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Calendar

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

January

January 9–14, 2010. Triglycerides and Triglyceride-Rich Particles in Health and Disease, Keystone Symposium, Big Sky, Montana, USA. Information: www.keystonesymposia.org/meetings/ViewMeetings.cfm?MeetingID=1033.

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

January 24–29, 2010. Adipose Tissue Biology, Keystone Resort, Keystone, Colorado, USA. Information: www.keystonesymposia.org/Meetings/ViewMeetings.cfm?MeetingID=1043.

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

January 31–February 5, 2010. Practical Short Course on Feeds & Pet Food Extrusion, Texas A&M University, College Station, Texas, USA. Information: e-mail: mnriaz@tamu.edu; www.tamu.edu/extrusion.

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 8–10, 2010. 2010 Packaging Conference, Aria CityCenter, Las Vegas, Nevada, USA. Information: www.thepackagingconference.com.

February 15–17, 2010. 15th Annual National Ethanol Conference: Climate of Opportunity, 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 21–26, 2010. Principles and Practice of Cosmetic Science: An Interactive Residential Course, Wessex Hotel, Bournemouth, United Kingdom. Information: e-mail: ifscc.scs@btconnect.com; www.scs.org.uk.

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AOCS Meeting Watch

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.

July 11–16, 2010. 19th International Symposium on Plant Lipids, Cairns Convention Centre, Cairns, Australia. Information: www.ispl2010.org.

October 4–7, 2010. 7th World Conference on Detergents: New Strategies in a Dynamic Global Economy, Montreux Music & Convention Centre, Montreux, Switzerland. Information: www.aocs.org/meetings/montreux.

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

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

March

March 2–5, 2010. Deuel Conference on Lipids, Laguna Cliffs Resort & Spa, Dana Point, California, USA. Information: www.deuelconference.org/index.html.

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.

March 3–5, 2010. 3rd Singapore Lipid Symposium, National University of Singapore. Information: www.lipidprofiles.com.

March 3–5, 2010. Victam 2010 [Animal Feed, Petfood, Aquatic Feed Technology], Queen Sirikit National Convention Centre, Bangkok, Thailand. Information: www.victam.com.

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 10–11, 2010. Nutracon 2010, Hilton Anaheim, Anaheim, California, USA. Information: www.nutraconference.com/nutracon2010/Public/mainhall.aspx?ID=1007318&sortMenu=101000.

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

March 14–18, 2010. NACE Corrosion 2010 Conference & Expo, San Antonio, Texas, USA. Information: http://events.nace.org/conferences/c2010/c2010.asp.

March 15–17, 2010. World Biofuels Markets, RAI Congress Centre, Amsterdam, the Netherlands. Information: www.worldbiofuelsmarkets.com.

March 21–25, 2010. 239th American Chemical Society National

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Letter to the Editor

Mr. Willhite,

I read your article on Frank Smalley and David Wesson with great interest (see *inform* *20*:671–672, 2009). I am the ConAgra plant manager in Memphis, Tennessee (USA), where all Wesson Oil and related oil and shortening products are manufactured. I started my career in oil processing in 1971 in the Savannah, Georgia (USA), plant where David Wesson and Frank Smalley worked for many years. Both lived there, and Wesson's home is still standing. I had the advantage as a young man to be trained at the knee, so to speak, by older men who were steeped in the history of David Wesson and his work.

Wesson's primary contribution to our industry was deodorization. Although there were some previous crude attempts at improving the flavor of cottonseed oil with steam (so it could be applied as an adulterant to lard), it was David Wesson who first combined deaeration, a vacuum vessel, and sparging steam to refine cottonseed oil to an extent that made it edible on its own. It was a four-kettle, multi-vacuum-system arrangement. He called it the "Wesson Process." First built in the Savannah plant of the Southern Cotton Oil Co. (SCOCO), it produced the first domestic edible vegetable oil, "Wesson Oil." Barbed wire and guards surrounded the process because Wesson did not trust that a patent would protect his secret. He personally off-scaled the dial thermometers in his temperature-sensitive operation and issued operating instructions in "degrees Wesson." As late as the 1980s, in what was by then the Hunt-Wesson Co., we still referred to a deodorizer as a "Wesson Process."

Winterization was key to producing a clear salad oil and to allowing cottonseed oil to be used in mayonnaise. The company sold mayonnaise makers in the 1920s (which can still be found on eBay) with a recipe etched in the glass. Wesson later introduced "Blue Plate" mayonnaise, one of the first prepared mayonnaises for retail sale. The original winter plant was still in use in Savannah when I started there. Of course, at first the process was simply to store cottonseed oil in large tanks in the wintertime (winterization) and use a movable suction pipe to pump stearine off the bottom and olein off the top. Ammonia refrigeration was applied later to a bank of rectangular tanks (cells).

When Wesson joined the SCOCO, there were three SCOCO plants: Savannah, Memphis, and New Orleans. All three were built in the 1800s, post-Civil War, and engaged in the crushing and processing of cottonseed oil for nonedible purposes (such as soap and paint base). There was still a paint manufacturing operation on the site of the Savannah plant in the 1970s. Although Wesson and Smalley both lived in Savannah, they had an active presence in the Memphis plant I now manage. It thus follows that they were both in Memphis at the founding of the AOCS and that New Orleans figured prominently in the annals of AOCS meetings.

I am fascinated by the history of our industry and always enjoy your articles. Keep up the good work.

Rick Brantley
Plant Manager
ConAgra Foods Inc.
Memphis, Tennessee, USA

The market situation and political framework in Germany for biodiesel and vegetable oil

Dieter Bockey

The final details compiled by the Federal Statistics Office and Federal Office of Economics and Export Control (BAFA) confirmed the drop in sales of biodiesel and vegetable oil in Germany in 2008 in comparison to 2007. Although utilization of biodiesel as an admixture component in fossil diesel fuel increased by 190,000 metric tons (MT) to 1.613 million metric tons (MMT), a slump of 739,000 MT in sales of pure fuel offset this positive development. In absolute figures: Whereas 1.821 MMT of biodiesel were marketed as pure fuel in 2007, only 1.082 MMT were sold in 2008, which equates to a reduction of 40.6%. Taking into consideration the increase in the utilization of biodiesel as an admixture, component sales of biodiesel fell overall by 16.9% from 3.245 MT in 2007 to 2.695 MT in 2008.

This negative sales development unfortunately also indicates the stark reduction in the number of public filling stations offering biodiesel. Whereas around 1,900 stations did so at the start of 2007 according to an AGQM (Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.) survey, this figure had fallen to around 250 by the end of 2008. Subsequently, the AGQM was obliged to discontinue quality assurance at the filling station level. Guided and supported intensively by UFOP (Union zur Förderung von Oel- und Proteinpflanzen) for around 20 years, this distribution channel was by far the most significant provision instrument for alternative fuel throughout Germany up to 2007. This network no longer exists, and given that each biodiesel filling station was an important public relations multiplier, biodiesel will also gradually disappear from the public eye. The pure vegetable oil (PVO) sector registered an even more dramatic slump in sales from 772,000 MT in 2007 to 418,000 MT in 2008, a drop of 46%.

Notable from the perspective of the biodiesel and PVO business sectors is the fact that—measured against overall diesel fuel consumption—these biofuels replaced 12.7% of the fossil diesel requirement in 2007 and 10.2% in 2008. As a consequence, the two fuels contributed to a CO_2 reduction within the transport sector of around 9 MMT in 2007 and 7.1 MMT in 2008. The federal government's national decarbonization strategy envisages a targeted reduction within the transport sector of 30 MMT of CO_2 per year from 2020. These figures show that the utilization of biodiesel and PVO is necessary if this climate protection target is to be achieved on time. As a result of the German Bundestag (lower house of German parliament) resolution to change the biofuels policy, a response is even more urgently needed to the question of how the reduction of biodiesel and vegetable oil utility can be compensated in light of climate protection mandates.

BUNDESTAG SETS THE WRONG TAX POLICY AGENDA

Although the German Bundesrat (upper house of German parliament) vigorously campaigned to adjust tax concessions in favor of biodiesel and PVO—to once more provide a perspective for the regional marketing of pure fuel and subsequently the small- and medium-sized plant operators—the federal government ultimately pushed through its Draft Law on the Amendment of the Promotion of Biofuels by way of the Bundestag resolution. As such, the mediating committee was overruled. Although the tax increase on biodiesel of $0.03 per liter was reduced retroactively to January 1, 2009, and for the coming years, this is not sufficient to ensure competitiveness given the price decline on the crude oil markets and, as a consequence, the diesel markets. Irrespective of the drastic drop in sales in terms of pure biodiesel (B100) and PVO, the Bundestag endorsed the government bill to change biofuel funding.

In its report on tax concessions, the UFOP recently established that pure biodiesel was undercompensated by $0.20 per liter. Moreover, in the case of the decentralized manufacturers of rapeseed fuel, the UFOP calculation shows an undercompensation of $0.28 per liter. In 2010, as a result of the Bundestag resolution, at least a halving of pure fuel sales must be anticipated if the diesel price remains at its present low level. The refusal to completely exempt public transport and rail traffic from tax has robbed pure fuel of a further future sales perspective.

In addition, the UFOP has reinforced its position that tax concessions from suppliers of petroleum products should specifically benefit the transport sector. In relation to the toll structure, the UFOP has also called for the promotion of climate protection by reducing tolls for companies that verifiably use biodiesel or PVO. Such a move would primarily boost regional sales for small- and medium-sized facilities, thereby providing a perspective for the structurally desired decentralization of raw material and biofuel manufacture. Significant for meeting quota mandates is that a certain quantity buffer in the form of pure fuel is available for generating tradable quotas; otherwise a punitive penalty of around €0.62 per liter may be imposed on incomplete quotas.

The Bundestag resolved in 2008 to reduce the admixture quota from 6.25 to 5.25% retroactively to January 1, 2009. This will be raised to 6.25% for the period 2010 to 2014. From 2015, Germany will be the first European Union (EU) country to introduce a CO_2 reduction quota. How this mandate is to be implemented and monitored remains, however, unclear. What is clear is that, from 2015 at the latest, CO_2 efficiency will be a determining criterion as regards the competitiveness of biofuel providers. As such, biofuel manufacturers should react to this situation as quickly as possible and calculate the CO_2 balance of individual plants to establish the reduction potential.

In terms of the Bundestag elections, of significance is the demand encompassed within the Bundesrat resolution of June 12, 2009, whereby the immediate creation of reliable legal and economic frameworks is required, with a commensurate, dynamic tax regulation adjusted to the market situation. Whether and how the new German government will provide tax framework conditions that are appropriately based on the market situation remains to be seen.

RENEWABLE ENERGY DIRECTIVE (EER) COMES INTO EFFECT

The energy and climate protection package was adopted in March 2007 within the scope of the German EU Council presidency. This envisages an average minimum 20% reduction of EU greenhouse gas emissions by 2020, a 20% increase in energy efficiency, and a 20% proportion of renewable energies within the energy mix. A subordinate obligatory goal for all member states is a renewable energy share of at least 10% for the transport sector from 2020. The EER proposal of the EU Commission and council resolution had to be approved by the European Parliament. Heated debate in the Parliament ultimately led to the compromise that verifiable sustainability criteria would be established as additional requirements, particularly regarding the use of vegetable oils for generating electricity and heat as well as for biofuel production. A prerequisite for national funding is the provision of evidence that biofuels and liquid bio-combustibles reduce greenhouse gas emissions by at least 35% in comparison to the emissions from fossil diesel fuel. This reduction figure has to rise to a minimum of 50% from January 2017, and at least 60% for new plants that are built after January 1, 2017.

Thus, a "CO_2 reduction gap" would exist in relation to biodiesel made from rapeseed as regards the required greenhouse gas reduction level. Consequently, to afford rapeseed a long-term opportunity to serve as a raw material for biodiesel production or as a fuel in a cogeneration unit, additional efforts to close this gap are needed throughout the life cycle, beginning with cultivation of the raw material and then through the processing stage to biodiesel production. Commensurate with this objective, the UFOP commissioned the German Biomass Research Centre (DBFZ) with a relevant project: "Optimization of the greenhouse gas balance of biodiesel." Noteworthy is the fact that "mixing" biofuels in relation to the balancing out of greenhouse gas emissions is only possible when the biodiesel produced using the respective raw material achieves a minimum 50% reduction in greenhouse gases! The Renewable Energy Directive was published in the *EU Official Journal* at the end of June 2009; member states have 18 months to incorporate the directive into national law.

GERMAN "BIOFUELS" BIOMASS SUSTAINABILITY ORDINANCE

Germany is going its own way as regards to its incorporation of the directive into national law. The key requirements of the biomass sustainability ordinance for biofuels are set forth in paragraphs 4 to 7, which specifically concern the verification obligations and limits concerning biomass origin requirements:

1. No utilization of biomasses grown in areas deemed worthy of high-level nature conservation. These include: primeval forests and natural areas containing domestic tree species or areas in which no clearly visible signs of human activity are evident; and areas that are already conservation areas or are conserved within the scope of international agreements.
2. Grassland encompassing significant biological diversity.
3. Carbon-rich areas, e.g., moors, wetlands, or permanently wooded areas.
4. No utilization of biomasses grown in areas that were deemed turf moors on January 1, 2008 (reference date).
5. Biomass cultivation must be carried out according to good professional practice (cross compliance).

Implementation of this ordinance is now generating discussion in the agricultural trade regarding its practicality and bureaucratic excessiveness. The background of the debate lies in the requirements of the EU directive and the aforementioned laws that stipulate the verification of sustainable biomass production via corresponding certification systems. Continuous proof of maintenance of these sustainability requirements has to be provided along the supply chain in the form of so-called mass balance systems. One question in particular is: under what contractual conditions must the raw material volumes be recorded at the first stage, the agricultural trade?

The motivation and origin of this debate are one of the reasons that an end-use-related verification is stipulated in the Biomass Sustainability Ordinance for biofuels. Previously, such verification was only required within the scope of the obligatory setting aside of fallow land and cultivating renewable resources on such land. The agricultural trade rightly demands that verification should be effected with as little bureaucratic involvement as possible and by way of requirements that go beyond cross compliance. Yet the directives and Biomass Sustainability Ordinances encompass supplementary requirements within the aforementioned paragraphs 4 to 7 that have to be adequately documented. These requirements have raised fears among agriculturalists that the bureaucracy will increase considerably. The Federal Office for Agriculture and Nutrition (BLE) is responsible for the implementation; however, in contrast to the obligation to set aside fallow land, it is apparent that in relation to implementation, the BLE is exclusively focusing on monitoring the "monitoring systems." Introduction and implementation of the corresponding certification systems at the first documentation stage and subsequent stages (oil mills, biodiesel manufacturers) are incumbent upon the relevant business sector, whereas the BLE merely approves the certification systems and monitoring posts.

Pressure from the relevant trade associations was nonetheless successful in ensuring that the new regulation would not actually apply to the 2009 harvest. As such, the ordinance stipulates that biomasses can be used for energy purposes without limit until June 30, 2010, that is, without verification. In Germany this relates to 1 million hectares of rapeseed crops, equating to around 3.5 MMT of rapeseed, as well as the domestically generated grain for bioethanol production. From July 1, 2010, onward, either proof of origin from the 2009 harvest or a sustainability certification will have to be presented. As such, the requirements stipulated in the Biomass Sustainability Ordinance only apply in full for the 2010 harvest. This ordinance will present all participants in the trade with enormous challenges. Moreover, there is much debate regarding the enforcement of these requirements in terms of third-party countries. Yet it is notable that practically all the agricultural nations involved (which are also the most internationally significant biofuel manufacturers)—the United States, Brazil, Argentina, Malaysia, and Indonesia—are intensely debating the national introduction of certification systems. It is apparent that a level playing field is being created in the form of practically equivalent, international regulations for biomass cultivation and documentation obligations. Such regulations would have been unthinkable or impossible to implement in the past due to frequent criticism aimed at the World Trade Organization from the EU as regards unfair competition in the biomass cultivation sector. However, it is still too early for a conclusive evaluation.

Dieter Bockey is with the Union for the Promotion of Oilseeds and Protein Plants reg. Ass., and managing director of the Working Group Quality Management Biodiesel reg. Ass. Contact him via e-mail at d.bockey@bauernverband.net.

Industrial oil crops—when will they finally deliver on their promise?

Denis J. Murphy

Most *inform* readers are aware of the large number of articles over the past few decades that have highlighted the promise of new types of industrial oils from crop plants. As a researcher in this area since the 1970s, I am one of many who have regularly pointed out the vast range of possible industrial oils that could be obtained from plants. Indeed it is now more than 15 years since I edited a book, optimistically entitled *Designer Oil Crops* (VCH Publishing, Weinheim, Germany, 1994), that described the brave new world of customized oil crops that could be bred or engineered for dozens of nonfood applications, from polymers to high-value cosmetics. However, as we approach the second decade of the 21st century, only a very few of these new oils have achieved any significant commercialization. The purpose of this article is to briefly survey the near- to medium-term prospects for the industrial oil crops sector.

