with multiple calibrated Pt-100 sensors placed both inside and outside a cylindrical phantom enclosed by the wetsuit under test. The phantom is placed in a large water tank with a volume of >500 L, chilled by a dedicated cooling system to an (external, cold) temperature of some 11 °C, and the absolute pressure can be regulated from 1 bar up to 6 bar. The water inside the phantom is heated to an (internal, warm) temperature of some 38 °C, by an electrical heater which thermal and electrical power, $P=UI$, is precisely known by voltage (U) and current (I) measurements. In the 2 years of tests performed on several wetsuit samples and using different temperature conditions, under both transient and stationary operations, at 1 bar or 6 bar pressure, a large amount of experience on the testing of neoprene wetsuits has been achieved. Results of different measurements and uncertainty, as well as pitfalls and tricks about testing the thermal resistance of neoprene wetsuits, will be reported at the Conference.

Abstract ID No. 60

Advancing Metrology for Extreme Electrical Currents: Traceability, Uncertainty Analysis, and Conformity Assessment

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The international metrology infrastructure is developing with two relevant orientations: to enable measurement capabilities for extreme (very high or very low) physical quantities not covered by the existing laboratory facilities, or to increase the measurement accuracy through decreasing measurement uncertainty by innovation, improvement or modification of already existing measurement procedures. The calibration of instruments for extreme, both low and high electrical current is a metrologically very challenging task, due to factors like a complex measurement procedure needed to be validated, unestablished international measurement traceability chain for extreme current values to the SI units, and high number of influential factors in the uncertainty budget. Based on the conducted thorough analysis of the current calibration and measurement capabilities in the area of extreme electrical current at international level, the developed calibration procedure for instruments for extreme electrical currents by the Laboratory for Electrical Measurements (LEM) at the Ss. Cyril and Methodius University will be presented. The uncertainty of the calibration results will be analyzed by applying the GUM approach as well as the advanced Monte Carlo methodology. For that purposes an original software MonteCalc Uncertainty Toolkit, developed in LabVIEW by LEM will be applied. The results derived by the two methods will be compared and discussed by using experimental data. Based on the uncertainty propagation distribution gained by the two approached, assessment of the conformity compliance of calibration artefacts in particular measurement points will be conducted against prescribed decision-making rules embedded in the MonteCalc Uncertainty Toolkit.

Abstract ID No. 61

Simultaneous Determination of Common Food Preservatives in Selected Sauce Products in the Philippine Market by HPLC-PDA Method

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Food safety is a fundamental component of public health protection and international trade, necessitating strict compliance with regulatory standards governing food additives. Chemical preservatives such as benzoic acid, sorbic acid, and parabens are widely employed to inhibit microbial spoilage in sauce-based products; however, excessive concentrations may pose potential health risks. Accordingly, robust and metrologically traceable analytical methods are essential for regulatory enforcement and quality assurance. In this study, an in-house validated High-Performance Liquid Chromatography–Photodiode Array (HPLC–PDA) method was employed for the simultaneous quantification of benzoic acid, sorbic acid, methylparaben, and propylparaben in various sauce matrices. Samples, including tomato and banana ketchups, pasta sauces, and soy sauce, were obtained randomly from selected stores in Metro Manila, Philippines. The method demonstrated detection and quantification limits ranging from 0.01–0.17 mg/kg and 0.04–0.58 mg/kg, respectively. Results indicated that sodium benzoate was the most frequently detected preservative. Measurement results were metrologically traceable to the International System of Units (SI) through the use of the Certified Reference Materials (CRM). While the majority of samples complied with established regulatory limits and labeling requirements, four (4) products were found to contain undeclared benzoic acid, although concentrations remained within the maximum allowable limits (MAL). Overall, the validated method is demonstrated to be suitable for routine analytical testing supporting regulatory monitoring of preservatives in complex food matrices. The findings further underscore the importance of cooperation between testing laboratories and regulators in continuous market surveillance to ensure compliance with labeling regulations and to safeguard consumer health.

