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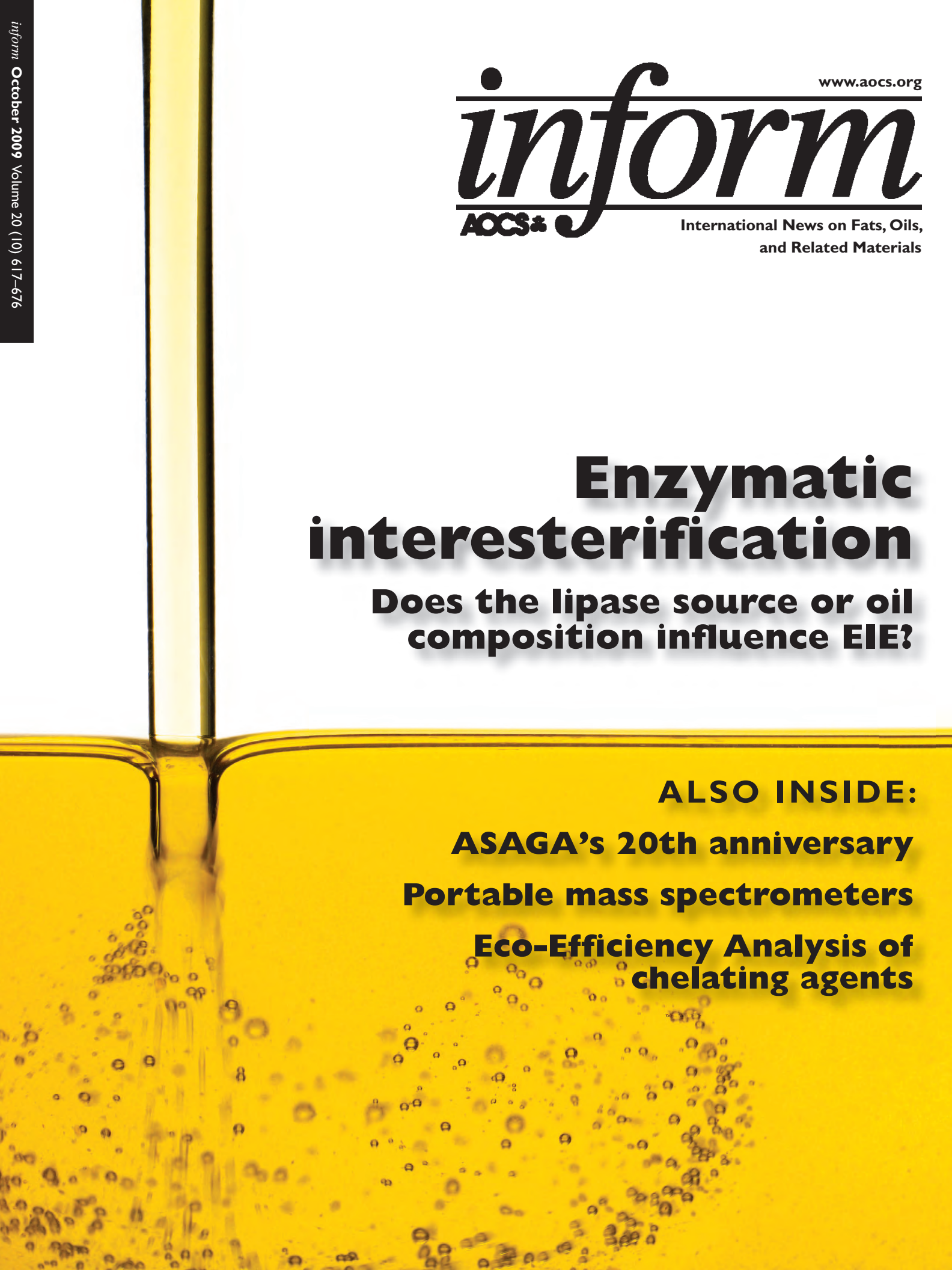
International News on Fats, Oils, and Related Materials

Enzymatic interesterification

Does the lipase source or oil composition influence EIE?



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Departments and Information

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Calendar

Bold type: *new listing*
For details on these and other upcoming meetings, visit www.aocs.org/meetings.

November

November 1–4, 2009. Annual Conference and Exhibition of the International Society for Nutraceuticals and Functional Foods, San Francisco, California, USA. Information: www.isnff.org.

November 1–5, 2009. ASA-CSSA-SSSA (American Society of Agronomy-Crop Science Society of America-Soil Science Society of American) 2009 International Annual Meetings, Pittsburgh, Pennsylvania, USA. Information. www.acsmeetings.org.

November 1–6, 2009. XIII Congreso Latinoamericano de Grasas y Aceites (XIII Latin American Congress on Fats & Oils), Metropolitano Events and Convention Center, Rosario, Argentina. Information: e-mail: asaga@asaga.org.ar; www.congreso.asaga.org.ar/eu.

November 2–4, 2009. BIO-Europe, 15th Annual International Partnering Conference, Messe Wien Exhibition & Congress Center, Vienna, Austria. Information: www.ebdgroup.com/bioeurope.

November 2–4, 2009. 7th Roundtable Meeting on Sustainable Palm Oil, Hotel Istana, Kuala Lumpur, Malaysia. Information: e-mail: rt7@rspo.org; www.rspo.org.

November 2–5, 2009. Soya & Oilseed Summit 2009/Global Soybean & Grain Transport 2009, The Roosevelt Hotel, New Orleans, Louisiana, USA. Information: www.soyatechevents.com.

November 8–12, 2009. 29th Practical Short Course on Vegetable Oil Extraction, Texas A&M University, Food Protein R&D Center, College Station, TX, USA. Information: e-mail: rclough@tamu.edu; http://foodprotein.tamu.edu/extraction-protein/scvegoil.php.

November 9–12, 2009. Malaysian Palm Oil Board International Palm Oil Congress 2009 (PIPOC 2009), Kuala Lumpur, Malaysia. Information: e-mail: pipoc2009@mpob.gov.my; www.mpob.gov.my or www.conferencealerts.com/seeconf.mv?q=ca1xmhs3.

November 10–11, 2009. 4th European Bioplastics Conference, Ritz Carlton Hotel, Berlin, Germany. Information: e-mail: info@european-bioplastics.org; www.european-bioplastics.org.

November 14–15, 2009. 3rd Practical Short Course: Industrial Uses of Vegetable Oils: Biodiesel, Ink, Solvents, Lubricants, and Bio-Plastics, Munich, Germany. Information: www.smartshortcourses.com or www.aocs.org/meetings/biodiesel09/index.cfm/2nd-International-Congress-on-Biodiesel-3rd-Practical-Short-Course.

November 14–19, 2009. Association for the Advancement of Industrial Crops 21st Annual Meeting: The Next Generation of Industrial Crops, Processes, and Products, Termas de Chillán, Chillán, Chile. Information: www.aaic.org/2009_meeting.htm.

November 15–17, 2009. 2nd International Congress on Biodiesel: The Science and the Technologies, The Westin Grand München Arabellapark Hotel, Munich, Germany. Information: www.aocs.org/meetings/biodiesel09.

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AOCS Meeting Watch

November 14–15, 2009. 3rd Practical Short Course: Industrial Uses of Vegetable Oils: Biodiesel, Ink, Biobased Solvents, and Lubricants, Munich, Germany. Information: www.smartshortcourses.com or www.aocs.org/meetings/biodiesel09/index.cfm/2nd-International-Congress-on-Biodiesel-3rd-Practical-Short-Course.

November 15–17, 2009. 2nd International Congress on Biodiesel: The Science and the Technologies, The Westin Grand München Arabellapark Hotel, Munich, Germany. Information: www.aocs.org/meetings/biodiesel09.

May 16–19, 2010. 101st AOCS Annual Meeting and Expo, Phoenix Convention Center, Phoenix, Arizona, USA. Information: http://Annual_Mtg.aocs.org; phone: +1-217-359-2344; fax: +1-217-351-8091; e-mail: meetings@aocs.org.

For in-depth details on these and other upcoming meetings, visit www.aocs.org/meetings.

November 17–19, 2009. Food Ingredients Europe 2009/Natural Ingredients 2009, Frankfurt Messe, Frankfurt, Germany. Information: www.fi-events.com.

November 17–19, 2009. CHEM SHOW: Processing Solutions for a Changing Marketplace, Javits Convention Center, New York City, USA. Information: www.chemshow.com.

November 25–28, 2009. Beijing Conference and Exhibition on Instrumental Analysis, China National Convention Center, Beijing, China. Information: www.bceia.cn/2009.

November 30–December 1, 2009. Fuels of the Future 2009: 7th International Congress for Biofuels of BEE and UFOP, International Congress Centre ICC, Berlin, Germany. Information: www.kraftstoffe-der-zukunft.com; http://event.bioenergie.de.

December

December 1–4, 2009. Indonesian Palm Oil Conference and Price Outlook 2010, Bali International Convention Centre, The Westin Resort, Nusa Dua, Bali, Indonesia. Information: phone: +603-7877-8458; e-mail: IPOC2010@gbworks.com.my; www.gapkiconference.org.

December 3–4, 2009. 2nd JatrophaWorld Americas, Miami, Florida, USA. Information: www.futureenergyevents.com/jatropha.

December 6–10, 2009. CSPA (Consumer Specialty Products Association) Annual Meeting, Marriott Harbor Beach Resort, Fort Lauderdale, Florida, USA. Information: www.cspa.org.

December 6–10, 2009. International Symposium on Olive Irrigation and Oil Quality, Nazareth, Israel. Information: www.olive-irrigation-symposium.org.

December 9–11, 2009. 64th Annual Convention and International Conference on Oils, Fats, Fuels and Surfactants of the Oil Technologists Association of India, Hotel Crowne Plaza, New Delhi, India. Information: www.icoffs09.com.

December 10–11, 2009. Society of Cosmetic Chemists Annual Scien-

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tific Meeting and Technology Showcase, New York Hilton Hotel, New York City, USA. Information: www.scconline.org/website/index_news.shtml.

January

January 23–27, 2010. LabAutomation2010, Palm Springs Convention Center, Palm Springs, California, USA. Information: www.labautomation.org/LA10.

January 27–31, 2010. Soap and Detergent Association Annual Meeting & Industry Convention, The Grande Lakes Orlando, Orlando, Florida, USA. Information: www.cleaning101.com/meetings.

February

February 7–10, 2010. National Biodiesel Conference & Expo, Gaylord Texan Resort & Convention Center, Grapevine, Texas, USA. Information: www.biodieselconference.org/2010.

February 7–11, 2010. National Oilseed Processors Association Annual Meeting 2010, Tucson, Arizona, USA. Information: www.nopa.org.

February 7–12, 2010. Glycolipid & Sphingolipid Biology, Gordon Research Conference, Ventura Beach Marriott, Ventura, California, USA. Information: www.grc.org/programs.aspx?year=2010&program=glycolipid.

February 15–17, 2010. 15th Annual National Ethanol Conference, Gaylord Palms Resort & Convention Center, Orlando, Florida, USA. Information: www.nationalethanolconference.com.

February 18–19, 2010. Agricultural Outlook Forum, Crystal Gateway Marriott Hotel, Arlington, Virginia, USA. Information: www.usda.gov/oce/forum.

February 20–23, 2010. Grain Elevator and Processing Safety (GEAPS) Exchange 2010, Century II Performing Arts and Convention Center, Wichita, Kansas, USA. Information: www.geaps.com/exchange.

February 28–March 5, 2010. Pittcon 2010, Orange County Convention Center, Orlando, Florida, USA. Information: www.pittcon.org.

March

March 3–4, 2010. 4th International Symposium on Dietary Fatty Acids and Health, Frankfurt, Germany. Information: www.eurofedlipid.org/meetings.

March 3–5, 2010. SNAXPO 2010, Fort Worth Convention Center, Fort Worth, Texas, USA. Information: www.snaxpo.com.

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Does the lipase source or oil composition influence enzymatic interesterification?

Editor's note: The following article is adapted from the author's presentation delivered during the General Processing session at the 100th AOCS Annual Meeting & Expo, held May 3–6, 2009, in Orlando, Florida, USA.

David Cowan

Enzymatic interesterification (EIE) is no longer an unknown technology but one that is widely applied. As experience in the field has grown, researchers have learned that not all oil types and lipases interact in the same manner. The following article highlights some of the recent research in this area, aimed at better understanding these interactions and their practical consequences.

OIL QUALITY CRITERIA

One of the major areas of research relating to EIE is the elucidation of the influence of the various oil quality factors on enzyme performance. The understanding of these is critical in achieving an acceptable economy, and product quality, for EIE so that it can compete with other fat-modification technologies. The quality specifications (see Table 1) are very similar to those of oil blends for chemical interesterification (CIE) but not always for the same reasons.

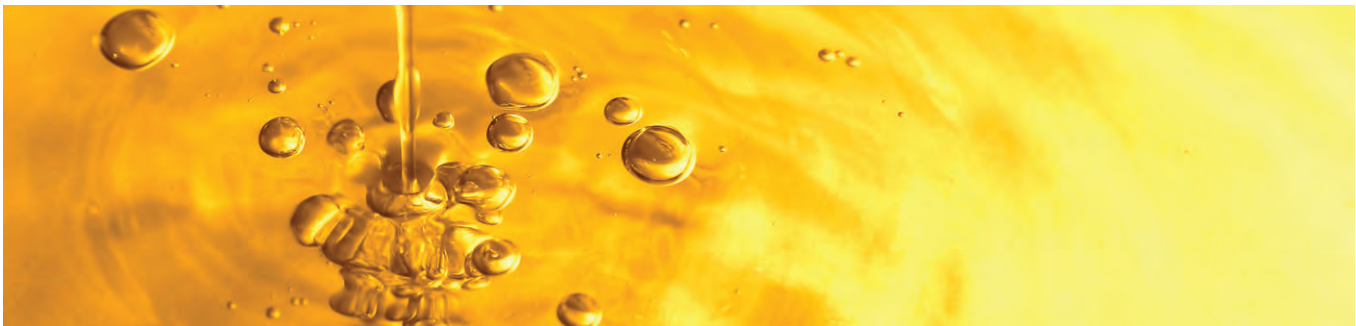
For example, a low FFA (free fatty acid) content is recommended, not because the enzymatic process is sensitive to FFA, but more as an indication of whether the oil has been properly refined and stored. Oxidation product levels are important as these components can interact with the enzyme protein and damage its activity and working life. High levels of moisture are not normally regarded as an issue for enzyme working life, but they do produce loss of yield through hydrolysis of the fats.

The most critical parameter for EIE, which is different from oil blends for CIE, is the presence of inorganic acid residues, derived from phosphoric acid degumming and/or from acid-activated bleaching earths. This can result in small amounts of strong acid becoming dissolved in water entrained in the oil blend. Passage down the immobilized enzyme column results in the uptake of this water by the granules; the internal pH then drops, reducing the activity of the enzyme and ultimately its working life. The discovery of this factor and the development of a simple analytical technique to demonstrate the presence of this non-fatty acid acidity have made a major contribution to understanding and improving enzyme performance.

ARE ALL OILS AND ENZYMES EQUAL?

When any new process is developed, the level of understanding of all the parameters influencing it progresses as more research is conducted. As research into EIE advanced, it became clear that not all oil blends react in exactly the same manner. Looking for parallels with the closest technology to EIE (i.e., CIE) revealed that the degree of saturation of the fats influences the completeness of the randomization obtained in CIE. In investigating further, we considered this fact as well as the lipase type and the fatty acid chain length.

Lauric fats in particular take longer to achieve the maximal degree of interesterification by EIE (as measured by change in solid fat content). Using a batch reaction setup and 4% *Thermomyces lanuginosus* lipase, palm olein reached its maximum much more quickly than a blend of 85% palm kernel oil and 15% palm stearine (Fig. 1).



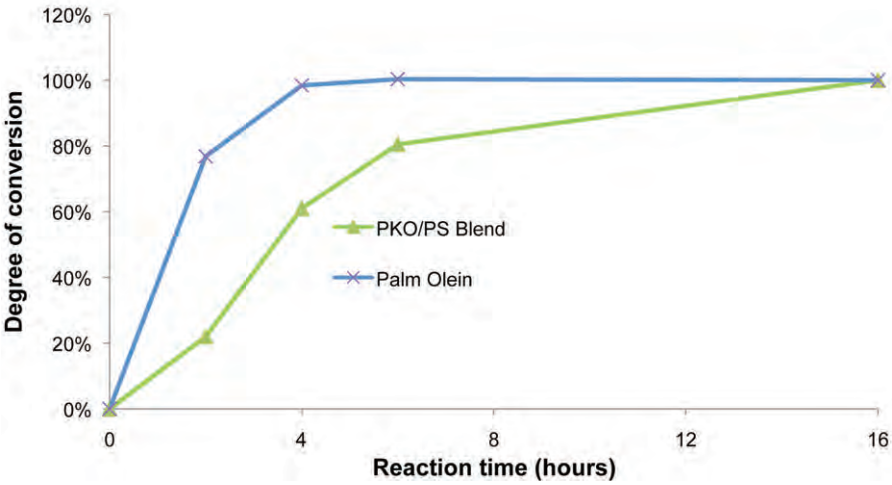


FIG. 1. *Conversion of two fats with* Thermomyces lanuginosus *lipase. PKO: palm kernel oil; PS, palm stearine.*

Substituting the *T. lanuginosus* lipase with one produced in *Candida antarctica* gave similar results with the lauric oil-containing blend. Full conversion was reached more slowly than with the nonlauric blend.

The lauric fats such as palm kernel and coconut oil contain much higher levels of C_{12} fatty acids than palm stearine or soybean oil, and, as lipases are normally characterized by their preferences for chain length, this could be a possible explanation for the observed differences. Two lipase types having preferences for either longer- or shorter-chain fatty acids were compared using three different oil blends. The blends (50% palm olein/50% coconut oil, 80% palm stearine/20% coconut oil, or 50% palm stearine/50% coconut oil) were chosen to provide a range of fatty acid compositions. As these were commercially derived oil blends, produced using phosphoric acid degumming and activated bleaching earth, residual mineral acid contents were high and this parameter was expected to affect productivity (kg oil converted/kg enzyme).

Lipase from *C. antarctica* B, which is known to be more acid tolerant, exhibited a higher productivity when used for hydrolysis than that from *T. lanuginosus*, which has an alkaline pH optimum. This suggests that, for oils with high residual inorganic acid contents, an acidophilic lipase could be a useful candidate for EIE. When the degree of saturation of the fats was considered, it was not possible to observe any major differences; the level only varied from 70.6 to 79.1% in the fat blends used. However, some lipases have different rates of reaction when highly saturated fats are used.

The rate of reaction using these three blends and the two lipase types showed some differences between both blend and enzyme. In both cases reaction rates were slower on the blends containing 50% lauric fats than on the blend with only 20% inclusion. This was more noticeable for the *T. lanuginosus* lipase than for the *C. antarctica* B enzyme. Overall, the rate of reaction for the *C. antarctica* B lipase was lower than that of the standard *T. lanuginosus* enzyme, but it was less sensitive to the fatty acid composition.

The *C. antarctica* B enzyme is more correctly characterized as an esterase and should show a preference for short-chain fatty acids, but in all blends the level of C_8, C_6, and lower was below 10% of the total fatty acid composition. However, when shorter-chain fatty acids are present, there will be a higher level of these per kilogram of fat than of the longer-chain fatty acids. So one possible explanation for the observed differences could be that the lipase has to move more fatty acids around the fats when short-chain fatty acids are to be interesterified. We made calculations of the number of moles of fatty acid per kilogram of fat for the different blends to see if there were significantly more fatty acids overall with the short-chain-containing fats. Overall, the differences were small, and it did not appear that rate of transport of fatty acids could be the reason why lauric fats generally were slower to convert than other fat types.

Table 1. *Oil quality specifications*[a]

Component	CIE	EIE
FFA	<0.05%	<0.1%
Phosphorus	<2 ppm	<3 ppm
Moisture	<0.01%	<0.1%
Peroxide value	<0.5 mequiv/kg	<2 mequiv/kg
Anisidine value	<10	<5
Acid extract value	—	6 < pH < 9
Citric acid		<25 ppm

[a] Abbreviations: CIE, chemical interesterification; EIE, enzymatic interesterification; FFA, free fatty acid.

PRACTICAL CONSIDERATIONS FOR LARGE-SCALE EIE

Our investigations into fat composition and its effect on EIE have demonstrated that this does influence the rate of reaction for the lipases applied today in production-scale reactors. This has a practical consequence: When a unit is being designed, the fat composition needs to be taken into account for calculating the required reactor volume for a given daily throughput.

Also, the observations on oil quality reinforce the need for this to be considered and the required quality specifications followed so that the best utilization of the enzyme can be achieved.

David Cowan is an application scientist at Novozymes working the area of oils and fats enzyme applications. Based in Chesham, United Kingdom, he can be contacted at dc@novozymes.com.

hfdialog

Subject: „Oilseed processing“

Field-portable mass spectrometers for onsite analytics: What's next?

Editor's note: The following article is adapted from the author's Hot Topic presentation delivered at the 100th AOCS Annual Meeting & Expo, held May 3–6, 2009, in Orlando, Florida, USA.

Christopher C. Mulligan

The need for rapid, onsite chemical analyses is as apparent as it has ever been, especially for compounds detrimental to health or to the environment, such as toxic industrial species, explosives, chemical warfare agents, and environmental toxins. Onsite analysis can allow early warning of a harmful release, saving time and resources and increasing safety compared with lab analysis of field samples. The utility of a field-portable, analytical device goes well beyond security applications, though. Many chemical analyses would benefit from being performed at the original location or native environment of the sample of interest.

Several analytical technologies with varying levels of performance and feasibility have emerged as candidates for continued development and evaluation as portable analytical instruments. Of these technologies, several exhibit significant drawbacks, including long analysis times, high false positive and negative rates, high limits of detection, and narrow applicability. Mass spectrometry (MS) has the potential to fulfill the major criteria for field-portable analytical instruments. Of the general-purpose methods of chemical analysis, MS has proven to be one of the most sensitive techniques, and detection of ultra-trace quantities of specific compounds has been demonstrated, even from complex mixtures (as little as 1 part in 10^{12}, even *ca.* 10^{-15} g in favorable cases). The high specificity of MS comes from tandem mass spectrometric analysis (two or more coupled stages of mass analysis), which allows both molecular weight and structural data to be gathered.

Recent advances in vacuum and electronic technologies have led to the miniaturization of MS instruments, thus making portability feasible, and commercialization of portable MS systems has grown rapidly. Most of the commercial equipment currently available uses membrane introduction or gas chromatography (GC) in combination with MS. Although this offers an added degree of separation, it also increases the time required for analysis. In a typical GC/MS analysis, preconcentration, followed by thermal separation of components on a capillary column, may increase the analysis time to several minutes or hours, with the actual MS analysis taking only a small percentage of the total analysis time.

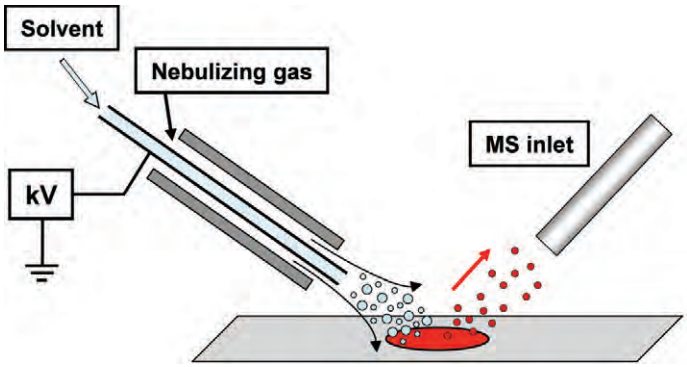


FIG. 1. *Schematic of DESI-MS (desorption electrospray ionization mass spectrometry). Charged microdroplets impact a surface, releasing analyte molecules as secondary ions. Ions are then sampled by the atmospheric pressure inlet of the mass spectrometer.*

Several research groups have designed and reported handheld MS prototypes (Ouyang *et al.*, 2009), and while these instruments typically require as little as 50 ms to acquire a complete mass spectrum, conventional sample preparation typically can take several hours, depending on the sample matrix in question and the desired analyte. While a significant savings in time is realized by performing analyses onsite, these instruments still require extensive preparation of samples before their introduction into the GC interface and lack the versatility in analysis and breadth of applicable samples that is desired for field-portable instrumentation.

Ionization of analyte outside of the instrumental vacuum system can be advantageous compared with traditional analytical methods that require extensive sample preparation and ionization *in vacuo*. Electrospray ionization (ESI), for which John Fenn was awarded the Nobel Prize in Chemistry in 2002, readily allows for the analysis of chemicals in solution and has revolutionized the analysis of biological macromolecules and thermally labile compounds. Atmospheric pressure chemical ionization (APCI) has allowed rapid analysis of volatile and semivolatile chemical species in complex gas matrices without preconcentration. Techniques such

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For further reading:

- Ouyang, Z., R.J. Noll, and R.G. Cooks, Handheld miniature mass spectrometers, *Anal. Chem. 81*:2421–2425 (2009).
- Cooks, R.G., Z. Ouyang, Z. Takats, and J.M. Wiseman, Ambient mass spectrometry, *Science 311*:1566–1570 (2006).
- Venter, A., M. Nefliu, and R.G. Cooks, Ambient desorption ionization mass spectrometry, *TrAC Trends Anal. Chem. 27*:284–290 (2008).
- Mulligan, C.C., N. Talaty, and R.G. Cooks, Desorption electrospray ionization with a portable mass spectrometer, *Chem. Commun.* 1709–1711 (2006).
- Wells, J.M., M.J. Roth, A.D. Keil, J.W. Grossenbacher, D.R. Justes, G.E. Patterson, and D.J. Barket Jr., Implementation of DART and DESI ionization on a fieldable mass spectrometer, *J. Am. Soc. Mass Spectrom. 19*:1419–1424 (2008).

as ESI and APCI have allowed analysis of liquid and gas phase analytes, but there are still substantial limitations to these ionization methods. Using ESI requires that pure liquid analytes be dissolved into organic solution before spraying and that natural aqueous solutions (e.g., contaminated groundwater) undergo extensive preparation, including filtration, desalting, and addition of organic solution, in order to attain acceptable ionization efficiencies. There is also one glaring constraint: the lack of surface analysis ability.

The ability to directly analyze untreated condensed phases and surface-bound species at ambient conditions had not been investigated until recently. New ambient mass spectrometric methods (Cooks *et al*., 2006), in which ionization takes place both at atmospheric pressure and directly from the native sample without prior preparation, have rapidly been developed, and several interesting applications have come from their implementation. As recently proposed by Venter *et al.* (2008), these newly developed methods can be distinguished by the processes used for desorbing analytes from the sampling surface (momentum, laser, or thermal desorption) and the subsequent ionization (ESI or APCI) of these molecules.