In 2008, worldwide-traded oil production from crop plants was almost 130 million metric tons (MMT), mostly used as edible vegetable oil. The proportion of plant oils used for nonedible or industrial purposes has fluctuated as petroleum and coal feedstocks increasingly competed with plant oils as sources of hydrocarbon-based products such as polymers, lubricants, fine chemicals, and fuels. Currently, only about 20% of global vegetable oil (25 MMT) is used for nonfuel industrial applications as oleochemicals. However, the recent interest in supposedly carbon-neutral crop-derived biofuels has started to divert significant amounts of vegetable oil feedstocks away from food or oleochemicals and toward the large-scale production of biodiesel.

CONVENTIONAL BREEDING

Due to the unusual and exotic nature of many industrially useful fatty acids (FA), conventional breeding approaches have been less useful in manipulating the FA profiles of edible oil crops to produce industrial oils. This is because most crop plants do not already contain genes allowing them to accumulate such exotic FA and therefore a transgenic (genetically modified) approach is normally required.

One important exception is oleic acid, which can be used as either a premium edible oil or a high-grade industrial feedstock. Existing uses of high-oleic soybean oil include lubricating oils, greases, printing inks, plasticizers, electrical insulation, detergents, soaps, shampoos, and disinfectants. Oleic acid is a major component of all plants and is often abundant in seed and fruit oils, which means that many plant oils have the potential to act as feedstocks for some of the uses listed above for soybean oil. However, the value of oleate-rich oils as industrial feedstocks is often severely limited by the additional presence of oxidation-prone polyunsaturates, especially linoleic and α-linolenic acids. These FA reduce the thermal performance and oxidative stability of many plant oils and therefore restrict their industrial uses. A major challenge for breeders has therefore been to reduce polyunsaturate levels in seed oils.

This challenge has been addressed with considerable success by breeders in several major oil crops. For example, breeders in the former Soviet Union developed high-oleic (75%) sunflower varieties. Sunflower and safflower lines are now available with 75% oleate and <1% α-linolenate. More recently, breeders in the United

States and Europe have developed high oleate/low polyunsaturate lines of soybean and rapeseed/canola, which may have potential industrial applications and are now being marketed by major seed companies. By 2004, high-oleic rapeseed/canola was already being planted on about 250,000 hectares (ha) in Canada, which is 5% of the total area of canola cultivation. Some of these new high-oleate oils have already been used as biodegradable lubricating fluids: Their characteristics include relatively long working lives and low susceptibility to oxidation at high temperatures.

Efforts are also under way to produce very high-oleate varieties of oil palm. This is especially challenging owing to the slow growth and long generation time of oil palm trees, which take 5–7 years to flower and produce oil and 10–15 years to reach full commercial productivity. Over the past decade, several promising lines of the two oil palm species, *Elaeis guineensis* and *E. oleifera*, that can contain up to 65% oleate in the mesocarp oil have been identified in Africa and South America. By using DNA-based molecular markers, breeders now hope to cross high-oleate lines into existing commercial lines; this is unlikely to produce commercial amounts of high-oleic palm oil, though, until well after 2020.

TRANSGENIC OIL CROPS

In theory, it is possible to express almost any FA in a plant oil by genetic engineering. However, despite 20 years of intensive research, most novel FA still only accumulate at relatively low levels in transgenic species, as shown in Table 1. The main reason is that simply transferring the relevant acyl modification gene into a plant does not necessarily mean that the corresponding FA will accumulate at high levels in the storage oil of the recipient plant. Indeed, despite more than 20 years of sometimes ingenious efforts by molecular biologists, yields of novel FA in most transgenic plants remain stubbornly low.

Sometimes novel FA levels can be increased by transferring additional genes, such as acyltransferases. But the additional enzymes/genes required to accumulate a given novel FA are not always predictable. A further problem in obtaining high levels of novel FA is that in some crop species, such as rapeseed/canola, not all of the novel acyl groups are necessarily channeled to storage lipids. Some of the exotic FA may accumulate instead in membrane lipids. This is one reason why some transgenic plants are unable to accumulate high levels of novel FA. It is also an important reminder of the complexity of metabolic regulation in plants and the difficulties of manipulating this process via the insertion of one, or a few, transgenes.

Although transgenic approaches to oil modification have mainly focused on the introduction of exotic FA, they have also been used to downregulate existing genes in order to reduce levels of unwanted FA. For example, linoleate desaturase genes have been suppressed to reduce levels of α-linolenate in seed oils. This approach has been used by several companies to complement conventional breeding programs aimed at developing high-oleate, low-polyunsaturate oils. The following high-oleate transgenic lines have been developed, but not necessarily commercialized, to date: rapeseed/canola with 89% oleate; soybean with 90% oleate; and cottonseed with 78% oleate.

CHEMICAL AND BIOTECHNOLOGICAL TRANSFORMATIONS OF BASIC INDUSTRIAL OILS

Even relatively homogeneous oils, such as 95% triricinolein, still often require downstream chemical and/or biotechnological conversions to generate specific oleochemical products at the required degree of purity. Less pure oils will require even more processing, and therefore research and development (R&D) into appropriate technologies will still be necessary, whatever the success of breeders in producing new crop-based oils. Downstream conversion and diversification transformations sometimes require biotechnological procedures such as lipase-catalyzed interesterification or transesterification. Alternatively, they may involve strictly chemical processes such as epoxidation or hydroxylation.

After a relatively slow start, novel oils from several new crops are also becoming industrially available, although not as yet in large quantities. Examples include petroselinic acid from coriander, calendic acid from *Calendula officinalis*, α-eleostearic acid from tung oil, santalbic acid from *Santalum album*, and vernolic acid from *Vernonia galamensis*. Useful new products include environmentally friendly industrial fluids and lubricants, insulating fluids for electric utilities, and additives to asphalt. In addition to modern methods of synthetic organic chemistry, enzymatic and microbial transformations can be used for the selective functionalization of alkyl chains. Some of the products of such syntheses include long-chain di-acids, ω-hydroxy FA, and ω-unsaturated FA. It is also possible to open up C=C bonds via chemical epoxidation to produce such advanced intermediates as polyetherpolyols. Finally, the purification of biologically produced (and therefore enantiomerically pure) FA from oil crops provides the basis for the synthesis of high-value nonracemic building blocks in the manufacture of fine chemicals.

KEY TARGETS FOR FUTURE INDUSTRIAL OIL CROPS

One of the prerequisites for the commercial viability of future industrial oil crops is that they should accumulate single FA

*inform*ation

For further reading:

- Cahoon, E.B., J.M. Shockey, C.R. Dietrich, S.K. Gidda, R.T. Mullen, and J.M. Dyer, Engineering oilseeds for sustainable production of industrial and nutritional feedstocks: solving bottlenecks in fatty acid flux, *Current Biology 10*:236–244 (2007).
- Dyer, J.M., S. Stymne, A.G. Green, and A.S. Carlsson, High-value oils from plants, The Plant Journal *54*:640–655 (2008).
- Gunstone F.D., J.L. Harwood, and A.J. Dijkstra (eds.), *The Lipid Handbook*, 3rd edn., Taylor & Francis, Oxford, United Kingdom, 2007.
- Metzger, J.O. and U. Bornscheuer, Lipids as renewable resources: current state of chemical and biotechnological conversion and diversification, *Applied Microbiology and Biotechnology 71*:13–22 (2006).
- Murphy, D.J., Future prospects for biofuels, *Chemistry Today 26*:44–48 (2008).
- van Beilen, J.B., and Y. Poirier, Prospects for biopolymer production in plants, *Advances in Biochemical Engineering and Biotechnology 107*:133–151 (2007).

TABLE 1. *Selected examples of transgenic plants modified to produce potential industrial oils*[a]

FA[b]	Donor species	% FA in donor species	Recipient species	% FA in recipient species
Lauric 12:0	California bay	65	Rapeseed	60[c]
Petroselinic 18:1 6*c*	Coriander	80	*Arabidopsis*	<1[c]
Ricinoleic 18:1-OH	Castor bean	90	*Arabidopsis*	26[d]
Vernolic 18:1 9*c*,12OH	*Crepis palaestina*	60	*Arabidopsis*	15[c]
Crepylinic 18:2 9*c*,12trp	*Crepis alpina*	70	*Arabidopsis*	25[c]
α-Eleostearic 18:3 9*c*,11*t*,13*t*	*Momordica charantia*	65	Soybean	17[c]
Calendic 18:3 8*t*,10*t*,12*c*	*Calendula officinalis*	60	*Arabidopsis*	20[e]

[a]In the vast majority of cases, which are not shown here, only very low levels (<5%) of novel fatty acids were produced.

[b]FA, fatty acid; *c*, *cis* double bond; *t*, *trans* double bond; trp, triple bond.

[c]Jaworski, J., and E.B. Cahoon, Industrial oils from transgenic plants, *Current Opinion in Plant Biology* 6:178–184 (2003).

[d]Burgal, J., J. Shockey, C. Lu, J. Dyer, T. Larson, I. Graham, and J. Browse, Metabolic engineering of hydroxy fatty acid production in plants: RcDGAT2 drives dramatic increases in ricinoleate levels in seed oil, *Plant Biotechnology Journal* 6:819–831 (2008).

[e]Cahoon, E.B., C.R. Dietrich, K. Meyer, H.G. Damude, J.M. Dyer, and A.J. Kinney, Conjugated fatty acids accumulate to high levels in phospholipids of metabolically engineered soybean and *Arabidopsis* seeds, *Phytochemistry* 67:1166–1176 (2006).

species, or very specific FA mixtures, or other lipid-derived feedstocks (such as polyhydroxyalkanoates) at the highest possible yields and purity. This needs to be achieved without compromising other important agronomic characteristics of the crop. It will also be necessary to ensure that such industrial crops can be grown, harvested, and processed on a large scale without affecting adjacent crops that might be destined for animal feed or for the human food chain. A list of some key targets for developers of industrial oil crops is given below.

- *Tailored oil composition*: The chosen FA for a particular end use should make up the vast bulk of the triacylglycerol oil of a crop, ideally at least 80–90%, in order to reduce downstream costs. This goal has been difficult to achieve due to the genetic and biochemical complexities underlying storage lipid composition in plants. Further progress here will depend on more information about the identity of target genes to be selected by breeders.
- *High oil yield*: An industrial oil should be accumulated at the highest possible yields by the crop in question; for example, simply increasing the proportion of oil in seeds of a crop like meadowfoam from its current low levels of 20% to a value of 30% would result in an increased crop oil yield of 50%, without affecting any other production costs. This could significantly increase the market uptake of such minor crops and stimulate further efforts to improve them to supply renewable oleochemicals.
- *Use of co-products*: The commercial viability of any industrial oil can be considerably increased if co-products of the crop are also exploited for profit, rather than being an additional expense for separation and disposal. Examples include the protein "cake" in oilseeds, which can often be processed to make animal feed. In other crops the vegetative parts of the plant, such as fibers, stems, and trunks, can be used.
- *Management and processing of industrial oil crops*: To date there has been relatively little research into the kinds of management and processing systems that will be required for many new industrial oil crops. Most of these crops have been developed separately on a piecemeal and rather empirical basis, with relatively little dissemination of useful methodologies or best practice. Among the novel challenges that might face the grower and user of completely new crops are differing requirements for the sowing, cultivation, harvesting, oil extraction, and downstream processing of such crops. This might entail the purchase or hire of new kinds of equipment on-farm. Cultivation of the new crops might also affect the management of existing crops being grown on the same farm.

FUTURE PROSPECTS

For the foreseeable future, oil crops will continue to serve primarily as sources of edible vegetable oils for a global population that is projected to rise to more than 9 billion people by 2050. The recent diversion of plant oils towards the biodiesel sector is likely to be transient as second generation biofuels are developed. In the much longer term, as fossil-derived hydrocarbons inevitably become depleted and therefore more expensive, plant oils will gradually begin to replace them in more and more applications. However, and unlike the picture a few decades ago, it now appears that this process will take many decades and the speed of the transition from petrochemicals to oleochemicals will depend crucially on factors such as the health of the global economy, progress in R&D into new plant oils, and wider political developments. Examples of the latter include government policies such as carbon taxes or renewables obligations that might encourage use of plant oils and stimulate a more rapid rate of R&D into industrial plant oils.

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News & Noteworthy

ILSI (International Life Science Institute) Europe has released a draft report on 3-MCPD (3-monochloropropane-1,2-diol) esters in food. The report summarizes the ILSI Europe workshop held in February 2009 in Brussels, Belgium, commissioned by the ILSI Europe Process-Related Compounds and Natural Toxins Task Force and Risk Assessment of Chemicals in Food Task Force in association with the European Commission and the European Food Safety Authority. The report is available at www.ilsi.org/Europe/Publications/ILSIEuropeReportMCPDEsters7Se09-1.pdf. A resource page about the issue of chloroesters in foods is available at www.aocs.org/tech/3-mcpd.cfm.

■■■

Presentations from an OECD (Organisation for Economic Cooperation and Development) workshop held in August 2009 on the sustainability of biobased products are now available at https://www.oecd.org/document/40/0,3343,en_2649_34537_43457128_1_1_1_1,00.html. The meeting looked at existing national and international approaches to assessing the health and environmental impacts of proposed new biobased products, including biobased chemicals, biobased plastics, enzymes, biobased materials, and biofuels.

■■■

AMC Technical Briefs, a resource provided by the UK's Royal Society of Chemistry (RSC), covers innovations and contemporary technical issues in analytical science. Designed for use by analytical practitioners and those commissioning and then using analytical data, each brief is a one-page document dealing with a single topic. The briefs are produced by the RSC's Analytical Methods Committee (AMC), which has been active in matters of analytical data quality since the 1930s. More than 40 briefs are available, free of charge, at www.rsc.org/amc.

■■■

Cognis Nutrition & Health (Monheim, Germany) announced in October

CONTINUED ON PAGE 754

SDA soy achieves GRAS status

Monsanto Co.'s biotech high-stearidonic acid (SDA) soy oil has achieved GRAS (Generally Recognized as Safe) status from the US Food and Drug Administration.

Monsanto (St. Louis, Missouri, USA) made the announcement in November in tandem with Solae LLC (St. Louis, USA), which will develop and market the oil. Solae's majority owner is DuPont and its minority owner is Bunge Ltd. Bunge also has a joint venture with Pioneer Seed, which is owned by DuPont, to market new biotech-derived soy oils.

"The production of SDA in soybean MON 87769 involves the introduction of two desaturase genes that encode for the proteins *Primula juliae* Δ6 desaturase and *Neurospora crassa* Δ15 desaturase," Monsanto said in its GRAS submission. "Soybeans lack Δ6 desaturase and the minimal requirement for production of SDA in soybeans would be the introduction of a gene encoding Δ6 desaturase. However, Δ6 desaturase also may convert LA [linoleic acid] to GLA [γ-linolenic acid]. Addition of a Δ15 desaturase with temporal expression similar to the Δ6 desaturase increases the flux of ALA [α-linolenic acid] to SDA. The Δ15 desaturase also lowers LA levels, thus lowering the substrate pool for GLA production. Compositional data on several lots of SDA soybean oil support the opinion that the phenotype is stable over several generations."

The fatty acid composition of the SDA oil is "significantly different" from conventional soybean oil, Monsanto said. SDA soybean oil contains 15 to 30% SDA (18:4n-3), which is not present in conventional soybean oil; 5 to 8% GLA (18:3n-6), which also is not present in conventional soybean oil; and slightly higher levels of ALA (18:3n-3) and palmitic acid (16:0) than in conventional soybean oil. It also contains lower levels of oleic acid (18:1) and linoleic acid (18:2) than those present in conventional soybean oil.

Now that the oil has achieved GRAS status, it can be used in a long list of foods and beverages including baked goods and baking mixes, breakfast cereals and grains, cheeses, dairy product analogs, fats and oils, and snack foods, at levels that provide 375 milligrams of the oil per serving.

2009 that the Ministry of Health of the People's Republic of China has recognized Tonalin as an approved novel food. This means that Cognis' brand of CLA (conjugated linoleic acid) can be used in functional foods and beverages in the Chinese market. Cognis received US Food and Drug Administration GRAS (Generally Recognized as Safe) status for Tonalin CLA in July 2008. The company has also applied for novel food approval in Europe and expects to gain it in 2010.

■■■

Food-labeling laws in Australia and New Zealand will soon be under review by an expert panel recruited by the Australian and New Zealand Food Regulation Ministerial Council. Former Australian health minister Neal Blewett heads the panel. More information is available at www.foodstandards.gov.au/newsroom.

■■■

In other labeling news, the Smart Choices Program, a US food industry-led effort to create front-of-package nutrition labels, voluntarily postponed "active operations" on October 23. This move followed an announcement by Food and Drug Administration Commissioner Margaret Hamburg that the agency intends to develop standardized criteria on which future front-of-package nutrition labeling will be based. ■

Research suggests that about 33% of the SDA ingested by humans is converted to eicosapentaenoic acid (20:5n-3), a long-chain polyunsaturated fatty acid usually sourced from fatty cold-water fish such as menhaden.

The new oil is not expected to be commercially available until 2011 or 2012, Monsanto said.