Abstract ID No. 62

Assessment of a Direct Mercury Analyzer Method for Rapid De-termination and Monitoring of Total Mercury in Harvested Fish

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The Laguna Lake Development Authority (LLDA) is mandated to ensure the comprehensive management of Laguna de Bay, including the control of contaminants affecting aquatic resources. To strengthen LLDA's capacity for pollution monitoring, this study assessed a rapid method for deter-mining total mercury in fish using a direct mercury analyzer that performs thermal decomposition, amalgamation, and atomic absorption without requiring sample preparation. Using 19.1-52.2 mg of milkfish meat, the method exhibited limits of detection (0.417 ug/kg) and quantification (1.39 ug/kg) well below 10% of the 500 ug/kg maximum limit set in the Codex Alimentarius for mercury in most fish. Linearity was established from 0.522 to 25.2 ug/kg (r = 0.9999) with a working range extending until 101 ug/kg (r = 1.000), demonstrating proportional relationship between concentration and peak height. Residual analysis showed random scatter around zero, indicating good model fit. Trueness by bias, assessed using DORM-4, was within the reference material's certified value and expanded uncertainty (412 +/- 36 ug/kg) while trueness by recovery, evaluated by spiking fish muscle with NIST SRM 3133, was within the 60-115% acceptable range. Repeatability at 2.76 ug/kg and 77.5 ug/kg (total mercury of actual milkfish samples) yielded %RSDs (5.04% and 1.24% respectively) below their corresponding thresholds. Uncertainty estimation identified reference material (90.8%), calibration curve (8.54%), and sample weight (0.408%) as major contributors. Overall, the method passed all performance characteristics evaluated using Eurachem procedures and AOAC criteria. Follow through studies may include spatial and temporal analyses of harvested fish from Laguna de Bay for monitoring applications.

Abstract ID No. 63

Low-Cost Barometer Calibration Using a Desiccant Jar-Based Vacuum Chamber in the Philippines

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A cost-effective and accessible vacuum system was developed by repurposing a standard desiccant jar into a functional vacuum chamber for barometric pressure calibration. The straightforward fabrication process involved modifying the jar to ensure airtight sealing and integrating appropriate fittings to connect it with a vacuum pump and a reference manometer. This simple yet robust con-figuration provides a controlled, low-pressure environment without specialized vacuum chambers. To evaluate its performance, an experimental setup connected the fabricated chamber to a calibrated barometer as the pressure reference. The vacuum pump varied internal pressure systematically within the range of 950 hPa to 1015 hPa, aligning with local calibration needs. The measurement principle involved a direct pressure comparison between the reference manometer and the barometers, ensuring traceable and reliable results.

Experimental results demonstrate that the repurposed system can achieve stable and repeatable pressure conditions within the target range suitable for barometer calibration. This indicates that the setup can reliably support calibration needs, fostering trust among metrology stakeholders. The observed agreement between the reference manometer and the test instruments suggests acceptable accuracy for practical purposes. Minor deviations were attributed to potential leakage, temperature effects, and limitations in sealing efficiency, which can be further optimized.

The study confirms the feasibility of low-cost, improvised equipment for metrological applications, especially in resource-limited settings. This approach provides a practical alternative for initial calibration, with acceptable measurement reliability. Addressing minor issues like leakage and sealing limitations offers opportunities for future enhancements in sealing, automation, and uncertainty assessment, encouraging continued innovation in affordable calibration methods.

Abstract ID No. 64

New perspectives in chemical measurements for dentistry

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Restorative dentistry focuses on the repair or replacement of damaged, decayed, or missing teeth, aiming to restore both masticatory function and natural aesthetics while preserving healthy dental structure. Despite significant advances, key challenges remain, including understanding the effects of restorative treatments on dental tissues and developing reliable methods for the early detection of carious lesions.

In this study, chemical measurement techniques, such as Raman spectroscopy and impedance spectroscopy integrated with neural classifiers, are investigated as diagnostic and analytical tools. These approaches provide insights into the interaction between restorative materials and dental tissues at molecular and structural levels, as well as enabling early detection of tooth demineralization.