One of the simplest and most versatile of these ambient MS techniques is desorption electrospray ionization mass spectrometry (DESI-MS; Cooks *et al*., 2006). DESI-MS uses charged microdroplets of solvent (usually 1:1 methanol/water) generated by traditional ESI methods to desorb condensed-phase and surface-bound analyte, releasing these neutral molecules as secondary ions. Recent fluid dynamic simulations have shown that a thin solvent layer quickly forms on the surface in question, and as new microdroplets impact this layer, progeny droplets containing analyte are released and evaporate with assistance of the heated capillary inlet of the mass spectrometer, forming ions from the desorbed neutral molecules. A schematic of DESI-MS can be seen in Figure 1. Although operating parameters can be tuned to provide optimal performance for certain analytes, typical voltages used for electrospraying are 3–5 kV and solvent flow rates are ~3 µL/min. Both the DESI emitter

and the capillary inlet of the mass spectrometer are positioned within 1–2 mm of the sampling point. The incident angle of the DESI source and collection angle of the atmospheric inlet are fairly critical, being 45° and 15° relative to the sample surface, respectively.

As in traditional ESI, DESI is a "soft" ionization method, yielding mostly protonated or deprotonated molecules in positive or negative ion mode, respectively. Multiply-charged ions can form, and adduct formation with low-mass alkali metals is common, considering the amount of salts and minerals that are present in untreated samples. DESI-MS allows highly sensitive analysis, and picogram detection limits are routinely obtained. The solvent used in DESI can also be manipulated, not only to enhance ionization efficiency of certain species but also to increase selectivity of the ions formed. For example, ions of enzyme-substrate complexes can be readily formed by addition of specific substrates to the DESI solvent.

To date, DESI-MS has been applied to several classes of chemicals, such as peptides, pharmaceuticals (as depicted through direct tablet analysis in Fig. 2), natural products, agricultural chemicals, and industrial polymers. There is also a vast array of surfaces and substrates that DESI-MS can be applied to, such as glass, plastics, leather, metal, plant surfaces, ultra thin-layer chromatography plates, powders, and biological matrices such as urine, saliva, and stomach contents. Although the quantity of literature using DESI-MS is continually growing, it is still a relatively young and untested technique. Its ability to directly analyze unconventional samples and surfaces has led to success in experiments that would be traditionally viewed as haphazard.

FIG. 2. *DESI-MS analysis of pharmaceutical tablets. The sampling stage and DESI emitter can be enclosed for analysis of hazardous samples. Photo courtesy of Prosolia Inc. (Indianapolis, Indiana, USA).*

More importantly, DESI has been recently demonstrated on field-portable MS systems, a coupling designed to allow rapid, direct chemical analysis from surfaces in their native environment, ridding the need for sample transport back to satellite laboratories for analysis. The research groups of R. Graham Cooks and Zheng Ouyang at Purdue University (West Lafayette, Indiana, USA) have coupled DESI-MS with both portable (Mulligan *et al.*, 2006) and handheld (Ouyang *et al.*, 2009) systems. These

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ASAGA celebrates 20th anniversary

Eduardo Dubinsky

In the same year as AOCS' 100th anniversary, ASAGA (Asociación Argentina de Grasas y Aceites; Argentine Society of Fats and Oils) observed its 20th anniversary. ASAGA's 35 past and present board members shared a dinner in Rosario City on September 18, 2009, to celebrate this anniversary (see below).

During the celebration dinner participants watched a video with highlights of ASAGA's history and interviews with the current and first presidents. There was also a Tango Show with live music and singers, and, finally, very emotional words from Jorge Baldi (current president of ASAGA), as well as other members from the Board. Participants received a gift as a souvenir.

ASAGA is an association that brings together institutions, companies, and people who are interested in the technical and scientific aspects of fats and oils and related products. Its foundation is closely linked to the history of AOCS' Latin American Section (LA-AOCS). In 1988, LA-AOCS was formed during an AOCS meeting in Phoenix, Arizona, USA. One year later, the Argentine LA-AOCS' delegate, author of this article, gathered a group of professionals and scientists related to fats and oils. This initiative led to the creation of a local society. Since its beginning, ASAGA received AOCS' support, allowing the society to publish the Spanish versions of AOCS articles in ASAGA's magazine *A&G* (*Aceites y Grasas*). This magazine first appeared in 1990 and is recognized as one of the most important technical magazines in its field. One of ASAGA's goals is to participate in collaborative work with other societies like AOCS, including SBOG (Sociedade Brasileira de Óleos e Gorduras) from Brazil and CORCHIGA (La Corporación Chilena de Aceites y Grasas) from Chile.

Annually, ASAGA conducts an important educational program that includes seminars and courses on crushing, quality control, maintenance, and health and nutrition. Every two years, a managers' meeting of the fats and oils industry takes place, in addition to courses on refining and rendering of animal fats. Attendees come from all Latin American countries to participate in high-level lectures from well-known local and international experts.

This year ASAGA is holding the 13th Latin American Congress on Edible Fats and Oils (November 1–6). The chairman of the congress is Hector Autino, the current president of LA-AOCS (for an interview with Hector Autino, see *inform 20*:261–262 and 283–284). The Latin American Congress is organized every two years in different countries in the region and is one of the most important technical events in Latin America. ASAGA had also organized two other successful Latin American congresses: one in Rosario in 1992 and the other one in Rosario and Buenos Aires in 2005.

For more information on ASAGA and the 13th Latin American Congress, visit www.asaga.org.ar and www.congreso.asaga.org.ar/eng/index.aspx.

ASAGA's 20th anniversary celebration. Pictured are ASAGA's presidents from its inception including, from left to right, Osvaldo Pioli, Juan Carlos Cajaraville, Hector Autino, Jorge Baldi, Martha Melgarejo, Eduardo Dubinsky, Diego Pereyra, Graciela Milito, and Pedro Vacca.

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The Economist Intelligence Unit (EIU; www.eiu.com) reported in August that its latest estimate of global oilseed production in 2008–2009 had been lowered to 301.4 million metric tons (MMT) because of the expected impact of drought on South American soybean production. "Drought in Argentina has led to a reduction of 1 MMT in our forecast for Argentinean soybean output in 2008–2009 to only 32.2 MMT. Paraguay was also affected, and output is expected to decline by 500,000 metric tons to 3.8 MMT. Most soybean areas in Brazil escaped the drought, and our estimate of Brazilian soybean production in 2008–2009 is little changed at 57.1 MMT," EIU noted.

■■■

A higher total load of pathogens—viruses, bacteria and fungi—appears to have the strongest link with Colony Collapse Disorder (CCD) found so far, according to a new study published by ARS scientists and their university colleagues. The researchers have not discarded the possibility that pesticides also play a role in the sudden disappearance of many Western honey bee colonies. The complete story is available at www.ars.usda.gov/is/pr/2009/090812.htm. See *inform 18*:765–766, 2007 for a review of CCD and oilseed production.

■■■

The Dutch operations of amafilter-group are now operating as MAHLE Industrial Filtration (Benelux) B.V. Although MAHLE Industrial Filtration is the global brand, amafilter will remain as one of the product brands of the organization. MAHLE acquired amafilter in July 2008.

■■■

Leatherhead Food Research (Leatherhead, Surrey, UK) is conducting a collaborative study to explore the replacement of fats with water-in-oil emulsions. The study aims to expand knowledge in achieving significant fat reduction in chocolate and fat-based fillings. For more information, contact Persis Subramaniam at psubramaniam@leatherheadfood.com. ■

News & Noteworthy

Soy moratorium extended

The Soy Moratorium in the Amazon Biome has been extended until July 2010, according to a consortium of trade associations and environmental organizations. The moratorium involves the commitment not to trade soy from areas in Brazil deforested after July 24, 2006. Signatories include ABIOVE (the Brazilian Oilseed Processors Association), ANEC (the national grain exporters association), Greenpeace, Conservation International-Brazil, and the Ministry of the Environment.

Data from the National Institute for Space Research of the Brazilian Ministry of Science and Technology on last year's forest canopy loss in the Amazon indicate the deforestation profile is changing. The number of deforested areas of less than 100 hectares has increased, compensated for by a significant drop in deforestation of larger areas—precisely those directly monitored by the Soy Work Group (GTS), which implements the moratorium.

Because of changes in the deforestation profile, the monitoring system "has to be changed to include small deforestations in the analysis of next year's crop, whose planting starts in October," ABIOVE said in a written statement. "The GTS intends to adopt a sampling system using remote sensory technology to identify crops through satellite images of adequate spatial resolution," the statement continued. "This technological advance should make it possible to preselect properties for field visits, so that a significant number of deforestations in the Amazon can be monitored in 2009–2010."

High levels of phytoestrogens found

Civil engineering researchers in the University of Minnesota's Institute of Technology have discovered high levels of plant-based estrogens in some industrial wastewater.

In their study, Associate Professor Paige Novak and her graduate student researcher Mark Lundgren studied wastewater from 19 different sites in the US states of Minnesota and Iowa. They found

very high concentrations of these hormone-mimicking phytoestrogens—up to 250 times higher than the level at which feminization of fish has been seen in other research—in the wastewater discharged from eight industrial sites, including biodiesel plants, a soy milk factory, a barbecue meat processing facility, and a dairy.

They also detected high concentrations of phytoestrogens in the water discharged by some municipal wastewater treatment plants. The good news is that the researchers revealed that phytoestrogens can be removed from water as it goes through standard treatment. In fact, they saw more than 90% removal of these compounds from the water. However, sometimes 99% removal is needed to reach levels that are considered harmless to fish, said Novak.

"Many people have looked at human-related chemicals such as those in birth control pills as the primary source of estrogens in the water supply, but they have not looked at plant-based estrogens from a wide variety of industries," Novak said. "Our research is the first study of its kind to provide a snapshot in time of what is going on in these industries. We hope that it can be used in planning new industrial sites and expansion of current sites," she added.

Novak pointed out that some of these industrial facilities are in small towns without sophisticated wastewater treatment plants. In these locations, there is potential for impacts on fish and wildlife.

The study appeared online ahead of print in *Environmental Toxicology and Chemistry* (doi: 10.1897/09-029.1) and was funded by the Water Environment Research Foundation and the University of Minnesota's Center for Urban and Regional Affairs (CURA).

Vietnam sets oil production goals

Vietnam has announced ambitious targets for vegetable oil production, according to the official news service of the Socialist Republic of Vietnam.

The country's Ministry of Trade and Industry hopes to produce 1.7–2.16 MMT/year of vegetable oil by 2020, of which nearly 60,000 metric tons (MT) will be exported, according to the report by the Vietnam News Agency. Those figures will increase to 2–2.65 MMT/year by 2025.

To reach these levels, Deputy Minister of Industry and Trade Bui Xuan Khu noted that Vietnam will have to address its lack of growing areas. (Currently, Khu said, up to 90% of raw materials must be imported by the country's 35 vegetable oil producers. At present, annual production stands at 1.13 MMT of refined oil and 85,000 MT of unrefined oil, the report said.)

Statistics released by the ministry indicate that the vegetable oil industry generated a turnover of VND6.62 trillion (almost $371.7 million) last year, accounting for about 5% of the total value earned by the country's food and drink industry. Per capita vegetable oil consumption in Vietnam was estimated at seven kilograms (kg).

The news agency report also said that:

- Vietnamese vegetable oil consumption is expected to grow by 8% during 2008–2018 and 3.5% during the 2018–2025 period. This growth is expected to result in a per capita consumption of 15.2 kg by 2018 and 19.4 kg by 2025.
- Between 2000–2008, Vietnam's vegetable oil imports increased 12.6% on average each year, whereas exports decreased. Last year import revenue was $700 million.
- "Experts have warned that if Vietnam does not have an effective program to cultivate raw materials for vegetable oil, it will have to import $1 billion worth of materials by 2015," according to the report.

Acrylamide found to pose risk

The Government of Canada is recommending that acrylamide be added to Schedule 1 of the Canadian Environmental Protection Act, 1999 (CEPA 1999) after finding that it may pose a risk to human health.

The recommendation came after Health Canada and Environment Canada released final screening assessments and proposed risk management approaches for 19 substances assessed in Batch 5 of the Chemicals Management Plan.

The majority of acrylamide is used in the manufacture of various polymers, which in turn are used in ore processing, food packaging, plastic products, and in molecular biology laboratory applications. Minute levels of acrylamide also form when certain foods are cooked at high temperatures, such as when making French fries or potato chips.

Health Canada is implementing a three-pronged risk management approach to reduce Canadians' exposure to acrylamide from food sources. The approach includes pressing the food industry to develop and implement acrylamide reduction strategies for use by food processors and the foodservice industry; regularly updating consumption advice; and coordinating risk management efforts for acrylamide in food with key international food regulatory partners.

The Government is also proposing to add acrylamide to the Health Canada Cosmetic Ingredient Hotlist and to the Environmental Emergencies Regulations of CEPA 1999.

The Government's screening assessments are final; however, stakeholders are encouraged to submit comments on the recommended risk management options until October 21, 2009.

EFSA update

The European Food Safety Agency (EFSA) has taken action on a number of issues recently, including phytosterols, dietary reference values for fats, and food enzymes.

PHYTOSTEROLS

EFSA's Panel on Dietetic Products, Nutrition and Allergies (NDA) said in an opinion that cholesterol in the blood can be reduced on average by 7–10.5% if a person consumes 1.5–2.4 grams of plant sterols and stanols every day. The scientists found that the effect usually occurs within the first two to three weeks.

CONTINUED ON PAGE 632

Acquisitions/ mergers

Nutreco Holding N.V. (Amersfoort, Netherlands) has purchased **Cargill**'s (Minneapolis, Minnesota, USA) animal nutrition operations in Spain and Portugal.

■■■

Finnish company **Lannen Tehtaat** says it will combine the operations of its subsidiaries **Avena Nordic Grain Oy** and **Mildola Oy**. The aim is to combine the commodity market expertise of Avena Nordic Grain with Mildola's expertise in oil milling, Lannen Tehtaat said in a statement.

Commodities

CACAO/CHOCOLATE

In August, **Cadbury New Zealand** returned its Cadbury Dairy Milk chocolate to a recipe containing only cocoa butter. The move followed the company's receipt of hundreds of letters and e-mails in which consumers told the company they did not approve of a new recipe in which a small proportion of the cocoa butter was replaced with vegetable fat, including palm oil.

■■■

Rabobank, the cooperative bank that deals mainly with agribusiness, says it expects **cocoa prices** to continue their upward momentum next year, although prices are expected to ease over coming months as the new crop supply hits the market. Global cocoa fundamentals look set to remain in a slight deficit in the 2008–2009 (October–September) season despite recent demand weakness. The International Cocoa Organization currently is estimating a global deficit of 73,000 MT despite better-than-expected crop estimates in West Africa.

CANOLA/RAPESEED OIL

Results from a study led by Z.H. Xue and colleagues at Tianjin University (People's Republic of China) suggest that **rapeseed peptide hydrolysate** may be useful as a human food ingredient, serving as a source of bioactive peptides with antioxidant properties. In the study, rapeseed (*Brassica napus*) meal protein isolates were first digested by Alcalase and Flavourzyme, and the resultant rapeseed crude hydrolysate exhibited a dose-dependent reducing antioxidant power and hydroxyl radical scavenging ability. The study appeared in the *Journal of Agricultural and Food Chemistry* (*57*:5287–5293, 2009).

■■■

Cargill (Minneapolis, Minnesota, USA) has completed a move to a new canola seed facility in Idaho Falls (Idaho, USA). The move almost doubled the amount of space and upgraded equipment, the company said in a news release.

Cargill has also entered into a license agreement for patented canola breeding technology with the **Wisconsin Alumni Research Foundation** (Madison, USA). The technology involves the use of traditional breeding techniques to introgress traits from winter canola lines into spring canola lines, resulting in higher spring yields. (Introgression is the movement of a gene from one species into the gene pool of another.)

FLAXSEED OIL

Shape Foods in Brandon, Manitoba, Canada, will continue bottling flaxseed oil under new co-owner and chief executive officer, Jim Downey. "I believe very strongly in value-added processing of grains that are grown in the Prairies," Downey told www.producer.com.

■■■

Agriculture and Agri-Food Canada says producers in western Canada have increased the seeded area of flax by 10% for 2009–2010, although production is forecast to decline slightly due to lower yields. The agency predicts flax planting will cover 636,000 hectares this growing season.

PALM OIL

The El Niño phenomenon is expected to reduce **Indonesia's crude palm oil production** by 1 MMT in the fourth quarter of 2009, an official told the Xinhua News Agency in August. With the reduction, production would decrease to 19.3 MMT, which is still higher than 2008's production of 18.8 MMT, Xinhua said.

■■■

The **Rural and Regional Development Ministry of Malaysia**, through its plantation services company, **Felcra**, will invest RM60 million (more than $17 million) to build two new palm-oil processing facilities. The new mills will be located in Sri Aman and Mukah, according to the *New Straits Times* newspaper.

SOY OIL

China National Cereals, Oils & Foodstuffs Corp. (COFCO), the country's largest oil and food producer, plans to build a soybean-processing plant in southwest China's Guangxi Zhuang Autonomous Region with a capacity of 1.2 MMT/year, according to the Xinhua News Agency. In April, the company opened a 4-billion-yuan ($586 million) oil-pressing project in Tianjin, Xinhua said. Per-capita edible oil consumption is 14.5 kg/year in China, according to the article.

SUNFLOWER OIL

Yug Rusi intends to invest more than $6 million to modernize its sunflower oil mills based in the Anna and Liski districts of Russia, according to the Esmerk news agency.

■■■

Even as *Oil World* was predicting on August 28 that world sunflowerseed production will decline this year, the **National Sun-**

CONTINUED ON PAGE 633

*inform*ation

Did you know that *inform* provides news updates on the AOCS home page at www.aocs.org? As well as alerts on Twitter at www.twitter.com/theAOCS?

The NDA Panel also concluded that foods such as yogurts and milk, including low-fat yogurts and cheese, margarine-type spreads, mayonnaise, salad dressing, and other dairy products, were the most suitable for delivering the cholesterol-lowering effects from plant stanols and sterols to the body. Information was either lacking for other foods or they appeared to be less effective in reducing blood cholesterol levels, the Panel said.

DIETARY REFERENCE VALUES

EFSA has also initiated a public consultation on its proposed dietary reference values (DRVs) for carbohydrates, dietary fiber, and fats. Comments from the scientific community and other stakeholders will be accepted by EFSA until October 15, 2009.

As part of this process, the NDA Panel concluded that intake of fats should range between 20–35% of the total energy intake, with different values recommended for infants. Intakes of both saturated and *trans* fatty acids should be "as low as possible within the context of a nutritionally adequate diet." The Panel also provided advice regarding the setting of DRVs for mono- and polyunsaturated fatty acids as well as cholesterol.

FOOD ENZYMES

EFSA has published a guidance document for industry specifying the type of information that industry should provide to enable EFSA to carry out its safety assessments on food enzymes. The document outlines what information on physicochemical characteristics and toxicological tests needs to be submitted. The guidance document is available at www.efsa.europa.eu/cs/BlobServer/Guidance_of_Panel/cef_ej1305_guidelines%20enzymes_en.pdf?ssbinary=true.

New work on storage of vegetable oils

Researchers from The Ohio State University in Columbus, USA, studied whether soybean, corn, safflower, and olive oils kept their healthful fatty acids during storage. Their findings are as follows:

- High concentrations of oxidized α-tocopherol were associated with a decrease in stability, or a loss of healthful qualities, in all the oils studied.
- Soybean oil, which contained the highest oxidized α-tocopherol content, had the lowest stability during storage.
- Corn, safflower, and olive oils had a decrease in their healthful fatty acids as their oxidized α-tocopherol levels increased.

The authors, led by AOCS member David Min, conclude that removing the oxidized α-tocopherol will help improve the oxidative stability of food during storage.

In the study, the researchers added 0, 650, 1,300, and 2,600 parts per million (ppm) of oxidized α-tocopherol to soybean, corn, safflower, and olive oils and 10,000 ppm of oxidized α-tocopherol to a mixture of oleic, linoleic, and linolenic acids. Samples in the gas-tight vials were stored in the dark for 6 or 35 days at 55°C. The oxidative stabilities of the oils were determined by headspace oxygen with gas chromatography (GC) and by peroxide value. Fatty acids were determined by GC. As the concentration of oxidized α-tocopherol in soybean, corn, safflower, and olive oils increased, the depletion of headspace oxygen and the peroxide values of oils increased during storage. The pro-oxidant effects of oxidized α-tocopherol on soybean and corn oils with about 55% linoleic acid were greater than those on safflower and olive oils with about 12% linoleic acid, respectively ($P < 0.05$). The changes in fatty acids during storage showed that the oxidation ratios of oleic, linoleic, and linolenic acids were 1:2:3, 1:12:26, and 1:8:16 after 5, 30, and 35 days of storage, respectively.

Planting dates and fatty acids

US researchers at Mississippi State University (Mississippi State, USA) have studied how agronomic factors—genotype, planting date, and rate of nitrogen application—affect the fatty acid composition of sunflower (*Helianthus annuus* L.). Their study appeared in *Agronomy Journal* (*101*:1003–1011, 2009).

The scientists, led by Valtcho Zheliazkov, found that earlier planting apparently reduced the level of total saturated fatty acids as well as producing the highest oil content of the four planting dates studied. As for individual fatty acids, "Overall, palmitic (16:0) and stearic acid (18:0) concentrations in sunflower seed grown in Mississippi from the first planting were reduced relative to the respective concentrations in the original seed. Later planting tended to increase these two acids relative to the first planting and relative to the original seed," the researchers write.

Unique omega-3 source?

InterMed Discovery (IMD) of Dortmund, Germany, is reporting a unique microbial

flower Association (NSA; Bismarck, North Dakota, USA) was announcing that sunflowerseed oil exports from the United States to Canada set a new record. Exports are up 59% compared with 2008, NSA said.

New ventures

Bruker Daltonics announced the establishment of the **Bruker LabMate PLC**, a life-science mass spectrometry joint venture between **Bruker Daltonics** (Billerica, Massachusetts, USA) and **LabMate Asia** (Chennai, Tamil Nadu, India), with customer support and technical expertise hubs in Bangalore, Chennai, Delhi, Kolkata, and Mumbai.

■■■

Bursa Malaysia Bhd, Malaysia's exchange holding company, and **CME Group Inc.**, an electronic futures trader based in New York and Chicago (USA), are collaborating on trade-matching services, product licensing, and minor cross-equity investments in the tropical oil derivatives market. The CME Group equity stake will relate to Bursa Malaysia's derivatives business. Specific terms will be announced at a later date and the initiative is subject to regulatory approval.

■■■

Bio-Extraction Inc. (Toronto, Ontario, Canada) is expanding to the United States, where it will build a second canola processing facility in Minot, North Dakota. The 80,000-MT/year facility is expected to open in 2011.

R&D

A combination of **sugar beet pectin and milk proteins** could be used in encapsulation processes or as fat replacers, according to research led by AOCS member D. Julian McClements of the University of Massachusetts (Amherst, USA). "These biopolymer particles could be used as fat mimetics (e.g., to simulate the light scattering or viscosity of fat droplet suspensions) or they could be used as delivery systems (e.g., to encapsulate bioactive components)," the researchers write in *Food Hydrocolloids* (*23*:1312–1321, 2009).

■■■

German specialty chemical supplier **Evonik Industries** has added a group of biobased polyamides to its Vestamid product line. The polymers, sold under the Vestamid Terra brand name, are based on monomers produced partly or entirely from fatty acids. The most important source currently is castor oil. Evonik is also developing further polyamides from palm kernel and rapeseed oils. ■

source for the production of omega-3 fatty acids. The company acquired the strain from the University of Saarland and will work with researchers there on further research and development of new products.

"This innovative microbial source has the potential to produce omega-3 [fatty acids] more sustainably and reliably compared to established sources," IMD said in a news release, adding that the new strain "significantly out-perform[s] current sources." IMD also said the new strain produces a "more favorable ratio between the fatty acids DHA and EPA."

DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid) are essential long-chain polyunsaturated fatty acids found in fatty coldwater fish that apparently offer protection against a variety of health disorders such as cardiovascular disease, macular degeneration, and ADHD (attention deficit hyperactivity disorder).

Canola protein closer to GRAS status

Burcon NutraScience Corp. (Vancouver, British Columbia, Canada) says the journal of *Food and Chemical Toxicology* will publish a peer-reviewed manuscript detailing a toxicology study on the company's Puratein canola protein isolate. Luis Mejia, director of scientific and regulatory affairs of Archer Daniels Midland Company (ADM; Decatur, Illinois, USA), is the primary author of the study.

Burcon and ADM have also submitted a toxicology study conducted for Supertein canola protein isolate to a peer-reviewed journal for publication. Once the Supertein toxicology study is accepted for publication, Burcon and ADM will proceed to submit a GRAS (Generally Recognized as Safe) notification for Puratein and Supertein to the US Food and Drug Administration. ■

2010

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On July 31 Rep. Brian P. Bilbray (R-California) introduced a bill (HR 3460) in the US House of Representatives to "amend the Clean Air Act to include algae-based biofuel in the renewable fuel program and amend the Internal Revenue Code of 1986 to include algae-based biofuel in the cellulosic biofuel producer credit." The legislation would also establish a tax credit for producers of algae-derived fuel. The bill had eight cosponsors. It was referred to the Ways and Means Committee and Energy and Commerce Committee.

■■■

To help ensure that biofuel development does not compete with traditional agricultural industry for land and resources, the Australian government made matching grants in August totaling A$14.4 million ($12.1 million) across seven projects through its Second Generation Biofuels Research and Development Program. Among these were the following: A consortium of the South Australian Research Development Institute (Adelaide), Flinders University (Adelaide), and CSIRO received A$2.7 million to develop a pilot-scale biorefinery for microalgal biofuels and other products. Curtin University of Technology (Perth) and Spitfire Oil (Perth) were awarded A$2.5 million to investigate production of biofuels from Mallee trees (*Eucalyptus* spp.), which are native to Australia's inland plains. And researchers at the University of Melbourne received A$1.2 million for a project at Victoria's coal-fired Hazelwood Power Plant to increase the efficiency of systems to derive biofuels from microalgae.

■■■

Greenline Industries, incorporated in 2005 in Larkspur, California, USA, filed for Chapter 7 Bankruptcy liquidation in August. The company had gone through three chief executive officers in the final 13 months and had terminated two chief financial officers and a chief operating officer as well. The company was formed to supply waterless modular biodiesel production systems for small- to mid-scale applications, and had provided clients

CONTINUED ON NEXT PAGE

Biofuels News

GENERAL

BP, Martek to develop microbial oils for biofuels

BP and Martek Biosciences Corp. (Columbia, Maryland, USA) signed a joint development agreement in mid-August to work on the production of microbial oils for biofuels applications. They will work together to establish proof of concept for large-scale, cost-effective microbial biodiesel production through fermentation.