EFSA: Health claims

The European Food Safety Authority (EFSA) has published its first series of opinions on the list of "general function" health claims compiled by member states and the European Commission. Experts on EFSA's Panel on Dietetic Products, Nutrition, and Allergies (NDA) evaluated the scientific evidence for more than 500 claims. The opinions will help inform future decisions of the European Commission and Member States concerning the authorization of health claims.

General function claims defined under Article 13.1 of the Regulation 1924/2006 on nutrition and health claims made on food include: The role of a nutrient/substance in growth, development, and the functions of the body; psychological and behavioral functions; slimming and weight control or reduction of hunger, increase of satiety, or the reduction of available energy from the diet. These claims do not include those related to children's development or health or disease risk reduction.

The full opinion is available online at www.efsa.europa.eu.

Kao incurs losses on DAG oil halt

Kao Corp. said on October 27, 2009, that it posted a 6-billion-yen (around $66 million) unaudited loss for April–September 2009.

The company, which is Japan's largest personal care and household products company, cited several reasons for the slide. They included reduced sales of cosmetics and chemicals as well as the company's decision in September to temporarily suspend shipments of its 59-item portfolio of products based on its Econa diacylglycerol (DAG) cooking oil. Shipments were halted because of the presence of high levels of a process contaminant known as glycidol esters. Shipments are expected to resume by March 2010.

US BioPreferred label program

A notice of proposed rulemaking regarding the US Department of Agriculture's (USDA) voluntary labeling program has appeared in the *Federal Register* (*74*:38295–38317, 2009). "When final, the regulation will allow biobased product manufacturers to participate in a voluntary labeling program to identify biobased products on retail store shelves," according to USDA.

The BioPreferred program was created by the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) as a preferred procurement program to increase the purchase and use of biobased products within the federal government. The Food, Conservation and Energy Act of 2008 (2008 Farm Bill) expanded the program's scope to promote the sale of biobased products in other sectors.

BioPreferred comprises two programs: a preferred procurement program for federal agencies and a voluntary labeling program for the broad-scale marketing of biobased products. A complete list and detailed description of each BioPreferred designated item, and items for future designation, can be found at www.biopreferred.gov.

A summary of how the USDA BioPreferred label differs from other ecolabels is available at www.betalabservices.com/News/2009/09/usda-biopreferred-program-label/.

Turkish Lipid Group formed

A group of participants from industry, academia, and government have formed the Turkish Lipid Group (YABITED), with Aziz Tekin of the University of Ankara as president. The group aims to further scientific research and the fats and oils industries, and to organize meetings. YABITED has joined Euro Fed Lipid as an institutional member, Tekin said.

Persons and companies interested in joining the Turkish Lipid Group should contact Tekin at atekin@eng.ankara.edu.tr. ■

Acquisitions/ mergers

Kamolkij Group, one of Thailand's oldest commodity export groups, plans to consolidate all of its edible-oil operations to improve efficiency for future growth, the *Bangkok Post* newspaper said in late October 2009. The group's rice-bran oil products under the Chim, Alfa One, and Rizi brands "have performed strongly in both export and domestic markets, with total sales expected to reach 2.5 billion baht (about $75 million) this year, up from about 1 billion baht in 2007," the report noted. According to Kamolkij Group Chief Executive Officer Korbsook Iamsuri, five companies handling upstream to downstream production will be grouped under a single entity, **Kasisingha Co.**, which will be renamed **Kasisuree Co.** when the process is completed in 2010.

■■■

Archer Daniels Midland Co. (ADM; Decatur, Illinois, USA) has acquired five oceangoing dry-bulk commodity vessels. The five carriers—one Handy, one Handymax, a Supermax, and two Panamax vessels—provide cargo-carrying capacity between 36,000 short tons and 67,000 short tons (roughly 33,000 and 61,000 metric tons) and will transport all types of grain, grain products, and bulk commodities to and from ports in Europe, South America, Asia, and other parts of the world. Once in operation, the five dry-bulk carriers will augment ADM's transportation network, which also includes 1,700 barges, 58 tow boats, 29 line boats, 23,500 railcars, and 1,600 trailers, according to the company.

■■■

In other **ADM** news, the company has acquired **ViaChem Group**'s oilseed processing assets in Olomouc, Czech Republic. This facility, in the eastern part of the Czech Republic, consists of an oilseed crushing, refining, and biodiesel plant that produces oil and meal for the food, feed, and energy markets.

■■■

Austrian soy food product maker **Mona** has acquired Germany's **Sojaland** and its production facility in Schwerin, according to FLEXNEWS.com. At the same time, Mona and the German aroma and flavor producer **Wild** concluded a strategic cooperation agreement in the area of research and development of soy products. "Thanks to the acquisition, Mona's production capacity is expected to double to 50 million liters annually," FLEXNEWS said.

Commodities

CACAO/CHOCOLATE

ADM officially opened its new cacao processing plant on October 9, 2009, in Kumasi, Ghana. The facility comprises a bean warehouse, a processing plant, and a finished goods warehouse that sit on a 75,000-square-meter site. The new plant processes cocoa beans into cocoa liquor for use in chocolate. Construction of the Kumasi plant started in January 2008, and the facility began processing beans in July 2009.

CANOLA/RAPESEED OIL

The Canadian government will invest $6.4 million in three projects in efforts to increase the competitiveness of the canola industry. One of the programs is the **Canola Council of Canada**'s Grow Canola 2015, which was allotted $1.7 million to build an efficient, up-to-the-minute communication network for canola growers using web and social media technology. Another $1.69 million will contribute to the Council's international promotion efforts about food use of canola oil under CanolaInfo (www.canolainfo.org).

FISH OIL

Signatories to the 28th meeting of the **Commission for the Conservation of Antarctic Living Resources**, which was held in early November 2009, agreed that krill fishing could only be increased significantly if the harvest moves to areas other than Area 48. Krill fisheries in Area 48 near Antarctica have been under pressure recently because of growing interest in the use of krill oil as a source of omega-3 fatty acids, phospholipids, and the antioxidant astaxanthin. Companies that produce krill oil such as Israel's **Enzymotec** and Canada's **Neptune Technologies & Bioressources Inc.** believe that krill are not threatened, noting that the current annual harvest constitutes less than 1% of the estimated biomass of krill. For more on krill oil, see *inform 18*:588–592, 2007.

■■■

A group of scientists, including a number of AOCS members, petitioned the **European Commission** (EC) to amend the EC's new omega-3 labeling regulation, saying they believe it will confuse consumers. The group vowed to continue the fight in the European Parliament, after the EC backed the regulation in October. The new rule does not discriminate between plant and marine-sourced omega-3 sources.

OLIVE OIL

Cargill and Spain's **Hojiblanca** cooperative have inaugurated a new oil bottling plant at Antequera, near Malaga. The 50:50 joint venture between the companies under the name of **Mercaóleo** represents an investment of €18 million in the plant itself, in addition to the working capital required to operate at full capacity. The oil bottled will be sold and distributed to customers by its parent companies.

PALM OIL

The **Malaysian Palm Oil Board** (MPOB) has released a statement on **3-MCPD (3-monochloropropane-1,2-diol) esters and glycidol fatty acid esters in foods** at www.mpob.gov.my/html/issue/issue40.html. In the statement, MPOB identifies its research strategies as working with others on a collaboratively tested method, elucidation of its formation and mitigation, and collaborative work on toxicological studies. For more information on chloroesters in foods, see *inform 20*:200–202, 2009.

SOYBEAN OIL

Chen Bin, director of **China's Department of Industry** under the National Development and Reform Commission, said in October that China would set up a soybean information release system and improve statistics services "in hopes of guiding the soybean processing industry through a healthy development." The country will also decline applications for new soybean processing projects or project expansions in principle, in order to curb overcapacity and avoid blind competition in the industry, Chen told the Asia Pulse Businesswire.

■■■

A recent study by the US soybean checkoff-funded **Soy Transportation Coalition** found that "42% of rail movements of soybeans are transported at rates that could be classified as excessive," according to the **United Soybean Board** (St. Louis, Missouri, USA). The study, titled "Railroad Movement of Soybeans and Soy Products," also analyzed the volume of soy transported by the railroad industry and the leading US rail destinations for soy.

New ventures

Cognis (Monheim, Germany) has introduced Lamequick SUN 40, a new whipping concentrate with fewer saturated fats, to the European market. The product is based on sunflower oil and is suitable for cake fillings, mousses, Chantilly cream, and other creamy desserts.

R&D

A research team at Taiwan's National Cheng Kung University in Taipei says it has discovered an indigenous alga that is rich in docosahexaenoic acid (DHA), containing 10 times as much of the omega-3 fatty acid as existing DHA supplements such as fish oil. The indigenous DHA-rich algal strain, called BL10, was discovered after the team isolated, cultivated, and identified marine microalgae from 10 marine habitats around Taiwan, according to a report by Taiwan's Central News Agency. ■

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Biofuels News

Briefs

Oxford Catalysts (Oxford, UK) and its US subsidiary Velocys (Plain City, Ohio) won the Best Innovation by an SME (small- and medium-sized enterprise) Award, presented by ICIS Innovation Awards 2009 (www.icis.com/awards). These awards, sponsored by Dow Corning and CRA International, recognize the resourcefulness of the chemical industry in meeting the needs of its customers, consumers, and the environment. Oxford/Velocys have developed small-scale, high-intensity microchannel reactors to convert bulk waste, including animal-derived waste, crop residues, lignocellulose waste from trees, and municipal solid wastes, into liquid biofuels such as diesel and jet fuel. Microchannel reactors minimize heat and mass transport limitations.

■■■

According to *Biofuels Digest* (October 13, 2009), the US Secretary of Energy, Steven Chu, told attendees of a meeting on alternative energy development, "If it were up to me, I would put every cent into electric cars." The *Digest* also said less than $20,000 in American Recovery and Reinvestment Act funds had been released by the Department of Energy (DOE) for biofuels, whereas the DOE had made loan guarantees of $1 billion for all-electric luxury sport cars.

■■■

A study carried out by P.C. Smith and coworkers at the University of Adelaide in Australia proposes that the alkoxylation of the unsaturated fraction of biodiesel could reduce the cloud point of the fuel without compromising ignition quality or oxidation stability, at least at lower concentrations. Specifically, the study considered the butoxylation of butyl biodiesel. The research appeared in *Energy & Fuels 23*:3798–3803 (2009).

■■■

Biodiesel production in India is running at 5% or less of its 200,000-metric-tons-per-year capacity. According to *Business Standard*, a majority of biodie-

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GENERAL

US energy research projects receive funding

The US Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) announced funding for 37 research projects on October 26. This is the first round of projects funded under ARPA-E, which is receiving a total of $400 million under the American Recovery and Reinvestment Act.

In announcing the selections, Department of Energy Secretary Steven Chu said, "ARPA-E is a crucial part of the new effort by the US to spur the next Industrial Revolution in clean energy technologies, creating thousands of new jobs and helping cut carbon pollution."

Selected projects receiving funding are listed in Table 1 (see page 758).

Relation of *M. tuberculosis* and biofuel?

Yeasts and bacteria such as *Escherichia coli* are known for their abilities to produce biofuels, especially bioethanol, but Anthony Sinskey and his research group at the Massachusetts Institute of Technology (Cambridge, USA) have been exploring representatives of a lesser-known bacterial group, *Rhodococcus*, as possible synthesizers of biofuel.

Rhodococcus spp., which are soil-dwelling microorganisms, are related to *Mycobacterium tuberculosis*, the causative agent for tuberculosis. They are known for their non-fastidious appetites for a wide range of sugars and toxic compounds. From these compounds *Rhodococcus* makes triacylglycerols (TAG), which can be processed further into biodiesel.

The strain that Sinskey and colleagues are studying, *R. opacus,* was originally isolated from contaminated soil in which

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sel units are not operational most of the year because of the lack of availability of jatropha seed and other nonedible oil feedstocks. The total area in India on which jatropha has been planted is estimated at around 450,000 hectares; of this, over 70% are new plantations and will mature in the next four years. Biodiesel is not produced from vegetable oils in India for food security reasons. Most producers are using nonedible oilseeds, nonedible oil waste, and animal or fish fat as feedstock.

■■■

The US Department of Energy's National Renewable Energy Laboratory (NREL) announced a new website that contains an online directory of web-based tools, database searches, cost calculators, and interactive maps—all related to alternative fuels and advanced vehicles. Twenty-three tools, maps, and searches are available on the Alternative Fuels and Advanced Vehicles Data Center (AFDC) web site for transportation technologies, the NREL said. Users can find the tools page on the AFDC under Information Resources at www.afdc.energy.gov/afdc/applications.html.

■■■

The Indonesian Ministry of Agriculture has indicated that the protein resulting as a co-product in the growth of algae for biofuel by PetroAlgae (Melbourne, Florida, USA) is suitable for use as a raw material in animal feed in Indonesia. The protein also has been cleared for importation as a raw material to be used as an ingredient for animal feed.

■■■

The OECD (Organisation for Economic Co-operation and Development) and the Food and Agriculture Organization (FAO) predict that biodiesel production within the European Union may reach 4.86 billion gallons per year, or 18.4 million kiloliters, by 2018. They also project that 9.1% of the European market will be biodiesel by that time, that global biodiesel consumption will be 11.5 billion gallons, that feedstock prices will increase 30%, and that biodiesel prices will rise 17%. ■

TABLE 1. ARPA-E funded research projects[a]

Lead organization Location	Grant amount	Project description
Agrivida, Inc. Medford, Massachusetts	$4,565,800	Cell wall-degrading enzymes grown within the plant itself that are activated after harvest
Arizona State University Tempe, Arizona	$5,205,706	Cyanobacteria that produce and secrete fatty acids for biofuel feedstock using sunlight, water, and CO_2 as inputs
Ceres, Inc. Thousand Oaks, California	$4,989,144	Genes that enable energy crops to produce more biomass using less land (and lower-quality land), less water, and less fertilizer than standard energy feedstocks
E.I. du Pont de Nemours & Co. Wilmington, Delaware	$9,000,000	Production of biobutanol, an advanced biofuel, from macroalgae
Iowa State University Ames, Iowa	$4,373,488	Metabolic engineering and synthetic biology approaches to increase lipid production, CO_2 uptake, and thermal tolerance of algae for the production of biofuels directly from sunlight and CO_2
Ohio State University Columbus, Ohio	$5,000,000	Syngas chemical looping (SCL) to convert biomass or coal into electricity while efficiently capturing the CO_2
Pennsylvania State University University Park, Pennsylvania	$1,900,067	Catalyst-coated TiO_2 nanotube membranes to convert sunlight, CO_2, and H_2O into CH_4 and other hydrocarbon fuels
United Technologies Research Center East Hartford, Connecticut	$2,251,183	Synthetic form of carbonic anhydrase for capturing CO_2 from coal plant flue gas streams
Univenture, Inc. Marysville, Ohio	$5,992,697	A new algae harvesting system that could reduce the energy cost to harvest, dewater, and dry algae by using a novel absorbent moving belt harvester
University of Minnesota St. Paul, Minnesota	$2,200,000	Production of liquid hydrocarbon transportation fuels directly from sunlight, water, and CO_2 using an artificial symbiotic colony of photosynthetic cyanobacteria and *Shewanella*, a hydrocarbon-producing bacterium

[a] ARPA-E, US Department of Energy's Advanced Research Projects Agency-Energy

the organisms were breaking down petroleum waste products. These researchers are working to engineer the organism to produce TAG more efficiently, using waste streams of carbon as feedstock. They have already created a strain of *Rhodococcus* that can use two types of sugars, glucose and xylose, at the same time. According to MIT's *Technology Review* (www.technologyreview.com/biomedicine/23526/), the hope is that "once scientists have found a way to break down cellulosic biomass into simpler sugars, the ability [of the organisms(s)] to use more than one will simplify the production process." Strains that can feed on glycerol have also been engineered.

Further down the road, Sinskey and his team hope to engineer the bacteria to aggregate the lipids they produce into lipid bodies, which would be easier to recover than solubilized lipids.

Sinskey is also known for founding Metabolix in the early 1990s, a company that makes biodegradable plastics.

BIODIESEL

Biodiesel without waste

In Amsterdam, the Netherlands, Yellow Diesel B.V. announced in mid-October that the company has succeeded in producing high-quality biodiesel in a continuous fixed-bed micro plant based on heterogeneous catalysis. Starting with various types of feedstock, including low-quality oils, waste oils, and fats, the process yields pure biodiesel—with specifications better than those required by the European norm, EN14214—and cosmetics/food grade glycerol.

All aqueous waste streams, as generated by conventional homogeneous acid/base catalyst technology, are eliminated. With the novel catalyst used in the reaction and the integrated process design, the process saves up to 40% of the capital costs and 30% of the operating costs compared to a conventional plant.

The company is presently scaling up the process to pilot-scale.

The energy needed to produce biodiesel

Research out of the University of Idaho and the US Department of Agriculture shows that for every unit of fossil energy needed to produce biodiesel, the return is 4.5 units of energy. That is, the energy balance of the process is 4.5.