Raman spectroscopy is employed to evaluate changes in the dentin matrix following exposure to endodontic irrigants (NaOCl, EDTA) and the application of commercial adhesive systems. Further-more, its combination with impedance measurements allows for a more comprehensive assessment of demineralization processes.

Preliminary in vitro results demonstrate the potential of these techniques for both the development of innovative remineralizing materials and the design of highly sensitive and selective diagnostic devices for carious lesion detection.

Abstract ID No. 65

Rin film technologies for gas cylinders passivation

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This work explores the application of low-pressure plasma technologies for the control and under-standing of gas –surface interactions in high-pressure gas cylinders. Thin film technology encompasses a wide range of non-equilibrium processes for advanced surface modification of materials. Among these, low-pressure plasmas, also called cold plasmas, are particularly effective for deposit-ing protective coatings with tailored chemical composition and structure, as well as for introducing specific chemical functionalities onto substrate surfaces. Additionally, cold plasma treatments enable controlled chemical modifications, such as nanoscale oxidation of metallic surfaces.

In this study, the feasibility of low-pressure plasma treatments is investigated with the aim of improving the stability of gas mixtures stored in high-pressure cylinders. This represents an open challenge in gas metrology, where maintaining long-term stability and comparability of certified reference materials (CRMs) is essential.

The research focuses on identifying optimal combinations of gas species and cylinder materials to minimize surface-induced interactions, particularly at low amount fractions. The results are expected to contribute to enhanced reliability and traceability in gas measurements by enabling better control of gas–surface phenomena.

Abstract ID No. 67

Evaluation of Laboratory Performance in Food Nutrient Measurements: Proficiency Testing of Infant Formula (2011–2024)

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Precise and consistent measurements are the foundation of both quality assurance and regulation, especially for complex food matrices such as infant formula. In the Philippines, infant formulas are strictly regulated and vary in composition, thus, reliable nutrient analysis is critical. The Department of Science and Technology–Food and Nutrition Research Institute (DOST-FNRI) as the country's sole ISO 17043-accredited provider of proficiency testing (PT) for food nutrients, routinely offers PT on infant formula.

This study assesses laboratory performance across four PT rounds for infant formula conducted in 2011, 2016, 2021, and 2024. The evaluations encompassed proximate components—moisture, fat, protein, and ash—as well as selected minerals, specifically iron, calcium, sodium, potassium, and zinc. The participants varied from 15 to 38 laboratories, representing government, industry, and private sectors. To ensure comparability, standardized evaluation was employed, utilizing consensus values derived from participant results and z'/z-scores ($|z'/z| \leq 2$ indicating satisfactory performance).

Results indicate an upward trend, with improved satisfactory performance for fat and ash, and protein increasing from 71% in 2011 to 100% in 2024. Minerals content, particularly calcium, sodium and zinc, showed improvement. These trends are indicative of both improved laboratory capabilities and inherent difficulties associated with complex matrices and methodological variations.

The PT program underscores the nation's advancing proficiency in nutrient assessment, identifies areas necessitating harmonization efforts, and facilitates regulation. As a recommendation for future rounds, additional parameters such as vitamins, fatty acids, and other minerals should be incorporated to expand analytical coverage and further strengthen the measurement comparability and traceability.

Abstract ID No. 68

Forward and inverse risk geometry in conformity assessment: linking acceptance probability and conformance probability

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Conformity assessment under measurement uncertainty can be viewed from two related yet distinct perspectives. The first is a forward approach based on the probability of acceptance for an item with a true property value x, denoted as $P_a(x) = P\,(Y_m \in A \mid X = x)$, where A represents the acceptance interval, and Y_m is the measured value. The second perspective is an inverse approach, aligned with JCGM 106:2012, which considers the posterior probability of conformity for an item with observed measurement y, expressed as $p_c(y) = P\,(X \in C \mid Y_m = y)$, where C indicates the tolerance interval.