In the joint statement, Philip New, chief executive officer of BP Biofuels, said: "As an alternative to conventional vegetable oils, we believe sugar to diesel technology has the potential to deliver economic, sustainable, and scaleable biodiesel supplies. In partnering with Martek, we combine the world's leading know-how in microbial lipid production with our expertise in fuels markets and applications, and our more recent experience in biofuels production and commercialization."

New added, "[This technology] is part of our approach of integrating sugar cane and lignocellulosic biofuels with advanced technologies to produce products with a wide range of uses."

Martek has based its business in the past on producing the long-chain polyunsaturated fatty acid DHA (docosahexaenoic acid), an omega-3 fatty acid, in microalgae and marketing it for inclusion in products such as infant formula. DHA supplementation is considered important for the optimal development of an infant's nervous and visual systems. The patents Martek has on DHA begin to expire in 2010, however, so this new venture with BP positions Martek to identify new businesses should competition arise on the DHA front.

BP will contribute $10 million to the initial phase of the collaboration.

Earlier in 2009, BP and Verenium Corp. (Cambridge, Massachusetts, USA) formed a joint venture company, to be called Vercipia Biofuels, which will open its new headquarters in Highland County, Florida, USA, in 2010. The focus of Vercipia is on the development of commercial-scale cellulosic ethanol facilities.

US state rejects biofuels from renewable biomass

The state of Massachusetts (USA) has initiated a Biofuels Mandate that will begin July 1, 2010. Under this mandate, all biofuels not made using waste feedstocks are

in four countries with 33 biodiesel processing lines, representing more than 250 million gallons (950 million liters) per year in capacity.

■■■

The first BQ-9000 certified producer of soybean-based biodiesel in Indiana (USA) is the Louis Dreyfus Soybean Processing and Biofuel Plant of Claypool. (BQ-9000 is a voluntary fuel quality assurance program overseen by the National Biodiesel Accreditation Commission and adopted by the National Biodiesel Board and the Canadian Renewable Fuels Association. The program covers storage, sampling, testing, blending, shipping, distribution and fuel management practices to achieve quality assurance.) The plant opened in August 2007, and has an annual production capacity exceeding 88 million gallons (330 million liters) of soy biodiesel. The facility also processes nearly 50 million bushels (1.4 million metric tons) of soybeans annually and produces more than 1 million tons (900,000 metric tons) of soybean meal each year.

■■■

A plant with a growth habit similar to jatropha, called the croton tree (*Croton tiglium* or *C. megalocarpus*; not to be confused with the houseplant *Codiaeum variegatum*, also called croton, which is grown for its glossy multicolored foliage), is being developed as a source of biofuel in Kenya and Tanzania. Kenyan farmers typically grow it as a windbreak or plant it as a fence. The plant's inedible nuts reportedly contain up to 35% oil. The oil, obtained by pressing crushed seeds, either can be filtered and used directly to fuel a generator, or can be reacted chemically to produce biodiesel. Research on uses for the presscake are ongoing but may include use as a fertilizer or as a feedstock for cogeneration of electricity.

■■■

US Senators Maria Cantwell (D-WA) and Charles Grassley (R-IA) introduced S. 1589, the Biodiesel Tax Incentive Reform and Extension Act, on August 6, and it was referred to the Senate Finance Committee. The purpose of the bill is to extend the current biodiesel tax credit, which expires at the end of 2009, for five years. The legislation also would change the biodiesel banned from qualifying under the state's Clean Energy Biofuels Act of 2008. One provision of the law is that biofuels must reduce greenhouse gas emissions by at least 50%.

The Massachusetts Department of Energy Resources defines waste feedstocks as previously used or discarded material from industrial, commercial, or household food service activities, including animal waste; animal by-products; organic portions of municipal solid waste; grease trap waste; and construction and demolition debris. Thus, other forms of renewable biomass—such as agricultural crop residues (e.g., corn cobs; see *inform 20*:579–580, 2009), dedicated energy crops such as switchgrass, miscanthus, other grasses, and jatropha; microorganisms; or algae (*inform 19*:432–437, 2008)—are excluded.

Brent Erickson, executive vice president of the Biotechnology Industry Organization's Industrial & Environmental Section, commented, "By permitting only biofuels made from waste feedstocks under its mandate, Massachusetts is preventing its own biotech companies from deploying their advanced technology to turn other sources of renewable biomass into advanced biofuels. . . . [T]his effort is based on good intentions, but it sets a very bad precedent by excluding some of the most sustainable renewable resources from being utilized to make cleaner and greener transportation fuels. Massachusetts has several biotech companies that are leading the way to making advanced biofuels from very sustainable feedstocks. We are surprised to see the state disadvantage its own companies."

ALGAE

LiveFuels proposes using fish to harvest algae

On August 13 LiveFuels Inc. (Menlo Park, California, USA) announced it was starting a new pilot project at its Brownsville, Texas (USA), facility, where it has nine 5-acre (total area: 18 hectares) open saltwater ponds that were once used for fish/shrimp farming. LiveFuels proposes growing native, unmodified, oil-producing algae in these ponds and letting filter-feeding fish and other herbivores graze on these oil-synthesizing algae. Once the minnow-sized fish/herbivores have fattened, they can be netted and processed into oil. The protein remaining after oil removal can be used for animal feed, and residual phosphorus from fish bones can be used for fertilizer.

Initially, the ponds will be used to identify which species of algae-consuming fish work best.

According to CleanTech.com (www.cleantech.com/news/4839/livefuels-fish-algae-series-b), Lissa Morgenthaler-Jones, chief executive officer of LiveFuels, said that the fish eat more than one-third of their body weight in wet algae per day. She added, "Fish need 1/800th of the energy of a centrifuge to process algal water." That is, in this proposed system, fish provide considerable efficiency and economy in harvesting the oil, compared to the energy needed to collect algae by a process such as centrifugation.

Ultimately the project could be expanded to growing algae in the open ocean, especially in areas that are experiencing algal blooms already. One proposal is to confine fish in netted enclosures that have been towed to the bloom area, and then harvest them after a suitable period. "Dead zones" in the middle of the blooms must be avoided, but fish could be placed at the edges of these oxygen-depleted areas to eat their fill and concentrate the fat contained in the algal cells.

John Benemann, one of the authors of the seminal report on growing algae for biofuel (Sheehan, J., T. Dunahay, J. Benemann, and P. Roessler, A Look Back at the U.S. Department of Energy's Aquatic Species Program: Biodiesel from Algae, National Renewable Energy Laboratory, Golden, Colorado, USA. Report #NREL/TP-580-24190, 1998, 328 pp.), commented to CleanTech.com that the LiveFuels process overcomes major problems of harvesting and processing algae. On the other hand, growing two species is more complicated than growing one.

Algae contest, prize to be offered

California-based Prize Capital LLC will be sponsoring prizes worth a total of $10 million for innovations in algae-to-fuel technology research and development, according to Matt Peak, director of technology

ventures for the company. The award will go to the team that produces the most finished renewable diesel fuel per acre of land between January 1, 2010, and December 31, 2013, with a minimum of 3,000 net-gallons (11,000 liters) produced at a cost of no more than $3 per gallon ($0.79 per liter). A champion racing prize series will be part of the challenge, with competitors racing in standard, uniform, sponsor-provided diesel-powered cars at raceways hosting national competitions.

Lee Stein, founder and chairman of Prize Capital, said the competition will provide incentives to determine which of the thousands of algae strains are best suited for absorbing energy and producing renewable fuels, where these strains work best, how to harvest algae most effectively, and how to extract the oil most efficiently from within algae's cellular walls at sufficient scale, among other challenges.

Further information is available at www.prizecapital.net/Prize_Capital/Algae_Fuel_Prize.html.

Aurora predicts $2/gallon biodiesel from algae

Having identified and optimized a genetic pathway in a species of single-celled oil-producing alga that boosts its growth and breeding cycle, Aurora Biofuels (Alameda, California, USA) announced the organism consumes more than double the amount of CO_2 as the wild type and produces twice as much oil. Company Chief Executive Officer Bob Walsh says yields of 5,000 gallons of algal oil per acre (47,000 liters per hectare) per year can now be achieved.

Aurora has been breeding the strain in open-air raceway ponds about the size of Olympic swimming pools in Florida and harvesting about half of the algae per day; from that, the yield has been about a gallon of oil per pond per day. Aurora plans to scale up to 50-acre (20-hectare) ponds that, it predicts, could produce 100 gallons (380 liters)/day by the second quarter of 2010. By 2011 or 2012, the company plans to be producing algal oil in 2,000-acre (800-hectare) ponds. Costs of production in the latter are predicted to approach $1.75/gallon; after conversion to biodiesel, the cost would be $2/gallon.

Other revenue streams from growing algae for fuel include the sale of carbon credits as well as the sale of leftover algae protein for $350 per ton to fish farms and pet food makers. At present, Aurora plans to sell its oil to fuel producers rather than make their own. Later they may explore the chemical market.

W2 Energy to build algae oil plant at Guelph

W2 Energy Inc., a developer of green energy headquartered in Carson City, Nevada, USA, announced in mid-August that it will build several commercial-scale algae bioreactors at its facility in Guelph, Ontario, Canada. Initially, 10 units of W2's SunFilter Algae Reactor will be constructed to sequester CO_2 from the company's other processes.

Once the first stage is complete, W2 plans to expand to 50 bioreactors. Each SunFilter has a capacity of 42 gallons (160 liters).

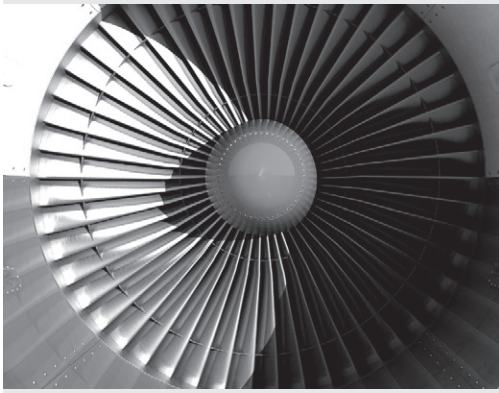
Gases containing nitrogen oxides and CO_2 enter the bottom manifold of the SunFilter and bubble up through the algae tubes. Low-power ultraviolet lights, in combination with the gases, feed the algae, which grow in the tubes. When the algae reach a suitable density, a set of magnetic rings inside the tubes scrape them clean and push the algae upward to the upper manifold, where compressed air pushes the algae out. The algae are then compressed, dried, and can then be processed into biodiesel by reaction with methanol or into renewable diesel by means of the Fischer-Tropsch reaction.

Targeted Growth increases oil content of cyanobacteria

Crop biotechnology company Targeted Growth, Inc. (TGI; Seattle, Washington, USA) has developed a way to increase the lipid content of cyanobacteria (blue-green algae) by as much as 400%. The company claims that this discovery will increase the yield per acre of algal oil, decrease the cost

tax incentive from a blenders' excise tax credit to a production excise tax credit. This change would focus the benefits of the credit on the production capacity of these fuels rather than on the activity of just blending them with petroleum diesel. This Act would also simplify the definition of "biodiesel" to encourage production from any biomass-based feedstock or recycled oils and fats.

■■■



Eight airlines signed an agreement in mid-August with Rentech, Inc. (Los Angeles, California, USA) and Aircraft Service International Group (Orlando, Florida, USA) to purchase up to 1.5 million gallons (5.7 million liters) per year of renewable diesel fuel (RenDiesel) for use in ground service equipment at Los Angeles International Airport beginning in late 2012, when Rentech's plant to produce the fuel is scheduled to go into service. RenDiesel will be produced at Rentech's facility in Rialto, California, primarily from urban woody green waste such as yard clippings and processed sewage sludge. Rentech also makes synthetic jet fuel. ■

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of algae production, and make algae-based fuels price-competitive with petroleum.

In the past four years TGI has sequenced the entire genome of cyanobacteria [genus/genera and species unspecified], identified and tested every active gene, and added and manipulated new genes to create a high oil-yielding algae strain.

TGI does not see itself as marketing millions of gallons of biofuel in wholesale or retail markets. Instead, it sees itself marketing the technology to grow and harvest the algae. For example, TGI is partnering with UOP LLC, a Honeywell company, to develop ways to convert algae to biojet fuel. UOP has participated in three separate tests in 2009 of algae-based fuels in airplanes.

ETHANOL

Increased ethanol content expensive for gas stations

As the required content of biofuels in US-sold gasoline rises, station owners are facing expenses that can jeopardize the continued operation of their businesses. For instance, in Florida, gas station owners have until the end of 2009 to replace or reline their fuel storage tanks so that they can contain the more corrosive ethanol additives. By the end of 2010, according to a 2008 Florida law, gasoline sold at retail outlets in the state must be 10% ethanol.

In advance of the requirement, refineries have already all but ceased production of ethanol-free gasoline.

Station owners have a choice of relining or replacing their tanks to counteract the ethanol content. Relining may be satisfactory in the short run, but ultimately station owners' tanks will need to be replaced. In discussing this issue, FloridaToday.com used as an example an independently owned gas station at South Patrick Shores, Florida, just north of Melbourne, Florida, that is facing costs of about $300,000 to install new, underground tanks.

Novozymes retreats from ethanol expansion

The world's largest maker of industrial enzymes, Novozymes A/S (headquartered in Bagsværd, Denmark), has decided to slow its expansion in the ethanol market. Falling demand for ethanol-containing fuel in the United States has driven several of the larger US bioethanol manufacturers into bankruptcy, including VeraSun Energy Corp. (Sioux Falls, South Dakota), Renew Energy LLC (Jefferson, Wisconsin), and Aventine Renewable Holdings Inc. (Pekin, Illinois).

Novozymes is cutting back on its plans to double enzyme production capacity at its Nebraska (USA) enzyme plant (see *inform 20*:298, 2009) and on its investment at a new facility in China. According to Bloomberg.com (August 13), investment will fall by as much as $38 million in 2009 and about $57 million in 2010.

Both Novozymes and rival Danisco A/S (Copenhagen, Denmark) plan to have commercial quantities of enzymes for making cellulosic ethanol starting in 2010.

BIODIESEL

EBB monitors biodiesel imports

As reported earlier, the European Commission (EC) imposed anti-dumping duties on US biodiesel that took effect July 12, 2009 (see *inform 20*:420, 511, 2009). Subsequently, the European Biodiesel Board (EBB) has been in conversations with the EC to identify any evidence that Argentina and the United States might be trying to circumvent these duties, as reported in the August issue of *Biodiesel Magazine*. Amandine Lacourt of the EBB was quoted as saying, "A lot of biodiesel already flows from Argentina to Europe and we have noticed an increase in the volumes, so it might be easier for some fraudulent practices to occur." The suspicion is that US biodiesel is being shipped to Europe via Argentina, to avoid duties. The EBB says Argentina's exports of biodiesel multiplied 20-fold from April 2008 to April 2009. ■

Health & Nutrition

According to research presented at the annual meeting of the Society for the Study of Ingestive Behavior (http://www.ssib.org/web/), brain scans revealed that women who had lower activity in food reward regions of the brain and who had genetic modifications associated with lower dopamine activity showed the greatest weight gain after one year. Study leader Eric Stice of the Oregon Research Institute in Eugene, Oregon, USA told RSSL Food eNews that "these findings provide some of the first prospective evidence that people who experience blunted reward from food may compensate by overeating, increasing risk for unhealth[ful] weight gain."

■■■

Researchers led by Clay F. Semenkovich of Washington Medical School in St. Louis, Missouri, USA, say they have found a compound that binds to a specific protein in the liver and helps to metabolize glucose and fat. This compound—1-palmitoyl-2-oleoyl-*sn*-glycerol-3-phosphocholine (16:0/18:1-GPC)—is a component of lecithin. The study appeared in *Cell* (*138*:476–488, 2009).

■■■

A new meta-analysis of studies on omega-3 fatty acids and cardiovascular disease appeared in the *Journal of the American College of Cardiology* (*54*:585–594, 2009). Carl Lavie, medical director of Cardiac Rehabilitation and Prevention, Ochsner Medical Center, New Orleans, Louisiana, USA, led the research.

"This isn't just hype; we now have tremendous and compelling evidence from very large studies, some dating back 20 and 30 years, that demonstrates the protective benefits of omega-3 fish oil in multiple aspects of preventive cardiology," he said.

■■■

Commercially available conjugated linoleic acid (CLA) slowed age-related muscle loss (sarcopenia) in mice, according to findings published in *Biochemical and Biophysical Research Communications* (*383*:513–518, 2009). The research team, led by Gabriel Fernandes from University of Texas Health Science Center at San Antonio (USA) pointed out that humans typically lose 1–2% of their muscle mass every year after the age of 50. ■

Producing brown fat

Researchers at Dana-Farber Cancer Institute (Cambridge, Massachusetts, USA) have shown that they can engineer mouse and human cells to produce brown fat, a natural energy-burning type of fat that counteracts obesity. If such a strategy can be developed for use in people, the scientists say, it could open a novel approach to treating obesity and diabetes.

A team led by Bruce Spiegelman has identified both parts of a molecular switch that normally causes some immature muscle cells in the embryo to become brown fat cells. With this switch in hand, the scientists showed in the laboratory that they could manipulate it to force other types of cells to produce brown fat, known as Brown Adipose Tissue (BAT). Their findings were reported in the journal *Nature* (*460*:1154–1158, 2009).

The scientists then transplanted these synthetic brown fat precursors, known as eBAT (engineered BAT), into adult mice to augment their innate stores of brown fat. Tests showed that the brown fat transplants were burning caloric energy at a high rate—energy that otherwise would have been stored as fat in white adipose tissue.

"Since brown fat cells have very high capacity to dissipate excess energy and counteract obesity, eBAT has a very high potential for treating obesity," said Shingo Kajimura, lead author of the paper. "We are currently working on this."

Excess caloric energy in the diet is stored in white fat calls that pile up in the body, particularly in the thighs and abdomen. The accumulated fat content in overweight people puts stress on these cells, which give out signals that cause inflammation in body organs and the circulatory system, creating risks of heart disease and diabetes.

Brown fat, by contrast, works in an opposite fashion; it evolved to protect animals from cold conditions and prevent obesity. Brown fat cells are equipped with a large supply of mitochondria—organelles that use oxygen to burn sugar from the diet to generate heat, rather than to store the energy as fat.

Scientists have long thought that brown fat was present in young animals and human newborns but virtually absent in

human adults. Recently, however, researchers have used modern PET (positron emission tomography) scanners—which detect tissue that is actively absorbing sugar—to search for deposits of brown fat in adults. Such experiments have revealed unexpectedly large amounts of brown fat scattered through the neck and chest areas.

In 2007, Spiegelman's team, led by Patrick Seale, who is the second author of the new *Nature* paper, discovered a protein, PRDM16, that serves as a switch that determines whether immature muscle cells will develop into mature muscle cells or become brown fat cells.

But this was not the whole story. The scientists suspected that PRDM16 worked with another unknown protein to initiate brown fat development. This proved to be the case. In the new experiments, the Spiegelman group found that PRMD16 works in tandem with the protein C/EBP-beta, and only as a two-part unit are they sufficient to jump-start brown fat development in several types of cells.

To find out if the PRDM16-C/EBP-beta switch could change the identity of other types of cells, forcing them to become brown fat cells, the researchers used viruses to transfer the switch into embryonic mouse connective tissue cells called fibroblasts. They also installed the switch into adult mouse skin cells, and into human skin cells isolated from foreskins removed from newborns during circumcision.

In all three cases, the fibroblasts produced mature brown fat cells. The scientists then transplanted the cells into mice, where they produced brown fat tissue. PET scans confirmed that the new brown fat tissue was burning excess energy in the animals, as it should. The experiments did not test whether the extra brown fat actually protected the mice from becoming obese.

Spiegelman said the results "give a lot more credence" to efforts to manipulate the brown fat switch as a potential means of treating people with obesity and diabetes. One strategy would be to remove some tissue from the patient, add the PRDM16-C/EBP switch, and return it to the patient where it would manufacture additional brown fat.

A more conventional possibility, Spiegelman said, would be to administer a drug to the patient that would ramp up the production of brown fat without the need for a transplant. "If we can find a hormone that does that, it's reasonable to think that it might provide a direct anti-obesity treatment."

Phytosterols and cancer

Phytosterols, which have been shown to reduce serum cholesterol levels in humans, may also "potentially prevent cancer development," according to a new meta-analysis. Emerging evidence links consumption of phytosterols to inhibition of cancers of the stomach, lung, ovaries, and breast.

Conducted by researchers from the Department of Animal Science and the Richardson Centre for Functional Foods and Nutraceuticals at the University of Manitoba, the meta-analysis appeared in the *European Journal of Clinical Nutrition* (*63*:813–820, 2009).

"This combined evidence strongly supports an anticarcinogenic action of phytosterols and hence advocates their dietary inclusion as an important strategy in prevention and treatment of cancer," the reviewers write. The mechanism of action may be linked to increased activity of caspase enzymes, they suggest. This may be achieved by incorporation of the phytosterols into the cell membranes, resulting in changes to the structure and function of the membranes and the activation of caspase enzymes.

A second possible mechanism could also involve the reduction of blood cholesterol. "High blood cholesterol level and hence the concentration of cholesterol in lipid rafts of cell membranes are associated with reduced apoptosis of cancer cells," the researchers write."Mounting evidence supports a role for phytosterols in protecting against cancer development," they continue. "Hence, phytosterols could be incorporated in diet not only to lower the cardiovascular disease risk, but also to potentially prevent cancer development," they conclude.

Do high-fat diets make us stupid and lazy?

If your short-term memory is getting worse and exercise is becoming more difficult, then scientists in the United Kingdom suggest you examine your diet. (Particularly if you are a rat, which was the animal model used in their study.)

The research, which was published online in *The FASEB Journal* (doi: 10.1096/fj.09-139691), shows that in less than 10 days of eating a high-fat diet, rats had a decreased ability to exercise and experienced significant short-term memory loss.

"Western diets are typically high in fat and are associated with long-term complications, such as obesity, diabetes, and heart failure, yet the short-term consequences of such diets have been given relatively little attention," said Andrew Murray, co-author of the study and currently at the University of Cambridge in the United Kingdom. "We hope that the findings of our study will help people to think seriously about reducing the fat content of their daily food intake to the immediate benefit of their general health, well-being, and alertness."

Murray and colleagues studied rats fed a low-fat diet (7.5% of calories as fat) and rats fed a high-fat diet (55% of calories as fat). The fat came from olive oil, soy oil, and hydrogenated coconut oil. The researchers discovered that the muscles of the rats eating the high-fat diet for four days were less able to use oxygen to make the energy needed to exercise, causing their hearts to worker harder—and increase in size.

After nine days on a high-fat diet, the rats took longer to complete a maze and made more mistakes in the process than their low-fat-diet counterparts. Researchers then investigated the cellular causes of these problems, particularly in the mitochondria of muscle cells. They found increased levels of a protein called uncoupling protein 3, which made the rats less efficient at using oxygen needed to make the energy required for running.

"It's nothing short of a high-fat hangover," said Gerald Weissmann, editor-in-chief of *The FASEB Journal*. "A long weekend spent eating hotdogs, French fries, and pizza in Orlando might be a great treat for our taste buds, but they might send our muscles and brains out to lunch."

Take your vitamins with tea

Here is a new strategy for longevity: Wash down your multivitamins with tea (preferably green).

Why? A study out of Hong Kong led by Ruth Chan found that the telomeres of people who drank an average of three cups of (largely) green tea per day were approximately 4.6 kilobases longer than people who drank an average of a quarter cup per day. (Telomeres are the sticky ends of chromosomes; they shorten as cells replicate and age. Telomere length may coincide with biological age. In this case, the researchers think the 4.6 kilobase difference corresponds to five extra years of life. A kilobase consists of a 1000-base fragment of nucleic acid.)

Put that study from the *British Journal of Nutrition* (doi:10.1017/S0007114509991383) with an epidemiological study from the *American Journal of Clinical Nutrition* (*89*:1857–1863, 2009), and the idea of washing down one's multivitamins with green tea is born. The latter study found that telomere length in the cohort of 586 women was longer among those subjects who regularly took multivitamins. Was it a matter of vitamin takers tending to lead more healthful lives or was it the multivitamins? That question is impossible to answer without further research. ■

CALENDAR (CONTINUED FROM PAGE 620)

March 4–6, 2010. Commodity Classic (sponsored by the American Soybean Association, National Corn Growers Association, National Association of Wheat Growers, and National Sorghum Producers), Anaheim Convention Center, Anaheim, California, USA. Information: www.commodityclassic.com.

March 5–6, 2010. waste to energy: International Exhibition and Conference for Energy from Waste and Biomass, Bremen, Germany. Information: www.wte-expo.com.

March 14–16, 2010. National Institute of Oilseed Products, JW Marriott Desert Springs Resort & Spa, Palm Springs, California, USA. Information: www.oilseed.org.

March 15–17, 2010. World Biofuels Markets, Amsterdam, the Netherlands. Information: www.greenpowerconferences.com.

March 21–25, 2010. American Chemical Society National Meeting and Exposition, San Francisco, California, USA. Information: http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_TRANSITIONMAIN&node_id=2060&use_sec=false&sec_url_var=region1&__uuid=b706dc39-e14f-4c5f-ba72-080d986957c1.

March 23–26, 2010. 22nd International Trade Fair and Analytica Conference ("Analytica"), New Munich Trade Fair Centre, Munich, Germany. Information: www.analytica.de.

March 23–26, 2010. Advancements in Food Safety Education: Trends, Tools and Technologies (sponsored by the US Department of Agriculture and the National Science Foundation), Hyatt Regency Atlanta, Atlanta, Georgia, USA. Information: e-mail: Atlanta2010@nsf.org; www.fsis.usda.gov/Atlanta2010.

March 24–25, 2010. Wellness 10, InterContinental Chicago O'Hare, Rosemont, Illinois, USA. Information: www.ift.org/cms/?pid=1001994.

April

April 14–15, 2010. CED 40 Annual Meeting [Comité Español de la Detergencia, Tensioactivos y Afines], Barcelona, Spain. Information: www.cedmeeting.com.

April 25–27, 2010. IMR Conference Food Hydrocolloids, Grand Hyatt Hotel, Berlin, Germany. Information: www.hydrocolloid.com.

May

May 13–15, 2010. International Symposium on Microbial Lipids: From Genomics to Lipidomics, Vienna, Austria. Information: www.eurofedlipid.org/meetings/vienna2010.

May 16–19, 2010. 101st AOCS Annual Meeting and Expo, Phoenix Convention Center, Phoenix, Arizona, USA. Information: phone: +1-217-359-2344; fax: +1-217-351-8091; e-mail: meetings@aocs.org; http://Annual_Mtg.aocs.org.

May 16–20, 2010. STLE [Society of Tribologists and Lubrication Engineers] 2010 Annual Meeting, Bally's Hotel & Casino, Las Vegas, Nevada, USA. Information: www.stle.org.