Key factors making biodiesel made from soybean oil an efficient fuel include (i) new seed varieties and management practices that are enhancing yields, (ii) reduced tillage practices that cut the amount of fuel needed to grow soybeans, (iii) soybean varieties that have lower need for pesticides, and (iv) modern processing and biodiesel manufacturing plants that use less energy. The report may be obtained at www.usda.gov/oce/energy; click on Papers and Reports, then on "Energy Life-Cycle Assessment of Soybean Biodiesel" by A. Pradhan *et al.*

ALGAE

New algal growth system

OriginOil, Inc. has added another method to its collection of ways to grow and harvest algae for use in producing biofuels. The Attached Growth System (AGS) uses types of algae that will attach to a surface rotating in and out of the aqueous medium, exposing the algae to sunlight (or artificial light). At harvest time, the algae are scraped off as a sludge, greatly decreasing the energy cost of dewatering during oil extraction. The AGS is reminiscent of rotating biological contactors that have been used since the 1960s in secondary treatment systems for municipal wastewater.

In fact, the company is proposing that their growth system can be used in wastewater treatment plants by configuring the reactor surfaces to encourage the growth of bacteria as well as algae. Better nutrient extraction can be achieved by combining algal and bacterial growth, which is one of the goals of sewage treatment, and at the same time CO_2 is tied up in biomass that can be used as feedstock for fuel.

A demonstration system is now being built at the company's headquarters in Los Angeles, California, USA.

Shocking algae

Organic Fuels, a Houston, Texas (USA)-based biodiesel producer, has entered into a joint venture (JV) with the University of Texas at Austin's Center for Electromechanics to use electricity to break open algal cell walls and release oils contained in the cells. The concept is somewhat similar to that of OriginOil (see *inform 20*: 576, 2009), which is using ultrasound to remove oil from cells.

The JV, called Organic Fuels Algae Technology (OFAT), subjects cell walls to "electromechanical lysis." OFAT claims the process is inexpensive, and estimates that their process would produce oil for about \$1.50 per gallon (\$0.40 per liter). The oil would then be processed further into biodiesel. Their technology could avoid having to harvest algae and dry them, both of which are expensive, before using solvent to extract their oil. And solvent extraction is costly, as well as hard to scale up.

OFAT's technology can work on algae in concentrations as low as the ones found in natural waters, 0.1–0.2% by weight, although the process is more cost effective if the concentration can be increased to 10% or more.

OFAT is seeking to raise about \$4 million to build a commercial prototype. The company plans to sell its technology to algae biofuels makers, instead of growing algae and converting them to fuel.

SunEco Energy predicts 200,000 gal/acre/yr of algae oil

Located in the Imperial Valley of California, SunEco Energy says it can currently produce at least 33,000 gallons of dewatered, de-gummed biocrude algal oil per acre-foot (1.01 million liters/hectare-meter) per year from algae grown in its 1,200 acres of outdoor ponds in Niland, California, USA (www.sunecoenergy.com). Company Chief Technology Officer Jim Hardin says that the company uses a polyclonal system composed of more than 30 algal species to achieve this yield, and that heterotrophy has a part in these high yields.

The company also claims it can achieve this growth in ponds that are 6–8 feet deep (1.8–2.4 m), which would be equivalent to 200,000–260,000 gallons of oil/acre/year (6.1–8.1 million liters/hectare/year). Surface area is the typical basis of comparison of yields in the industry, not volume (acre-foot), since in conventional systems most photosynthesis takes place in the surface few centimeters.

Experts have expressed considerable misgivings regarding these claims because of the depth to which the company claims photosynthesis takes place. The company counters that they are not at liberty to explain these yields in detail because of intellectual property security.

CONTINUED ON NEXT PAGE

Parallels in corn and algae production

In an article by Annie Jia in the October 7 issue of *Environment and Energy Daily* (www.eenews.net/cw), James Levin, a research biologist with Kent Bioenergy (San Diego, California, USA) who studies algae, said, "Similar to what occurred in the Green Revolution, where there were advances made both in traditional farming techniques and the adopting of new technology to farming, biofuels will probably follow a similar path."

That is, 100 years ago, the typical yield of corn per acre in the United States was 30 bushels/acre (1,900 kg/ha). With all the study of corn nutrition, and advances in corn genetics, yields in 2008 averaged more than 150 bushels per acre, or 9,400 kg/ha.

Most of the yield predictions and cost figures for algal oil production published so far (e.g., see story on SunEco Energy, *inform 20*:759–760, 2009) have been developed in the laboratory, where one does not have to deal with or can control wide swings in temperature, out-competition by windborne algal-contaminant species, excessive light, and predation by invasive animals.

The crux of making algal oil production competitive lies in growing algae "in the field." That is, entrepreneurs will have to think like and act like farmers, according to Michael Melnick, venture capitalist, investor in Biolight Harvesting, and president of Inventure Chemicals (www.eenews.net/public/climatewire/2009/10/07/1).

A number of entrepreneurs, though, are betting that sooner or later field experience with algae production will reach a critical point and that algal oil production will take off in the same way that corn production did—and these risk-takers want to be there to see algal oil compete head-to-head with petroleum products.

ETHANOL

Gevo retrofitting for biobutanol

Gevo Inc. (Englewood, Colorado, USA) has formed Gevo Development, LLC to develop a number of biorefineries to produce biobutanol. The plan is to retrofit existing ethanol plants, based on Gevo's proprietary technology, to produce biobutanol. This higher alcohol can be blended directly with gasoline and also can be used to make renewable hydrocarbons, jet and diesel fuel, chemical intermediates, and biobased plastics.

A primary component in Gevo's technology is its genetically modified biocatalyst, that is, a strain of yeast that can produce isobutanol rather than ethanol. In the past, yeast production of isobutanol has not been attractive for two reasons: high levels of isobutanol would kill the organisms producing the alcohol, and the separation of isobutanol from the growth medium is difficult. Gevo solved these issues by genetically modifying the organism to tolerate butanol, and by separating the butanol out as soon as it is produced with its patented Gevo Integrated Fermentation Technology.

The process offers the advantage of a flexible choice of feedstock; it can use all typical ethanol feedstocks as well as cellulosic biomass.

The additional cost of capital equipment to convert to the biobutanol process is projected to be approximately $0.30 per gallon of installed ethanol capacity. Retrofitted facilities will have the flexibility to produce either ethanol or biobutanol.

Gevo plans to acquire and retrofit as many as five ethanol plants to produce biobutanol. ■

Published something lately?

We would like to begin listing recent publications of our student members, including dissertations. Please send complete citations to *inform* Associate Editor Catherine Watkins (cwatkins@aocs.org).

Health & Nutrition

Aflatoxin trigger found

Jennifer Fitzenberger

University of California Irvine (UCI; USA) scientist Sheryl Tsai and colleagues have discovered what triggers aflatoxin to form on nuts and grains, which could lead to methods of limiting its production.

Aflatoxin, which is produced by mold, can cause liver cancer if consumed in large quantities.

Because of lax or nonexistent regulation, 4.5 billion people in developing countries are chronically exposed to vast amounts of aflatoxin—often hundreds of times higher than safe levels. In places such as China, Vietnam, and South Africa, the combination of aflatoxin and hepatitis B virus exposure increases the likelihood of liver cancer occurrence by 60 times, and toxin-related cancer causes up to 10% of all deaths in those nations.

"It's shocking how profoundly these molds can affect public health," says Tsai, UCI molecular biology and biochemistry, chemistry, and pharmaceutical sciences associate professor and lead author of a study that appeared in *Nature* (*461*:1139–1143, 2009).

Aflatoxin can colonize and contaminate nuts and grains before harvest or during storage. The US Food & Drug Administration considers it an unavoidable food contaminant but sets maximum allowable limits.

The toxin wreaks havoc on a cancer-preventing gene in humans called p53. Without p53 protecting the body, aflatoxin can compromise immunity, interfere with metabolism, and cause severe malnutrition and cancer.

Tsai, graduate student Tyler Korman, and undergraduate Oliver Kamari-Bidkorpeh, along with Johns Hopkins University researchers, found that a protein called PT is critical for aflatoxin to form in fungi.

Briefs

Work led by Dennis Hsieh of the China Medical University in Taiwan may cause regulatory agencies to reexamine the tolerable daily intake (TDI) for melamine. Hsieh and colleagues calculated a TDI of 0.0081 mg/kg of body weight per day, as compared with the World Health Organization's TDIs of 0.5 and 0.2 mg/kg of body weight per day. (The second WHO value is a result of increasing the safety factor values in the calculation.) Melamine, an industrial chemical, is an adulterant used to create economic value for food ingredients by seeming to increase protein content (see *inform* *20*:563–565, 2009).

■■■

A soy supplement (SE5-OH) containing *S*-equol—an isoflavandiol metabolized from the soy isoflavone daidzein—improved menopausal symptoms, including significantly reducing hot flash frequency by nearly 59%, according to a study in Japanese women. The study was delivered in an oral presentation at the North American Menopause Society's 20th annual meeting (Sept. 30–Oct. 3, 2009; San Diego, California, USA). A second oral presentation reported peer-reviewed data that documented for the first time the pharmacokinetics, or absorption and distribution in the body, in menopausal women of *S*-equol when taken as a supplement using SE5-OH containing *S*-equol. For more on equol, see *inform* *19*:718–721, 2008).

■■■

Which is better for the prevention of coronary heart disease (CHD): eating as many as 17 small meals each day or feasting on one large meal a day? A recent review article by Surabhi Bhutani and Krista A. Varady of the Department of Kinesiology and Nutrition at the University of Illinois at Chicago (USA) concludes that nibbling may be the better option, although there were only eight randomized, controlled, crossover studies available for review. The study appeared in *Nutrition Reviews* (*67*:591–598, 2009). ■

Previously, scientists did not know what prompted the toxin's growth.

"The protein PT is the key to making the poison," Tsai says. "With this knowledge, perhaps we could kill the PT with drugs, inhibiting the mold's ability to make aflatoxin."

Destroying the mold—rather than just the PT—is the traditional method of decontamination, but it is expensive, costing hundreds of millions of dollars worldwide.

"This finding will lead to an increased understanding of how aflatoxin causes liver cancer in humans," says Frank Meyskens, Daniel G. Aldrich Jr. Endowed Chair and director of UCI's Chao Family Comprehensive Cancer Center. "It should allow for the development of inhibitors and, hopefully, a new chemoprevention approach to this deadly cancer."

Aflatoxin belongs to a class of organic compounds called polyketides. "Because polyketides provide the building blocks for both carcinogens and some of our most significant drugs, the importance of this study cannot be overemphasized," says Christopher Hughes, UCI molecular biology and biochemistry professor and chair.

"This discovery provides insight into the mechanism of carcinogen production as well as an Achilles' heel that can be targeted by new generations of inhibitors. The basic understanding of polyketide synthesis that this work provides will be invaluable in the design of new polyketide-derived drugs."

The National Institutes of Health, the Pew Charitable Trusts, the U.S. Department of Energy, and the Damon Runyon Cancer Research Foundation supported the study.

Jennifer Fitzenberger is a member of the Communications Department staff at the University of California Irvine.

Omega-3s and heart failure

The news release headline was definite: "No Major Role for Fish in the Prevention of Heart Failure, Study Suggests." With interest high among consumers for information about omega-3 fatty acids, the story made the rounds quickly. In fact, by early November 2009, 9,960 websites and blogs had broadcast the "news" about the study, which appeared in the *European Journal of Heart Failure* (*11*:922–928, 2009).

A closer look at the study results, however, suggests the jury is still out on omega-3 fatty acids and congestive heart failure. First, although large, the study was observational, involving men and women over the age of 55 living in a suburb of Rotterdam. The analysis comprised 5,299 subjects (41% men, with a mean age 67.5 years) who were free from heart failure and for whom dietary data were available. During 11.4 years of follow-up, 669 subjects developed heart failure. Their habitual diet had been assessed at baseline (in a self-reported checklist and by expert interview); subjects were specifically asked to indicate the frequency, amount, and kind of fish they had eaten, either as a hot meal, on a sandwich, or between meals.

Results found that the dietary intake of fish was not significantly related to heart failure incidence. This relative risk was measured according to five levels of fish consumption as reflected in intake of two long-chain omega-3 polyunsaturated fatty acids (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]), both of which have been shown to exert some cardiovascular benefit via anti-inflammatory mechanisms, anti-arrhythmic effects, and/or a reduction in serum triglycerides, blood pressure, and resting heart rate.

"Scientists and health authorities are increasingly persuaded that the intake of fish—even in small amounts—will protect against the risk of fatal myocardial infarction," said Marianne Geleinjse (Wageningen University, the Netherlands) in a news release. Geleinjse was the corresponding author on the study, which was led by S. Coosje Dijkstra, also of Wageningen. "However, there is no strong evidence that eating fish will protect against heart failure. One study has suggested that this might be so, but we could not confirm it in our cohort study of older Dutch people."

Harry Rice, who is director of regulatory and scientific affairs for GOED (Global Organization for EPA and DHA Omega 3; Salt Lake City, Utah, USA) questions that conclusion. He points out that the study Geleinjse alludes to (*Journal of the American College of Cardiology 45*:2015–2021, 2005), which was led by Dariush Mozaffarian of the Harvard Medical School, is not mentioned in the actual 2009 study by Dijkstra and colleagues.

"The Mozaffarian study was the first to examine the relationship between fish intake (EPA + DHA) and risk of heart failure. Findings from that study support a role for fish intake (EPA + DHA) in the prevention of heart failure," Rice wrote in an e-mail.

Further, fish intake (EPA + DHA) likely was too low in the 2009 study to demonstrate a benefit for the prevention of heart failure. "In fact, the level of EPA + DHA in four of the five quintiles was below what has previously been reported to have a benefit," he wrote (see Table 1).

For more on this issue, see the online report on a recent Heart Failure Society of America meeting at www.natap.org/2009/newsUpdates/101709_05.htm.

TABLE 1. *Comparison of EPA + DHA intake levels (milligrams/day) by quintile*[a]

	Mozaffarian *et al.*, 2005	Dijkstra *et al.*, 2009
Q1	19	14
Q2	83	42
Q3	261	89
Q4	474	161
Q5	1064	313

[a]Mozafarian *et al.*, *Journal of the American College of Cardiology 45*:2015–2021 (2005); Dijkstra *et al.*, *European Journal of Heart Failure* (*11*:922–928, 2009). Abbreviations: EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid; Q, quintile.

Oleocanthal and Alzheimer's disease

Oleocanthal, a naturally occurring compound found in extra virgin olive oil, alters the structure of neurotoxic proteins believed to contribute to the debilitating effects of Alzheimer's disease according to a recent study. This structural change apparently impedes the proteins' ability to damage brain nerve cells.

"The findings may help identify effective [preventive] measures and lead to improved therapeutics in the fight against

Alzheimer's disease," said study co-leader Paul A.S. Breslin, a sensory psychobiologist at the Monell Center, Philadelphia, Pennsylvania, USA.

Known as ADDLs (amyloid-derived diffusible ligands), these highly toxic proteins bind within the neural synapses of the brains of Alzheimer's patients and are believed to directly disrupt nerve cell function, eventually leading to memory loss, cell death, and global disruption of brain function. (Synapses are specialized junctions that allow one nerve cell to send information to another.)

"Binding of ADDLs to nerve cell synapses is thought to be a crucial first step in the initiation of Alzheimer's disease. Oleocanthal alters ADDL structure in a way that deters their binding to synapses," said William L. Klein, who co-led the research with Breslin. "Translational studies are needed to link these laboratory findings to clinical interventions." Klein is professor of neurobiology and physiology and a member of the Cognitive Neurology and Alzheimer's Disease Center at Northwestern University, Evanston, Illinois, USA.

Klein and his colleagues identified ADDLs in 1998, leading to a major shift in thinking about the causes, progression, and treatment of Alzheimer's disease. Also known as β-amyloid oligomers, ADDLs are structurally different from the amyloid plaques that accumulate in brains of Alzheimer's patients.

Reporting on a series of *in vitro* studies, the team of researchers found that incubation with oleocanthal changed the structure of ADDLs by increasing the proteins' size.

Knowing that oleocanthal changed ADDL size, the researchers next examined whether oleocanthal affected the ability of ADDLs to bind to synapses of cultured hippocampal neurons. The hippocampus, a part of the brain intimately involved in learning and memory, is one of the first areas affected by Alzheimer's disease.

Measuring ADDL binding with and without oleocanthal, they discovered that small amounts of oleocanthal effectively reduced binding of ADDLs to hippocampal synapses. Additional studies revealed that oleocanthal can protect synapses from structural damage caused by ADDLs.

An unexpected finding was that oleocanthal makes ADDLs into stronger targets for antibodies. This action establishes an opportunity for creating more effective immunotherapy treatments, which use antibodies to bind to and attack ADDLs.

Breslin commented on the implications of the findings. "If antibody treatment of Alzheimer's is enhanced by oleocanthal, the collective antitoxic and immunological effects of this compound may lead to a successful treatment for an incurable disease. Only clinical trials will tell for sure."

In earlier work at Monell, Breslin and co-workers used the sensory properties of extra virgin olive oil to identify oleocanthal based on a oral irritation quality similar to ibuprofen. Oleocanthal and ibuprofen also have similar anti-inflammatory properties, and ibuprofen—like extra virgin olive oils presumably rich in oleocanthal—is associated with a decreased risk of Alzheimer's when used regularly.