This paper introduces a concise dual framework that connects the two concepts through a joint model of production and measurement. It demonstrates that $P_a(x)$ functions as a forward acceptance operator, whereas $p_c(y)$ functions as an inverse conformity operator. For additive measurement errors, $P_a(x)$ can be formulated as a sliding-window finite difference of the error's cumulative distribution function, offering a simple geometric interpretation of its extremal points.

In the normal–normal case, closed-form solutions are derived for both $P_a(x)$ and $p_c(y)$, enabling straightforward comparison of their shapes and peaks. A numerical example with guard banding illustrates that the point maximising forward acceptance probability need not be identical to that maximising posterior conformity probability. This discrepancy is not contradictory but results from conditioning on different variables and using different informational bases: the measurement system alone in the forward context, and both the measurement system and the process distribution in the inverse context. The framework thus provides a valuable conceptual link for risk-based conformity assessment.

Abstract ID No. 70

Validation of a Direct Saponification GC-FID Method for Cholesterol Determination in Selected Foods

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Accurate determination of cholesterol in foods is essential for nutrition labeling and regulatory compliance, particularly in the Philippines where declaration is mandated by Food and Drug Administration guidelines. This study presents the validation of a gas chromatography–flame ionization detection (GC-FID) method for simplified cholesterol analysis across food matrices. The method is a direct saponification technique enabling a rapid and cost-efficient analysis.

Method detection limit was established with LOD and LOQ values of 0.9930 mg/100g and 3.3100 mg/100g, respectively. Instrument-level sensitivity showed LOD and LOQ of 0.0077 mg/mL and 0.0081 mg/mL respectively. The method exhibited good linearity (r = 0.9949) across the working range (0.0199 - 0.1987 mg/mL).

Precision and accuracy were evaluated using NIST SRM 1869 and quality control materials ranging from cereals, fish and meat-based matrices. Repeatability (6-8 replicates) results showed $\%RSD_r$ values from 1.66% to 4.66%, while intermediate precision (6-7 days) had acceptable $\%PRSD_R$ ranging from 2.56% to 5.41% Assessment of trueness demonstrated that all matrices are within respective acceptable ranges.

Method performance was further supported by satisfactory participation in BIPEA proficiency testing, with z-scores of −0.56 (butter biscuit) and −1.25 (clinical nutrition cream). The method is currently applied in routine testing services for nutrition labeling and research and development samples.

Overall, the validated method is fit for purpose, providing reliable and comparable cholesterol measurements across diverse food matrices. Continued participation in proficiency testing programs is recommended to further strengthen measurement comparability and long-term analytical performance.

Abstract ID No. 71

Method Validation Using Isocratic RP-HPLC-PDA Assay for Simultaneous Quantification of Acetaminophen and Caffeine in Local Pharmaceutical Formulations

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The combination of acetaminophen (APAP) and caffeine (CF) is an FDA-recognized formulation for pain management. Given their prevalence in pharmaceutical products, establishing a validated analytical method for their simultaneous quantification is essential to ensure consumer safety and dosage accuracy. This study validated a Reversed-Phase HPLC (RP-HPLC) method using Photodiode Array (PDA) detection for the robust quantification of APAP and CF in local pharmaceuticals. Chromatographic separation was performed using a Shimadzu Nexera LC-40 system with an Inertsil ODS column. Based on spectral analysis, detection was set at absorbance maxima of 245 nm (APAP) and 273 nm (CF). Samples were separated using methanol:water, with optimal baseline separation (resolution ≥ 2.0) achieved using an isocratic mobile phase of methanol and water (60:40, v/v) at 1.0 mL/min. Calibration curves with concentration ranges of 1–100 mg/L were used for both analytes. The method was validated for linearity, selectivity, precision, and robustness. Linearity was established from 1–100 mg/L, with residual plots confirming a random distribution. LOD values were reported as 0.2 mg/L (APAP) and 0.8 mg/L (CF), and LOQ values of 0.7 mg/L and 3 mg/L, respectively. Trueness was verified via recovery studies within acceptable limits, complemented by satisfactory repeatability and robustness across evaluated performance criteria.