May 29–June 2, 2010. 9th ISSFAL Congress. Maastricht, Netherlands. Information: www.issfal.org.uk/meetings.html.

June

June 15–17, 2010. International Probiotic Conference 2010, Kosice, Slovakia. Information: www.probiotic-conference.net.

June 17–18, 2010. CosmeticBusiness 2010, M.O.C. (Münchener Order Center), Munich, Germany. Information:www.cosmetic-business.com/en/tradefair/kontakt.php. ■

Biotechnology News

Briefs

In a surprising move, Egypt recently reversed course and announced that it would no longer accept the import or allow the export of genetically modified (GM) foods. "It is necessary that all crops imported from abroad and exported from Egypt are accompanied by a certificate from the country of origin stating they are free of genetically modified materials," Green Planet.net quoted Egyptian Agriculture Minister Amin Abaza as saying. Although Egypt had been identified as "consum[ing] large quantities of biotech products" and being on their way to commercialization of GM crops (including an insect-resistant long-staple GM cotton strain; see *inform 20*:588, 2009), a recent dispute over GM Russian wheat apparently became the catalyst for the blanket ban.

■■■

The US Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) is seeking public comment on a petition to deregulate a soybean genetically engineered (GE) to have higher levels of oleic acid. APHIS has regulated the soybean, designated as event 305423, through its permitting process since 2002. The petition for deregulation, submitted by Pioneer Hi-Bred International, Inc. (Johnston, Iowa, USA), is in accordance with APHIS' regulations concerning the introduction of GE organisms and products. As part of the decisionmaking process, APHIS has also prepared a draft environmental assessment (EA) for review and comment.

Consideration will be given to comments received on or before November 2. Send two copies of comments by postal mail or commercial delivery to Docket No. APHIS-2007-0156, Regulatory Analysis and Development, PPD, APHIS, Station 3A-03.8, 4700 River Road, Unit 118, Riverdale, MD 20737-1238. Or visit the Federal eRulemaking portal at www.regulations.gov/fdmspublic/component/main?main=DocketDetail&d=APHIS-2007-0156.


Fernando Weberich

Steroid plant discovery shows promise

In September researchers at the Carnegie Institution for Science's Department of Plant Biology (Stanford, California, USA) announced they had discovered a key missing link in the signaling pathway for plant steroid hormones (brassinosteroids). Many important signaling pathways are relays of molecules that start at the cell surface and cascade to the nucleus to regulate genes.

This discovery marks the first such pathway in plants for which all the steps of the relay have been identified. Since this pathway shares many similarities with pathways in humans, the discovery not only could lead to the genetic engineering of crops with higher yields but also could be a key to understanding major human diseases such as cancer, diabetes, and Alzheimer's.

Brassinosteroids regulate many aspects of growth and development in plants. Brassinosteroids are similar in many respects to animal steroids but appear to function very differently at the cellular level. Animal cells usually respond to steroids using internal receptor molecules within the cell nucleus, whereas in plants the receptors, called receptor-like kinases, are anchored to the outside surface of cell membranes. For over a decade, scientists have tried to understand how the signal is passed from the cell surface to the nucleus to regulate gene expression. The final gaps were bridged in the study, published in *Nature Cell Biology* (*11*:1254–1260, 2009). The research team unraveled the pathway in cells of *Arabidopsis thaliana*.

"This is the first completely connected signaling pathway from a plant receptor-like kinase, which is one of the biggest gene families in plants," says Carnegie's Zhi-Yong Wang, leader of the research team. "The *Arabidopsis* genome encodes over 400 receptor-like kinases. . . . We know the functions of about a dozen or so. The completely connected brassinosteroid pathway uses at least six proteins to pass the signal from the receptor all the way to the nuclear genes expressed. This will be a new paradigm for understanding the functional mechanism of other receptor-like kinases."

Understanding the molecular

CONTINUED ON PAGE 644

Discovering soybean plants resistant to aphids, and a new aphid

Debra Levey Larson

This year farmers in the US Midwest are growing a new variety of soybeans developed by University of Illinois (U of I; Urbana-Champaign, USA) researchers that has resistance to soybean aphids. However, in addition to the resistant plants, U of I researchers also discovered a new soybean aphid that is not controlled by this resistance.

Soybean aphids made their first appearance in North America in the summer of 2000, resulting in tremendous crop losses for farmers. U of I researchers began immediately searching for a variety of soybean that is resistant to the new pest.

Dowling and Jackson were the first two resistant varieties to be identified. "We have the US Soybean Germplasm collection here at Illinois. It houses about 18,000 different accessions," said Glen Hartman, soybean plant pathologist with the US Department of Agriculture and U of I. "We didn't screen all 18,000, but we went through a small set of 4,000 to 5,000 and that's where Jackson and Dowling came from. We knew they were resistant, but we had to do the crossings and look at the inheritance patterns to figure out whether the resistance was because of a single gene or multiple genes."

With additional screening, a third soybean resistant to aphids was found—a Japanese variety known as PI 200538. "After we mapped the genes from these sources, we discovered that Jackson and Dowling had genes mapping to the same place on a chromosome and the PI had a gene mapping to a different place. This means that Jackson and Dowling likely have the same resistance gene and PI 200538 has a different gene we can use in breeding."

Researcher Brian Diers said that both Jackson and Dowling originated in the southern United States, so neither could be grown to seed in the Midwest. They used traditional breeding techniques together with marker-assisted selection to quickly breed the resistance genes into varieties that are adapted to the Midwest.

"Because the aphid resistance is conferred by a single gene in the resistance sources, we were able to breed these genes into Midwest-adapted varieties quickly and easily," Diers said. "We can complete three crossing generations a year by using both greenhouses and fields. This year is a milestone because we now have a variety that's being commercially produced that carries the resistance gene from Dowling. This is its first commercial production of an aphid-resistant variety in the Midwest."

While studying soybean plants, though, they discovered a new type of aphid. "We were excited about finding the resistance. We discovered this gene from Dowling and Jackson, bred it into varieties, and we hoped that we could solve the aphid problem, but of course things are never that simple," Diers said. "We found that there are different biotypes of soybean aphids, including a biotype that can overcome the resistance gene for Dowling."

In tests, this new aphid was able to infest Dowling as well as it could any susceptible genotype of soybean. "We don't know how widespread those aphids are or whether or not this is actually going to occur in fields, but certainly it's something to be concerned about because we know that resistance isn't going to be perfect," Diers said.

The good news is that the PI 200538 gene for resistance is different from the one in Dowling and Jackson. "We found that this second resistance gene in the PI protects the plants against this new biotype of aphid. We are currently breeding the PI 200538 gene into varieties, but it will be at least a few years before any varieties with this gene will be released."

Even after the appearance of this new aphid, Diers is still optimistic. "We have one variety with the Dowling resistance gene that's being commercialized this year. A company is increasing seed of a second variety with the Dowling gene that should be commercialized next year. So we'll have two varieties available to growers." He explained that the U of I aphid-resistant germplasm and marker technology is licensed to private seed companies who are using it to breed their own varieties.

Debra Levey Larson can be contacted at dlarson@uiuc.edu.

■■■

Great Plains—The Camelina Company (Cincinnati, Ohio, USA) recently announced that its partner, Agragen (Cincinnati), has filed for patent protection on a novel method designed to increase the tolerance of camelina to Group 2 herbicides. Agragen's science team has introduced specific modifications that increase camelina's tolerance to Group 2 herbicides by more than 300-fold in laboratory testing. This unique approach is designed to make camelina more tolerant for planting in areas where residual Group 2 herbicides in the soil limit a farmer's cropping options. The introduction of an herbicide-tolerant camelina will potentially open up the crop to millions of additional acres of rotational land.

■■■

Bayer CropScience (Monheim am Rhein, Germany) and Precision BioSciences Inc. (Research Triangle Park, North Carolina, USA) announced in September a collaborative agreement to create site-specific genome modifications in plants. The agreement provides Bayer CropScience with nonexclusive access to aspects of Precision BioSciences' proprietary Directed Nuclease Editor™ (DNE) technology, which can be used to develop novel traits in plants.

Precision BioSciences' DNE technology uses protein engineering methods to produce rationally designed, obligate heterodimer endonucleases that have the ability to modify single, unique sites within a large genome. Using DNE technology, crop researchers can insert multiple genes at a single site within a plant chromosome, thereby efficiently and precisely conferring desirable traits into plant species. This technology could thus streamline the trait development and breeding processes and potentially accelerate a trait's time to market.

In related news, Bayer CropScience and Performance Plants Inc. (Kingston, Ontario, Canada) have entered into an exclusive licensing agreement for the development and commercialization of drought-tolerant cotton using Performance Plants'

CONTINUED ON NEXT PAGE

Yield Protection Technology® (YPT). According to the companies, this agreement follows several years of field trials that have shown YPT to be effective in preserving yields under conditions of drought stress. They reported that, in five years of field trials, YPT canola has produced consistent seed yield increases of up to 26%.

■■■

Monsanto Co. (St. Louis, Missouri, USA) recently announced a non-exclusive research and commercial license agreement with Cellectis S.A. (Romainville, France), a biotechnology company specializing in genome engineering, for broad use of its meganuclease technology in plants. Meganucleases are molecular scissors that can be directed to a single site in the genome of a plant cell, thereby allowing a wide range of precise genome modifications, including gene stacking and gene knock-out as well as modulation of gene function to develop new traits. Under the agreement, Monsanto will have access to Cellectis' intellectual property on meganucleases and its custom meganuclease production platform.

■■■

In September, Reuters reported that two new varieties of GM corn engineered to resist pests and glyphosate-based herbicide had been approved by Brazil's biosecurity regulator, CTNBio. The varieties were developed separately by Monsanto and Syngenta. A third strain developed by Syngenta, with insect-resistant properties only, was also approved. Nine GM corn varieties are now approved for use in Brazil, according to the report. Reuters also said that about 30% of the seeds planted for Brazil's 2009–2010 corn crop will be genetically modified.

■■■

DuPont (Wilmington, Delaware, USA) announced in September that it had received full Canadian regulatory approval of its proprietary herbicide tolerance trait, Optimum™ GAT™, in corn and soybeans for cultivation, feed, and food. DuPont business Pioneer Hi-Bred has already received US approval of the Optimum GAT trait in soybeans and anticipates US approval of the Optimum GAT trait in corn in the coming months. ■

mechanism of brassinosteroid signaling could help researchers develop strategies and molecular tools for genetic engineering of plants with modified sensitivity to hormones, either produced by the plant or sprayed on crops during cultivation, resulting in higher yield or improved traits.

DEFRA, FSA publish reports on GM food and feed

In July 2008, the *Food Matters* report was published and included two parallel action points for the Food Standards Agency (FSA) and the UK Department for Environment, Food and Rural Affairs (DEFRA) on GM food and animal feed. They were:

- DEFRA, working with FSA, would publish an analysis of the potential impacts on the livestock sector arising from global food trends in GM production and the current operation of the GM approval system in the EU.
- In parallel, FSA, working with DEFRA, would publish an analysis of the extent to which changes in the market are putting a strain on the regulatory system for GM products (including animal feed) and the implications for UK consumers.

The report on the work that FSA and DEFRA have undertaken in response has been published and can be found at www.food.gov.uk/news/newsarchive/2009/aug/gm. Further, a progress report updating all of the *Food Matters* actions, including the two action points above, was published in August. Entitled *Food Matters: One year on*, the report can be found at www.defra.gov.uk/foodfarm/food/pdf/food-matters-oneyearon090806.pdf. Among the findings:

"DEFRA has assessed the potential impacts of global trends in GM production on the UK livestock sector. It confirms that if soya feed imports from South America were curtailed because of problems with the EU GM regime, it could have a serious effect on livestock production. There would be little scope for alternative soya supplies, and use of other protein feeds would cost more and be less efficient. The likelihood of a major supply problem arising is uncertain, being dependent on whether or not Brazil and Argentina cultivate new GM soya crops before they are cleared for EU import, and on whether the EU adopts a more pragmatic approach towards the potential for low level presence of unapproved GM material in imported commodities."

Further: "FSA's research concluded that the supply of GM and non-GM soya are of immediate concern to the animal feed industry."

INRA reports on GMO detection

In late August, INRA (the French National Institute for Agricultural Research) reported on recent developments in GMO (GM organism) detection methods.

In recent years, growth in the numbers of GM plants, the asynchronous approval of GMO between the European Union and other countries, and the dissemination of GMO not authorized in any particular country (Bt10 in the United States, Bt63 in China, etc.) have necessitated the development of detection techniques that will enable a distinction between authorized and non-authorized GMO.

As early as 1999, in the context of the European GMOchips program, INRA researchers proposed the "Matrix Approach," the aim being to develop methods that would be able to detect non-approved and generally unknown GMO (UGM). This matrix approach represents the second stage in the methods and strategies for the detection of UGM developed by INRA, the first having been the so-called differential quantitative polymerase chain reaction (*Anal. Biochem. 376*:189–199, 2008), which is currently used by control laboratories and is under validation in the context of the European Co-Extra research program (www.coextra.eu), coordinated by INRA.

Thanks to the satisfactory results obtained by the GMOchips program, a new biochip, called DualChip®, which utilizes EAT (Eppendorf Arrays Technology) was proposed and then validated by the European Joint Research Centre under ISO standard 5725 (Co-Extra program). The results of interlaboratory studies have now been published (http://bgmo.jrc.ec.europa.eu/home/documents/report-JRC-EAT.pdf; *Eur. Food Res. Technol. 227*:1621–1632, 2008).

INRA also jointly chairs the UGM working group for the European Network of GMO Laboratories (ENGL). A document explaining the approach adopted regarding UGM and their detection is scheduled to appear in the near future. ■

Briefs

Technip (Courbevoie, France) has been awarded a contract by Chevron Pacific Indonesia for an oil recovery trial project in Indonesia. The contract covers a range of services including construction management for a polymer and surfactant mixing plant at the Minas oilfield in Sumatra. The work is scheduled to be completed in the second quarter of 2013. See the November issue of *inform* for a feature on enhanced oil recovery.

■■■

Chemguard, a manufacturer of fluorosurfactant specialty chemicals based in Mansfield, Texas, USA, has expanded its short-chain (C_6) fluorosurfactant products to include a new line of phosphate ester-based anionic fluorosurfactants. More information is available at www.chemguard.com.

■■■

In August, the German Federal Institute for Risk Assessment (BfR) recommended a ban on the antibacterial agent triclosan (5-chloro-2-[2,4-dichlorophenoxy]phenol) in food contact plastic materials. Triclosan is used in a wide range of personal care products, including toothpaste and cosmetics, as well as in clothing and in plastics. The report is available, in German, at www.bfr.bund.de/.

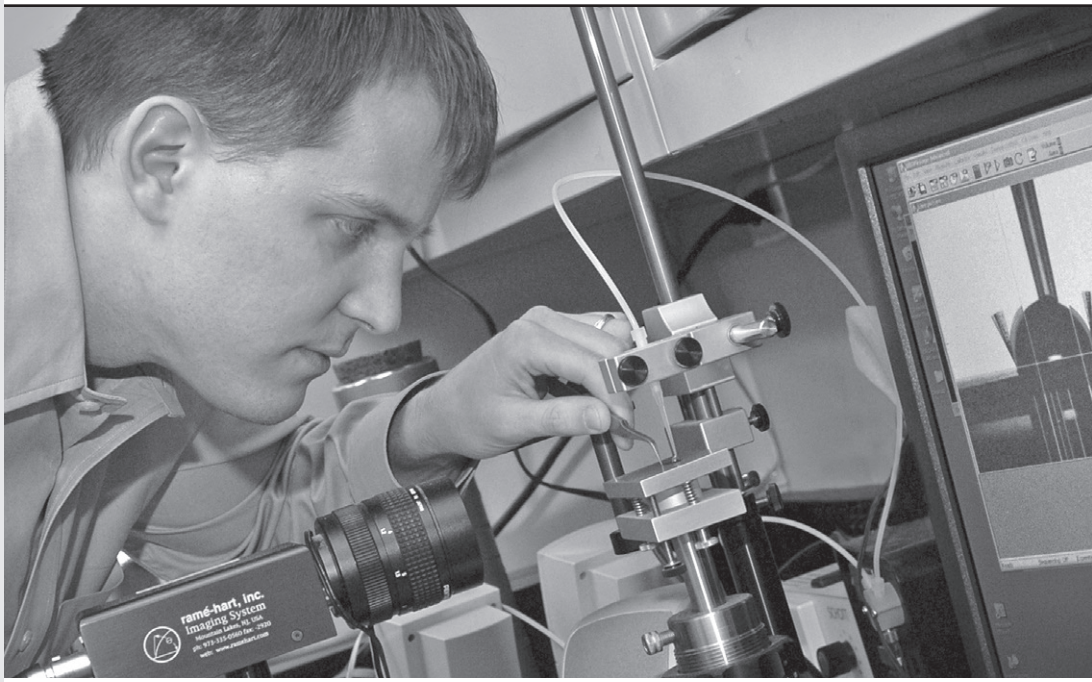
■■■

In 2008, Spokane County in the US state of Washington enacted a ban on high phosphate levels in home dishwashing detergents. The *Spokesman-Review* newspaper reported in August that water coming into Spokane's sewage plant during the first 12 months of the ban had nearly 11% less phosphorus than the annual average the previous three years.

■■■

Japan's Kao Corp. is building a 16-billion-yen (almost $171 million) research center in the city of Wakayama to develop a range of environmentally friendly products. Completion of the Eco-Technology Research Center is expected in February 2011. The company also announced it has set a goal of cutting its carbon emissions by 35% by 2020. ■

S&D News



Jeffrey Youngblood, an assistant professor of materials engineering at Purdue University (West Lafayette, Indiana, USA), works with equipment that enables researchers to measure the contact angle of a liquid as it beads up on a surface. Photo courtesy of Purdue News Service/ David Umberger.

Water as a super detergent

The next disruptive technology likely to affect the household products industries may be a mere CRADA (Cooperative Research and Development Agreement) away from reality.

" . . . Using this product transforms water into a super detergent," said lead researcher Jeffrey Youngblood of Purdue University in West Lafayette, Indiana, USA. Youngblood described what he and his co-workers believe is a simple and effective coating for glass, plastics, and other materials that will allow oily smears to be cleaned away with plain water.

Their report at the 238th National Meeting of the American Chemical Society pointed out that the same coating-forming material can be added to common window cleaning sprays and used to prevent bathroom mirrors, automobile windshields, and other surfaces from fogging up.

"You add water, and the oil just comes right off like magic," Youngblood added. "These are eco-friendly coatings—environmentally 'green' in the sense that they eliminate the need for detergents and solvents in settings ranging from home kitchens to industrial machine shops that must contend with heavy oil spills."

The materials could be used in a range of consumer and industrial products, Youngblood said. They include household cleaners, easy-to-clean paints, water filters that separate water from oil, sealants for concrete floors and walls that repel oil in home garages and auto repair shops. In addition, anti-fog coatings could be used on windshields or eyewear, including everyday lenses and fog-free scuba masks.

The eco-friendly coatings could reduce the need for detergents containing phosphates. "We put out tons of detergents and phosphates each year," said Youngblood, adding that the polymer materials also could reduce the use of detergents for laundering clothes. This would cut down on the release of phosphates, which, left untreated, wash into lakes and streams and stimulate growth of algae, depleting oxygen supplies in ways that cause fish kills in waterways.

"The idea is to use these polymers to clean in situations where it is inconvenient

to apply soap or anywhere you would need to have oil cleaned off easily," said Youngblood, a materials engineer at Purdue. "Oil fouling is always a problem. A lot of people overlook the fact that pure water will generally not remove oil from a surface, but using this product transforms water into a super detergent."

Youngblood's group spent years in an effort to develop the coatings. Once successful, their framework for self-cleaning plastics was in place. "With these materials, if you stuck an oil droplet on them you could completely remove it with water. You could basically do soap-free rinsing."

The coatings have a bottom layer of polyethylene glycol, which attracts water, and an upper layer of a Teflon-like molecule that prevents the passage of oil. The result is a surface that holds a film of water while repelling oil. "Our work is a big step forward toward useable materials as either additives or coatings," he said, "and few others are working in this area. Most research on self-cleaning is done with different surfaces."

Youngblood is currently evaluating self-cleaning and anti-fog capabilities for polymers on different kinds of metals and ceramics. Preliminary tests on the lifetime of anti-fog coatings are especially encouraging. "We have stored these on shelves and use them months afterwards, and we haven't noticed a decrease in performance," he said. "We feel that we can make all our self-cleaning plastics commercially available within a few years."

Nanotech products top 1,000

The number of "nanotechnology-enabled" consumer products on the global market has passed the 1,000 mark, according to the Project on Emerging Nanotechnologies (PEN).

Health and fitness items continue to dominate the PEN inventory, representing 60% of products listed. More products are based on nanoscale silver—used for its antimicrobial properties—than any other nanomaterial; 259 products (26% of the inventory) use silver nanoparticles. The updated inventory represents products from over 24 countries, including the United States, China, Canada, and Germany.

A quick look at some of the personal care items on the list finds that many companies give only the most cursory information about how (and why) nanotechnology has been used in their products' manufacture. For example, a hair-care product states that "with the unique molecular nanotechnology, Color Longevity Formula hair color lasts longer and is more vibrant."

"The use of nanotechnology in consumer products continues to grow rapidly," says PEN Director David Rejeski. "When we launched the inventory in March 2006 we only had 212 products. If the introduction of new products continues at the present rate, the number of products listed in the inventory will reach close to 1,600 within the next two years. This will provide significant oversight challenges for agencies like the US Food and Drug Administration and Consumer Product Safety Commission, which often lack any mechanisms to identify nanotech products before they enter the marketplace."

As defined by PEN, nanotechnology "is the ability to measure, see, manipulate, and manufacture things usually between 1 and 100 nanometers. A nanometer is one billionth of a meter. A human hair is roughly 100,000 nanometers wide. The limit of the human eye's capacity to see without a microscope is about 10,000 nanometers." In 2007, the global market for goods incorporating nanotechnology totaled $147 billion. Lux Research Inc., a market research firm based in New York, projects that figure will grow to $3.1 trillion by 2015.

The Wilson Center and The Pew Charitable Trusts created PEN in 2005. It is a partnership dedicated to helping business, governments, and the public anticipate and manage the possible health and environmental implications of nanotechnology. To learn more, visit www.nanotechproject.org.

SDA and CSPA call for change

The American Chemistry Council (ACC; Washington, DC, USA) released its specific guidelines for the modernization of US chemical safety laws.

"Current law [the Toxic Substances Control Act, or TSCA] is more than 30 years old and the law must be updated to keep pace with science," said Cal Dooley, president and chief executive officer (CEO) of ACC. Dooley presented the Council's proposed 10 principles for effective chemicals management at a press briefing in August in Washington.

Dooley was joined at the press briefing by Mark Rohr, president and CEO of Albemarle Corp.; Dave Kepler, executive vice president of Dow Chemical Co.; Tom Shepherd, chairman and CEO of The Shepherd Chemical Co.; Chris Cathcart, president and CEO of the Consumer Specialty Products Association (CSPA); and Ernie Rosenberg, president and CEO of The Soap and Detergent Association (SDA).

"Some might be surprised that we in the industry are supporting enhanced regulation. They should not be. We have invested hundreds of millions of dollars annually in testing and research and support a robust chemicals management system. High priority chemicals should be tested and evaluated under generally accepted scientific principles and the effort should be overseen by an Environmental Protection Agency that is provided adequate resources to do its job. It will give the public confidence in what we do," said Kepler.

"Modernizing TSCA will go a long way toward enhancing the public's confidence in responsible management and regulation of chemicals," said Rosenberg. "SDA is committed to targeted risk-management measures that focus priorities and are practical, timely, transparent, and responsive to the needs of consumers and other stakeholders."

The principles include the following statements:

- Chemicals should be safe for their intended use.
- The US Environmental Protection Agency (EPA) should prioritize chemicals for safe use determinations to focus on chemicals of highest concern.
- The chemical industry should continue to provide robust information in a transparent manner on chemicals it produces.
- Potential risks faced by children should be an important factor in safe use determinations.
- Companies and EPA should work together to enhance public access to chemical health and safety information.
- EPA should rely on scientifically valid data and information, and should have the resources it needs to ensure the safety of chemicals.
- A modernized TSCA should encourage technological innovation.

For the full list of chemical management principles, see www.americanchemistry.com/TSCAprinciples.

S&D patents

Lavatory-freshening and/or cleaning system

Moodycliffe, T.I., and J. Veltman, S.C. Johnson & Son Inc., July 21, 2009, US7563755

A lavatory-freshening and/or cleaning system comprises a dispenser for dispensing liquid composition from under the rim of a lavatory bowl. The dispenser is in the form of a reservoir arranged for suspension from the rim of a lavatory bowl, and the reservoir contains the liquid composition. The liquid composition comprises a combination of anionic and nonionic surfactants having a total concentration equal to substantially 7.6 wt%, a thickening agent having a concentration of 0.40 wt%, and a perfume having a concentration of 6.00 wt%.

Water-soluble, liquid-containing pouch

Kouvroukoglou, S., *et al.*, The Procter & Gamble Co., July 21, 2009, US7563757

The present invention relates to water-soluble pouch which contains a liquid detergent composition, wherein the pouch is a water-soluble film, the film material comprising a polyvinyl alcohol, and wherein the liquid detergent composition also comprises a plasticizer, wherein the plasticizer is selected from the group consisting of glycerol, ethylene glycol, diethylene glycol, triethylene glycol, 2-methyl-1,3-propanediol, sorbitol, methanol, diglycerol, 1,4-butanediol, urea and mixtures thereof, and wherein the liquid detergent composition further comprises a viscosity modifier, preferably a hydrogenated castor oil.

Floor-cleaning and -care compositions

Rogmann, K.-H., *et al.*, Ecolab Inc., July 21, 2009, US7563759

The patent involves an aqueous floor-cleaning and/or -care composition, containing, based on the total composition, at least 3% by weight of a nonionic surfactant of formula I: ##STR00001## wherein R^1 represents hydrogen or an alkyl radical having 1 to 18 C atoms, and R^2, independently of R^1, represents hydrogen or an alkyl radical having 1 to 18 C atoms, and the sum of the C atoms present overall in R^1 and R^2 is between 6 and 18, and R^3 represents an alkyl radical having 4 to 18 C atoms, and R^4 hydrogen or an alkyl radical having 1 to 6 C atoms and n is a number from 1 to 30 and m a number from 0 to 5.

Fabric care composition

Frankenbach, G.M., The Procter & Gamble Co., August 4, 2009, US7569529

The patent involves the use of a first fabric care composition comprising a first perfume delivery agent to treat a fabric and subsequently and independently treating the fabric using a second fabric care composition comprising a second perfume delivery agent provides a synergistic odor benefit on the fabric.