Future studies to identify more precisely how oleocanthal changes ADDL structure may increase understanding of the pharmacological actions of oleocanthal, ibuprofen, and structurally related plant compounds. Such pharmacological insights could provide discovery pathways related to disease prevention and treatment.

The study appeared in *Toxicology and Applied Pharmacology* (*240*:189–197, 2009). ■

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Biotechnology News

Briefs

A report on pesticide use and genetically engineered (GE) crops claims that GE corn, soybeans, and cotton have increased the use of weed-killing herbicides by 383 million pounds (about 174 million kilograms) in the United States for the 13-year period from 1996 to 2008. The report, entitled "Impacts of Genetically Engineered Crops on Pesticide Use in the United States: The First Thirteen Years," was released November 17 by The Organic Center, the Union for Concerned Scientists, and the Center for Food Safety.

Sharon Bomer Lauritsen, executive vice president, food and agriculture for the Biotechnology Industry Organization (BIO), issued a statement in response: ". . .Biotech crop varieties have dramatically reduced farmers' reliance on pesticide applications. Since 1997, the use of pesticides on global biotech crop acreage has been reduced by 790 million pounds, an 8.8% reduction.

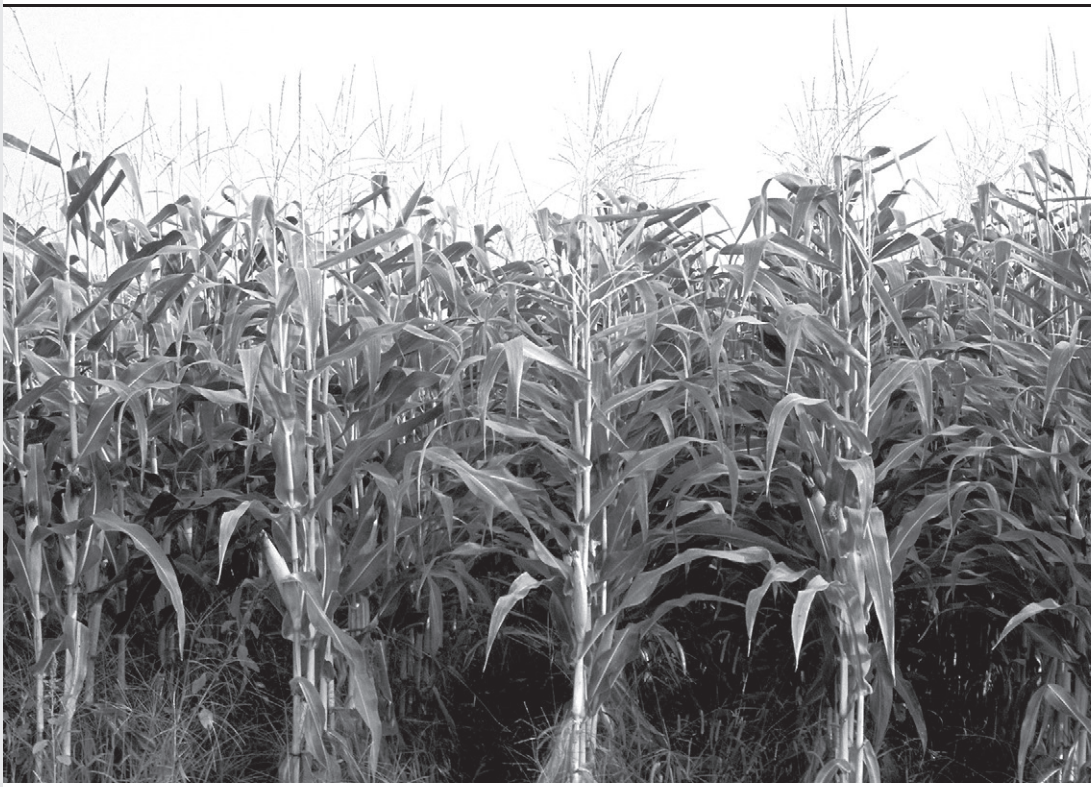
"Decades of documented evidence demonstrate that agricultural biotechnology is a safe and beneficial technology that contributes to both environmental and economic sustainability. Many experts agree that agricultural biotechnology has an important role to play in helping to feed and fuel a growing world. In the future, biotechnology's benefits will only improve."

For more on the report, visit http://truefoodnow.files.wordpress.com/2009/11/13years2009-fullreport-11-16-09.pdf.

■■■

Three oil palm genomes have been sequenced and assembled, according to a consortium that includes the Malaysian Palm Oil Board (MPOB) and Orion Genomics of St. Louis, Missouri, USA. The work aims to find ways to increase yield, protect against disease, and strengthen plants against environmental stress. The three genomes came from two oil palm species: *Elaeis oleifera*, which originates in South America, and *E. guineensis*, which is native to Africa.

CONTINUED ON NEXT PAGE



Report finds environmental noncompliance on GE crops

In November, the Center for Science in the Public Interest (CSPI; Washington, DC, USA) released a report that maintained "[o]ne out of every four farmers who plants genetically engineered (GE) corn is failing to comply with at least one important insect-resistance management requirement." The report argued that this noncompliance would increase the likelihood that pesticide-resistant insects will threaten both biotech crops and some of their nonbiotech neighbors. With the report's release, CSPI called on the Environmental Protection Agency (EPA) to not renew registrations of the GE corn varieties unless compliance rates improve.

The report found that, in 2008, 57% of the US corn acreage was planted with corn spliced with genes from the *Bacillus thuringiensis* bacterium (*Bt*). Those crops produce natural toxins that kill corn rootworms and corn borers, which otherwise reduce crop yields. Farmers who plant such crops are supposed to plant a refuge of conventional corn in, adjacent to, or near the GE crop. That refuge is designed to reduce the risk that pests that survive the toxin will breed with each other and produce resistant offspring. Resistant offspring not only would reduce yields of the *Bt* crops but could also threaten organic or conventional farmers who use natural *Bt*-based pesticides on non-GE crops.

Depending on the location of the crop and the pests targeted by the strain of corn, farmers have varying requirements specifying the size of the refuge and its distance from the GE crop. According to industry surveys submitted to EPA in 2008,

- 78% of growers planting corn-borer-protected crops met the size requirement; 88% met the distance requirement.
- 74% of growers planting rootworm-protected crops met the size requirement; 63%, the distance requirement.
- 72% of farmers growing stacked varieties of GE corn—corn protected against both corn borer and rootworm—met the size requirement and 66% met the distance requirement.

The report found that those compliance

The consortium also included MOgene and The Genome Center at Washington University, both in St. Louis, as well as South Korea's Macrogen and Adelaide, Australia-based GeneWorks. MPOB, Orion, and MOgene also announced plans to study the epigenetic makeup of oil palm in 2010 in an effort to improve yields, according to the Cleantech Group consultancy.

■■■

Monsanto Co. (St. Louis, Missouri, USA) has completed US regulatory submissions in support of the Vistive III soybean trait. The company expects that this second-generation product will be available for farmers to plant by the "middle of the next decade," according to a spokesperson. To increase stability and extend fry life of the Vistive III soy oil, the fatty acid profile of the bean was changed as follows: oleic acid (18:1) increased from 24% to 75%, linoleic acid (18:2) decreased from 52% to 15%, and linolenic acid (18:3) decreased from 8% to less than 3%, the spokesperson said.

■■■

Bayer CropScience (Monheim am Rhein, Germany) announced in October that it had sequenced the entire genome of rapeseed/canola (*Brassica napus*) and its constituent genomes present in *B. rapa* and *B. oleracea*. Rapeseed/canola is the second-largest oilseed crop after soybeans, accounting for approximately 15% of world production. The Bayer CropScience sequencing project was a collaboration with several parties: The Beijing Genomics Institute-Shenzhen (BGI-Shenzhen, China) provided Bayer with a high-density, fully assembled, and annotated sequence of a *B. rapa* and a *B. oleracea* line. Complementary genome sequence data sets of an elite proprietary Bayer CropScience *B. napus* parental line were provided by Keygene N.V. (the Netherlands) and the University of Queensland (Australia). ■

rates are down from 2003 to 2005, when compliance rates often topped 90%. Although compliance assessments made on the farm tend to show higher compliance rates than the surveys, those rates also decreased in the last three years, according to CSPI.

In lieu of the EPA not re-registering the existing varieties of *Bt* corn until companies demonstrate better compliance, the CSPI asked the EPA to levy "severe fines or seed sales restrictions" if noncompliance rates remain high.

To view the report, visit http://cspinet.org/new/pdf/complacencyonthefarm.pdf.

Plant oil enhancement

Technology that could enhance plants' seed oil content for food and animal feed applications has been licensed to BASF Plant Science under an exclusive commercial agreement with Michigan State University (MSU), East Lansing, USA.

Following a long-term collaboration, a plant gene that regulates oil accumulation in plant seed was licensed to BASF Plant Science by MSU Technologies, Michigan State's technology transfer office. The gene is a transcription factor that produces a protein, dubbed Wrinkled1, that was isolated in the laboratory of Christoph Benning, professor of biochemistry and molecular biology. It is being licensed by the plant biotechnology company for further development of enhanced soybean and canola varieties.

"The technology can be used in the development of new oil crops that have this transcription factor turned up to produce more oil in their seeds, and farmers can earn a bonus," MSU Technologies technology manager Thomas Herlache said. "This can improve production of vegetable oil in general, but also the oil used for biofuels."

The transcription factor can be used to turn gene expression up or down, like a tap on a faucet, he said. It was discovered in Benning's lab as a mutation causing wrinkled seeds of the *Arabidopsis* plant.

"Photosynthesis produces sugars," said Benning. "The Wrinkled1 protein controls the conversion of sugars into fatty acids and thereby affects carbon partitioning between carbohydrates and lipids. Enhancing this process is a viable strategy to increase the oil content in seeds."

"The worldwide license applies to development of Wrinked1 in canola and soybean for the life of the patents, approximately 20 years," Herlache said, but not oil-producing plants such as sunflower, safflower, peanut, and palm.

"Beyond the application in seeds as currently licensed by BASF Plant Science, we believe that MSU can use this transcription factor to convert a starch storage organ into an oil storage organ in plants such as rutabaga," Benning said. "Moreover, we are confident that we can use Wrinkled1 to produce oil in straw of different grasses to enhance their energy density."

International congress yields fats and oils research

The 9th International Congress on Plant Molecular Biology was held at the end of October in St. Louis, Missouri (USA). Abstracts from the presentations include:

PROTEOMICS ANALYSIS OF SEED FILLING IN OILSEED CROPS—CURRENT STATUS AND FUTURE GOALS

Author/Presenter: Jay Thelen, University of Missouri

Oilseeds are important renewable sources of protein and oil, which are produced primarily during the maturation or seed-filling phase of embryo development. To characterize this developmental process at the proteome level, my lab employed high-resolution two-dimensional gel electrophoresis (2-DE) coupled with mass spectrometry to quantitatively profile and identify over 500 proteins expressed during seed filling in diverse crop oilseeds including soybean, canola, and castor. As an 'omics approach, proteomics does not require a sequenced genome or the development of analytical tools such as microarrays thus enabling global investigations of nearly any crop. The principal objective of these studies was to quantitatively compare protein expression in developing seed that differs in oil/protein ratio and photosynthetic capacity. I will present some of the findings from these studies and illustrate features of the Oilseed Proteomics web database (www.oilseedproteomics.missouri.edu) that was developed to warehouse these datasets. I will also present results on global, 2-DE-based phosphoproteomic screens and propose alternative approaches to 2-DE for in-depth, quantitative proteomics.

FLUX CARTOGRAPHY IN OIL SEEDS—ANALYSIS OF METABOLIC ROADBLOCKS

Authors: Vidya Iyer, Matt Studham, Ling Li, Eve Wurtele, Mark Westgate, Julie Dickerson, all Iowa State University; **Presenter:** Jacqueline Shanks

The inverse relationship between the protein and oil yields in soybeans presents a conundrum for developing high-protein or high-oil seeds. Our research group uses metabolic flux analysis to provide clues to this riddle. Metabolic flux maps provide a quantitative depiction of carbon flow through competing metabolic pathways, thus providing: analysis of substrate utilization and product formation; flexibility or rigidity of carbon flow at network nodes; the rate of a given enzymatic reaction *in vivo*; and inferred availability of NADPH or ATP. Thus, metabolic fluxes are an important physiological characteristic complementary to levels of transcripts, proteins, and metabolites and can help to identify metabolic roadblocks. Our group has developed a comprehensive generic mathematical tool (NMR2Flux) for ^{13}C metabolic flux analysis in plant systems (Sriram, G., *et al.*, *Plant Physiol. 136*:3043–3057, 2004). ^{13}C metabolic flux analysis, with isotope detection via two-dimensional HSQC (^{1}H, ^{13}C heteronuclear single quantum correlated spectroscopy) NMR (nuclear magnetic resonance) of metabolites (proteinogenic amino acids and starch), quantifies intracellular metabolic fluxes for medium-sized reaction networks, as well as tests the consistency of the network topology operating for the given physiological conditions. We have charted metabolic flux maps for soybean (*Glycine max*) in response to two parameters: temperature and genotype. The dominant effect of early development temperature on several nodes in central carbon metabolism in *Glycine max* Evans was evident from flux map data (Iyer, V.Y., *et al., Plant Cell Environ. 31*:506–517, 2008). More recently, we have examined the metabolic flux maps of three different soybean genotypes with varying protein contents to investigate the changes in the pathway interactions. The BC3-128 genotype, a back-crossed line created from a high-protein line (High PI) and Evans, produced more protein than Evans and less than High PI. The temperature studies and genotype studies have enabled the development of hypotheses of important metabolic nodes in protein/oil partitioning. The integration of the flux and transcript data from the genotype study is under way to better understand the underlying physiology of these isolines and thus identify possible targets for genetic manipulations for influencing higher protein or oil yields.

PRIMARY CARBON METABOLISM AND STORAGE SYNTHESIS IN DEVELOPING OIL SEEDS

Author/Presenter: Jorg Schwender, Brookhaven National Laboratory

In developing seeds the transformation of maternal carbon supplies to storage products is mediated by the primary (central) carbon metabolism reaction network. The biosynthesis of different storage products has different requirements for the intermediates and cofactors provided by central metabolism. Central metabolism is a highly connected network and the use of metabolic flux analysis has revealed in part unexpected functionality, for example the bypass of glycolysis by RubisCO in developing seeds of *Brassica napus*. To understand how carbon allocation into oil, protein, and other storage compounds is regulated, the study of *in vivo* pathway usage in developing embryos of the oil crop *B. napus* by metabolic flux analysis in parallel with the determination of enzyme and metabolite levels is presented. This allows one to determine flexible adjustment of metabolism to different nutritional conditions and identifies rigid behavior of key metabolic branch points, which can be further explored by enzyme kinetic models. Since most extractable enzyme activities are in large surplus relative to the flux capacity required to sustain the observed *in vivo* fluxes, the biochemical architecture and regulation of central metabolism is expected to play an important role in carbon partitioning. Further insights into central metabolism during storage synthesis in oil seeds is presented with the study of metabolic flux for two different mutants with severely impaired oil accumulation.

CONSTRAINT-BASED FLUX VARIABILITY ANALYSIS OF DEVELOPING OILSEED RAPE SEED STORAGE COMPOUND TRADEOFFS

Authors: Jordan Hay; Jorg Schwender; **Presenter:** Jordan Hay

Oil stored in the embryo of oilseed rape (*Brassica napus*) is a promising renewable energy source. However, the efficient conversion of nutrients taken up by the developing embryo into oil is limited by starch and protein synthesis. How carbon and nitrogen are partitioned into these biomass components is not well understood. We have modeled stoichiometric and thermodynamic constraints on the central metabolic network of developing *Brassica* seeds according to the literature. The full model contains 435 reactions, and lumping of reactions into 50 summary reactions reduces the total number to 283. In the reduced model, there are 143 metabolites, 11 compartments, and 9 transport/exchange interfaces. By using linear programming (flux balance analysis), we quantify the feasible range (variability) of each flux of the reduced network as a function of each of three storage compound tradeoffs (starch/protein, TAG/protein, TAG/starch, where TAG = triacylglycerols), various nutritional cases of carbon (heterotrophic and photoheterotrophic) and nitrogen (organic and inorganic), and different objectives (e.g., minimize all uptake or only sugar uptake); and we describe metabolic pathway usage patterns involved with storage metabolism. Relatively large flux variability is characteristic of biomass compositions with a high TAG proportion. Some simulated tradeoffs reveal discontinuities (piecewise linear phases) in the biomass composition-dependence of flux variability and shadow prices, indicating how shifting biomass between biomass components may involve readjustments in the pattern of metabolic network usage. In addition, the model lends support for the coupling of biomass formation to biosynthetically produced pyrophosphate by predicting the activity of various pyrophosphate-metabolizing enzymes.

For more on the congress, visit www.ipmb2009.org. ■

Briefs

Genencor, a division of Danisco, has introduced PuraFast™ HS protease. PuraFast is a performance ingredient for laundry detergent aimed at improving cleaning performance in shorter-cycle and lower-temperature washes.