The RP-HPLC-PDA method is validated for its intended purpose. Results from different performance criteria confirm its suitability for simultaneous quantification of APAP and CF as part of routine quality control and regulatory compliance of local pharmaceuticals.

Abstract ID No. 74

Validation of a Dual-Channel Ion Chromatography Method for Multi-Ion Determination and Environmental Water Quality Assessment

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A dual-channel ion chromatography method enabling the simultaneous determination of nitrite (NO_2^-), nitrate (NO_3^-), phosphate (PO_4^{3-}), and ammonium (NH_4^+) in environmental water samples was validated according to Eurachem Guidelines. Method performance was evaluated through selectivity, linearity, sensitivity, limits of detection and quantification, precision, trueness, and measurement uncertainty assessment. Chromatographic separation achieved complete resolution of target ions within 26 min, with resolution values exceeding 1.5 and absence of interfering peaks, confirming high selectivity. Excellent linearity was obtained across working ranges of 0.04–0.16 mg L^{-1} (NO_2^-), 0.1–5.0 mg L^{-1} (NO_3^- and PO_4^{3-}), and 0.04–4.0 mg L^{-1} (NH_4^+), yielding correlation coefficients between 0.9951 and 0.9998 with randomly distributed residuals. Enhanced sensitivity for nitrite and nitrate was achieved using UV–Vis detection, producing signal responses up to 24-fold higher than conductivity detection. Limits of detection ranged from 0.001 to 0.011 mg L^{-1}, while limits of quantification ranged from 0.003 to 0.037 mg L^{-1}. Repeatability and intermediate precision demonstrated %RSD values below 3.6% with no statistically significant inter-day variation ($p > 0.05$). Trueness evaluation indicated spike recoveries within 80–110% and percent bias below 2%. The validated method was ap-plied to freshwater samples from Tikub Lake (Tiaong, Quezon, Philippines) and the Bagtingon River (Marinduque, Philippines), allowing for reliable quantification of target inorganic ions in these environmental matrices. Measurement uncertainty was estimated from validation data, providing a quantitative indication of the reliability and confidence of the analytical results. This study demonstrates that the validated method is fit for its intended purpose in routine multi-ion monitoring and comprehensive freshwater quality assessment. By meeting established analytical requirements, this methodology provides the innovative measurements necessary to support industrial compliance, environmental stewardship, and public health initiatives.

Abstract ID No. 76

Physico-Mechanical Comparative Analysis of Coco Lumber and Coco Peat Powder-Reinforced Polyester Resin Composite Fiber-boards as an Eco-Friendly Substitute for Medium-Density Fiber-boards

Authors: Emerson Leonard M. Mata[1]; John Vergel O. Mendoza[1]; Lee Rotchel C. Orpilla[1]; Ray Antonette B. Padilla[1]; Blessie A. Basilia [1]

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Medium-density fiberboard (MDF) is widely used in furniture and interior construction but commonly relies on urea–formaldehyde binders that present environmental and health concerns. Coconut-derived residues such as coco peat and coco lumber are abundant agricultural byproducts in the Philippines and may serve as reinforcement materials for alternative composite panels. In this study, coco peat powder and coco lumber powder were evaluated as untreated particulate reinforcements in an R10-103 orthophthalic unsaturated polyester resin matrix at filler volume fractions of 10% and 25%, with neat resin used as the control. Composite specimens were fabricated using 3D-printed PLA molds and tested for tensile strength in accordance with ASTM D3039 and water absorption following ASTM D570. All specimens exhibited linear-elastic behavior followed by brittle fracture. Increasing coco peat content reduced tensile strength, whereas coco lumber reinforcement resulted in improved tensile performance at higher filler loading, attributed to improved mechanical inter-locking between angular particles and the polymer matrix. After 24 h immersion, reinforced composites exhibited water absorption of approximately 0.1–0.2 g, compared with 0.6 g for the neat resin specimen. Among the tested formulations, the 25% coco lumber composite demonstrated the most favorable balance of tensile performance and moisture resistance. These results indicate that coco lumber powder shows potential as a reinforcement material for composite panels intended as alternatives to conventional MDF.