Antimicrobial composition

Pan, R.Y.-L., *et al.*, The Procter & Gamble Co., August 4, 2009, US7569530

The patent involves antimicrobial compositions that provide enhanced immediate and residual antiviral and antibacterial efficacy against rhinovirus, rotavirus, coronavirus, respiratory syncytial virus, Gram-positive bacteria, Gram-negative bacteria, and combinations thereof. More specifically, antimicrobial compositions comprising an organic acid or organic acid mixture and a short-chain anionic surfactant having at least one of a large head group; a branched alkyl chain and an unsaturated alkyl chain. Further, products incorporating the antimicrobial compositions of the present invention and methods of using the antimicrobial compositions and products are disclosed herein.

Cosmetic composition

Dumousseaux, C., and M. Kawamoto, L'Oreal, August 6, 2009, WO/2009/095808

The invention relates to a cosmetic composition comprising in a cosmetically acceptable medium flakes comprising at least one fluorescent agent, entrapped in an hybride [*sic*] matrix comprising at least one metal oxide, at least one hydrophobic group linked to the at least one metal oxide and at least one organic surfactant.

Impregnated powder improving bioavailability, solubility

Besse, J., *et al.,* SAS Galenix Innovations, August 4, 2009, US7569274

The invention relates to an impregnated powder for increasing the bioavailability and/or the solubility of at least one active principle comprising a solid, inert support in a particle form impregnated by a liquid medium comprising a hydrophobic phase and optionally a hydrophilic phase, at least one surfactant and at least one active principle dissolved in at least one of said phases, wherein said active principle(s) is(are) also present in at least one of said phases in the form of a suspension. Such an impregnated powder is used as a base for various preparations in the pharmaceutical, parapharmaceutical, and cosmetic field, in the food complement field, and in the food processing industry.

Fabric-softening laundry detergent

Vanpachtenbeke, T.R.M., *et al.*, The Procter & Gamble Co., August 6, 2009, WO/2009/095823

The invention relates to aqueous laundry detergent compositions containing surfactants and fatty acid, having a hydrogen potential of from about 6 to about 11 and containing a polymer having a number average molecular weight of from about 700,000 to about 4,000,000 and comprising monomeric units including nonionic monomers selected from acrylamide, N,N-dialkyl acrylamide, methacrylamide, N,N-dialkylmethacrylamide, hydroxyalkyl acrylate and vinyl pyrrolidone, vinyl acetate, vinyl alcohol, and mixtures.

Liquid composition

Geret, L., *et al.*, Ecolab Inc., August 6, 2009, WO/2009/095827

The invention involves a liquid composition . . . based on surfactants and enzymes, and is particularly useful for manual cleaning of instruments. In manual and ultrasonic application the composition in use concentration shows low foaming and gives a cleaning solution which is not cloudy at least at a temperature in the range from 16°C to 40°C. ■

*inform*ation

Free online access to the *Journal of Surfactants and Detergents* (*JSD*) is available from now until the end of November at www.springerlink.com/content/1097-3958. *JSD* is published by AOCS Press and Springer Business+Media.

People News/ Inside AOCS

DuPont streamlines its organization

In response to current economic conditions, DuPont (Wilmington, Delaware, USA) announced a number of changes in mid-August. Among these were the elimination of five group vice president positions and existing support structure; consolidation of the company's 23 businesses into 14; and increases for these 14 businesses in regional business responsibility and accountability.

Effective October 1, the following leadership appointments took place:

- **Thomas M. Connelly, Jr**., executive vice president and chief innovation officer, took responsibility for the Applied Biosciences, Nutrition & Health, Performance Polymers, and Packaging & Industrial Polymers businesses. He continues to lead science and technology and geographic regions outside the United States.
- **James C. Borel**, group vice president for DuPont Agriculture, was named executive vice president. His responsibilities include Pioneer Hi-Bred and the Crop Protection businesses.
- **Craig F. Binnetti**, senior vice president, Nutrition & Health, took on the additional responsibility for Appled BioSciences and became president, Nutrition & Health and Applied BioSciences.
- **Uma Chowdhry** is now senior vice president and chief science & technology officer.
- **Paul E. Schickler** is now president of Pioneer Hi-Bred and **Dean Oestreich** is chairman.
- **James C. Collins** is president of Crops Protection.

LiveFuels appoints Paul as advisor

Former Chevron vice president and chief technology officer **Donald L. Paul** has been added to the scientific advisory board of LiveFuels (San Carlos, California, USA), a developer of algae-based renewable fuel (see *inform 20*:636, 2009). In the company press release, Paul said, "We know today that biofuel technology can create renewable materials which integrate into the petroleum processing system to produce transport fuels; what we need are business models for producing them sustainably . . . . LiveFuels may be the only startup company that has thought about algal biofuel production from start to finish in the context of the existing fuel infrastructure."

New president for Novozymes North America

Adam Monroe

Lars Hansen

On August 11 Novozymes, whose North American headquarters is in Franklinton, North Carolina, announced the appointment of **Adam Monroe** as president of its North American region. Monroe replaces **Lars Hansen**, who has returned to Denmark to head the company's European region.

Monroe has been with Novozymes since 1991 and most recently had responsibilities for supply chain and capacity planning in the Americas and global planning. He successfully established the company's global manufacturing supply line of enzymes for the biofuels market during a period of rapid growth. The Franklinton facility also supplies enzymes for other uses, including brewing beer, making detergents, and treating wastewater. ■

In Memoriam

Walter Marvin Cochran

Long-time AOCS member Walter Marvin Cochran died on January 6, 2009, in Camarillo, California, USA. Born in Richmond, Virginia, USA on September 16, 1916, he grew up in DeKalb, Illinois, USA, and graduated from Northern Illinois State Teachers College, now Northern Illinois University. He also did post-graduate work at the University of Chicago.

Cochran served in World War II as a Naval Air Combat intelligence officer, stationed in the Aleutians.

He started his professional career as an analytical chemist with Swift and Co. in Chicago. After his Naval service, he joined the Durkee Famous Foods Division of Glidden Co., also in Chicago, where he attained the position of food research and technical service director. He stayed with Durkee until 1970, when he rejoined Swift as manager of edible oils research. After retirement from Swift in 1981, Cochran provided consulting services for Bunge Foods for five years.

In 1975 he received the Alton E. Bailey Award and Medal from the American Oil Chemists' Society North Central Section, "for his many practical contributions to the fats and oil industry, including the development of emulsifier, fat, and shortening systems for use in bakery, confectionery, imitation dairy, and prepared mix products."

Cochran married Elizabeth Thomson Parkhurst in 1944. They were 53-year residents of Highland Park, Illinois. They moved to California in 2003 to be near a daughter.

He is survived by his wife of 64 years, two daughters and a son; seven grandchildren; and two great-grandchildren.

Book Review

Modern Techniques for Food Authentication
Da-Wen Sun (editor), 2008
Academic Press/Elsevier, 689 pages
ISBN-978-0-12-374085-4, $159.95

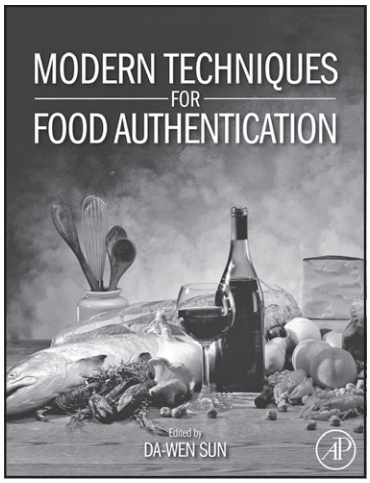
Anakalo Shitandi

Many food processors have developed and are installing systems to ensure that their products meet the legislated demands of the countries where their products are sold. This is partially in response to the growing interest and awareness of the need to trace and authenticate food products. Governments, through their local standards bodies, are striving to ensure that tested and valid methods are available to meet industry needs and to protect the public. The production and widespread sale of genetically engineered foods has increased expectations among consumers to be better informed and protected by their governments.

Modern Techniques for Food Authentication, edited by Da-Wen Sun, provides an important review of both established and developing technologies in food authentication. Over the course of 17 chapters, the book covers recently developed techniques, including aspects of spectroscopy, chromatography, DNA analyses, enzymatic assays, electrophoretic techniques, and thermal and chemometric methods. While the book is rather large, the chapters are grouped into well-designed components, which make it much easier to read.

Chapter 1 provides a comprehensive introduction summarizing the analytical techniques applied to food authentication. Chapters 2 through 9 discuss the numerous spectroscopic techniques used for food authentication. These include mid-infrared and Fourier transform mid-infrared spectroscopies, near-infrared spectroscopy, Fourier transform near-infrared spectroscopy, Raman spectroscopy and fluorescence, and ultraviolet-visible spectroscopy including the combined isotopic-spectroscopic techniques. Chapter 9 is particularly informative with good depth of the topics discussed. The discussion includes stable isotope ratio measurements using recent applications of food authenticity from the literature. The inclusion of referenced applications makes the text useful for scientists and researchers in the field of food authenticity.

Chapters10 and 11 cover chromatographic techniques, particularly gas chromatography and high-performance liquid chromatography. Chapter 12 highlights DNA-based techniques, which are based on the polymerase chain reaction, while Chapter 13 discusses the enzyme-linked immunosorbent assay. Chapter 12 examines



the genetic discrimination of related food species. The molecular techniques discussed are of particular interest since genetically engineered foods have found their way into supermarkets. The techniques discussed can be used for identifying various species in food products and feedstuffs including fish, plant species, cell lines, animal breeds, and genetically modified organisms. The important subject area of proteomics and metabolomic analysis is rather limited in coverage and perhaps this could be extended in future editions. Issues in detecting genetically-modified organisms (GMO) and developing improved GMO detection methods could also be strengthened.

Chapters 14, 15, and 16 cover electrophoretic techniques, thermal techniques, and chemometric methods currently used for food authentication. The book appropriately ends with a chapter highlighting the trends in food authentication.

One possible drawback of this book may be the limited coverage and discussion on traceability and food processing. While it does not fall into the typical framework of analysis, good traceability systems can be particularly useful and important when problems arise in the food supply chain. It may be of future interest to consider a chapter on this topic, specifically the development and implementation of effective traceability and product recall systems.

In conclusion, *Modern Techniques for Food Authentication* is interesting reading on an important subject. It provides a comprehensive survey of analytical methods applied to investigate and confirm authenticity or adulteration. This book should be a useful text for undergraduate and graduate students, as well as a very good reference source for researchers interested in food authentication.

Anakalo Shitandi has a Ph.D. from the Swedish University of Agriculture in Uppsala, Sweden, with a focus on food safety. He is a senior lecturer and researcher at Egerton University in Kenya. He can be reached at either anakalos@gmail.com or guildfordresearch@lycos.com.

Patents

Patent Application

Method for reducing acrylamide in foods, foods having reduced levels of acrylamide, and article of commerce

Zyzak, D., *et al*., Procter & Gamble Co., July 30, 2009, US20090191310A1

A method for the reduction of acrylamide in food products, food products having reduced levels of acrylamide, and an article of commerce. In one aspect, the method comprises reducing the level of asparagine in a food material before final heating (e.g., cooking). In another aspect, the method comprises adding to a food material an enzyme capable of hydrolyzing the amide group of free asparagine. In yet another aspect, an article of commerce communicates to the consumer that a food product has reduced or low levels of acrylamide or asparagine.

Published Patents

Method for producing vegetable oil fuel

Matsumura, M., *et al*., Foundation for Advancement of International Science, March 3, 2009, US7497939B2

A method for producing vegetable oil fuel with low viscosity, including transesterification of vegetable oil with triglyceride having unsaturated fatty acid, ozone treatment of unsaturated fatty acid methyl ester generated in the transesterification step, and reduction of the ozonide generated in the ozone treatment step.

Edible spread composition and packaged product

Kincaid, C., *et al*., Kraft Foods Global Brands LLC, March 3, 2009, US7498050B2

An edible spread composition comprises a homogenous mixture of plant fiber-containing material, edible oil, water, and an effective amount of an emulsifier that prevents separation of oil from the plant fiber and other mixture solids that otherwise occurs in its absence when the edible spread composition is discharged while held under pressure. The edible spread composition may be, for instance, a peanut butter spread composition or a chocolate spread composition. There also is a packaged spread product comprising the edible spread composition that is held inside a pressurized container and dispensed without experiencing oil separation.

Homogeneous process for the hydrogenation of dicarboxylic acids and/or anhydrides thereof

Wood, M., *et al*., Davy Process Technology Ltd., March 3, 2009, US7498450B2

A homogeneous process for the hydrogenation of dicarboxylic acids and/or anhydrides in the presence of a catalyst comprising: (i) ruthenium, rhodium, iron, osmium, or palladium; and (ii) an organic phosphine; wherein the hydrogenation is carried out in the presence of at least about 1% by weight water and wherein the reaction is carried out at a pressure of from about 500 psig to about 2000 psig and a temperature of from about 200 to about 300°C such that from about 1 mol to about 10 mol of hydrogen are used to strip 1 mole of product from the reactor.

Low *trans*-fatty acid fats and fat compositions and methods of making same

Van Toor, H., *et al*., Cargill, March 3, 2009, US7498453B2

This disclosure describes select low *trans*-fatty acid fats and fat compositions and methods of making such fats and fat compositions. These fats and fat compositions achieve properties commonly associated with typical partially hydrogenated fats, but avoid the high *trans*-fatty acid contents typically associated with such fats.

Immobilized cells and liposomes and method of immobilizing the same

Nagamune, T., *et al*., National Institute of Advanced Industrial Science and Technology, March 10, 2009, US7501280B2

In an inexpensive and convenient method for immobilizing a suspension cell, a phospholipid vesicle, or the like regardless of the type of cell, on the surface of a solid phase, a cell is immobilized by causing the cell to contact a support having a hydrophobic chain and a hydrophilic chain.

Aqueous resin dispersion for adhesive and composition thereof

Ootuka, M., and Igarashi, Y., Asahi Chemical Corp., March 10, 2009, US7501475B2

To provide a water-based polymer dispersion for isocyanate-crosslinked adhesives comprising a polymer (i) that is obtained by emulsion polymerization of a monomer composition comprising at least one monomer selected from the group consisting of an aromatic vinyl monomer and a (meth)acrylate monomer, a cross-linkable monomer, and a different monomer, in respective predetermined amounts; and a polymer (ii) that is obtained by emulsion polymerization of a monomer composition comprising at least one

monomer selected from the group consisting of an aromatic vinyl monomer and a (meth)acrylate monomer, a hydroxyl group-containing vinyl monomer, an ethylenically unsaturated carboxylic acid monomer, and a different monomer, in respective predetermined amounts, wherein the polymers (i) and (ii) have a T_g (glass-transition temperature) difference of 20 to 80°C.

Process for the pre-treatment of vegetable oils for physical refining

Chakrabarti, P., and others, Council of Scientific and Industrial Research, February 24, 2009, US7494676B2

The present invention relates to a simple and economically attractive process for the pretreatment of vegetable oils that involves (i) enzymatic degumming with commercially available phospholipase A_1 from sources such as the *Aspergillus oryzae* microorganism, (ii) bleaching of the enzymatically degummed oil using bleaching earth and activated carbon, and (iii) dewaxing (in case of rice bran oil) of degummed and bleached oil at lower temperature to obtain oil with less than 5 ppm of residual phosphorus, which is amenable for physical refining.

Method and apparatus for processing vegetable oil miscella, method for conditioning a polymeric microfiltration membrane, membrane, and lecithin product

Jirjis, B., *et al*., Cargill, February 24, 2009, US7494679B2

A method for processing vegetable oil miscella is provided. The method includes steps of feeding vegetable oil miscella to a conditioned polymeric microfiltration membrane, and recovering a permeate stream having a decreased weight percentage of phospholipids compared with the weight percentage of phospholipids provided in the miscella. The retentate stream can be further processed for the recovery of lecithin. The polymeric microfiltration membrane can be conditioned for the selective separation of phospholipids in the miscella. A method for conditioning a membrane for selective separation of phospholipids from vegetable oil miscella, and the resulting membrane, are provided. The membrane that can be conditioned can be characterized as having an average pore size of between about 0.1 and about 2 microns.

Method of quantification of carboxylic acids by mass spectrometry

Nguyen, H., *et al*., February 24, 2009, US7494822B2

Method of identification and quantitative analysis of carboxylic acid(s) in a sample by mass spectrometry using stable isotope-labeled internal standard is provided. Said internal standard is prepared by reaction of an authentic sample of said carboxylic acid with a stable isotope-labeled reagent, and is added to a sample containing said carboxylic acid. Said carboxylic acid in said sample is then quantitatively converted to a chemical compound of identical structure, except the stable isotope atoms, as that of said internal standard using a nonlabeled reagent. Said sample is then extracted and the extract is analyzed by mass spectrometry. Identification and quantification of said carboxylic acid are made from a plot of ion ratio of said converted carboxylic acid to said internal standard versus carboxylic acid concentration.

Nonaqueous coating compositions

Nguyen, L., Cabot Corp., February 24, 2009, US7495042B2

The present invention relates to a dispersant composition comprising at least one anionic surfactant and at least one polymer comprising at least one salt of a carboxylic acid group. Also disclosed are pigment compositions and nonaqueous coating compositions comprising the dispersant composition.

Biodegradable polymer

Long, Y., *et al*., Plantic Technologies Ltd., February 24, 2009, US7495044B2

A biodegradable polymer is disclosed having a composition from 8 to 80% by weight of a starch modified to include a hydroxyalkyl C_{2-6} group or modified by reaction with an anhydride of a dicarboxylic acid, preferably hydroxypropylated high-amylose starch, (i) from 0 to 87.9% of starch, (ii) from 4 to 11% by weight of a water-soluble polymer selected from polyvinylacetate, polyvinyl alcohol, and copolymers of ethylene and vinylalcohol that have a melting point compatible with the molten state of the starch components, (iii) from 0 to 20% by weight of a polyol plasticizer, preferably glycerol, (iv) from 0.1 to 1.5% by weight of a C_{12-22} fatty acid or salt, preferably stearic acid, and, (v) 0 to 12% added water. The polymers are suitable as biodegradable rigid sheet or flexible film materials for use in packaging foodstuffs.

Acyltransferase

Dahlqvist, A., *et al*., Danisco US Inc., Genencor Division, March 3, 2009, US7498026B2

The invention relates to at least one nucleotide sequence, derived from a nucleotide sequence encoding an acyltransferase polypeptide comprising at least one membrane-spanning region, encoding an improved active membrane-independent acyltransferase polypeptide in which at least one amino acid residue of the membrane-spanning region has been deleted and/or substituted as compared with the original acyltransferase polypeptide, wherein the encoded active membrane-independent acyltransferase polypeptide can produce fatty acid esters and/or fatty acid thioesters such as triacylglycerols, diacylglycerols, monoacylglycerols, phospholipids, glycolipids, wax esters, acylated carbohydrates, acylated amino acids, and lysolipids, e.g., lysophosphospholipid, lysolecithin. Thereby one single acyltransferase can be used for the

production of a huge number of products. The invention also relates to means and methods for the production of such an improved active membrane-independent acyltransferase and the use of such a membrane-independent acyltransferase in industry.

Methods of incorporating polyunsaturated fatty acids in milk

Abril, J., *et al*., Martek Biosciences Corp., March 17, 2009, US7504121B2

Method for incorporating polyunsaturated fatty acids into milk with improved efficiency. The methods include protecting the polyunsaturated fatty acids, including omega-3 and omega-6 polyunsaturated fatty acids, with a protective agent prior to feeding the fatty acids to a milk-producing animal. Methods for feeding polyunsaturated fatty acids to milk-producing animals by top-dressing a polyunsaturated fatty acid supplement on top of animal feed compositions and methods of making and using such compositions are also provided.

Δ12 desaturases suitable for altering levels of polyunsaturated fatty acids in oleaginous yeast

Yadav, N., *et al*., DuPont, March 17, 2009, US7504259B2

The present invention relates to fungal Δ12-fatty acid desaturases that are able to catalyze the conversion of oleic acid to linoleic acid (18:2). Nucleic acid sequences encoding the desaturases, nucleic acid sequences which hybridize thereto, DNA constructs comprising the desaturase genes, and recombinant host microorganisms expressing increased levels of the desaturases are described. Methods of increasing production of specific ω-3 and ω-6 fatty acids by overexpression of the Δ12-fatty acid desaturases are also described herein.

Catalyst composition for the selective conversion of alkanes to unsaturated carboxylic acids, method of making and method of using thereof

Hazin, P., and Ellis Jr., P., Saudi Basic Industries Corp., March 17, 2009, US7504357B2

A catalyst composition having the formula: $Mo_1V_aSb_bNb_c$-M_dO_x wherein M is gallium, bismuth, silver, or gold, *a* is 0.01 to 1, *b* is 0.01 to 1, *c* is 0.01 to 1, *d* is 0.01 to 1, and *x* is determined by the valence requirements of the other components. Other metals, such as tantalum, titanium, aluminum, zirconium, chromium, manganese, iron, ruthenium, cobalt, rhodium, nickel, platinum, boron, arsenic, lithium, sodium, potassium, rubidium, calcium, beryllium, magnesium, cerium, strontium, hafnium, phosphorus, europium, gadolinium, dysprosium, holmium, erbium, thulium, terbium, ytterbium, lutetium, lanthanum, scandium, palladium, praseodymium, neodymium, yttrium, thorium, tungsten, cesium, zinc, tin, germanium, silicon, lead, barium, or thallium may also be components of the catalyst. This catalyst is prepared by co-precipitation of metal compounds that are calcined to form a mixed metal oxide catalyst that can be used for the selective conversion of an alkane to an unsaturated carboxylic acid in a one-step process.

Soy proteins and/or soy derivatives with zero-valent iron compositions and use for environmental remediation

Zhang, W.-x., Lehigh University, March 24, 2009, US7507345B2

Preparation of dispersions of zero-valence nanoscale iron particles and one of soy protein, soy milk, or other soy derivative. The dispersions can be used to treat contaminated soil or water.

Laminate film

Hase, T., *et al*., Nippon Bee Chemical Co. Ltd., March 31, 2009, US7510769B2

A laminate film has a clear layer (B) comprising an acrylic-based polymer (B1) having at least one longer unsaturated double bond group and at least one shorter unsaturated double bond group as side chains, and having a weight-average molecular weight not less than 50,000 but not more than 500,000, the longer unsaturated double bond group introduced in the acrylic-based polymer (B1) by a long-chain unsaturated carboxylic acid having a molecular weight of 150 or more, and the shorter unsaturated double bond group introduced in the acrylic-based polymer (B1) by a short-chain unsaturated carboxylic acid having a molecular weight of less than 150. Compared with laminate films prepared by spray coating, dip coating, or other coating methods, this laminate film is excellent in processability, coating film properties, and ornamental properties. Thus, an article can be excellently decorated with the laminate film provided by the present invention.

Patent information is compiled by Scott Bloomer, a registered US patent agent with Archer Daniels Midland Co., Decatur, Illinois, USA. Contact him at scott_bloomer@admworld.com.

Extracts & Distillates

A small molecule that blocks fat synthesis by inhibiting the activation of SREBP

Kamisuki, S., *et al.*, *Chem. Biol. 16*:882–892, 2009

Sterol regulatory element binding proteins (SREBP) are transcription factors that activate transcription of the genes involved in cholesterol and fatty acid biosynthesis. In the present study, we show that a small synthetic molecule we previously discovered to block adipogenesis is an inhibitor of SREBP activation. The diarylthiazole derivative, now called fatostatin, impairs the activation process of SREBP, thereby decreasing the transcription of lipogenic genes in cells. Our analysis suggests that fatostatin inhibits the ER (endoplasmic reticulum)–Golgi translocation of SREBP through binding to their escort protein, the SREBP cleavage-activating protein (SCAP), at a distinct site from the sterol-binding domain. Fatostatin blocked increases in body weight, blood glucose, and hepatic fat accumulation in obese *ob/ob* mice, even under uncontrolled food intake. Fatostatin may serve as a tool for gaining further insights into the regulation of SREBP.

Physicochemical properties of European bakery margarines with and without *trans* fatty acids

Cavillot, V., *et al.*, *J. Food Lipids 16*:273–286, 2009.

Physicochemical properties of commercially available European bakery margarines (cream margarines, cake margarines [CM], and puff pastry margarines [PPM]) containing and devoid of *trans* fatty acids (TFA) were investigated. Studied physical properties were the solid fat content (SFC), dropping points (DP), polymorphism, texture (hardness), plasticity, and the melting profile by differential scanning calorimetry. Experimental results confirm that physical properties of the margarines corresponded with their application area. For example, SFC and DP of PPM were higher than for cream margarines and CM; they were also harder at 15°C. Moreover, all the investigated physical properties were affected by the suppression of TFA in bakery margarines.

Antioxidant activity of bene hull oil compared with sesame and rice bran oils during the frying process of sunflower oil

Sharif, A., *et al.*, *J. Food Lipids 16*:394–406, 2009.

The antioxidant activity of bene hull oil (BHO) was compared with that of sesame oil (SEO) and rice bran oil (RBO) during the frying process of sunflower oil (SFO) at 180°C. The ratios between the polyunsaturated and saturated fatty acids and calculated oxidizability were statistically greater for the SFO (4.26 and 6.48, respectively), followed by the SEO (3.18 and 6.27, respectively), RBO (1.53 and 4.37, respectively), and BHO (0.37 and 1.67, respectively). Peroxide and acid values of the oils studied ranged from 0.34 to 3.07 mequiv/kg and from 0.19 to 5.20 mg/g, respectively. Total tocopherols and phenolics contents of the SEO (1093.28 and 1042.43 mg/kg, respectively) were significantly higher than those of the SFO (740.27 and 38.68 mg/kg, respectively), BHO (573.41 and 276.67 mg/kg, respectively), and RBO (832.98 and 67.98 mg/kg, respectively). In total, based on the conjugated diene value and carbonyl value measurements during the frying process, the BHO showed an antioxidant activity higher than those of the SEO and RBO at the level of 2%, and the levels higher than 2% of the antioxidative oils caused the oxidative stability of the SFO to decrease, indicating the pro-oxidant effect of the oils added at these levels.

Reduced mania and depression in juvenile bipolar disorder associated with long-chain ω-3 polyunsaturated fatty acid supplementation

Clayton, E.H., *et al.*, *Eur. J. Clin. Nutr. 63*:1037–1040, 2009.

Long-chain ω-3 polyunsaturated fatty acid (LCn-3PUFA) supplementation may improve symptoms of depression in children and bipolar disorder (BD) in adults. No studies have examined the effectiveness of LCn-3PUFA supplementation in the treatment of mania and depression in juvenile BD (JBD) when given as an adjunct to standard pharmacological treatment. Eighteen children and adolescents with JBD received supplements containing 360 mg per day eicosapentaenoic acid (EPA) and 1,560 mg per day docosahexaenoic acid (DHA) for 6 weeks in an open-label study. Intake and fasting red blood cell (RBC) LCn-3PUFA, mania, depression, and global function were assessed before and after supplementation. RBC EPA and DHA were significantly higher following supplementation. Clinician ratings of mania and depression were significantly lower and global functioning significantly higher after supplementation. Parent ratings of internalizing and externalizing behaviors were also significantly lower following supplementation. A larger randomized controlled trial appears warranted in this participant population.

