

TECH 1: Technology Showcase I

Chair: James Jasko, *ICOF America, Inc.; a Member of Musim Mas Group, USA*

High Performance Structural Analysis of Fat Crystals, Oils, Waxes, and Gels Using Passive Thermally-activated Microrheology Maxime Bazin¹, Giovanni Brambilla¹, Roland Ramsch¹, Mathias Fleury¹, Matt Vanden Eynden^{*2}, and Gerard Meunier¹, ¹*Formulation, France*; ²*Formulation, USA*

New methods for passively analyzing sensitive and bulk samples is evident based upon inherent issues with current sampling methods for traditional thermal analysis. By using Diffusing Wave Spectroscopy (DWS) coupled with an accurate temperature ramp, we can analyze the movement of micron-sized particles and correlate their motion to their viscoelastic and rheological properties. By observing the movement of these particles during crystallization and melting transitions, it is possible to identify specific crystalline structures present in an end-use product, as well as track the changes that can occur to these structures during repeated heating and cooling cycles. Here, we will present how this method can apply to the accurate prediction of chocolate blooming by monitoring the crystal structure evolution of cocoa crystals. We will also present methods for determining properties of palm oils, carnauba waxes and beeswaxes, and mixtures thereof in order to determine optimal blending formulations and transition temperature curves. Additionally, analysis of baked goods, butters and margarines, and organogels will be discussed.

Application of Gas Chromatography-vacuum Ultraviolet Absorption Detection to the Analysis of Fatty Acid Methyl Esters Jonathan Smuts^{*1}, Phillip Walsh¹, Kevin A. Schug², and Paul Johnson¹, ¹*VUV Analytics, USA*; ²*University of Texas, USA*

Fatty acids and their corresponding methyl esters (FAMES) are important analytes for consideration in terms of food science, nutrition, and bio-based fuels. Typically, these are characterized by gas chromatography – mass spectrometry (GC-MS), but the complexity of the system, as well as many closely related isomers and isobars, can make complete

speciation difficult. We have applied a new vacuum ultraviolet absorption detector for GC (GC-VUV) to demonstrate its superior capability for FAME characterization. GC-VUV measures the absorption of eluting compounds in the 115 – 240 nm range where all chemical species absorb. Each FAME and class of FAME have unique absorption features that enable both qualitative and quantitative analysis. The differentiation of FAMES is demonstrated with standard mixtures, as well as mixtures of FAMES prepared from various food oils. GC-VUV is shown to be extremely well adept at characterizing FAME compositions from real oil samples without significant interferences.

New Distillation Applications in the Fats and Oil Industry Robert J. Schavey^{*}, *VTA GmbH & Co., KG, USA*

This is a summary of the new developments in the Fats and Oils industry using Wiped Film Molecular distillation technology. • New Distillation applications in the Fats & Oil Industry • EPA/DHA Distillation o Pesticide Removal o Concentration alternatives to Molecular Distillation o Deodorization • Lecithin Drying o 0.3% residual moisture o Cooling alternatives to Scraped Surface Heat Exchangers • Tocopherol-Concentration alternatives to Molecular Distillation • Hemp Oil Distillation-Concentrating CBD and separation via distillation • Cannabis Oil Concentration

Enabling High Performance in Low Temperature Washing with Enzymes and Chemistry Keith E. Gutowski^{*}, *BASF Corporation, USA*

New formats and claims toward compaction, convenience, and sustainability are at the forefront of the changing liquid laundry detergent market. One of the most potentially impactful claims intends to alter consumer behavior by encouraging washing in cold water. Consumers agree that setting their washing machine dials to cold is a step toward reducing their energy consumption, keeping money in their pockets, and mitigating their carbon footprint. However, they perceive that washing with cold water reduces stain

removal and overall efficacy of their detergents. Consumers also question whether cold water can provide an adequate level of hygiene and odor removal. BASF has developed a new solution for enabling consumers to choose cold water detergents without having to compromise on total cleaning performance: Lavergy™ Pro 104 L. Combined with a complete offering of detergent ingredients and formulating know-how, BASF's new protease Lavergy™ Pro 104 L supplies the power to achieve superior efficacy, differentiation at low temperatures, and broad formulation compatibility to customers who expect sustainable, high-performing solutions.