■■■

At the end of September 2009, Administrator Lisa Jackson of the US Environmental Protection Agency (EPA) announced core principles that outline the Obama Administration's goals for legislative reform of the country's chemical management law, the 1976 Toxic Substances Control Act. Jackson also announced plans for a major effort to strengthen EPA's current chemical management program and increase the pace of the agency's efforts to address chemicals that pose a risk to the public. The core principles are available online at www.epa.gov/oppt/existingchemicals/pubs/principles.html.

■■■

Many US consumers are likely to purchase eco-friendly products across many industries, including 74% in health and beauty and 59% in apparel, according to a report by Grail Research, a consultancy based in Cambridge, Massachusetts, USA. The report, entitled "The Green Revolution," also finds that price is the main reason some consumers do not buy green products, followed by a lack of choices, and the lack of availability. The complete report is available at http://grailresearch.com/About_Us/FeaturedResearch.aspx?aid=90.

■■■

Unilever has taken viral marketing to a new level, according to *The New York Times*. The Anglo-Dutch consumer products giant is paying about 20 New York City street musicians and college bands a reported $1,000 each to help market Unilever's Axe Instinct deodorant. For that sum, the lucky buskers will put up signs, give out samples, and sing "Look Good in Leather," which is featured in the deodorant's TV campaign. ■

S&D News

Montreux 2010 promises history

For more than 30 years, the AOCS World Conference on Detergents has created a singular opportunity for participants to share knowledge, to network, and to conduct business.

The seventh conference in the series will be held October 4–7, 2010, at the Montreux Music & Convention Center in Montreux, Switzerland. There, history will be made when, for the first time, the chief executive officers of the three top detergent-manufacturing companies—P&G, Henkel, and Unilever—will give their unique perspectives on the industry, along with their strategies for the future.

The speakers, who are all invited, will examine "New Strategies in a Dynamic Global Economy" and include top-level executives offering significant insights from both inside and outside the industry. To join them by becoming a poster presenter, visit www.aocs.org/meetings/montreux/. To stay current on conference details, follow Montreaux2010 at www.twitter.com/Montreux2010.

European home and fabric care market

The chemicals industry was particularly hard hit by the economic recession, as reflected in the closure of numerous manufacturing plants, laying off of personnel, and bankruptcies of some major players. However, the market for specialty ingredients in home and fabric care formulations remains dynamic, fueled by consumers' desire to minimize risks from bacteria and germs and to reduce the time and effort required for household chores. Or so says market research firm Frost & Sullivan in its new report entitled *Strategic Analysis of the Home and Fabric Care Specialty Ingredients Markets in Europe*.

The home and fabric care specialty ingredients market generated €615.8 million in revenues in 2008, according to the report, which estimates revenues will reach €706.2 million in 2015. The segments covered in the report include specialty surfactants, functional polymers, fabric enhancers, active ingredients, and rheology modifiers in home and fabric care, as well as hard-surface cleaners, car interior and upholstery cleaners, fabric care, furniture, shoe and leather polishes, and dishwashing products.

"The advent of the 'green' consumer who prefers natural products that are derived from renewable or recycled sources, have an environmentally friendly profile in terms of toxicity, and are safe to use is the catalytic driving force," notes Frost & Sullivan Industry Analyst Leonidas Dokos. "The growing demand for more efficient and technically novel chemicals to assist in daily home and fabric care tasks has rejuvenated this mature market as producers focus on addressing the evolving demands of consumers."

Specialty ingredients with an improved environmental profile are driving the market and influencing demand. At the same time, there is a push in the form of European Directives, with regulators increasingly insisting on reduced toxicity and enhanced biodegradation of such products.

Increasing consumption in emerging European markets will further assist in the growth of home and fabric care specialty ingredients, whereas in the developed markets of Western Europe, green products and innovation are crucial. Also important to growth is the fact that companies active in the market are focusing on reducing the average product development time as product life cycles shorten.

However, sustaining capital and resource investment in research and development in order to maintain healthy pipelines of innovative products, while at the same time controlling the cost, will be the key challenge for suppliers to this market. Moreover, the current economic crisis is eating into consumer products demand, particularly in Europe and the United States, temporarily highlighting consumer price consciousness.

"In 2008 the chemicals sector was the only one among the top 15 sectors in the world showing an investment decrease in research and development of 1.3%, while the household goods sector experienced a decrease in research and development investment of 6.1%," explains Dokos. "When combined with plant shutdowns, recently introduced legislative frameworks that increase costs (such as REACH), and the ongoing economic uncertainty, it becomes clear that the suppliers to the home and fabric care industry are facing a challenging environment."

Strategic acquisitions, focus on key market segments, promotion of product differentiation, and green innovation are critical in overcoming market challenges and addressing evolving market and consumer needs. However, only market participants with strong cash flows can complete strategic acquisitions.

"Some of the leading chemicals companies have opted for strategic acquisitions continuing the consolidation trend, while others have focused on strategic alliances," says Dokos. "However, the key to growth remains innovation and addressing the needs of the 'green' consumer without compromising the technical performance of products."

Strategic Analysis of the Home and Fabric Care Specialty Ingredients Markets in Europe is part of the *Chemicals & Materials* Growth Partnership Services program, which also includes research in the following markets: U.S. Polymers in Personal Care Market (2008), U.S. Emulsifiers in Personal Care Market (2008), European Markets for Actives Ingredients in Skin Care (2008), and European Vitamins in Personal Care Markets (2008). For more information about the report, e-mail Monika Kwiecinska, Corporate Communications, at monika.kwiecinska@frost.com.

Consumers and sustainability

US market research firms Packaged Facts and The Hartman Group have published a series of reports tracking current consumer attitudes and shopping behaviors in relation to "sustainable" consumer packaged goods. The four reports in the just-completed series on consumers and sustainability are on food and beverage, personal care, household cleaners, and over-the-counter medications and supplements.

Not surprisingly, sustainability means different things to different people. Asked to identify what the term means to them, consumers most frequently respond "the ability to last over time" and "the ability to support oneself." Sustainability is also strongly associated with environmental concerns, whereby consumers are being challenged to develop and express an "eco-consciousness" in their daily habits and purchases. But using "eco-conscious" or "green" as synonymous with sustainability unduly limits the frame of reference, according to the reports; these older terms fail to acknowledge the variety of social, economic, and environmental issues that real-world individuals believe to be important to sustaining themselves, their communities, and society at large.

Within the personal care market, personal health and wellness concerns remain the most important motivation for purchasing sustainable products. On the other hand, household cleaning products with a focus on sustainability have only recently begun to enter the US mainstream. Formerly, the act of cleaning was a form of "germ warfare" and entailed a combative relationship between consumers and their environment. "Recently, however, more consumers talk about the idea of working with nature, not against it, to naturally restore balance to their home environments," the report on household cleaners notes.

In response to the current economic downturn, many consumers have modified their purchasing behaviors in relation to sustainable products. Nonetheless, the report argues that tradeoffs and cutbacks are less likely for product categories that consumers view as essential to their quality of life, with food at the top of that list, and including personal care and household cleaners.

The consumers and sustainability four-report series draws on an online survey of 1,856 US adult consumers conducted in September 2008 by The Hartman Group, as well as qualitative research on sustainability in three markets (Seattle, Washington; Dallas, Texas; and Columbus, Ohio) during August 2008. For more information, visit www.packagedfacts.com.

Unilever: Sara Lee and JohnsonDiversey

Anglo-Dutch consumer products giant Unilever announced in early October that it had made a binding offer to acquire the personal care business of the Sara Lee Corp. for €1.275 billion (almost $1.8 billion) in cash. The transaction is subject to regulatory approval and consultation with European employee works councils.

Unilever will add skin-cleansing and deodorant brands such as Sanex, Radox, and Duschdas to its portfolio of products as it builds on its operations in Western Europe and Asia.

In an interview with *The Wall Street Journal* (*WSJ*), Sara Lee (Downers Grove, Illinois, USA) CEO Brenda Barnes said she expects the deal will probably close "more to the latter part of 2010" and said proceeds will allow the company to continue growing its core food and beverage businesses and to repurchase stock. Barnes also told the *WSJ* that Sara Lee has received "significant interest in the remainder of its household business and is continuing to pursue sale options for the unit, which includes air care, shoe care, insecticides, and non-European cleaning brands."

In other Unilever news, the company announced in late October that it will reduce its equity interest in JohnsonDiversey from 33% to 4%. This transaction follows on from the original 2002 sale of Unilever's institutional and industrial cleaning business to Johnson Wax Professional.

At the same time, JohnsonDiversey announced that Clayton, Dubillier & Rice, Inc. (CD&R) will take a 46% equity interest as part of a broader recapitalization transaction. In addition, JohnsonDiversey will continue to sell and distribute certain Unilever products into the professional commercial cleaning and hygiene market.

The transaction, which is conditional on JohnsonDiversey and CD&R completing debt financing and receiving regulatory approvals, was expected to close before the end of 2009. ■

*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?

twitter™

Meet Bena-Marie Lue

2009 AOCS Honored Student Bena-Marie Lue has pursued her interests in lipids across three countries. She started out in food science and agricultural chemistry at McGill University (Montréal, Canada), where she completed a B.Sc. in 1999. During her undergraduate career she found applied science—exemplified in enzyme applications, lipid technology, and bioactive compounds—interested her much more than pure science.

Lue had her first experience working in Europe at a summer job at the University of Ulster in Ireland while she was still an undergraduate. After completing her B.Sc., she returned to Europe and completed two internships in Denmark before returning to Canada and McGill, where she earned a master's degree under Selim Kermasha on the esterification and transesterification reactions of phenolic compounds with long-chain fatty alcohols or triacylglycerols in organic solvents.

Pursuing her interest in practical problems, Lue returned to Europe, where she worked for almost two years at the University of Copenhagen (Denmark). Ultimately she moved to the University of Aarhus (Denmark) to work toward a Ph.D. under the supervision of Xuebing Xu. Her work has involved the use of "green" solvents (i.e., room-temperature ionic liquids: RTIL) as media for lipase-catalyzed synthesis of bioactive flavonoid esters.

The decision to study flavonoids was made in part because they are present in a number of foods and are known for their antioxidative, anticarcinogenic, and antimicrobial properties. Lue's work was based on the hypothesis that incorporating lipidic moieties onto flavonoid structures might enhance their solubility and miscibility and "enhance the uses of these bioactives as antioxidants in food systems."

As to her choice of RTIL, Lue explained that they are viewed as "environmentally friendly alternative to traditional solvents," in part because of their "thermal stability, low vapor pressure, and adjustable solubilities." To develop an efficient system for the acylation of flavonoids with long-chain fatty acids, she first used a quantum chemical model to calculate such parameters as solubilities and activity coefficients across a range of solvents to select ones that might be used in the reaction. The solvents tentatively identified as promising were then examined to optimize the reactions she carried out. Lue considered parameters such as a_w (water activity), reaction time, temperature, substrate concentration, molar ratio, and enzyme efficiency in the acylation reaction of the flavonoids rutin and esculin with palmitic acid.

Lue found that lipase activity was profoundly affected by the choice of RTIL used in the reaction (the anion in particular) and was attributable to interactions between RTIL and the protein structure of the enzyme.

Lue expected to defend her dissertation in November. With that out of the way, she is looking for a position in applied research and development, either in industry or academia.

Food has both a professional and a personal importance to Lue. She enjoys baking desserts and decorating cakes. She also is a social dancer, and plays squash and badminton. Another avocation is travel—last year she traveled to China and visited Hanzhou, near Shanghai. With her thesis finished, she has a "long-term project: to continue to improve my Danish language skills since I'm now living in Denmark." ■

People News/ Inside AOCS

From abstract to presentation

Catherine Watkins

Whether you have been presenting at AOCS Annual Meetings & Expos (AM&E) for years or are just beginning your career, knowing more about the process of AOCS' technical program development can only help your results.

Previous annual meeting articles have described how division members and interested parties discuss possible session topics at roundtable meetings held at the AM&E. Attending a roundtable meeting is the best way to get involved in program planning. If you cannot attend the one, however, simply contact your division chairperson using the contact information in your AOCS directory.

Once the call for papers is announced, online submission of declarations of intent begins. Although only the presentation title, authors, affiliations, and keywords are required initially, providing a full abstract is to your advantage. Why that is so will become apparent in a moment.

Along with key information about your presentation, you are asked to identify your two primary interest areas. Once your submission is complete, it is immediately available online for review by the session chairs of your No. 1 interest area. They pick and choose among submissions, making your chances of acceptance greater if you have provided an abstract.

If the session chairs of your first interest area do not choose your submission, it is next referred to the chairs of sessions in the second interest area. If it has still not been picked after that review, you may be offered the opportunity to convert your presentation to a poster. There are distinct advantages to poster presentations: They are visible throughout most of the meeting, and there is a dedicated viewing time during which you can talk with interested parties.

Co-chairing sessions is an excellent way for student members to gain visibility and experience. The precise nature of a student co-chair's duties are up to the primary chairperson, but duties often include taking house counts, doing introductions, helping speakers load their presentations, and handling the speaker timer. Students interested in learning more about this opportunity should contact Donna Elbon at donnae@aocs.org.

Jim Kenar, who has led the AOCS Annual Meeting Program Committee since 2002, finds the entire annual meeting program development process to be highly effective. "Every year at the annual meeting, the program committee comes together for a brief but intense session to develop the framework of the next year's technical program. The exchange of ideas, the sometimes heated discussions, and the interactions among the division representatives are always fascinating to observe as the technical sessions come together.

"As a past division representative and now chairperson of the technical program committee for the past few years, it has been exciting for me to have had the opportunity to work closely with division representatives, guide the workings of the program committee, and to watch how the technical program has developed over the years," he concluded.

You, too, can become involved in meeting program development. It is just one of the many opportunities AOCS provides for you to become a leader.

Catherine Watkins is associate editor of inform *and can be reached at cwatkins@aocs.org.*

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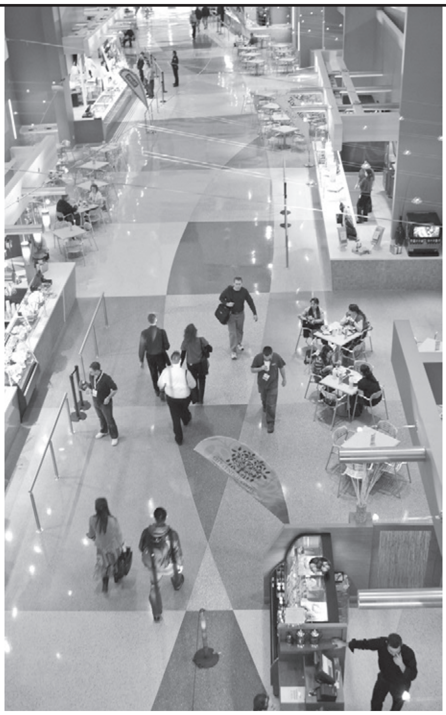


The Phoenix Convention Center is one of the top 20 convention venues in the United States. Photo credit: Jill Richards.

In search of better abstracts

Effective abstracts are more than just summaries of the four major sections of a scientific paper. An abstract that draws peers to the presentation exhibits the following characteristics:

- Each paragraph is well developed in addition to being "unified, coherent, concise, and able to stand alone," suggests an article at http://leo.stcloudstate.edu/bizwrite/abstracts.html.
- It uses an introduction/body/conclusion structure that "presents the article, paper, or report's purpose, results, conclusions, and recommendations in that order," the article continues.
- It provides logical connections between the elements included.
- It adds nothing that is not already in the paper or presentation.
- It is accessible to a broad audience.

In Memoriam

William L. Porter, who spent over 50 years conducting research with what is now known as the US Army Natick Research, Development, and Engineering Center (NRDEC) in Natick, Massachusetts, died on May 26, 2009, at the age of 91.

Born in Philadelphia, Pennsylvania, USA, and reared in Galveston, Texas, USA, Porter received his undergraduate education in a pre-med program at Oberlin College (Ohio, USA). During World War II he served with the US Army Air Corps in England in air traffic control, emerging as a Captain. His growing awareness of unmet environmental needs led him to complete an MS in geography at the University of Chicago in 1951 and then a Ph.D. at Harvard University in 1962 in plant biochemistry.

Porter's research with NRDEC explored the shelf stability of military foods under adverse conditions. To this end, he published in both *Lipids* and *Journal of the American Oil Chemists' Society* (as well as other journals) on the effects of temperature and ventilation on stored foods, packaging effects, oxidation of fatty acids, and pro-oxidants and antioxidants. He continued his research at NRDEC well past his nominal retirement, and a paper that he co-authored (*JAOCS 83*:697-705, 2006) on Maillard browning and antioxidants received the ADM Protein and Co-Products Division Award at the 2007 AOCS Annual Meeting & Expo (AM&E).

In an oft-cited paper that appeared in the *Journal of Agricultural and Food Chemistry* (*37*:615–624, 1989), Porter and coworkers Edward Black and Anne Drolet presented what they called The Polar Paradox: "Nonpolar antioxidants function best in polar lipid emulsions and membranes while polar antioxidants are relatively more effective on nonpolar lipids." That concept was fruitfully explored for years afterward, as Porter recounted in a presentation to the AOCS Lipid Oxidation and Quality Division at the AOCS AM&E in 1999.