Abstract ID No. 77

Influence of Solvent-Type on the Structure and Surface Wettability of PVDF/O-MMT Composite Membranes

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Poly(vinylidene fluoride) (PVDF) membranes are attractive for oil/water separation, but their performance depends strongly on crystalline phase, morphology, and surface properties. This study investigates how solvent selection and low-loading organically modified montmorillonite (O-MMT, 0.25 wt%) influence the structure and wettability of PVDF membranes fabricated by non-solvent-induced phase separation (NIPS) using N-methyl-2-pyrrolidone (NMP) and N, N-dimethylacetamide (DMAc). X-ray diffraction shows that NMP promotes a highly crystalline α-phase PVDF matrix, whereas DMAc yields γ-phase-rich membranes with lower crystallinity. SEM reveals rougher, more porous, and interconnected surfaces in NMP-based membranes, with O-MMT further refining the pore structure, while DMAc-based membranes are smoother and exhibit clay agglomeration. FTIR confirms the PVDF backbone and Si–O bands from O-MMT, and water contact angle measurements show that NMP-cast membranes become more water-repellent upon clay addition, whereas DMAc-based membranes change little, highlighting solvent-dependent control of PVDF/O-MMT membrane sur-face properties.

Abstract ID No. 78

Multivariate Analysis of Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) Migration Measurements Using Principal Component Analysis (PCA)

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Understanding the sources of variability in chemical migration measurements is essential for ensuring data reliability and supporting regulatory decision-making. This study applies Principal Com-ponent Analysis (PCA) to evaluate the multivariate structure of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) migration measurements obtained from multi-analyst replicate datasets across low, medium, and high concentration levels. PCA was performed on standardized concentration data to identify dominant patterns and assess potential sources of variability. The first principal component (PC1), representing concentration-driven variation, accounted for 98.79% of the total variance, while the second principal component (PC2), associated with minor residual variability, explained only 1.21%. Clear separation of low, medium, and high concentration measurements was observed along PC1, indicating that variability is primarily governed by concentration level rather than measurement instability. PCA loadings showed strong positive contributions from both PFOS and PFOA, confirming a high degree of correlation between the analytes. No pronounced clustering by analyst was observed in the PCA score plots, suggesting minimal operator-induced variability relative to concentration effects. These findings demonstrate that PCA is an effective tool for identifying dominant sources of variability and for distinguishing systematic variation from potential measurement inconsistencies. The application of multivariate analysis provides valuable insights into measurement behavior and supports improved interpretation of PFAS migration data in chemical testing laboratories.

Abstract ID No. 80

Assessment of Conventional Mass Drift in Working Mass Standards

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The significance of accurate and reliable mass measurements extends from advanced scientific research to everyday commercial transactions. Mass Standards are material measure of mass with controlled physical and metrological properties such as shape, surface quality, density and maximum permissible error (MPE). These are classified according to accuracy, ranging from OIML Class E1 (highest) to OIML Class M3 (lowest). They are primarily used to calibrate, verify, and test Non-Automatic Weighing Instruments (NAWI).

Over time, mass standards are subject to gradual changes in mass due to handling, routine use, surface contamination, and material interaction with the environment. This study presents a comprehensive assessment of the drift in the conventional mass of working mass standards maintained by the Mass Standards Section (MSS) of the Department of Science and Technology –Industrial Technology Development Institute (DOST-ITDI) – National Metrology Laboratory of the Philippines (NML-Phil). It aims to quantify the drift rates and estimate the service life of these masses as a reliable standard for mass measurement and NAWI evaluation.

This assessment of conventional mass drift is based on the repeated calibration data of MSS' working mass standards over the years –covering different available accuracy classes to explore and evaluate variation in their stability. Results show that the drift in every calibration are relatively small, however, accumulates over time. Frequently used mass standards exhibits noticeable drift with some approaching to the set tolerance (about one-third of the MPE) after only few calibration cycles.