UltraPerformance Convergence Chromatography™ for Food Analysis Jinchuan Yang*, *Waters, USA*

UltraPerformance Convergence Chromatography™ (UPC2) is a separation technique that leverages the unique properties of compressed CO₂ at or near its supercritical state, i.e., low viscosity and high diffusivity, and sub-two micron particle packed columns to improve separation efficiency, speed, and selectivity. In this talk, we will highlight the application of UPC2 in various applications, including fatty acids and vitamins, and the advantageous of UPC2 technology.

Introducing the Vapor Pro® XL—A Chemical Free Karl Fischer Alternative Quincy Biamonte and Garrett Rowe*, *Arizona Instrument LLC, USA*

Moisture in frying oils causes more than just popping - it can also affect the frying process itself well as the consistency and flavor of the final product. Monitoring the moisture content of new and used frying oils can help you maintain quality and consistency of both your frying oils and your final products. So, whether you use peanut, olive, corn, mustard or an oil that is altogether unique, moisture analysis is essential to your production process. Moisture analysis of frying oils has traditionally been performed using Karl Fischer (KF) titration. Although the results are both accurate and precise, maintenance is both costly and labor intensive. The testing process itself is also complicated and requires special training to operate with the consistency needed to obtain accurate and repeatable results. An alternative is the Vapor Pro® XL by

Computrac®. The Vapor Pro® XL (VPXL) is a chemical free alternative to Karl Fischer titration that is able to give moisture specific results without the use of hazardous chemical reagents or complicated test procedures. It requires little maintenance or training and allows users to test a variety of samples with the touch of a button. The Vapor Pro® XL is equipped with a touchscreen and redesigned navigational menus, making it the most user-friendly Computrac® to date. It also features an upgraded heater, is compatible with multiple sizes of sample bottles, and is equipped with stepped temperature testing capabilities for enhanced method development.

Reduction of Toxins in Fish Oil from PPM to PPB in a Specialized Passive Stripper at Micron-level Vacuum Perry Alasti, Csky Young*, and Caitlin A. Davis, *Artisan Industries Inc., USA*

Artisan Industries manufactures gravity-fed disc-and-tray stripping columns which are used to remove undesirable trace organics in oil products. In most cases, residual concentration specifications in the ppb range can be met with the normal equipment design. In the case study to be presented, relatively low vapor pressure toxins were successfully removed from fish oil by modifying the stripper design for continuous operation at 0.1 torr, permitting trace contaminant removal at temperatures below the threshold at which decomposition becomes a risk. The equipment employed was an Artisan Evaporator/Stripper™ modified with low pressure drop chimneys, along with a Jet-Vac® multi-stage steam jet vacuum system. Neither the stripper nor the vacuum equipment have any moving parts and both are easy to clean, providing the combined advantages of low product loss, extended campaign times, and fewer maintenance intervals.

Optimized GC Column Selectivity for Fast Separation of Complex Cis/Trans Fatty Acid Methyl Esters (FAMES) A.

Carl Sanchez, Marc Gregerson, Ramkumar Dhandapani*, Kristen Parnell, and Timothy Anderson, *Phenomenex, USA*

Testing of fatty acid methyl esters (FAMES) by GC is valuable in determining both an oil's unique fingerprint

as well as authenticity. As such, it is a routine method that is commonly performed, especially for testing of products with high incentive for adulteration such as olive oil. Historically, GC columns with polyethylene glycol stationary phases were popular for the analysis of simple FAMES. Analysis of complex cis/trans and detailed FAMES, however, is typically challenging to complete in a short time period using these columns. In this study, we present an optimized high-cyano stationary phase, Zebron ZB-FAME, designed to improve resolution of complex cis/trans FAME mixtures. Commercially available oils, including olive oil, were derivatized and analyzed using traditional phases along with the optimized ZB-FAME column. The potential for using two-dimensional GC to improve separation is also explored. The experiment revealed key differences in resolution and run time amongst the phases, as well as a high potential for time and cost savings using the optimized ZB-FAME stationary phase.