Porter was a man of many interests. In addition to his work as a scientist, he was an avid environmentalist and outdoorsman who enjoyed hiking, camping, skiing, kayaking, and tennis. For many years he commuted to work by bicycle. Porter enjoyed music and singing, and had a gift for reciting poetry, frequently surprising others by his recall and choice of just the right poem for a given moment.

He joined AOCS in 1964. He was also active in the Natick chapter of Sigma Xi.

Porter is survived by his wife, Nancy Amstutz, and two sisters, Eleanor Porter and Ruth Martin. ■

Furman becomes president, CEO of Ventura Foods

In October, the Ventura Foods Members Committee announced the retirement of **Richard Mazer** as president and chief executive officer (CEO) of Ventura Foods, LLC (Brea, California, USA). He was succeeded by **Christopher Furman** in these two positions on November 9. Furman joins Ventura Foods from PepsiCo, Inc. (Purchase, New York, USA), where he had 20 years of experience in a series of leadership roles.

Ventura Foods is a joint venture between CHS Inc. (St. Paul, Minnesota, USA), an energy grains and foods company, and Mitsui & Co., Ltd. (Tokyo, Japan). Ventura processes a range of private-label and branded foods, such as LouAna Oils; ClassicGourmet dressings, sauces, and bases; SmartBalance Buttery Spread; Hidden Valley salad dressings; Dean's Dairy Dip; and Marie's salad dressings.

New COO at Dean Foods

Joseph Scalzo was promoted to the position of chief operating officer (COO) for Dean Foods (Dallas, Texas, USA) on November 1. Before his promotion, he was president and CEO of Dean Foods' WhiteWave-Morningstar group. In his new role, Scalzo will oversee all of Dean Foods' operating businesses, including Fresh Dairy Direct, WhiteWave, Morningstar, and Alpro, as well as key strategic functions including worldwide supply chain, research and development, and innovation.

With Scalzo's promotion, **Blaine McPeak**, president of Horizon® and Silk®, was promoted to president, WhiteWave Foods, in Broomfield, Colorado. Blaine will lead Horizon, Silk Soymilk, International Delight®, and Land O'Lakes® cultured and liquid dairy products. This includes overseeing all functions, including marketing, research and development, supply chain, finance, and sales.

Solix Biofuels appoints new leaders

Located in Fort Collins, Colorado, USA, Solix Biofuels announced that three new officers joined the company in September. **Peter Lammers** is now the company's vice president of biotechnology. He had previously been the cultivation track lead for the US Department of Energy's Algal Biofuels Roadmap. He brings to the company considerable expertise in large-scale cultivation and will oversee the company's efforts in algal growth and biochemical optimizations.

Joanna Money is vice president of business development. She has 20 years of experience in the biotechnology industry in corporate and business development and strategy development.

Joel Butler is now chief technology officer for Solix, and **Bryan Willson** continues as the company's chief technology strategist.

National Medal of Science to Venter

On October 7, President **Barack Obama** presented the National Medal of Science to nine researchers for their outstanding contributions to science and engineering. One of the recipients was **J. Craig Venter**, who was recognized for his dedication to the advancement of the science of genomics, his contributions to the understanding of its implications for society, and his commitment to the clear communication of information to the scientific community, the public, and policymakers.

Venter is well known for his publication of the first draft human genome in 2000. More recently, his company, Synthetic Genomics Inc. (SGI; La Jolla, California, USA) has been using genetic and genomic techniques to devise ways to acquire biofuel from algae. SGI and ExxonMobil jointly announced a five-year research and development agreement in July (*inform 20*:577, 2009) for the creation of next-generation biofuels from algae. ExxonMobil may contribute as much as $600 million to the effort.

Book Review

Wine Wise: Your Complete Guide to Understanding, Selecting, and Enjoying Wine
Steven Kolpan, Brian H. Smith, and Michael A. Weiss,
The Culinary Institute of America, 2008
John Wiley & Sons, Inc., 368 pages ,
ISBN: 978-0-471-77064-0, $29.95.

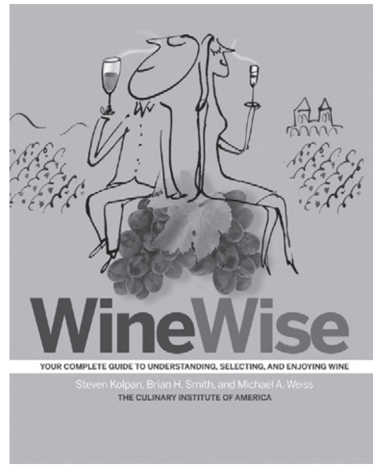
Bradley Beam

The appreciation for wine often starts simply; either you like it or you do not. Sooner or later, though, a wine comes along, changes everything, and you have been hit by the bug. Simple quaffing will no longer satisfy your thirst. You require more information.

As the popularity of wine continues to grow, so does the amount of information available to help new wine consumers enhance their tasting experiences. Introductory books are designed to give the reader just enough information to begin their independent wine tasting experiences and explorations. Intermediate wine education texts are more specialized, focusing on specific wine-related themes, including wine tasting and food pairing, grape and wine production, wine geography, and consumer guides. Wine-themed art books offer beautiful pictures and labels but little useful information to add depth to consumers' appreciation of wine.

There are many valuable books fitting each of these categories, but what appears to be lacking is something a bit more comprehensive, with greater detail on a variety of wine-related subjects. As the title plainly states, *Wine Wise: Your Complete Guide to Understanding, Selecting, and Enjoying Wine* intends to fill this niche. While not as complete as it claims, this book does a great job of bridging the gap between general material for the novice and detailed information for the passionate wine consumer. It provides basic consumer information on a wide variety of topics while offering enough reference material to earn a space in an enthusiast's library. The book's style is simple, direct, and organized, making it a useful reference tool. Additionally, the language is friendly enough for beginners, and the images and illustrations are attractive enough for home display.

The real strength of the book is its ability to tell the story of regions from all over the world and the wines they produce. It accomplishes this task well by providing a matrix of information, including relevant history and culture, terroir (geography, topography, geology, and climate), important grape varieties, deciphering labels, and important subregions whenever applicable. For example, Chapter 9, entitled "Andiamo: Italy," begins by discussing the drastic changes in quality that have occurred in Italian wines over the past few years, followed by a thorough list and description of the common grape varieties grown in the country. It then helps decipher the complexities of an Italian wine label, and subsequently delves into the major subregions of Italy in great detail. Maps and



images of wine labels are well represented throughout this book, adding another dimension to the reader's learning experience. This organizational pattern is repeated throughout the book for both major world regions and under-explored regions such as Canada, Austria, Greece, and New York State.

Another positive attribute of *Wine Wise* is its snobbery-free, consumer-oriented tone, specifically in the sections pertaining to wine and food matching, ordering wine in restaurants, and introductory wine tasting. While the section on wine sensory evaluation could be more comprehensive, it contains enough information for those beginning the journey through the world of wine, and some practical tasting exercises applicable to novice and intermediate wine enthusiasts alike. It even includes an extensive list of recommended bargain wines. Typically, these lists force the authors' tastes upon the reader, but Kolpan, Smith, and Weiss show remarkable, and much appreciated, restraint. No flowery descriptions, scores, or even vintages are present; simply regions, producers, and varietals that have proven reliable based on the authors' experiences.

While this book should satisfy novice and intermediate wine drinkers interested in expanding their knowledge of wine regions, those searching for more information on sensory analysis training techniques or the impact of vineyard management and wine processing on wine sensory characteristics likely will be disappointed. The very short sections on grape and wine production provide enough information and scattered vocabulary to adequately arm the novice for a first wine-tasting party, but not quite enough to add significant depth to the overall appreciation of such a complex beverage.

Bradley Beam is the Illinois state enology specialist at the University of Illinois in Urbana-Champaign (USA). He teaches an introductory course on wine processing and sensory analysis and has been involved in grape and wine research, industry support, and education since 1999.

We are looking for additional book reviewers, including reviewers from outside North America. If you are interested in reviewing one or more books, please send an email to the book review editor (William Artz) at wartz@illinois.edu and indicate your subject area of interest. An email request for the review with information about the text is sent to each reviewer, before any book is mailed out for review. Reviews are generally expected three to four months later. After review submission, the books belong to the reviewer. AOCS provides a general review guideline, available to each reviewer upon request.

Patents

Published Patents

Production of a refinery feedstock from soaps produced during a chemical pulping process

Logan, M., *et al.*, Bluekey Energy Inc., US7540889B2, June 2, 2009

The process for preparing a refinery feedstock from black liquor soap comprising adding excess alcohol (preferably methanol) to black liquor soap. Acid is then added to the mixture to drop the pH of the mixture to approximately 2 to convert carboxylate salt of fatty and resin acids to the free fatty and resin acids. In the reaction process, the free fatty and resin acids react with the alcohol, with the aid of the acid catalyst, to yield the desired ester products. The resulting feedstock can be distilled or refined to yield sterols and related alcohols, biodiesel, and other fuels.

Catalytic cracking process for the production of diesel from vegetable oils

Pinho, A., *et al.*, Petróleo Brasileiro SA, US7540952B2, June 2, 2009

The present invention relates to a thermocatalytic process to produce diesel oil from vegetable oils, in refineries that have two or more fluid catalytic cracking (FCC) reactors. At least one reactor processes heavy petroleum or residue in conventional operation conditions while at least one reactor processes vegetable oils in proper operation conditions to produce diesel oil. This process employs the same catalyst employed in the FCC process, which processes conventional feedstocks simultaneously. This process transforms high heat content raw materials into fuel hydrocarbons. It may improve efficiency for the obtainment of highly pure products and may not yield glycerin, one by-product of the transesterification process. The diesel oil produced by said process may have superior qualities and/or a cetane number higher than 40. Once cracking conditions occur at lower temperatures, it may form a less-oxidized product, which is consequently purer than those obtained by existent technology.

Method and article for applying and monitoring a surfactant

Copland, D., *et al.*, Spencerhall Inc., US7544409B2, June 9, 2009

The present invention is directed to a method and an article for performing the method of monitoring a surfactant. A preferred embodiment of the invention, an article comprises a substrate having an image and a surfactant thereon. The substrate is formed from various known fabrics or materials capable of absorbing and retaining a substantial quantity of the surfactant. During use, as the surfactant is dissipated, the image changes in appearance thereby indicating the quantity of surfactant remaining on the substrate. In a preferred embodiment of the invention, the method and article of the present invention are effective for encouraging and making washing enjoyable for children and include the use of an epidermal surfactant, such as soap, detergent, or other active ingredient.

Catalyst for partial oxidation and preparation method thereof

Kang, J.-H., *et al.*, LG Chemical Ltd., US7544633B2, June 9, 2009

The present invention relates to a catalyst for partial oxidation and a preparation method thereof, more particularly to a preparation method of a complex metal oxide catalyst that shows high activity for conversion of propylene or isobutylene, maintains good selectivity for such unsaturated aldehydes as acrolein or methacrolein, and improves production yield of such unsaturated carboxylic acid as acrylic acid or methacrylic acid through stable process by using a drying control chemical additive.

Rubber composition for tire tread and pneumatic tire comprising the same

Nakazono, T., and S. Sakamoto, Sumitomo Rubber Industries, US7544731B2, June 9, 2009

The present invention provides a rubber composition for a tire tread that can prepare a tire having improved grip properties under conditions of a high temperature, and a pneumatic tire comprising the same. The present invention relates to the rubber composition for a tire tread containing more than 5 parts by weight of a basic antioxidant based on 100 parts by weight of the diene rubber components, wherein a metallic compound is a metallic compound comprising (i) a metallic salt of an organic carboxylic acid or (ii) an inorganic metallic salt and an acid, and the pneumatic tire having a tire tread comprising the same.

Catalyst-free process for the manufacture of a fatty acid ester oil polyol

Kazemizadeh, M., Arkema Inc., US7544763B2, June 9, 2009

The present invention relates to a manufacturing process for producing a polyol from a fatty acid ester *in situ*. The process does not use any added organic or inorganic acid catalyst. The polyol produced by the process is essentially free of any cation or anion. The fatty acid ester oil epoxidation and hydroxylation reactions can occur progressively in the same reactor for essentially a one-pot reaction. The polyol produced by the process is essentially free of any cation or anion. The polyol can be used to produce polyurethanes having improved properties.

Methods and systems for alkyl ester production

Parnas, R., *et al.*, University of Connecticut, US7544830B2, June 9, 2009

Liquid biomass is combined with an alcohol to form a combined liquid stream, introducing the combined liquid stream to a first transesterification reactor between a liquid glycerol outlet and a liquid alkyl ester outlet, reacting the liquid biomass and the alcohol to form liquid glycerol and liquid alkyl ester, and removing a liquid alkyl ester stream from an upper portion of the first transesterification reactor. The combined liquid stream flows upward through the reactor at a rate that is less than a settling velocity of the liquid glycerol.

Solid drawing material

Seki, K., and J. Sin, Buncho Corp., US7547355B2, June 16, 2009

A solid drawing material containing a gel-forming substance of an alkali metal salt or an ammonium salt of an aliphatic carboxylic acid having 8 to 36 carbon atoms, an alkoxylated nitrogen-containing compound, a reduced starch saccharide, and a coloring agent. The solid drawing material, which is in the form of a stick, features a large strength, a small drawing resistance, is less subject to be collapsed or broken, produces little shavings while drawing, makes it possible to favorably form a drawing even on smooth surfaces such as windowpanes, and of which the traces after drawing can be easily wiped out with a wet cloth.

Particulate creamer comprising fat and food compositions comprising said creamer

Flöter, E., *et al.*, Unilever Bestfoods North America, US7547458B2, June 16, 2009

Particulate compositions comprising 10–90 wt% of a matrix material and 10–90 wt% of triglycerides of fatty acids, wherein of said triglycerides the amount of H3 (triglyceride of 3 saturated fatty acids of 16 or more carbon atoms) and H2U (triglyceride of 2 saturated fatty acids of 16 or more carbon atoms and 1 *cis*-unsaturated fatty acid) taken together is at least 55 wt% based on the total amount of triglycerides, wherein the compositions are preferably low in triglycerides of transunsaturated fatty acids, for use as, for example, a creamer and/or whitener. The invention also relates to a process for preparing such particulates and food products containing such creamer.

Method for esterification of free fatty acids in triglycerides

Banavali, R., and G. Pierce, Rohm & Haas, US7550614B2, June 23, 2009

A method for esterification of free fatty acids in triglycerides, with C_1–C_8 aliphatic alcohols. The method uses an acidic ion exchange resin as a catalyst. The catalyst is contacted with a reaction mixture containing a triglyceride having at least 1% free fatty acids and a C_1–C_8 aliphatic alcohol under conditions suitable for esterification.

Electro-optic displays, and materials for use therein

Fazel, S., *et al.*, E Ink Corp., US7551346B2, June 23, 2009

An electro-optic display comprises a layer of solid electro-optic material; a backplane comprising at least one electrode; and an adhesive layer disposed between the layer of electro-optic material and the backplane and adhesively securing the layer of electro-optic material to the backplane, the adhesive layer comprising a thermally activated cross-linking agent comprising an epoxidized vegetable oil fatty acid or an epoxidized ester of such a fatty acid. The cross-linking agent reduces void growth when the display is subjected to temperature changes.

Enzymatic production of peracids using perhydrolytic enzymes

Dicosimo, R., *et al.*, DuPont, US7550420B2, June 23, 2009

A process is provided to produce a concentrated aqueous peracid solution *in situ* using at least one enzyme having perhydrolase activity in the presence of hydrogen peroxide (at a concentration of at least 500 mM) under neutral to acidic reaction conditions from suitable carboxylic acid esters (including glycerides) and/or amides substrates. The concentrated peracid solution produced is sufficient for use in a variety of disinfection and/or bleaching applications.

Starch-vegetable oil graft copolymers and their biofiber composites, and a process for their manufacture

Narayan, R., *et al.*, Michigan State University, US7553919B2, June 30, 2009

A new starch–vegetable oil graft copolymer, wherein the vegetable oil has been reacted onto the starch backbone using thermal or free radical initiators, has been produced in a twin-screw corotating extruder. The starch–vegetable oil graft copolymer can further be reinforced with biofiber in the presence of an optional modifier such as maleic anhydride by reactive extrusion processing to form composites suitable to be injection-molded into biodegradable articles.

Biofuel and process for making biofuels

Morris, M.A., Bio-Alternative, LLC, US7553982B1, June 30, 2009

A method of producing biodiesel from a source of triglycerides. The source of triglycerides is reacted with a blended alcohol composition in the presence of a catalyst to form a mixture of at least one fatty acid alcohol ester and glycerin. The fatty acid alcohol ester is then separated from the glycerin and is purified to produce a biofuel. The blended alcohol composition comprises at least one lower alcohol, a ketone, and ethyl acetate. The use of the blended alcohol composition allows the esterification process to proceed under ambient temperature and pressure conditions within a relatively short reaction time.

Pendant fatty acid imaging agents

Babich, J., Molecular Insight Pharmaceuticals, Inc., US7556794B2, July 7, 2009

The disclosure provides pendant fatty acid compounds for use in diagnostic imaging (particularly the cardiovascular system), as well as kits comprising the same. The disclosure also provides for a method administering an imaging agent with a high specificity for the myocardium.