The findings provide insight into the longevity of different classes of working standards under typical usage conditions. These can be helpful for laboratories in planning their calibration interval, improving handling and storage practices, and making informed decisions regarding the maintenance and replacement of mass standards.

Abstract ID No. 81

Development of Proficiency Test Materials For Dairy Products

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To ensure technical competence, laboratories participate regularly in proficiency testing (PT) schemes, which provide external assessment of a laboratory's performance in specific analyses. This is vital for quality assurance and is required for ISO/IEC 17025 accreditation. In the Philippines, there are 47 PAB-accredited laboratories for food testing. It shows an evident need for accessible PT schemes, but there are still no local PT providers for select food matrices. This forces laboratories to outsource services abroad, despite higher costs and importation restrictions. To address this need, the Metrology in Biology (MiB) section of the NML aims to develop PT items by optimizing existing methods used in previous PT item development. The chosen analyte and food matrix were *E. coli* ATCC 25922 and skim milk powder, respectively. The analyte study included growth curve analysis, which established the harvest time of 15–17 hrs for *E. coli* cells. Cells were immobilized via freeze-drying, which resulted in 70% recovery. The milk was sterilized via irradiation with a 15 kGy dose to preserve its physical properties. Batch production of freeze-dried cells yielded 90 units, and these were tested for homogeneity and stability. Results showed that the PT material is homogeneous and stable for 112 days at -20℃ to -18℃ and 35 days at 4-8℃. Since the PT material proved to be homogeneous and stable, a new batch should be prepared using the optimized conditions. This can potentially serve as the PT item for future PT schemes that MiB is aiming to provide to local laboratories.

Abstract ID No. 82

Black Metals and Aerogels as Highly Porous Platforms for Chemical Sensors

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Nanostructured porous materials offer an attractive route toward highly sensitive chemical sensors because they combine a large active surface area with tunable electrical and sorption properties. This contribution summarizes our work on black metals as functional layers for chemical sensing and outlines its extension toward aerogel-based sensing materials. Black metal films, prepared as highly porous nanostructured layers, were investigated as active and transducing elements in chemiresistive and quartz crystal microbalance sensors. Their performance is governed by the relationship between deposition conditions, morphology, porosity, electrical conductivity, and analyte transport. Our results show that black metals provide a versatile platform for enhancing sensor response through their developed surface, controllable microstructure, and compatibility with further functionalization by organic receptor materials. These features enable improved sensitivity and open a path toward selective hybrid architectures for gas detection. Current work expands this concept to aerogels, whose extremely low density, high porosity, and large internal surface make them promising materials for next-generation chemical sensors. In combination with conductive or receptor-active phases, aerogels can support efficient analyte uptake while maintaining favorable transport and transduction characteristics. The contribution therefore highlights a common mate-rials strategy based on engineered porosity and interfacial design, showing how black metals and aerogels can be exploited as complementary platforms for low-power chemical sensing.

Abstract ID No. 83

Surface modified black metals for gas sensors and light utilization in sensing

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Co-authors: Dejan Prokop[1]; Eva Maresova[1]; Jan Kejzlar[2]; Jan Lancok[1]; Jaroslav Otta[3]; Joris More-Chevalier[1]; Martin Hruska[4]; Martin Vrňata[5]; Petr Hruska[1]; Petr Pokorny[1]; Premysl Fitl[5]; Raivo Jaaniso[3]; Sarka Havlova[6]; Sergii Chertopalov[1]; Tereza Hodná[5]

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Black metals (BMs) thin films, benefiting from highly porous structure and large effective surface, provide a good potential toward applications in light absorbers and chemical sensors. BMs can be used as an active layer in gas sensing applications based on electrochemical, chemiresistors or Quartz Crystal Microbalance (QCM) sensors. PVD techniques such as magnetron sputtering and evaporation have been successfully employed for the BMs films preparation.