The Power of Controlled Flow Cavitation to Enhance Degumming, Refining, and Biodiesel Operations Oleg Kozyuk¹, Paul Reinking², and Darren J. Little*³, ¹*ASI Chief Technology Officer, Ukraine*; ²*ASI Director of New Applications Engineering, USA*; ³*Arisdyne Systems, Inc., USA*

An overview of the application of controlled flow cavitation (CFC™) and compression-decompression jet atomization (C/DC) phenomenon for the intensification of chemical processing applications is presented. For vegetable oil acid degumming and/or neutralization reactions, the reasons for enhanced performance of the refining operation, reduced environmental impact, observed reduction in necessary acid and/or caustic addition as well as decrease in oil loss, potential savings in steam consumption and decrease in maintenance opex is discussed and industrial scale examples given. The efficient removal of residual soaps, phosphorus, ffa and metals while minimizing and in some cases even eliminating the need for water washing or silica addition is also described. Finally, the power of controlled flow

cavitation to reduce catalyst consumption up to 25%, increase throughput up to 20%, and reduce monoglyceride content in finished biodiesel is also described.

NMR Spectroscopy Will be the Answer of All Your Questions Bernd W.K Diehl* and Elina Zailer, *Spectral Service AG, Germany*

NMR Spectroscopy has been used in analytical laboratories for several decades to analyze compounds in complex pharmaceutical compounds, cosmetics, foods, pesticides as well as in forensic and medical samples. However, quantitative NMR can be used to determine concentration of one or more chemical species in one sample – the advantage of NMR! One sample is prepared and analyzed once and several parameters are determined from just one spectrum. Anisidine, iodine, peroxide value, saturation, free fatty acids, omega-3 fatty acids, sterols, diglycerides – all oil quality parameters in only one analysis run by the NMR holistic control of oils. Do you want to assay the chemical modification of native oil components and by entry of foreign components during extraction and refining? Are you interested in the characterization of lipid oxidation, the analysis of low peroxide values in edible and fish oils, krill oils, lecithin and fats? Do you want to analyze the vegetable source of a given lecithin? And how much Polyethylene glycol can be found in your skin creams and toothpastes? Are you interested in quality control of pharmaceutical products? Can you imagine that NMR can determine inorganic cations in food matrices? And which phospholipids are present in infant nutrition? The answer for all these questions is the NMR spectroscopy – our scientific service. Spectral Service is an independent private laboratory, which is GMP- and GLP-certified as well as approved by the US Food and Drug Administration (FDA). With our 25 years' experience we will have an answer to all of your questions!

TECH 2: Technology Showcase II

Chair: Bob Schavey, VTA GmbH & Co., KG, USA

Unlock your Surfactant Space Steffen Eller*, *Chemspeed Technologies AG, Switzerland*

Virtually any product from chemical industry from nutrition, personal and home care, agrochemical products to lubricants contain surfactants as a key component. However, there is an industrial desire and a consumer demand to replace conventional surfactants with naturally derived, sustainably sourced and biodegradable alternatives. Switching from one surfactant to another, keeping the same product properties and performance is a tough challenge for the formulation chemist. Chemspeed has been providing fully automated solutions to accelerate and standardize formulation R+D in the chemical industry for more than 10 years. By combining overhead gravimetric dispensing of virtually any ingredient with parallel high-performance formulation vessels, our solutions enable faster and better, virtually unrestricted investigation of both the raw material and the process space, i.e. screening of new components (High-Throughput) and shifting from “know-how” to “know-why” (High-Output). The presentation covers a selection of case studies in order to highlight the beneficial use:

- Sample preparation for analysis, e.g. routine analysis of fatty acids in food oil
- Formulation and testing of food and beverages
- Formulation and testing of lubricating oils and greases
- Formulation and testing of agrochemical emulsion concentrates
- Formulation and testing of micro-encapsulation in home care and personal care

New Polymeric Co-builder to Improve Stain Removal and Whiteness in Liquid Laundry Detergents Fabio Costiniti*, and Diego Boscardin, *Italmatch Chemicals S.p.A., Italy*

Laundry formulations generally include chelating agents in order to manage water hardness and optimize the action of the active ingredients, such as the surfactant system, to get their full functionality. The most common builder is citrate. The standard builder system is frequently supported by polymeric co-builders that actively help with water hardness ions and at the same time deliver anti-redeposition properties. Avoiding redeposition of dirt is key to maintain the degree of whiteness desired. One of the industry focuses is in the development of new co-builders to boost both primary and secondary performance of liquid laundry detergents. In this paper, we will present a new polymeric material that delivers overall improvements in stain removal performance and whiteness maintenance when tested in US and/or European conditions and on standardized technical stains or white fabrics. Our performance data indicate that, when dosed on top of a premium regular liquid laundry detergent, a small addition of this material can maintain or improve the performance, even after a 20% dosage reduction of the liquid laundry detergent.