Determination by Fourier transform Raman spectroscopy of conjugated linoleic acid in I_2-photoisomerized soybean oil

Bernuy, B., *et al.*, *J. Agric. Food Chem.* 57:6524–6527, 2009.

The potential of Fourier transform (FT)-Raman spectroscopy to quantify the total conjugated linoleic acid (CLA) content was evaluated to find a technique for the routine control of CLA synthesis by chemical procedures. The calibration and validation samples were obtained by photoisomerization of linoleic acid contained in soybean oil. The catalyst was iodine (I_2), and the light source was the green line (514.5 nm) of an argon ion laser. The criteria to select the best partial least-squares (PLS) calibration model were a low standard error of prediction (SEP), a high correlation coefficient (R), and the selection of relevant variables of the Raman spectrum to reduce spectral interferences. The total CLA content of the 22 samples ranged from 0.05 to 3.28% of total lipids. The best PLS calibration model was obtained with three optimal factors, a SEP of 0.22, and an R of 0.97. This calibration model was obtained after baseline correction of the C=C stretching region (1642–1680 cm^{-1}), which contained sufficient spectral information for reliable CLA quantification.

Phytosterols accumulation in the seeds of *Linum usitatissimum* L.

Herchi, W., *et al*., *Plant Physiol. Biochem. 47*:880–885, 2009.

A comparative study was performed to determine the free sterols content and composition during the development of three varieties of linseed (H52, O116, and P129). Seed samples were collected at regular intervals from 7 to 60 days after flowering (DAF). Ten compounds were identified: cholesterol, campesterol, brassicasterol, stigmasterol, β-sitosterol, Δ5-avenasterol, cycloartenol, 24-methylene cycloartanol, obtusifoliol, citrostadienol. The maximum level of 4-desmethylsterols (1515 mg/100 g oil) was reached at 7 DAF in P129 variety. H52 had the highest level of 4-4 dimethylsterols (355 mg/100 g oil) at 28 DAF. The greatest amount of 4-monomethylsterols (35 mg/100 g oil) was detected in H52 at 14 DAF. During linseed development, β-sitosterol (830 mg/100 g oil) was the major 4-desmethylsterol, followed by campesterol (564 mg/100 g oil) and stigmasterol (265 mg/100 g oil). Some of these compounds followed nearly the same accumulation pattern during linseed maturation.

Synthesis and characterization of a structured lipid from amaranth oil as a partial fat substitute in milk-based infant formula

Pina-Rodriguez, A.M., and C.C. Akoh, *J. Agric. Food Chem.* 57:6748–6756, 2009

The aim of this study was to use enzymatic interesterification techniques to modify underutilized amaranth oil as a structured lipid (SL) by increasing its palmitic acid content at the *sn*-2 position and incorporating docosahexaenoic acid (DHA). This SL can be partially or complementarily used in milk-based infant formulas to deliver a lipid component similar to that in breast milk. Amaranth oil was modified by enzymatic interesterification in two stages. First, the palmitic acid content was increased specifically at the *sn*-2 position to resemble breast milk triacylglycerols (TAG) using Novozym 435 lipase. Then DHA was incorporated, mainly at the *sn*-1,3 positions, by using Lipozyme RM IM, an *sn*-1,3-specific lipase. An optimization model was developed to determine the

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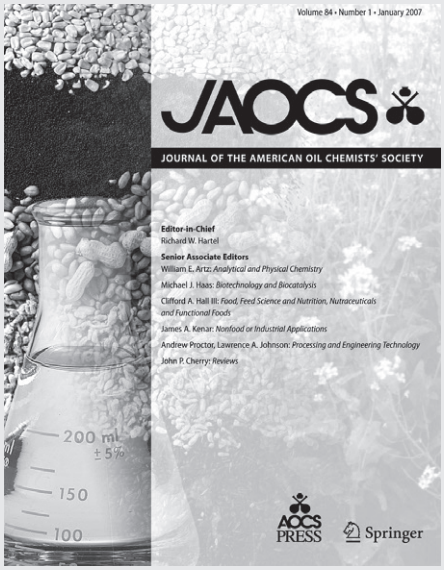
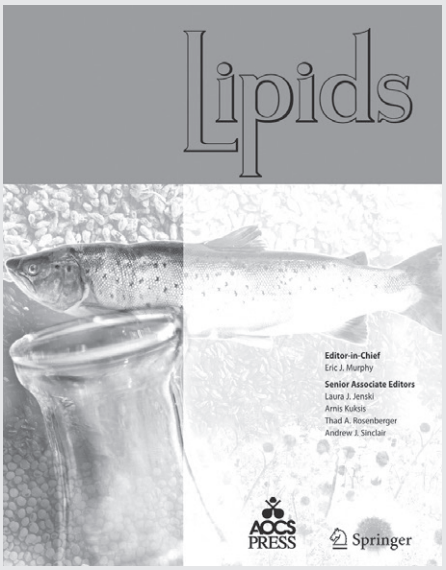


Journal of the American Oil Chemists' Society (September)

- Evaluation of authenticity of Iranian olive oil by fatty acid and triacylglycerol profiles, Piravi-Vanak, Z., M. Ghavami, H. Ezzatpanah, J. Arab, H. Safafar, and J.B. Ghasemi
- Fourier transform near infrared spectroscopy as a quality control tool for the analysis of lecithin and by-products during soybean oil processing, Li, H., M. Goulden, R. Cocciardi, and J. Hughes
- A comprehensive evaluation of the melting points of fatty acids and esters determined by differential scanning calorimetry, Knothe, G., and R.O. Dunn
- Chemical characterization of the seed and antioxidant activity of various parts of *Salvadora persica*, Mariod, A.A., B. Matthäus, and I.H. Hussein
- Variations in fatty acids, phospholipids and sterols during the seed development of a high oleic sunflower variety, Zlatanov, M.D., M.J. Angelova-Romova, G.A. Antova, R.D. Dimitrova, S.M. Momchilova, and B.M. Nikolova-Damyanova
- Differential scanning calorimetry analysis of goat fats: Comparison of chemical composition and thermal properties, Yılmaz, M.T., and M. Karakaya
- Frying quality characteristics of French fries prepared in refined olive oil and palm olein, Tabee, E., M. Jägerstad, and P.C. Dutta
- Effects of temperature and UV light on degradation of α-tocopherol in free and dissolved form, Sabliov, C.M., C. Fronczek, C.E. Astete, M. Khachaturyan, L. Khachatryan, and C. Leonardi
- Quality of crude oil extracted from aging walleye pollock (*Theragra chalcogramma*) by-products, Wu, T.H., and P.J. Bechtel
- Optimization of an oil extraction process for algae from the treatment of manure effluent, Mulbry, W., S. Kondrad, J. Buyer, and D.L. Luthria
- Wild Brazilian mustard (*Brassica juncea* L.) seed oil methyl esters as biodiesel fuel, Jham, G.N., B.R. Moser, S.N. Shah, R.A. Holser, O.D. Dhingra, S.F. Vaughn, M.A. Berhow, J.K. Winkler-Moser, T.A. Isbell, R.K. Holloway, E.L. Walter, R. Natalino, J.C. Anderson, and D.M. Stelly
- Foam separation of oil from enzymatically treated wet-milled corn germ dispersions, Dickey, L.C., M.J. Kurantz, N. Parris, A. McAloon, and R.A. Moreau



Lipids (September)

- Michael T. Arts, Michael T. Brett, Martin J. Kainz (eds.): *Lipids in Aquatic Ecosystems*, Carballeira, N.M.
- Marine two-headed sphingolipid-like compound rhizochalin inhibits EGF-induced transformation of JB6 P^+ Cl41 cells, Fedorov, S.N., T.N. Makarieva,

A.G. Guzii, L.K. Shubina, J.Y. Kwak, and V.A. Stonik

- Tocotrienols suppress proinflammatory markers and cyclooxygenase-2 expression in RAW264.7 macrophages, Yam, M.-L., S.R.A. Hafid, H.-M. Cheng, and K. Nesaretnam
- Phospholipid, oleic acid micelles and dietary olive oil influence the lutein absorption and activity of antioxidant enzymes in rats, Lakshminarayana, R., M. Raju, M.N.K. Prakash, and V. Baskaran
- Radical scavenging activity of lipophilized products from transesterification of flaxseed oil with cinnamic acid or ferulic acid, Choo, W.-S., E.J. Birch, and I. Stewart
- The hypolipidemic effect of an ethyl ester of algal-docosahexaenoic acid in rats fed a high-fructose diet, Ryan, A.S., E. Bailey-Hall, E.B. Nelson, and N. Salem
- Comparison of seal oil to tuna oil on plasma lipid levels and blood pressure in hypertriglyceridaemic subjects, Meyer, B.J., A.E. Lane, and N.J. Mann
- Organ-specific distributions of lysophosphatidylcholine and triacylglycerol in mouse embryo, Hayasaka, T., N. Goto-Inoue, N. Zaima, Y. Kimura, and M. Setou
- Four new fatty acid esters from the feces of *Trogopterus xanthipes*, Yang, N.-Y., W.-W. Tao, J.-A. Duan, J.-M. Guo, and L.-L. Cao
- Nitro-fatty acids occur in human plasma in the picomolar range: A targeted nitro-lipidomics GC–MS/MS study, Tsikas, D., A.A. Zoerner, A. Mitschke, and F.-M. Gutzki
- Liquid chromatography–high-resolution mass spectrometry for quantitative analysis of gangliosides, Fong, B., C. Norris, E. Lowe, and P. McJarrow

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exact parameter combinations to incorporate a specific amount of DHA (1.0–2.5%). The model suggestions were used for a gram-scale interesterification to yield the expected product. The final SL composition was as follows: palmitic acid, 33.9%; stearic acid, 2.8%; oleic acid, 23.3%; linoleic acid, 37.3%; linolenic acid, 0.7%; and docosahexaenoic acid, 1.9%. The original amaranth oil and the final SL were characterized by determining the fatty acid composition, melting profile, chemical characteristics, oxidative stability (peroxide, *p*-anisidine, and total oxidation values), and phytosterol, tocopherol, and squalene contents. The physical and chemical characteristics determined in this study support the potential application of DHA-containing customized amaranth oil as a partial fat substitute or complement for milk-based infant formula. Research on the application and stability of this SL used in an infant formula is being conducted.

Enzymatic interesterification of anhydrous milk fat with rapeseed and/or linseed oil: Oxidative stability

Giet, J.-M., *et al.*, *J. Agric. Food Chem.* 57:6787–6794, 2009.

Blends of anhydrous milk fat (AMF) and linseed oil (70:30) and of AMF, rapeseed oil (RO), and linseed oil (LO; 70:20:10) were submitted to enzymatic interesterification. The oxidative stabilities of the blends, the interesterified (IE) blends, and IE blends with 50 ppm of α-tocopherol added as antioxidant were studied. Samples were stored in open flasks at 60, 25, and 4°C and periodically submitted to peroxide, *p*-anisidine, and thiobarbituric acid value determinations and ultraviolet measurement at 232 and 268 nm. The analysis of volatile compounds was carried out by solid-phase microextraction for the samples stored at 60°C. Peroxides appeared to be the only significant oxidation products after 12 weeks of storage at 4°C. As expected, the binary blends (BB) were more sensitive to oxidation than the ternary blends (TB). The BB were associated with increased volatile emission compared to the TB. Interesterification led to variable effects on the oxidation of fat mixtures, depending on composition and temperature (beneficial effect on BB, at both 25 and 60°C, and a rather neutral effect on TB). The IE blends exhibited higher volatile release prior to aging. A pro-oxidant effect of α-tocopherol addition was observed at 25°C on both BB and TB. At 60°C, an antioxidant effect was observed on TB.

Statistical evaluation of triacylglycerol composition in plant oils based on high-performance liquid chromatography–atmospheric pressure chemical ionization mass spectrometry data

Lísa, M., *et al.*, *J. Agric. Food Chem.* 57:6888–6898, 2009.

The statistical evaluation of triacylglycerol profiles in plant oils based on high-performance liquid chromatography–mass spectrometry (HPLC/MS) analysis enables the differentiation of various plant oils on the basis of the multidimensional data matrix. A data set of 93 oil samples from 60 varieties of plants composed from 355 triacylglycerols is evaluated using principal component analysis (PCA). Analyzed samples are resolved in the PCA plot, and similarities among some types of plant oils are visualized by the formation of clusters. The authentication of plant oils is tested with model samples of olive oil adulterated with sunflower oil at different concentration levels. Our HPLC/MS method using the statistical multivariate data analysis of a large data matrix enables a clear identification of adulterated olive oils already from 1% of added sunflower oil as an adulterant.

Enzymatic measurement of phosphatidic acid in cultured cells

Morita, S.-y., *et al.*, *J. Lipid Res. 50*:1945–1952, 2009.

In this work, we developed a novel enzymatic method for measuring phosphatidic acid (PA) in cultured cells. The enzymatic reaction sequence of the method involves hydrolysis of PA to produce glycerol-3-phosphate (G3P), which is then oxidized by G3P oxidase to generate hydrogen peroxide. In the presence of peroxidase, hydrogen peroxide reacted with Amplex Red to produce highly fluorescent resorufin. We found that lipase from *Pseudomonas* sp. can completely hydrolyze PA to G3P and fatty acids. The calibration curve for PA measurement was linear between 20 and 250 μM, and the detection limit was 5 μM

(50 pmol in the reaction mixture). We also modified the method for the enzymatic measurement of lysophosphatidic acid. By this new method, we determined the PA content in the lipid extract from HEK293 cells. The cellular content of PA was decreased with increasing cell density but not correlated with the proliferation rate. The diacylglycerol kinase inhibitor R59949 markedly reduced the cellular PA content, suggesting the diacylglycerol kinase activity was involved in a large part of the PA production in HEK293 cells. This novel method for PA quantification is simple, rapid, specific, sensitive, and high-throughput and will help to study the biological functions of PA and its related enzymes.

Comparison of dietary conjugated linoleic acid with safflower oil on body composition in obese postmenopausal women with type 2 diabetes mellitus

Norris, L.E., *et al.*, *Am. J. Clin. Nutr. 90*:468–476, 2009.

Weight loss may improve glucose control in persons with type 2 diabetes. The effects of fat quality, as opposed to quantity, on weight loss are not well understood. We compared the effects of two dietary oils, conjugated linoleic acid (CLA) and safflower oil (SAF), on body weight and composition in obese postmenopausal women with type 2 diabetes. This was a 36-wk randomized, double-masked, crossover study. Fifty-five obese postmenopausal women with type 2 diabetes received SAF or CLA (8 g oil/d) during two 16-wk diet periods separated by a 4-wk washout period. Subjects met monthly with the study coordinator to receive new supplements and for assessment of energy balance, biochemical end points, or anthropometric variables. Thirty-five women completed the 36-wk intervention. Supplementation with CLA reduced body mass index (BMI) ($P = 0.0022$) and total adipose mass ($P = 0.0187$) without altering lean mass. The effect of CLA in lowering BMI was detected during the last 8 wk of each 16-wk diet period. In contrast, SAF had no effect on BMI or total adipose mass but reduced trunk adipose mass ($P = 0.0422$) and increased lean mass ($P = 0.0432$). SAF also significantly lowered fasting glucose ($P = 0.0343$) and increased adiponectin ($P = 0.0051$). No differences were observed in dietary energy intake, total fat intake, and fat quality in either diet period for either intervention. Supplementation with CLA and SAF exerted different effects on BMI, total and trunk adipose mass, and lean tissue mass in obese postmenopausal women with type 2 diabetes. Supplementation with these dietary oils may be beneficial for weight loss, glycemic control, or both.

Pressurized liquid extraction of soil microbial phospholipid and neutral lipid fatty acids

White, P.M., *et al.*, *J. Agric. Food Chem.* 57:7171–7177, 2009.

Soil microbial lipid biomarkers are indicators of viable microbial biomass and community structure. Pressurized liquid extraction (PLE) of soil phospholipid fatty acids (PLFA) and neutral lipid fatty acids (NLFA) was compared to a conventional extraction method in four soils with differing physical and chemical properties. PLE efficiency was greater than that of the conventional method for about half of the saturated PLFA and for selected other Gram-positive (i16:0) and Gram-negative bacteria (18:1ω7c) PLFA, fungal PLFA (18:2ω6,9c), and eukaryotic NLFA from a coarse-textured soil. Lipids extracted by the two methods did not indicate a significant difference in microbial community structure data. Principal component analysis revealed that PLFA clustered by location, with data indicating that the group of microbes contributing the greatest weight differed among soils. Overall, the PLE method proved to be more efficient at extracting soil-borne microbial lipids while not altering microbial community information. These advantages indicate the PLE method is robust and well-suited to soil microbial ecology research.

Characterization of conjugated linoleic acid production by *Bifidobacterium breve* LMC 520

Park, H.G., *et al.*, *J. Agric. Food Chem. 57*:7571–7575, 2009.

This study was performed to characterize the conjugated linoleic acid (CLA) production ability of a bacterial strain, *Bifidobacterium breve* LMC 520, which can actively convert linoleic acid (LA) to *cis*-9,*trans*-11 CLA, a major isomer derived from microbial enzymatic conversion. The culture conditions were optimized to improve CLA production under the aerobic conditions. *Bifidobacterium breve* LMC 520 was tested with different amounts of LA in varied culture conditions, such as air, additives, and pH. A maximal level of CLA production (up to 90% of substrate) was obtained after 24 h of incubation in culture medium containing 1 mM LA at pH 5.5 and under anaerobic conditions. There was no decline in the CLA level with prolonged incubation until 48 h. When the effect of pre-incubation with LA on CLA production was tested, there was no significant difference between the CLA-producing activity of pre-incubated and untreated bacteria at the third passage but there was a significant reduction in CLA production by the pre-incubated cells after the fourth passage. These results demonstrate that the CLA-producing activity of *B. breve* LMC 520 could be maximized by numerous environmental factors. The data also indicate its potential for increasing CLA accumulation in dairy products when *B. breve* LMC 520 is used as a functional starter culture.

Fatty acid selectivity of lipases during acidolysis reaction between triolein and saturated fatty acids varying from caproic to behenic acids

Karabulut, I., *et al.*, *J. Agric. Food Chem.* 57:7584–7590, 2009.

The chain length selectivity of three immobilized lipases, namely, Lipozyme TL IM from *Thermomyces lanoginosus* [*sic*], Lipozyme RM IM from *Rhizomucor miehei*, and Novozym 435 from *Candida antarctica*, was determined in acidolysis performed in hexane using the homologous series of even carbon number, saturated fatty acids (SFA) of 6–22 carbons. Triolein with individual SFA or a mixture of equimolar quantities of SFA was used as the substrate. The effects of operating variables including the mole ratio of fatty acid to triolein, temperature, enzyme dosage, and time on incorporation were also investigated. Incorporation abilities of the enzymes tested were found to be significantly different for most of the fatty acids at the experimental conditions evaluated. Lipases acted weakly on SFA of which the carbon chain length was shorter than eight carbon atoms and higher than 18 carbon atoms. Lipases showed a bell-shaped distribution plot in incorporation vs. chain length with a maximum around C_{12}–C_{16}.

Among the experimental parameters tested, the effect of the substrate mole ratio was greater than those of the others, and the highest incorporation was observed for C_{12} (36.98%), C_{14} (37.63%), and C_{16} (38.66%) at a 4:1 substrate mole ratio with Lipozyme TL IM. Lipases caused significantly different levels of acyl migration from *sn*-1,3 to *sn*-2 positions.

Implications of biodiesel production and utilisation on global climate—A literature review

Majer, S., *et al*., *Eur. J. Lipid Sci. Technol. 111*:747–762, 2009.

Over the last few years, the favorable political environment has led to an increasing use of biofuels in the worldwide transportation sector. This development is mainly driven by concerns about the security of energy supplies and the intention to mitigate anthropogenic greenhouse gases (GHG). However, recently, the sustainability of a broad biofuel production and use has, in particular, been strongly questioned. Against this background, in this study a literature review on available and recently published life cycle assessment (LCA) studies for biodiesel has been carried out and the potential GHG emission savings from biodiesel production and use compared to fossil diesel have been analyzed. The results of the reviewed studies underline the significant influence of the effects of land use change and the importance of avoiding the conversion of natural land into agricultural areas. If no land use change takes place, the results show moderate to good GHG savings for biodiesel (depending on the type of converted raw materials as well as on the chosen biomass conversion technology). In particular, the biodiesel feedstock production and the source of energy for the production process strongly influence the overall result of the GHG balance of biodiesel.

Recent advances in the conversion of bioglycerol into value-added products

Pagliaro, M., *et al*., *Eur. J. Lipid Sci. Technol. 111*:788–799, 2009.

A versatile platform chemical and energy vector, bioglycerol from biodiesel manufacturing is increasingly finding new commercial applications. We report on some of the main achievements for converting glycerol into high-value products and energy developed in the last two years, and conclude by providing an outlook on the evolving status of bioglycerol in the chemical industry.

Microemulsion-based palm kernel oil extraction using mixed surfactant solutions

Naksuk, A., *et al*., *Ind. Crop Prod. 30*:194–198, 2009.

This study introduces a novel technique using surfactant microemulsion-based oilseed extraction. To achieve this objective, microemulsion formation with palm kernel oil was studied first. Then, the selected microemulsion system was used for palm kernel extraction. The results showed that the mixed surfactant of 3 wt% Comperlan KD and either 0.1 wt% Alfoterra145-5PO or 145-8PO provided an ultralow interfacial tension with the palm kernel oil (0.0197 and 0.0359 mN/m, respectively). By using those two aqueous surfactant systems for palm kernel oil extraction, the extraction efficiency was 93.99 and 94.13% at the optimum crushed kernel size between 0.212 and 0.425 mm, using 1 g seed load to 10 mL of solution and 30 min of contact time. The extracted oil was evaluated for water content, fatty acids composition, and surfactant partitioning into the oil phase. The results showed that the quality of the oil obtained using the surfactant microemulsion-based technique is of similar or better quality than when extracted by hexane solvent.

Meta-analysis of the effects of flaxseed interventions on blood lipids

Pan, A., *et al*., *Am. J. Clin. Nutr. 90*:288–297, 2009.

Several clinical trials have investigated the effects of flaxseed and flaxseed-derived products (flaxseed oil or lignans) on blood lipids; however, the findings have been inconsistent. We aimed to identify and quantify the effectiveness of flaxseed and its derivatives on blood lipid profiles. A comprehensive literature search was performed on the basis of English reports of randomized controlled trials of flaxseed or its derivatives on lipid profiles in adults, which were published from January 1990 to October 2008. Attempts also were made to access unpublished data. Study quality was assessed by using the Jadad score, and a meta-analysis was conducted. Twenty-eight studies were included. Flaxseed interventions reduced total and LDL (low-density lipoprotein) cholesterol by 0.10 mmol/L (95% CI: –0.20, 0.00 mmol/L) and 0.08 mmol/L (95% CI: –0.16, 0.00 mmol/L), respectively; significant reductions were observed with whole flaxseed (–0.21 and –0.16 mmol/L, respectively) and lignan (–0.28 and –0.16 mmol/L, respectively) supplements but not with flaxseed oil. The cholesterol-lowering effects were more apparent in females (particularly postmenopausal women), individuals with high initial cholesterol concentrations, and studies with higher Jadad scores. No significant changes were found in the concentrations of HDL (high-density lipoprotein) cholesterol and triglycerides. Flaxseed significantly reduced circulating total and LDL-cholesterol concentrations, but the changes were dependent on the type of intervention, sex, and initial lipid profiles of the subjects. Further studies are needed to determine the efficiency of flaxseed on lipid profiles in men and premenopausal women and to explore its potential benefits on other cardiometabolic risk factors and prevention of cardiovascular disease.

Rapid seed oil analysis using UPLC for quality control and authentication

Lee, P.J., and A.J. Di Gioia, *Lipid Technol. 21*:112–115, 2009.

Without derivatization and halogenated solvent, various seed oil samples were rapidly characterized using a UPLC (ultra performance liquid chromatograph) equipped with UV (ultraviolet) photodiode array and mass spectrometer detectors. The method acquires multiple types of data in a single injection to authenticate seed oil, analyze triacylglycerol composition, and evaluate seed oil oxidation. It can, for example, identify olive oil samples adulterated with <1% of other seed oils. Compared with conventional high-performance liquid chromatography methods, the UPLC solution shortens analysis time, reduces solvent usage, and provides more information, resulting in a cost benefit. The reduction in analysis time and solvent usage align with the principles of green chemistry. ■

Meet Thrandur Helgason

Thrandur Helgason meets up with his reflection in Anish Kapoor's Cloud Gate sculpture at Chicago's Millennium Park.

Thrandur Helgason, a 2009 Honored Student, remembers the moment he first became interested in food science: "It was after I saw my teacher put a whipped egg yolk into a pot of Béarnaise sauce that had separated because I added the butter and heated it too fast (I was in a hurry). After the addition of the egg yolk, my Béarnaise sauce became stable again. This is when I first realized how interesting the chemistry behind food can be and how much you can learn from understanding the interactions in food matrices. As you might have guessed, I was studying to be a chef at the time, but all these small details fascinated me so much that I gave up on being a chef and started studying food science at the University of Iceland."

Helgason, who was born in Akureyri, Iceland, currently is working on his Ph.D. as an exchange student at Hohenheim University in Germany, under the supervision of AOCS member Jochen Weiss. After his expected completion date of September 2010, Helgason hopes for a post-doctoral appointment on the way toward a faculty position. "I think it is safe to say that I will be doing research after I finish, which is in my opinion fantastic," he says.

His doctoral project involves encapsulating bioactive ingredients (β-carotene) in solid lipid nanoparticles, which consist of crystalline lipid particles dispersed in water. Because lipid molecules can recrystallize, resulting in the expulsion of the bioactive compounds, Helgason and colleagues have been working to control the crystal structure by engineering the particle interface.

To date, the work has resulted in what Helgason calls "an astounding increase in oxidative stability of β-carotene.

"We found that by using surfactants that form crystals at high temperatures we can control the subsequent crystallization of the lipid, which leads to particles that do not recrystallize as much and thus maintain a spherical shape," he explains. "In the past, this system has not been considered viable, since regular solid lipid nanoparticles will change shape and recrystallize. This results in the expulsion of the incorporated bioactive material and an increase in surface area that causes a decline in oxidative stability, as compared with regular emulsions. In our studies, however, we have been able to produce particles that showed almost no breakdown of the β-carotene by controlling the crystallization and recrystallization of the solid lipid nanoparticles," Helgason concludes.