The functionalization of the black metal surface to improve on its gas sensing properties was in-vestigated. Selected materials included nickel oxide, copper nitride, metal phthalocyanines, MXene Ti_3C_2, ferrocene, TiO_2:Sm and ZnO:Eu. Several analytes, ie. NO_x, H_2, ethanol vapor, and O_2, were tested for gas sensing. The effect of light of various wavelengths (UV-VIS-NIR) on sensor proper-ties was investigated. Improvement of the sensing properties of the prepared layers was observed on certain analytes on qualities such as recovery, response rate and selectivity. Synergic combi-nation of the BMs and lanthanoide doped oxide layers revealed potential toward development of novel multivariable single gas sensor employing measurement of photoluminescence excited by UV light combined simultaneously with either electrical (AC/DC) conductivity or sorption processes by QCM.

Abstract ID No. 84

Interdigitated Sensors' Geometry Influence on Temperature and Humidity Response

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Wearable interdigitated sensors, inkjet-printed on flexible substrates, were developed and tested for monitoring skin temperature and humidity on the human body. The study was aimed at the experimental characterization of the sensors' behavior with respect to their geometry and, in particular, to the sensor's area. The sensors are made of 8 interdigitated fingers, with 4 different lengths, printed on a 50 μm Kapton film to provide robust and repeatable printing while maintaining sensors' flexibility. Impedance measurements were conducted in air on the 4 different sensing areas, with frequency sweeps from 1 kHz to 1 MHz, highlighting a capacitive behavior with the capacitance value increasing with the area and with good linear sensitivity to the temperature. The relative temperature sensitivity with respect to the area value is higher for the sensors with a smaller area. The sensors exhibit an exponential sensitivity to relative humidity (RH), increasing with the RH value and again with a higher sensitivity associated with the smaller sensor's area. However, in the case of RH sensing, the sensitivity of the small-area sensor is limited to the high-humidity range, above 50% RH, while the large-area sensor provides good sensitivity in a much broader humidity range, starting at 20% RH and above. Our conclusion is that smaller-area sensors enhance local responsiveness to moisture-related dielectric changes, which may be advantageous for the detection of rapid or localized hydration variations. Instead, larger-area sensors average out local environmental fluctuations, providing smoother and more stable signals suitable for long-term wearable monitoring.

This research was funded in the framework of the project "MuSe: Multi-Sensor Wearable Device for Telemedicine" by the Italian Ministry of University and Research (MUR) under the PRIN 2022 program (project code 2022WT443M, CUP E53C24002640006).

Abstract ID No. 85

Automating LC-MS Method Validation for Food Safety: A Software-Assisted Approach Using ValChrom

Author: Christian Laurio[1]
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Method validation is a critical prerequisite in analytical chemistry to guarantee the reliability, accuracy, and legal defensibility of quantitative data. However, translating the extensive scientific literature and diverse regulatory guidelines into practice presents a significant challenge for analytical chemists, who must frequently navigate conflicting terminologies, assessment criteria, and complex statistical workflows. To address these hurdles, this study demonstrates the use of ValChrom, a specialized software solution designed to standardize and automate analytical method validation. As a proof-of-concept, the software was applied to validate a liquid chromatography-mass spectrometry (LC-MS) method for the determination of two post-harvest pesticides, imazalil and thiabendazole, in orange matrices, in accordance with the Eurachem guide. The validation comprehensively evaluated the calibration function, limit of detection (LOD), limit of quantification (LOQ), precision (repeatability and intermediate precision), and accuracy (recovery). While conventional validation workflows rely on manual, user-defined spreadsheets—which are inherently susceptible to transcription errors, formula corruption, and limited audit traceability—ValChrom provides a robust, compliant alternative. The software ensures data integrity through automated statistical processing and standardized reporting. This study demonstrates that transitioning from rudimentary spreadsheets to dedicated method validation software significantly mitigates operational risk, reduces data processing bottle-necks, and enhances regulatory compliance in routine food safety workflows.

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