An Independent State-of-the-Art Pilot and Demonstration Facility for Bio-Based Products and Processes Sophie LKW Roelants*¹, Brecht Vanlerberghe¹, Lieve Hofflack¹, Katrien Molders¹, Frederik De Bruyn¹, Hendrik Waegeman¹, and Wim Soetaert², ¹*Bio Base Europe Pilot Plant, Belgium*;

²*Centre for Industrial Biotechnology and Biocatalysis (InBio.be), Ghent University, Belgium*

Bio Base Europe Pilot Plant (BBEPP) is an open

innovation pilot and demonstration facility for process development, scale-up and custom manufacturing of bio-based products and processes from lab to multi ton scale. A wide and flexible spectrum of modular unit operations combined with a team of highly trained and experienced engineers, process operators and technicians facilitates the translation of bio-based laboratory processes into viable industrial processes. BBEPP offers equipment and expertise in the field of biomass pretreatment, biocatalysis, (gas) fermentation, green chemistry and purification and product recovery. Over the last three years Bio Base Europe Pilot Plant has successfully performed over 250 projects for more than 150 companies. Why did these companies team up with BBEPP?

1. To save time and money thanks to our unique combination of equipment and expertise: A broad variety of state-of-the-art technical solutions is available at different scales, including:
Fermentation scale up to 15 m³
Gas fermentation facilities
A wide range of DSP unit operations from bench-top to multi ton scale • Combination of fermentation and Ex proof downstream processing...
2. BBEPP is an independent facility. We have no industrial shareholders and operate in full confidentiality.
3. Flexibility: We design the project outline to your needs and flexibly build up process lines that can be operated 24/7.
4. Transparency: A close communication throughout the project ensures a seamless technology transfer in both directions. We welcome your presence at our facilities during the trials.
5. Quality management systems: ISO9001, FSSC22000 BBEPP is a global player and collaborates with companies and research institutes from all over the world (Europe, Asia and

The Americas). We assisted many key players in the biobased economy with their developments and managed to build up a vast network.

Proposing: C10-P Shin Arimoto *, *The Nisshin OilliO Group, Ltd., Japan*

The structuring of triacylglycerol brings about different functions for the formulation of oils and fats. The Nisshin OilliO Group has always been intrigued about what different structures of triacylglycerol can do to the fat design, the taste and feel of diverse food applications, and the distinct nutritional functions. One type of structured triacylglycerols that has become one of the pillars of our oils and fats R&D/business is the medium-chain triacylglyceride (MCT). Embracing 50 years' experience with MCTs, and with a bit of luck, we have recently developed C10-P. C10-P is MCT. The triacylglyceride is "structured". Over 90% of the fatty acids are C10 (capric acid). C10-P is powderized and 100% pure, which means that no diluent is used. The mean particle diameter of the powder is 40 micrometers. At first it is liquid; all you have to do is cool it. No special equipment is necessary. C10-P may hold the key to take the function of MCTs, structural or nutritional, to a higher level.

Direct Carbohydrate Analysis in Beverages and Foods Using Pulsed Amperometric Detection or Charged Aerosol Detection Lori Dolata*, *Thermo Fisher Scientific, USA*

Carbohydrates are important food components affecting taste and nutrition. The determination of the types and levels of carbohydrates in foods is important for energy evaluation, nutritional labeling, and quality control and for identifying possible product adulteration. Separation and detection of carbohydrates can be challenging. Simple carbohydrates are highly polar, uncharged, and as they lack a chromophore cannot be

measured directly by UV absorbance detectors. HPLC with various detection techniques has been used for carbohydrate analysis, such as IR, mass spectrometry, UV or fluorescence following derivatization. Although methods utilize derivatization improve the chromatographic

resolution and detector sensitivity, they can lead to increased assay variability. This presentation discusses two approaches for direct carbohydrate analysis, HPLC-PAD and HPLC-CAD, which solve the challenges for separation and detection without requirement for derivatization.