Away from the laboratory, he can often be found in an outdoor setting. "I hiked in the Alps for one week in August, which was spectacular. But I have also taken many canoeing camping trips in America and also have gone scuba diving in Florida and Aruba. I also enjoy playing badminton, tennis, and basketball. Besides that, I studied music for many years and used to play in many bands in Iceland before I started my graduate studies." ■

2008–2009 AOCS Laboratory Proficiency Program winners

The Laboratory Proficiency Program (LPP) utilizes AOCS methods to ensure quality in the laboratory. Winners are those demonstrating the most accurate results over the program year.

Aflatoxin Corn Meal
First Place
Cindy McCormick
Office of the Texas State Chemist
College Station, TX, USA

Honorable Mention
Kelley Renkemeyer, Ryan Malone
Trilogy Analytical Laboratory
Washington, MO, USA

Aflatoxin Corn Test Kit
First Place
Janet Duran
A&L Plns Agrl Labs Inc.
Lubbock, TX, USA

Honorable Mention
Sandy Holloway
Cotecna Inspections Inc. USA
Memphis, TN, USA

Honorable Mention
Eric Stone
Illinois Dept. of Agriculture
Springfield, IL, USA

Aflatoxin Cottonseed
First Place
Jose F. Izaguirre
Chandler Analytical Lab
Chandler, AZ, USA

Honorable Mention
Roger McDaniel
Food & Drug Protection Dev NCDA&CS
Raleigh, NC, USA

Aflatoxin in Milk
First Place
My Chieu Nguyen
Division of Analytical Laboratories
Lidcomb, NSW, Australia

Aflatoxin Peanut Butter
First Place
Edenton Analytical Team
J. Leek Associates
Edenton, NC, USA

Aflatoxin Peanut Paste
First Place
N'Tegra Analytical Team
N'Tegra Inc., JLA member Company
Arbuckle, CA, USA

Honorable Mention
De Leon Analytical Team JLA USA
De Leon, TX, USA

Honorable Mention
Mariana Astore
SGS Argentina S.A. Villa Mercedes
Buenos Aires, Argentina

Honorable Mention
JLA China Analytical Team
JLA China Inc.
Qingdao Shandong, P.R. China

Aflatoxin Peanut Paste Test Kit
First Place
Louisville Quality Assurance Team
Algood Food Co.
Louisville, KY, USA

Honorable Mention
Jocelyn Alfieri
Silliker Canada Co.
Markham, ON, Canada

Honorable Mention
N'Tegra Analytical Team
N'Tegra, Inc. JLA member Co.
Arbuckle, CA, USA

Cholesterol
First Place
Helen Li (Extraction), Peggy McLaren, Roxana Banaru, Zhinan Feng (Instrumentation)
Maxxam Analytics
Mississauga, ON, Canada

Honorable Mention
Thomas P. Mawhinney
University of Missouri
Columbia, MO, USA

Cottonseed
First Place
Tammy Kahlich
PYCO Industries
Lubbock, TX, USA

Cottonseed Oil
First Place
Rodney Kuss
PYCO Industries
Lubbock, TX, USA

Edible Fat
First Place
Lloyd Boatright
Ag Processing Inc.
St. Joseph, MO, USA

Honorable Mention
Deborah McRoberts
Golden Foods/Golden Brands
Louisville, KY, USA

Honorable Mention
James Houghton
Golden Foods/Golden Brands
Louisville, KY, USA

Honorable Mention
Beth Miller
Ag Processing Inc.
St. Joseph, MO, USA

Honorable Mention
Gregg Newman
Fuji Vegetable Oil
Savannah, GA, USA

Honorable Mention
Bill Zubrinic
Bunge Canada
Hamilton, ON, Canada

Feed Microscopy
First Place
Elizabeth Krzykwa
Canadian Food Inspection Agency
Ottawa, ON, Canada

Second Place
Marion Smith
Canadian Food Inspection Agency
Ottawa, ON, Canada

Third Place
Piotr Czajkowski
Provimi
Osnowd, Poland

Fish Meal
First Place
Carl W. Schulze
N.J. Feed Lab Inc.
Trenton, NJ, USA

Honorable Mention
Cecilia Palomino
SGS Del Peru SAC
Callao, Peru

Fumonisin in Corn
First Place
Ted Oplinger
Office of the Texas State Chemist
College Station, TX, USA

Fumonisin in Corn Test Kit
First Place
Usevolod Potapov
Mars LLC
Moscow region Stupino-1, Russia

Gas Chromatography
First Place (tie)
Pete Cartwright
N.J. Feed Lab Inc.
Trenton, NJ, USA

First Place (tie)
James Houghton
Golden Foods/Golden Brands
Louisville, KY, USA

Honorable Mention
Analytical Team
Bunge Oils
Bradley, IL, USA

Honorable Mention
Ardin Backous, Anders Thomsen
Eurofins Scientific
Des Moines, IA, USA

Honorable Mention
Tracy Hildebrand
ADM Quincy
Quincy, IL, USA

Honorable Mention
Paul Thionville, Shani Jolly, A. Thionville, Nancy Trosclair
Thionville Laboratories Inc.
New Orleans, LA, USA

Honorable Mention
Linda S. McLaren
Loders Croklaan
Channahon, IL, USA

Honorable Mention
Sandy Holloway
Cotecna Inspections Inc. USA
Memphis, TN, USA

Marine Oil
First Place
Paul Thionville, Shani Jolly, A. Thionville, Nancy Trosclair
Thionville Laboratories, Inc.
New Orleans, LA, USA

Honorable Mention
Ernesto Hernandez, Hema Marwaha
OmegaPure
Houston, TX, USA

Honorable Mention
Cecilia Palomino
SGS Del Peru SAC
Callao, Peru

Marine Oil Fatty Acid Profile
First Place
Pete Cartwright
N.J. Feed Lab Inc.
Trenton, NJ, USA

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Paul Thionville, Shani Jolly, Boyce Butler

Honorable Mention
John Reuther, Chris Lirette
Eurofins Central Analytical Labs
Metairie, LA, USA

NIOP Fats & Oils
First Place
Philip Bastijns
Oleotest NV
Antwerp, Belgium

Nutraceutical Oils
First Place
Fitri Sudradjat, Chris Lirette
Eurofins Central Analytical Labs
Metairie, LA, USA

Honorable Mention
Gudmundur Gudmundsson
LYSI hf
Reykjavik, NA, Iceland

Honorable Mention
Hema Marwaha
OmegaPure
Houston, TX, USA

Nutritional Labeling
First Place (tie)
Jocelyn Alfieri
Silliker Canada Co.
Markham, ON, Canada

First Place (tie)
Sonia Bouchard
CFIA Food Lab
Lonqueuil, PQ, Canada

Oilseed Meal
First Place
Paul Thionville, Shani Jolly, A. Thionville, Nancy Trosclair
Thionville Laboratories, Inc.
New Orleans, LA, USA

Honorable Mention
Frank Tenent, Edgar Tenent
K-Testing Lab Inc.
Memphis, TN, USA

Honorable Mention
Frank Fuentes
Southern Cotton Oil Co.
Lubbock, TX, USA

Honorable Mention
Mike White, Brian Eskridge
ATC Scientific
N. Little Rock, AR, USA

Oilseed Meal 100% Crude Fiber
First Place
Mike White, Brian Eskridge
ATC Scientific
N. Little Rock, AR, USA

Honorable Mention
H. Newton Beavers III
Carolina Analytical Services
Bear Creek, NC, USA

Honorable Mention
Lynn Hawkins, Michael Hawkins, John Peden
Barrow Agee
Memphis, TN, USA

Honorable Mention
Keith Dominey
Waters Agricultural Laboratories
Camilla, GA, USA

Oilseed Meal 100% Moisture
First Place
Trevor Meredith
Solbar Hatzor
Ashdod, Israel

Honorable Mention
Vira Suphanit
SGS Thailand Ltd.
Bangkok, Thailand

Honorable Mention
Frank Fuentes
Southern Cotton Oil Co.
Lubbock, TX, USA

Honorable Mention
Frank Tenent, Edgar Tenent
K-Testing Lab Inc.
Memphis, TN, USA

Oilseed Meal 100% Nitrogen Ba 4d-90
First Place
Trevor Meredith
Solbar Hatzor
Ashdod, Israel

Oilseed Meal 100% Nitrogen Ba 4e-93
First Place
Ardin Backous, Anders Thomsen
Eurofins Scientific
Des Moines, IA, USA

Honorable Mention
Paul Thionville, Shani Jolly, A. Thionville, Nancy Trosclair
Thionville Laboratories, Inc.
New Orleans, LA, USA

Honorable Mention
Duane O. Winter
ServiTech
Dodge City, KS, USA

Oilseed Meal 100% Oil
First Place
Frank Fuentes
Southern Cotton Oil Co.
Lubbock, TX, USA

Honorable Mention
Paul Thionville, Shani Jolly, A. Thionville, Nancy Trosclair
Thionville Laboratories, Inc.
New Orleans, LA, USA

Honorable Mention
Jana Pogacnik
Shur-Gain/Nutreco Canada
St. Hyacinthe, QC, Canada

Honorable Mention
Trevor Meredith
Solbar Hatzor
Ashdod, Israel

Olive Oil Part A
First Place
Manolis Fafoutakis
E.A.S. Heraklion
Heraklion, Crete, Greece

Olive Oil Part B
First Place
Manolis Fafoutakis
E.A.S. Heraklion
Heraklion, Crete, Greece

Olive Oil Part C
First Place
Giorgio Cardone
Chemiservice sas Monopoli
Bari, Italy

Peanut Seed
First Place
Brownfield Analytical Team
JLA USA
Brownfield, TX, USA

Honorable Mention
Max Everhart
USDA AMS S&T
Blakely, GA, USA

Phosphorus in Oil
First Place
Analytical Services
POS Pilot Plant Corp.
Saskatoon, SK, Canada

Solid Fat Content by NMR
First Place
Ricardo Arevalo
Numar Co.
San Jose, Costa Rica

Honorable Mention
Randy Kruger
Bunge North America
Council Bluffs, IA, USA

Soybean Oil
First Place
Frank Hahn
Hahn Laboratories Inc.
Columbia, SC, USA

Soybeans
First Place
Ardin Backous, Anders Thomsen
Eurofins Scientific
Des Moines, IA, USA

Honorable Mention
Paul Thionville, Shani Jolly, A. Thionville, Nancy Trosclair
Thionville Laboratories, Inc.
New Orleans, LA, USA

Tallow & Grease
First Place (tie)
Jose Garcia
National Beef Packing Co.
Liberal, KS, USA

First Place (tie)
Paul Thionville, Shani Jolly, A. Thionville, Nancy Trosclair
Thionville Laboratories, Inc.
New Orleans, LA, USA

Honorable Mention
Adalberto Cornado
National Beef Packing Co.
Liberal, KS, USA

Trace Metals
First Place
Mark Gulden, Ken Determan
CHS
Mankato, MN, USA

Honorable Mention
Jerome J. King
Midwest Laboratories Inc.
Omaha, NE, USA

***trans* by GC**
First Place
Wakako Tsuzuki
National Food Research Institute
Tsukuba, Ibaraki, Japan

Honorable Mention
My Chi Mai
Division of Analytical Laboratories
Lidcomb, NSW, Australia

Honorable Mention
Val Buckner
ADM Valdosta 564/217
Valdosta, GA, USA

Honorable Mention
Eddie L Baldwin, Helen Cianciolo
Stratus Foods-Technology Center
Bartlett, TN, USA

Honorable Mention
Linda S. McLaren
Loders Croklaan
Channahon, IL, USA

Honorable Mention
William Lillycrop
Health Canada
Scarborough, ON, Canada

***trans* by IR**
First Place
Eddie L. Baldwin, Helen Cianciolo
Stratus Foods-Technology Center
Bartlett, TN, USA

Unground Soybean Meal
First Place
Ardin Backous, Anders Thomsen
Eurofins Scientific
Des Moines, IA, USA

Honorable Mention
Sherry Muse
Ag Processing Inc.
St. Joseph, MO, USA

Honorable Mention
Ms. Malinee, Ms. Benya Boriboonwiggai
Thai Vegetable Oil Public Co. Ltd.
Bukkalow Thonburi, Thailand

Vegetable Oil Color Only
First Place
Phil Fontenot
Ventura Foods Louana Div.
Opelousas, LA, USA ■

Eco-Efficiency Analysis—applied to different chelating agents

Tobias Borén, Kjerstin Ludvig, Karin Andersson Halldén, and Jan Seetz

Chelating agents are used to improve the detergency power of cleaners and detergents. AkzoNobel (Amsterdam, the Netherlands) has conducted an Eco-Efficiency Analysis (EEA) of the alternative chelating agents GLDA (tetrasodium L-glutamic acid, N,N-diacetic acid); EDTA (ethylene diamine tetraacetic acid); NTA (nitrilotriacetic acid); and STPP (sodium tripolyphosphate). An EEA integrates and assesses the ecological and economic profiles of alternative systems delivering the same customer benefit. This paper gives an account of the main results of the environmental dimension of the chelate study and provides an in-depth description of the EEA methodology currently practiced within AkzoNobel. It concludes that GLDA is the most environmentally benign chelating agent, and that the main reasons for this are that it is biodegradable, phosphorus free, and based on a renewable raw material.

Chelating agents are widely used in detergents and cleaners to improve the detergency power. The chelating agents bind hard water ions (calcium and magnesium) firmly in complexes, thus softening the water, so that these ions cannot interfere with the cleaning action of the detergent and less detergent has to be used to achieve the necessary cleaning effect.

With the purpose of assessing different chelating agents from environmental and financial perspectives, an Eco-Efficiency Analysis (EEA) was carried out (for European conditions). In this study GLDA was compared with its main alternatives, EDTA, NTA, and STPP. The chelating agents were compared on an *equal weight basis* in order to make the study independent of the exact amounts used in the many detergent recipes.

EEA METHODOLOGY

An EEA assesses the ecological impact and cost structure of competing products, processes, or services delivering the same customer benefit and identifies the best alternative. It includes all steps along the value chain. The general procedure for carrying out the EEA is presented in Figure 1 (modified from Rudenauer *et al*., 2005). The eco-efficiency methodology is based on a combination of a Life Cycle Assessment (LCA) according to ISO 14040+14044 and an assessment of the Life Cycle Costing (LCC). ISO standards on LCA methodology have been prepared for harmonization of LCA procedures and for credibility reasons. The grey-shaded steps in Figure 1 can be found in the LCA standards. The LCA is also complemented with an analysis of the alternatives' toxicity potential and risk potential. The eco-efficiency method used by AkzoNobel is also used by BASF and many more corporations and institutes.

DEFINITION OF GOAL AND SCOPE

The goal definition states the purpose of the study and the intended use of the results. The scope definition includes a description of the product function to be studied. The function is quantified in terms of a functional unit, which is the reference to which all environmental impacts and costs are related. Also included in the scope definition is a definition of the environmental and technical time perspective of the study, and of geographical and technical (against nature and other products' life cycles) system boundaries. This defines which processes to include in the EEA.

ECONOMY: LCC

The focus of LCC is adapted according to the goal and scope of the study (Rudenauer *et al*., 2005). The LCC is actor-specific; that is, all costs for a certain actor that are associated with a given alternative over the whole period of ownership or stewardship are taken into account. The actor to focus the LCC around is given by the goal and scope definition. Often the actor is the purchaser of a product, and the purpose of the LCC result is to communicate how future costs of the product will affect the economy of the purchaser (Bengtsson and Sjöborg, 2004). External costs are not covered by the LCC since by definition external costs are borne by society and reflect environmental aspects of the system under study (Rudenauer *et al*., 2005). These aspects are covered by the LCA steps.

ECOLOGY: LIFE CYCLE INVENTORY (LCI)

The LCI step involves quantification of inflows and outflows of material and energy over the defined system boundaries of the life cycle. It includes flows related to raw material extraction,

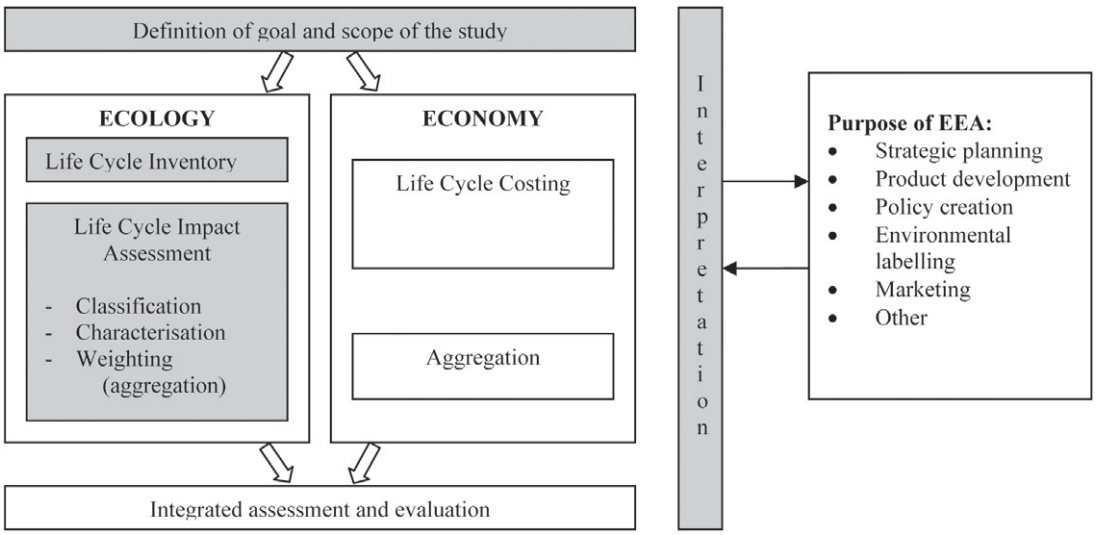


FIG. 1. *General procedures for Eco-Efficiency Analysis (EEA).*

processing of raw materials, manufacturing, use, maintenance, recycling/reuse, waste management, and transportation (Fig. 2). Each process requires material and/or energy inflow and produces different kinds of emissions and waste. The LCI results in a long list of different environmental interventions.

ECOLOGY: LIFE CYCLE IMPACT ASSESSMENT (LCIA)

The vast amount of data produced by the LCI and the complexity of the cause and effect of different environmental interventions make it hard to identify which data are important from an environmental point of view (Rydh *et al.*, 2002). For interpretation and communication purposes, methods have been designed to aggregate the LCI data to fewer digits, representing either different impact categories (characterization) or the total environmental load of the system (weighting). In this way the environmental hot spots of the life cycle can more readily be identified. The LCIA encompasses three parts: classification, characterization, and weighting (Fig. 3).

In the classification phase, inventory data are sorted into environmental impact categories. The classification is based on scientific cause-effect relations, and hence one substance can be assigned to more than one environmental impact category. In the characterization process the inventory data are multiplied with a characterization factor that is specific for each data and environmental impact category. In this way, for each category, the potential environmental impact of all substances in the category is summed up and is represented by one index.

The impact categories that were considered in the EEA and were applied for different chelating agents are: primary energy consumption, resource depletion, area use, emissions, human toxicity, and risk. The impact category "emissions" is further subdivided into other impact categories (see Table 1).

In a further weighting process, the impact category results are aggregated into a single indication or statement of the total strain put on the environment. In the ISO standards the weighting is an optional step of the LCA, and no specific weighting methodology is recommended (ISO 14044, 2000). However, weighting is often a necessary step to simplify communication and decision making and is therefore widely used within industry. In the EEA method currently practiced by AkzoNobel, a weight that expresses the environmental importance of that impact category relative the other impact categories is assigned to each impact category.

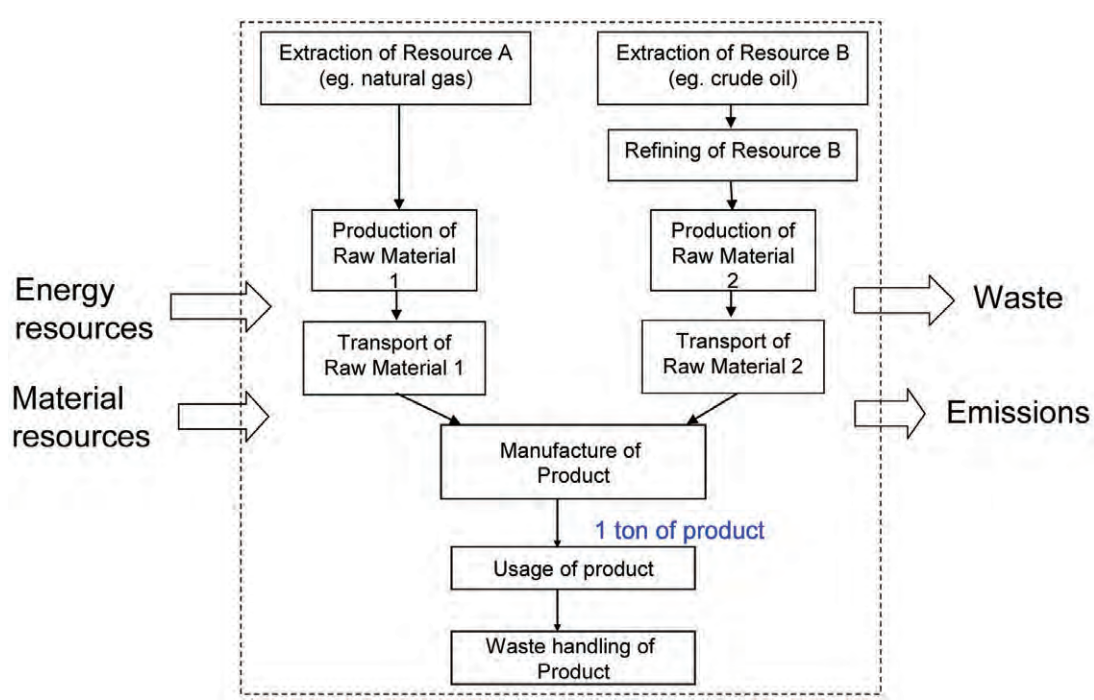


FIG. 2. *A product life cycle.*

These weighting factors are the geometric means of impact category-specific "relevance factors" and "societal factors." For the European weighting, and the resulting weighting factors for the chelate study, see Table 1. To derive the relevance factor, the result of the alternative with the highest impact in that category is normalized against the total load of the same category in a specific region. This step yields the relative significance of the different impact category results. The societal factors, on the other hand, express the severity of each item relative to the other impact categories as perceived by a group of people (see Table 1). The societal factors are based on the opinions of people in the same region as were chosen for the derivation of the relevance factors. The societal factors have been presented by BASF and were derived through a public opinion poll (Kicherer, 2005). [For more information regarding the weighting methodology and the subsequent integration of ecological and economic data, presented below, see Saling *et al*. (2002) and Kicherer *et al*. (2007).]

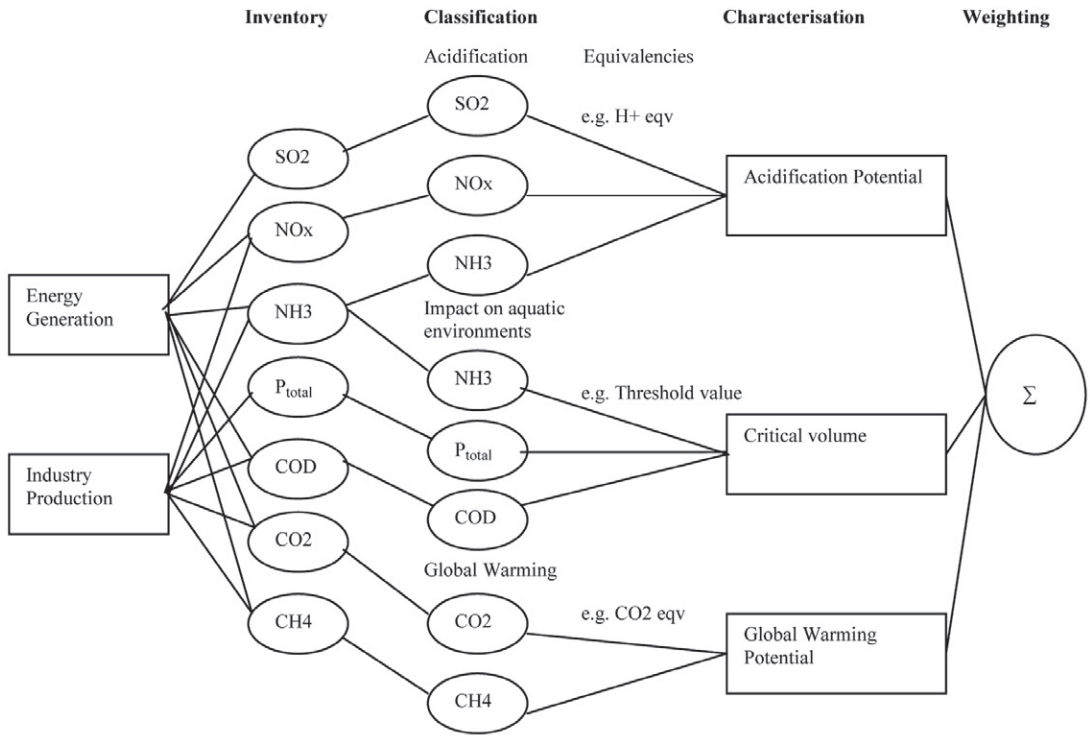


FIG. 3. *Phases included in Life Cycle Impact Assessment (LCIA)—the stepwise aggregation of information in Life Cycle Assessment (LCA). The inventory list is usually considerably more extensive, and more characterization/impact categories are normally included in the Eco-Efficiency Analysis (EEA). Modified from Rydh et al. (2002).*

In this way the weighting step combines all environmental loads and impact categories and makes it possible to assess the relative contribution of different data to the total strain. This facilitates effective communication and interpretation of the results and provides a better overview of a complex system. When performing an EEA the need for weighting is high, since otherwise each of the various environmental impacts would have to be compared with the cost side individually (Rudenauer *et al*., 2005).

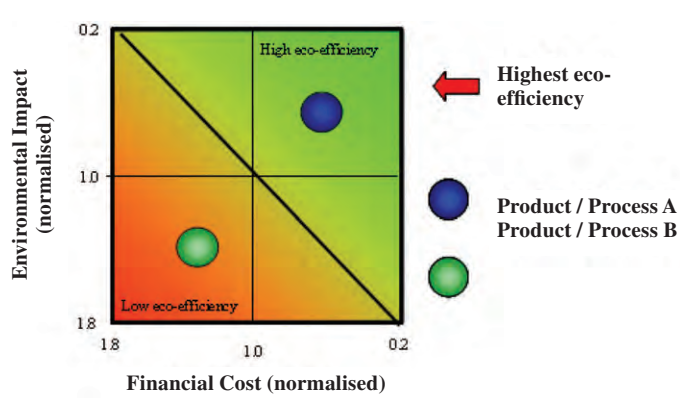


FIG. 4. *The eco-efficiency portfolio.*

information

For further reading:

- Bengtsson, S., and L. Sjöborg, Environmental costs and environmental impacts in a chemical industry, M.Sc. Thesis, Chalmers University of Technology, Göteborg, Sweden, 2004.
- ISO 14044, Life cycle assessment–Life cycle interpretation, 2000.
- Kicherer, A., BASF Eco-Efficiency Analysis Methodology Seminar, BASF AG, Ludwigshafen, 2005.
- Kicherer, A., *et al*., Eco-efficiency. Combining life cycle assessment and life cycle costs via normalization, *International Journal of Life Cycle Assessment 12*:537–543 (2007).
- Rudenauer, I., *et al*., Integrated environmental and economic assessment of products and processes, *Journal of Industrial Ecology 9*:105–116 (2005).
- Rydh, C.J., *et al*., *Livscykelanalys-en metod för miljöbedömning av produkter och tjänster,* ISBN 91-44-02447-9, Studentlitteratur, Lund, 2002.
- Saling, P., *et al*., Eco-efficiency analysis by BASF: The method, *International Journal of Life Cycle Assessment 7*:203–218 (2002).

TABLE 1. *Weighting factors for the chelate study*[a]

Impact category	Societal factor (*S*) [%]	Relevance factor (*R*) [%]	Total weighting factor (*T*) [%] (geometric mean[b] of *S* & *R*)
Resource use	20	4	11
Primary energy use	20	5	13
Area use	10	0.3	2
Toxicity potential	20	20	20
Risk potential	10	10	10
Emissions	20	61	44
Water emissions[c]	35	95	78
Solid waste	15	—	—
Air	50	5	22
Global warming potential (GWP)	50	69	68
Photochemical ozone creation potential (POCP)	20	8	15
Ozone depletion potential (ODP)	20	—	
Acidification potential (AP)	10	23	17

[a]Totals may not agree because of rounding. The relevance factors and total weighting factors, as presented in the table, have been normalized so that they add up to 100%.
[b]The geometric mean of a data set $[a_1, a_2, ..., a_n]$ is given by $(a_1, a_2, ..., a_n)^{1/n}$. For example, in this table, $T = \sqrt{S*R}$.
[c]This impact category takes into account the eutrophication potential of substances emitted to water recipients.

From these results it is clear that a trade-off between different kinds of environmental impacts is needed in order to generate a priority list of the different chelating agents from a holistic environmental perspective. This trade-off is done via the weighting step. The weighting factors that were used to aggregate the impact category results in a single score, denoting the total environmental pressure of the different alternatives, are presented in Table 1 and represent European conditions.

The result of the weighting is illustrated in the bar chart and table in Figure 5. They show the weighted values for each impact category and alternative chelating agent; the top of the bars denotes the

INTEGRATED ASSESSMENT AND EVALUATION

The eco-efficiency method includes a weighting of environmental impact and costs, resulting in displaying the most eco-efficient alternative in a two-dimensional diagram (Fig. 4). The axes in the diagram are inverted so that the alternative that has the lowest sum of environmental and financial performance is found closer to the upper right corner. This alternative is termed the most eco-efficient alternative and is hence favored from an eco-efficiency perspective.

INTERPRETATION

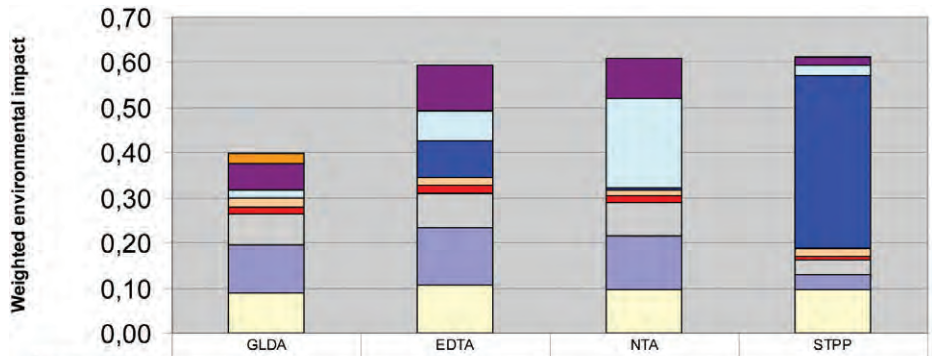
The purpose of the interpretation phase is to analyze the results of the study, evaluate and explain its limitations, and generate conclusions and recommendations (ISO 14044, 2000). The robustness of the results can be assessed with a sensitivity analysis of the effects that chosen methods and data have on the result of the study.

Results of EEA of different chelating agents. The impact category results for one ton of chelating agent are presented for the different alternatives in Table 2.

TABLE 2. *Characterization/impact category results for 1 ton of the studied chelating agents*[a]

	Alternatives			
Impact categories	**GLDA**	**EDTA**	**NTA**	**STPP**
Primary energy use [GJ]	71	83	77	20
Resource use [$yr^{-½}*10^{-3}$]	1.2	1.4	1.3	1.3
Area use [m^2*yr]	358	3	3	1
Toxicity potential [dimensionless]	0.09	0.34	1	0.11
Risk potential [dimensionless]	0.58	1	0.89	0.18
Global warming potential [ton CO_2 equiv]	5.1	5.7	5.5	2.7
Photochemical ozone creation potential [kg C_2H_4 equiv]	1.0	1.1	1.0	0.4
Ozone depletion potential [kg CFC equiv]	—	—	—	—
Acidification potential [kg SO_2 equiv]	17	15	12	15
Waste [kg]	—	—	—	—
Water emissions [1000 m^3]	0.6	6	0.2	27

[a]Darker blue-shaded items constitute emissions. Abbreviations: GLDA, tetrasodium L-glutamic acid, N,N-diacetic acid; EDTA, ethylene diamine tetraacetic acid; NTA, nitrilotriacetic acid; STPP, sodium tripolyphosphate; CFC, chlorofluorocarbon.



	GLDA	EDTA	NTA	STPP
Area use	0,02	0,0002	0,0002	0,0001
Risk potential	0,06	0,10	0,09	0,02
Toxicity potential	0,02	0,07	0,20	0,02
Water emissions	0,0009	0,08	0,003	0,38
AP	0,02	0,02	0,01	0,02
POCP	0,01	0,02	0,02	0,006
GWP	0,07	0,08	0,07	0,04
Energy use	0,11	0,13	0,12	0,03
Resources use	0,09	0,11	0,10	0,10

FIG. 5. *Weighted values for the different impact categories and chelating agents. For abbreviations, see Tables 1 and 2.*

total and final environmental results that were integrated with economic data in the complete EEA.

DISCUSSION

The result of this study indicates that GLDA scores best or second-best in all impact categories except "area use" and "acidification." However, Table 1 and Figure 5 reveal the small relevance of "area use" in this assessment. Even though GLDA requires more land than its alternatives since it is based on renewable raw materials, the land use is small on an absolute basis and therefore not a key criterion in an environmental assessment of different chelating agents. In fact, in this study, emissions to water is the most important environmental aspect according to the applied weighting methodology, followed by toxicity, risk potential, and global warming potential.

CONCLUSIONS

GLDA performs well in all important aspects compared with the other alternatives, mainly because it is based on renewable raw materials and is readily biodegradable. Another advantage of GLDA is that (unlike STPP) it does not give rise to any phosphorus emissions to water and hence the eutrophication potential of GLDA is insignificant. With respect to the toxicity potential, GLDA scores much better than especially NTA, for which there is limited evidence of carcinogenic effects from exposure (= R40 label as defined in Annex III of European Union Directive 67/548/EEC). For these reasons it can be concluded that on an equal mass basis GLDA is the most environmentally benign chelating agent. A sensitivity analysis also showed that this result is robust with regard to the region (continent) that is chosen for the weighting.

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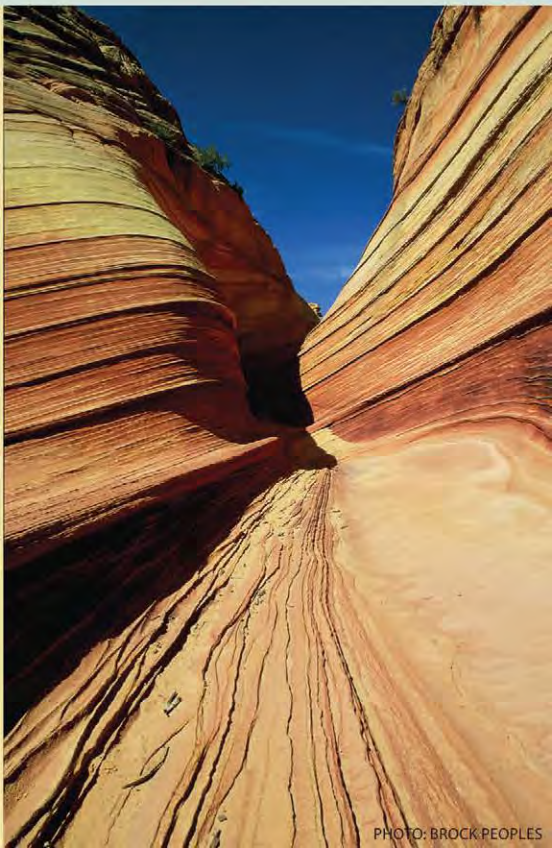

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AOCS 100 Years 1909–2009

Your Global Fats and Oils Connection

Outtakes from the history of AOCS

Editor's note: To celebrate AOCS' 100th anniversary, AOCS Centennial Historian George Willhite chronicled its history with a series of articles in inform. *During the research, writing, and revision of those 12 articles—appearing in* inform *from April 2008 to April 2009—countless anecdotes and interesting facts failed to make the final cut each month because of space constraints. Beginning this month, we present the "best of the rest" of his research on the history of AOCS.*

George Willhite

FELIX PAQUIN

AOCS' founding president Felix Paquin did not plan to become a chemist.

Paquin was born December 17, 1865, in St. Andrews, Québec, Canada. His father died while Felix was a boy, and his mother moved the family to Columbia, Missouri, USA (for reasons not yet discovered).

In the late 1880s, Paquin enrolled at Missouri State University in a three-year program, not in chemistry, but engineering. He later wrote in a biographical sketch that he left college "due to bad health and a flat purse." He left to earn some money in railroad siting and construction work during a railroad-building boom in the United States. US railroad track mileage had tripled between 1870 and 1880. But when the boom burst in 1893, Felix went back to school, enrolling in a two-year program at the St. Louis College of Pharmacy when he was 28.

His first job after graduation was with a biological laboratory, but before long he accepted a position as city chemist in Memphis, Tennessee, a half-time position that involved testing water purity, testing milk samples (he ordered the arrest of a milkman for delivering milk that did not have the required minimum fat content), and similar chores. His autobiographical sketch said that when a smallpox epidemic scare arose, "I propagated the necessary vaccine to vaccinate the whole city of Memphis, about 80,000" persons.

Memphis was the cotton commerce capital of the United States at the end of the 19th century. Paquin opened an independent analytical laboratory in 1900—one of the first in the nation to specialize in cottonseed products. He became the official chemist for the Memphis Merchants Exchange. The exchange's trading rules specified Memphis as the settlement point for cottonseed oil trading disputes. Paquin conducted analyses, when needed, for arbitration cases.

He also taught chemistry at the College of Physicians and Surgeons in Memphis in 1908. The next year he bought an analytical laboratory in Galveston, Texas, where he moved.

In 1909, the number of US cottonseed oil mills was near its all-time high (about 880 cottonseed oil mills were recorded in the 1914 US Census of agriculture), and they crushed approximately 3.3 million tons (3.0 million metric tons) of cottonseed annually. Today there are fewer than 40, crushing a slightly lower tonnage.

Thus, he was a logical "president *pro tem*" for the fledgling organization he helped found.

FRANK NEWELL SMALLEY

Frank Smalley—founder of AOCS' check sample program—served as a US Army nurse in the Philippines during the Spanish-American War. He also had bad handwriting.

He obtained his bachelor's degree from MIT (Massachusetts Institute of Technology, Boston) about the time Paquin was completing his pharmacy studies in St. Louis, in the final years of the 19th century.

Smalley became a teacher at the University of Cincinnati (Ohio), where he received his master's degree in 1898.

He moved to the University of California to pursue a doctorate. But before the end of the school year, the Spanish-American War began and Smalley enlisted in the US Army. He served as a chemist and nurse at Corregidor Island, Manila, the Philippines.

After the war (which for Smalley lasted only five months), he returned to Framingham, Massachusetts, where his father, H.W. Smalley, had a firm that manufactured straw hats for "ladies, misses, and children." Smalley worked there for about two years, then for

an iron foundry in Rhode Island, and then became a chemist for Southern Cotton Oil Co.

Smalley also apparently had poor handwriting.

Theo Rettger, who worked for Smalley at Southern Cotton Oil, said one time that Smalley left Rettger with a handwritten note of things to be done while Smalley was on a business trip. When Rettger looked at the note, he couldn't decipher the writing. After Smalley returned, Rettger handed him the note and said, "I didn't get these done." Rettger said Smalley looked at the note, crumpled it up, and said, "I can't read the damn thing myself."

Smalley was AOCS president in 1913, when there were about 40 members. That also was the year in which the first colonial oilseed mill in the United States—in Bethlehem, Pennsylvania—closed down. The plant had first crushed linseed in 1745.

The 1921 AOCS meeting was the last Smalley attended. After an elective operation in Boston (I have been unable to discover what type of operation was being done), Smalley developed peritonitis and died on August 15, 1921.

DAVID WESSON

David Wesson—whose name survives on supermarket shelves that stock ConAgra's Wesson Oil—left the fats and oils industry for five years to manufacture bicycles.

Wesson grew up in Brooklyn, New York, and attended the Polytechnic Institute in Brooklyn. He received his bachelor's degree in 1883 at MIT, followed by a post-grad assistantship there.

In 1884, Wesson joined the N.K. Fairbank & Co. of Chicago, which had been purchased in 1875 by American Cotton Oil. In 1930, Wesson wrote that "I was employed as a cub chemist to analyze soaps for the new factory which had just started." That's where he first began working on cottonseed oil, of which he wrote, "I had hardly heard of cottonseed oil before this time. Nothing had been said about it at the Massachusetts Institute of Technology, from which I had just escaped."

A few years later, Fairbank was absorbed by W.J. Wilcox Lard and Refining Co., and in 1890, Wesson was transferred to a plant in New Jersey. He left the company five years later to open a bicycle factory in Cortland, New York, which, from 1895 to 1900, produced the Loyal brand of bicycles. There's no record of why he chose to manufacture bicycles or why he established his facility in Cortland, but there is a university there.

Wesson, however, may have run the bicycle operation to make money while retaining his interest in fats and oils, for he formed the Wesson Process Co. in Cortland and maintained a chemistry laboratory there.

It was during these five years in Cortland that he developed his winterizing process, which led, in 1900, to his becoming technical director for the Southern Cotton Oil Co. Wesson was with that firm until he died in 1934, serving as technical advisor after 1920.

David Wesson became AOCS' second president in 1911, when the society had about 20 members (the total rose to between 30 and 40 members by the end of the year). It was while Wesson was AOCS president that a Seattle firm began using hydraulic presses to crush imported soybeans, and it may well have been the first commercial soybean crushing activity in the United States.

In a 1924 New Year's greeting published in the *Journal of Oil and Fat Industries* (later, *Journal of the American Oil Chemists' Society* [*JAOCS*]), Wesson noted that when AOCS was formed, "The discussion of broad chemical principles as applied to our industry was considered high treason by the manufacturing interests; therefore our mutual efforts were confined to the improvement of analytical methods, to the great advantage of the industry. Now that the analytical baby has happily grown into a big boy and has changed his name to the American Oil Chemists' Society, let us all pull together and make the society helpful to all of us and keep our profession on the highest plane."

In another commentary, he had noted that at AOCS meetings many attendees would attend sessions hoping to learn as much as possible but not contribute much about their own operations. But later in the evening, when everyone had spent a few hours talking in the bars, tongues loosened and as tales were compared, everyone learned that they had all been trying similar routes to better results and, in listening to each other, found new ways to proceed.

Wesson apparently also was the person most responsible for the crossed-flask drawing that was AOCS' logo for many years. The symbol first appeared on the program for the 12th annual meeting during May 1921 in Chicago. F.B. Porter, in his president's address at that meeting, said, "Dr. Wesson, with the help of others, has supplied us with the design for our stationery, a copy of which you will find on the cover of our program." The logo was used through 1984, when it was updated for the 75th anniversary celebration.

Look for part two of this article in next month's issue of inform.

George Willhite, AOCS' centennial historian, retired from AOCS in 2002 after 27 years as a member of its publications staff. He is an honorary member of AOCS. He can be contacted via e-mail at GeorgeWillhite@aol.com.

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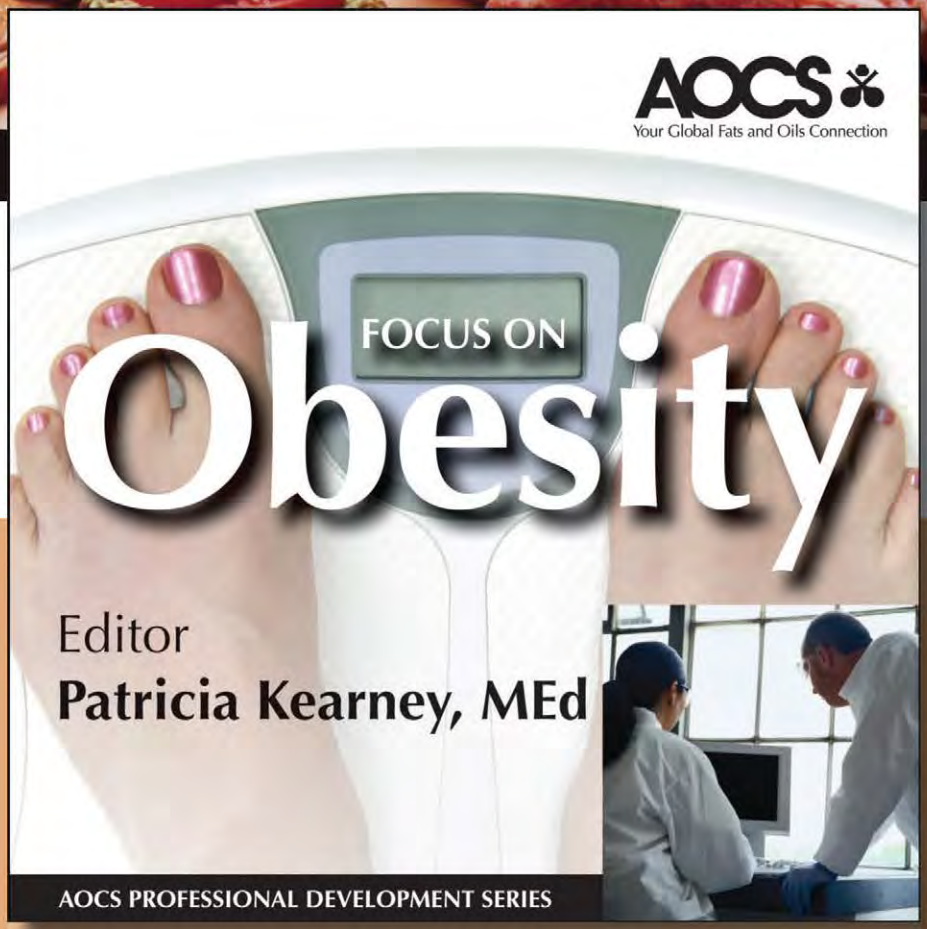

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Obesity and immune functions

Two new studies connect the immune system with obesity and type 2 diabetes.

David Cameron

Crack open the latest medical textbook to the chapter on type 2, or adult-onset, diabetes, and you will be hard-pressed to find the term "immunology" anywhere. This is because metabolic conditions and immunologic conditions are, with a few exceptions, distant cousins.

However, a group of papers that appeared in *Nature Medicine*, two of which are from Harvard Medical School (HMS; Boston, Massachusetts, USA) researchers, have linked type 2 diabetes with immunology in a way that might persuade leading researchers to start viewing them as siblings.

In the first study (*Nature Medicine 15*:940–945, 2009), researchers used two common over-the-counter allergy medications to reduce both obesity and type 2 diabetes in mice. The medications, called Zaditor® and cromolyn, stabilize a population of inflammatory immune cells called mast cells. In the second study, researchers found that a kind of white blood cell called a regulatory T cell, once thought to manage only other white blood cells, also acts as a liaison between the metabolic and immune systems—in this case, controlling inflammation in fat tissue. Fat tissue from obese and insulin-resistant mice and people is marked by a dramatic absence of this cell type, in contrast to an already reported overabundance in fat tissue of inflammatory immune cells called macrophages.

"It seems that we're seeing the emergence of a new biomedical discipline: immunometabolism," says HMS professor of pathology Diane Mathis, senior author on one of the papers (*Nature Medicine 15*:930–939, 2009).

MOLECULAR GARBAGE

Type 1 and type 2 diabetes both involve abnormalities in the insulin-producing beta cells of the pancreas, but their root causes are completely different. Type 1 diabetes is an autoimmune disease in which the immune system attacks the pancreas, destroying its ability to produce insulin. In contrast, type 2 diabetes is a strictly metabolic condition in which cells grow increasingly "deaf" to insulin signals and thus lose their ability to metabolize glucose. In both cases, glucose content mounts in the blood, at times to fatal levels.

But it is becoming increasingly clear that we should also think of type 2 diabetes in the context of immune function, Harvard scientists assert.

Guo-Ping Shi, a biochemist from the Department of Medicine, Brigham and Women's Hospital and Harvard Medical School, began to suspect such a connection when, in a previous study, he found mast cells present in a variety of inflammatory vascular diseases.

Mast cells are immune cells that facilitate healing in wounded tissue, primarily by increasing blood flow to the site. However, in certain conditions, mast cells build up to levels far beyond what the body needs. As a result, these cells become unstable and eventually, like punctured trash bags, leak molecular "garbage" into the tissue. This can result in chronic inflammation that causes asthma and certain allergies.

As Shi and postdoctoral research fellow Jian Liu discovered, mast cells were far more abundant in fat tissue from obese and diabetic humans and mice than they were in normal-weight fat tissue. This led to an obvious question: by regulating mast cells, could we then control the symptoms?

To find out, Shi and colleagues took a group of obese and diabetic mice and, for a period of two months, treated them with either ketotifen fumarate (also called Zaditor) or cromolyn, both over-the-counter allergy drugs.

"We knew from published research that both cromolyn and Zaditor help stabilize mast cells in people suffering from allergy or asthma," said Shi. "It's almost as if the drugs place an extra layer of plastic on the ripped trash bag. So it seemed like a logical place to begin."

The mice were divided into four groups. The first was the control group; the second group was simply switched to a healthful diet; the third was given cromolyn or ketotifen fumarate; and the fourth was both given the drug and switched to a healthful diet.

While symptoms of the second group improved moderately, the third group demonstrated dramatic improvements in both body weight and diabetes. The fourth group exhibited nearly 100% recovery in all areas.

To bolster these findings, Shi and colleagues then took a group of mice whose ability to produce mast cells was genetically impaired. Despite three months of a diet rich in sugar and fat, these mice neither became obese nor developed diabetes.

"The best thing about these drugs is that we know [they are] safe for people," says Shi. "The remaining question now is: Will this also work for people?"

Shi now intends to test both cromolyn and ketotifen fumarate on obese and diabetic non-human primates.

BEYOND FRIENDLY FIRE

In findings independent of Shi, researchers at HMS and Joslin Diabetes Center (Boston, USA) discovered that a class of immune system cells called regulatory T cells, or Tregs, were abundant in the abdominal fat tissue of normal-weight humans and mice but were virtually absent in the same tissue from obese and diabetic humans and mice.

Their numbers were inversely correlated with the numbers of a class of inflammatory immune cells, macrophages, in a sense creating parallel universes of fat. While obese and diabetic fat tissue was full of inflammatory macrophages and nearly absent of Tregs, normal-weight fat tissue was the diametric opposite.

"For immunologists this is very important, because Tregs had always been thought to control other T cells and that is it," says Markus Feuerer, a postdoctoral researcher in the lab of HMS professors of pathology Diane Mathis and Christophe Benoist. "But this is an entirely new concept." Mathis and Benoist collaborated on the study with Steven Shoelson, HMS professor of medicine at the Joslin Diabetes Center.

"I come at this studying the effects of obesity and why it can spread systemically to cause chronic health problems," says Shoelson, an endocrinologist. "It's possible that the inflammation caused by macrophages results in insulin resistance. And it is more likely, from what we have just seen, that Tregs are keeping the macrophages in check in normal fat tissue, thus preventing inflammation."

For over a decade, Tregs have been known as guardians for the immune system, ensuring that when white blood cells attack a foreign pathogen they do not become overzealous and harm healthy host tissue in a kind of friendly fire. Malfunctioning Tregs, however, have recently been implicated in diseases as diverse as multiple sclerosis and certain cancers.

"Now we're seeing that Tregs may be needed to prevent metabolic abnormalities as well," says Mathis. She adds, half joking, "As an immunologist, I always thought that type 2 diabetes was a pretty boring condition. After these findings, I'm starting to change my mind."

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David Cameron is a member of the Harvard Medical School public affairs staff.

FIELD-PORTABLE MASS SPECTROMETERS (CONTINUED FROM PAGE 627)

prototype instruments mark an important step toward a field-portable MS instrument, but these systems are not constructed for or rugged enough for constant operation in harsh environments. Recently, ICx Technologies, Inc. (Arlington, Virginia, USA)/ Griffin Analytical Technologies LLC (West Lafayette, Indiana) has developed a field-ready mass spectrometer capable of ambient MS (Wells *et al*., 2008). It is the first robust, commercial-grade instrument of this kind. Customized DESI-MS ionization sources are also currently available from Prosolia, Inc (Indianapolis, Indiana) for most laboratory-scale, atmospheric inlet mass spectrometers. Commercialization of technologies like those of ICx/Griffin and Prosolia is a key milestone in making this technique available to scientists and practitioners in all fields of science.

It is exciting to think of the impact that DESI-capable, field-portable systems could have in the near future, as they are well suited for law enforcement and corrections, forensics, and homeland security. The robust nature of the technique suggests it could be applicable to future threats and samples of interest. This technology could also have an immediate impact on industrial hygiene and quality control, and the ability to directly analyze consumable products as they are being made, imported, or sold could revolutionize food safety. Researchers are already busy applying DESI-MS to several high-profile food safety concerns, such as melamine screening in milk products and bacterial profiling in foodstuffs (for more on melamine, see *inform 20*:563–565, 2009).

In the essay "Hazards of Prophecy: The Failure of Imagination" in *Profiles of the Future* (1961), Arthur C. Clarke stated, "Any sufficiently advanced technology is indistinguishable from magic." While there is still much to do to optimize these instruments, field-portable DESI-MS systems have already been shown capable of rapid and routine analysis of traditionally difficult samples.

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