Flame retardant

Iio, M., *et al*., Yazaki Corp., US7563395B2, July 21, 2009

A flame retardant is provided that has excellent dispersibility in resin ingredients and can give flame-retardant resin moldings excellent flame retardancy and mechanical properties. The flame retardant comprises magnesium hydroxide particles; a higher fatty acid, preferably stearic acid, bonded to part of the surface of the magnesium hydroxide particles; and a silicone oil, having reactivity, bonded to that surface part of the magnesium hydroxide particles that does not have the higher fatty acid bonded thereto.

Green biodiesel

Matson, J., and D. Kannan, Penn State Research Foundation, US7563915B2, July 21, 2009

Methods for improved manufacture of green biodiesel focus on the selection and use of one or more solid metallic oxide base catalyst(s) selected from the group consisting of calcium oxide (CaO), calcium aluminum oxide ($CaO\text{-}Al_2O_3$), calcium titanate ($CaTiO_3$), barium titanate ($BaTiO_3$), magnesium aluminum oxide ($MgO\text{-}Al_2O_3$), zinc oxide (ZnO), copper (II) oxide (CuO), nickel oxide (NiO), manganese oxide (MnO), titanium oxide (TiO), vanadium oxide (VO), cobalt oxide (CoO), iron oxide (FeO), chromite ($FeCr_2O_4$), hydrotalcite [$Mg_6Al_2(CO_3)(OH)_{16}\cdot 4(H_2O)$], magnetite ($Fe_3O_4$), magnesium silicate, and calcium silicate.

Oil filtration process

Oberlin, T., *et al*., Oberlin Filter Co., US7566468B1, July 28, 2009

A process of continuous, on-line active filtration of cooking oil during food processing in a vat to remove free fatty acids and other undesirable impurities includes moving oil from the vat to a treatment tank; adding an amount of adsorbent to the oil in the treatment tank; mixing the oil and the adsorbent in the treatment tank for a time to allow substantially all of the free fatty acid adsorption of the process to occur in the tank; drawing treated oil from the treatment tank and moving it to a flatbed pressure filter; filtering the treated oil through the filter to remove the impurity-laden adsorbent therefrom; returning the filtered oil to the vat; and conducting the foregoing steps at a rate such that a volume of oil substantially equal to the volume of the vat is filtered each hour.

Non-dairy whippable food product

Joseph, J., *et al*., Rich Products Corp., US7563470B2, July 21, 2009

The present invention provides a nondairy whippable food product that comprises an oil-in-water emulsion. This product is pourable at refrigeration as well as room temperature, making it easily whippable. The product comprises at least 30% triglyceride fats, emulsifiers comprising polysorbate 60 and polysorbate 80, stabilizers, and proteins such that the whipped confection has a smooth and nongreasy texture, nonwaxy mouth feel and pleasurable organoleptic characteristics.

Method for the separation of phospholipids from phospholipid-containing materials

Abril, J., *et al*., Martek Biosciences Corp., US7566570B2, July 28, 2009

Methods are disclosed for extracting and separating polar lipids, including phospholipids, from materials containing oil, polar lipid, protein, ash, and/or carbohydrate, such as egg yolks and other phospholipid-containing materials. In particular, methods for extracting phospholipids from phospholipid-containing materials through the use of an aliphatic alcohol and control of temperature are disclosed. Using these methods, phospholipids in the aqueous liquid fraction will be efficiently separated and will precipitate readily, and can be subjected to separation for improved purity.

Bonded foam product manufactured with vegetable oil polyol and method for manufacturing

Gilder, S., L&P Property Management Co., US7566406B2, July 28, 2009

A bonded foam product manufactured with a vegetable oil polyol is herein disclosed. The pre-polymer for use as a binder in the manufacture of a bonded foam product comprises an isocyanate and a vegetable oil polyol, wherein the pre-polymer is substantially free of any petrochemical polyol. In another aspect, the invention is method for making a bonded foam product, the method comprising coating a plurality of foam pieces with a pre-polymer, the pre-polymer comprising an isocyanate and a vegetable oil polyol, wherein the pre-polymer is substantially free of any petrochemical polyol, compressing the foam pieces into a foam log of a desired density, and steaming the foam log to cure the pre-polymer. If desired, a process oil may be added to the pre-polymer to modify the viscosity of the pre-polymer.

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

Analysis of phytosterols in extra-virgin olive oil by nano-liquid chromatography

Rocco, A., and S. Fanali, *J. Chromatogr. A 1216*:7173–7178, 2009.

In this work the applicability of nano-liquid chromatography (nano-LC) was evaluated for the determination of phytosterols in extra virgin olive oil samples. These compounds represent a minor part of lipids in vegetable oils, but their quantification can be useful to establish oil origin and to reveal intentional adulterations. The analysis of five main sterols, specifically brassicasterol, stigmasterol, campesterol, cholesterol, and β-sitosterol, was performed in a laboratory-assembled nano-LC system coupled with a UV (ultraviolet) detector. The separation of all compounds was obtained in about 20 min by using a capillary column packed with a C18-RP (sub 2-µm particles) stationary phase for 15 cm. Methanol only was used as mobile phase. The simple method developed and optimized was validated in terms of repeatability, linearity, limit of detection, and limit of quantification (0.78 and 1.56 µg/mL, respectively) achieving good results. After this, it was applied to the determination of phytosterols in extra virgin olive oil samples. Isolation of phytosterols was obtained by solid-phase extraction, after saponification and liquid–liquid extraction of the unsaponified fraction with diethyl ether. Recovery tests were performed and values between 90 and 103%, with RSD (relative standard deviation) within 5%, were obtained. Moreover, the nano-LC system was coupled with a mass spectrometer for an accurate identification of phytosterols.

Profile and relative concentrations of fatty acids in corn and soybean seeds from transgenic and isogenic crops

Jiménez, J.J., *et al.*, *J. Chromatogr. A 1216*:7288–7295, 2009.

In this work 44 fatty acids, which were analyzed as methyl esters by GC–MS (gas chromatography–mass spectrometry) in scan mode, were determined in genetically modified corn and soybean seeds. Their relative concentrations were compared with those of isogenic lines grown in the same conditions. Studied compounds comprised saturated and unsaturated fatty acids, including *cis*/*trans* isomers and minor fatty acids. A classical Soxhlet extraction and an accelerated solvent extraction were assayed to extract the fatty compounds from seeds, and the GC separation was carried out on a biscyanopropylpolysiloxane chromatographic column. Soxhlet extraction was selected as the most convenient and applied to compare the samples. Specific compounds that could denote the origin of the crop were observed, but for some sample pairs, significant differences were found in relation to the percentage of certain acids; the highest differences for major acids were 4.1% in corn and 4.8% in soybean. The concentrations of long-chain acids such as 24:0, 26:0, and 28:0 were higher in some isogenic lines, whereas the concentrations of short-chain acids such as 6:0, 8:0, 9:0, 10:0, and 12:0 were higher in their transgenic counterparts.

Influence of ripe table olive processing on oil characteristics and composition as determined by chemometrics

López-López, A., *et al.*, *J. Agric. Food Chem.* 57:8973–8981, 2009.

The changes in ripe olive fat produced by processing were studied according to cultivars using the general linear model, principal component analysis (PCA), predictive discriminant analysis (DA), and hierarchical clustering. Acidity, peroxide value, K_{270}, and ΔK increased during storage. Acidity also increased after sterilization, whereas K_{270} decreased after darkening; K_{232} showed a progressive decrease during processing. Fatty acids (except 17:0, 18:0, and 24:0), triacylglycerols (except PLLn, OOLn+PoOL, PLL+PoPoO, SOO, and POS+SLS [where P = palmitic, L = linoleic, Ln = linolenic, O = oleic, Po = palmitoleic, and S = stearic]), polar compounds, diacylglycerol, and monoacylglycerols also suffered statistically significant changes during processing. A PCA discriminated between cultivars and, within the same cultivar, among the raw materials from the rest of the treatments. Using fatty acid and triacylglycerol compositions, predictive DA discriminated between cultivars (100% correct), but high discriminant capacity among processing steps (95% correct assignation and 87% in cross-validation) was achieved only with fatty acids. A hierarchical clustering analysis successfully grouped cultivars and processing steps according to overall olive oil composition and quality.

Effect of minor oil constituents on soy oil conjugated linoleic acid production

Tokle, T., *et al.*, *J. Agric. Food Chem.* 57:8989–8997, 2009.

Conjugated linoleic acid (CLA) is produced by photoisomerization of soy oil linoleic acid. Yields increase with the degree of oil refining, but the effect of specific minor oil components is not known. Therefore, the objectives were to determine the effect of each soy oil minor component on CLA yields and oxidative stability after processing, to determine the effect of soy oil minor constituent interactions on CLA yields and oxidative stability, and to determine how soy oil Magnesol adsorption pretreatment affects CLA yields. Soy oils with varying levels of peroxides, tocopherols, phospholipids, free fatty acids (FFA), and lutein were each irradiated by ultraviolet light; and the CLA content and oxidative stability were determined. A peroxide value of above 0.8 greatly decreased CLA yields, as did a phospholipids content above 500 ppm. Tocopherols enhanced CLA production at low levels and reduced yields at high concentrations, whereas lutein and FFA had little effect. High CLA yields corresponded with a lower oil oxidative stability. The interactions between the minor components showed similar trends as seen in the single-component study. These findings were supported by observations that Magnesol adsorption removed large quantities of phospholipids and peroxides from soy oil and greatly increased CLA yields but reduced the oxidative stability. Minor components, particularly peroxides and phospholipids, need to be removed from the oil to optimize CLA yields.

Oxidation of cholesterol and β-sitosterol and prevention by natural antioxidants

Xu, G., *et al.*, *J. Agric. Food Chem.* 57:9284–9292, 2009.

Consumption of cholesterol oxidation products (COP) is a growing health concern, but little is known about the intake of β-sitosterol oxidation products (SOP). The present study was performed (i) to compare the oxidative stability of cholesterol with that of β-sitosterol; (ii) to investigate the oxidative pattern of cholesterol and β-sitosterol in lard, corn oil, and olive oil; and (iii) to examine the effectiveness of green tea catechins (GTC), α-tocopherol, and quercetin in prevention of cholesterol and β-sitosterol oxidation compared with butylated hydroxytoluene (BHT). Results showed both cholesterol and β-sitosterol were thermally unstable with 75% of cholesterol and β-sitosterol being oxidized at 180°C for 2 h. The oxidation behavior of β-sitosterol was similar to that of cholesterol in terms of oxidative rate and oxidation products. The major COP produced were 7-ketocholesterol, 7α-hydroxycholesterol, 7β-hydroxycholesterol, 5,6α-epoxycholesterol, and 5,6β-epoxycholesterol, whereas the major SOP were 7-ketositosterol, 7α-hydroxysitosterol, 7β-hydroxysitosterol, 5,6α-epoxysitosterol, and 5,6β-epoxysitosterol. Under the same experimental conditions, both cholesterol and β-sitosterol were oxidized more slowly in corn oil, lard, and olive oil, attributable to the unsaponified antioxidants present in these fat and oils. GTC, α-tocopherol, and quercetin were more effective than BHT in preventing the oxidation of cholesterol and β-sitosterol.

Measurement of endogenous lysophosphatidic acid by ESI-MS/MS in plasma samples requires pre-separation of lysophosphatidylcholine

Zhao, Z., and Y. Xu, *J. Chromatogr. B 877*:3739–3742, 2009.

The levels of lysophosphatidic acid (LPA) or lysophosphatidylcholine (LPC) in plasma have been shown to be markers for several human diseases, including cancers. Here we show that the presence of LPC or other lysophospholipids (LPL) in lipids extracted from biological samples affects accurate measurement of endogenous LPA in biological samples. We report for the first time the artificial conversion of LPC and lysophosphatidylserine to LPA at the ion source of electrospray ionization tandem mass spectrometry (ESI-MS/MS). To avoid the interference of LPC with the quantification of LPA, a method based on high-performance liquid chromatographic separation of LPA from LPC has been developed.

Biodiesel preparation in a batch emulsification reactor

Hájek, M., *et al.*, *Eur. J. Lipid Sci. Technol. 111*:979–984, 2009.

The transesterification of vegetable oils (rapeseed oil was used here) by low molecular weight alcohol is the most used method of biodiesel production. Since the reaction proceeds at the alcohol-oil interface, it is necessary to create a large interphase surface area using a special emulsifying attachment. We studied how the conditions (e.g., independent variables: molar ratio alcohol to oil, amount of catalyst used, KOH, time and temperature of reaction, intensity of stirring, revolution of emulsifying attachment) affected the quality and quantity (dependent variables) of the ester phase, i.e., the biodiesel. The amount of used catalyst was calculated with respect to the content of free fatty acid in the oil. The statistical system of Plackett-Burman was used for experiment planning. The relationship between independent and dependent variables was determined and described by multidimensional linear regression. Various statistical tests (principal component analysis, correlation matrix) were also performed.

Ethanolamines used for degumming of rapeseed and sunflower oils as diesel fuels

Zufarov. O., *et al.*, *Eur. J. Lipid Sci. Technol. 111*:985–992, 2009.

Pure vegetable oils can be used as alternative fuel for standard unmodified diesel engines, provided the oil viscosity has been lowered by heating before they enter the fuel injection system. In its role as diesel fuel, a vegetable oil has to have, among other parameters, a low acidity and low contents of phosphorus and the alkali earth metals Ca + Mg. Such parameters can be achieved by appropriate partial refining of oil by degumming. In this article, three common ethanolamines, monoethanolamine (MEA), diethanolamine (DEA), and triethanolamine (TEA), were used as degumming agents for removing nonhydratable phospholipids from crude rapeseed and sunflower oils. Among the studied ethanolamines, MEA is the most effective for the removal of phosphorus. After degumming with MEA (0.5 wt%), the phosphorus content in rapeseed oil was reduced from 445 to 3.5 ppm, and from 163 to 2.2 ppm in sunflower oil. After oil treatment with MEA (1.0 wt%), the residual content of Ca and Mg decreased from 136 to 4.2 ppm and from 55.4 to 1.1 ppm in rapeseed oil. In sunflower oil, the values of Ca and Mg decreased from 23.9 to 1.5 ppm and from 24.6 to 1.0 ppm. The acid value of the oils also decreased after degumming with ethanolamines. The advantage of this oil treatment process is that it takes place at ambient temperature, resulting in lower production costs and simpler technology.

Distribution of monomeric, dimeric, and polymeric products of stigmasterol during thermo-oxidation

Lampi, A.-M., *et al.*, *Eur. J. Lipid Sci. Technol. 111*:1027–1034, 2009.

When plant sterols are oxidized at moderate temperatures (≤100°C), products mainly derive from hydroperoxides, but at temperatures close to 200°C, thermal reactions such as dehydration and condensation become important. Although sterols are often subjected to frying conditions, very little is known of their thermal reactions. In this study, stigmasterol was thermo-oxidized at 180°C, and the formation of dimers and polymers and the amounts of monomers were measured by high-performance size-exclusion chromatography. The products were further characterized by polarity using solid-phase extraction fractionation. During heating, the amounts of monomers decreased at a steady rate, and those of dimers and polymers increased. After 3 hr of heating, 21% of the material existed in higher-molecular-weight products. The amount of polar monomers increased especially during the first hour, demonstrating the formation of oxides and their further reactions, whereas that of midpolar monomers decreased constantly, indicating losses of stigmasterol. Polar dimers contributed to approximately 60% of the dimers, and polar polymers to approximately 78% of the polymers, which suggests that in most higher-molecular-weight products at least one of the sterol moieties was oxidized. This study showed that a significant proportion of thermo-oxidation products are not polar monomeric oxides which are commonly analyzed as oxidation products.

Methods for the analysis of oxylipins in plants

Göbel, C., and I. Feussner, *Phytochemistry 70*:1485–1503, 2009

Plant oxylipins comprise a highly diverse and complex class of molecules that are derived from lipid oxidation. The initial oxidation of unsaturated fatty acids may either occur by enzymatic or chemical reactions. A large variety of oxylipin classes are generated by an array of alternative reactions further converting hydroperoxy fatty acids. The structural diversity of oxylipins is further increased by their occurrence either as free fatty acid derivatives or as esters in complex lipids. Lipid peroxidation is common to all biological systems, appearing in developmentally regulated processes and as a response to environmental changes. The oxylipins formed may perform various biological roles; some of them have signaling functions. To elucidate the roles of oxylipins in a given biological context, comprehensive analytical assays are available for determining the oxylipin profiles of plant tissues. This review summarizes indirect methods to estimate the general peroxidation state of a sample and more sophisticated techniques for the identification, structure determination, and quantification of oxylipins.

Mechanisms of aqueous extraction of soybean oil

Campbell, K.A., and C.E. Glatz, *J. Agric. Food Chem.* 57:10904–10912, 2009.

Aqueous extraction processing (AEP) of soy is a promising green alternative to hexane extraction processing. To improve AEP oil yields, experiments were conducted to probe the mechanisms of oil release. Microscopy of extruded soy before and after extraction with and without protease

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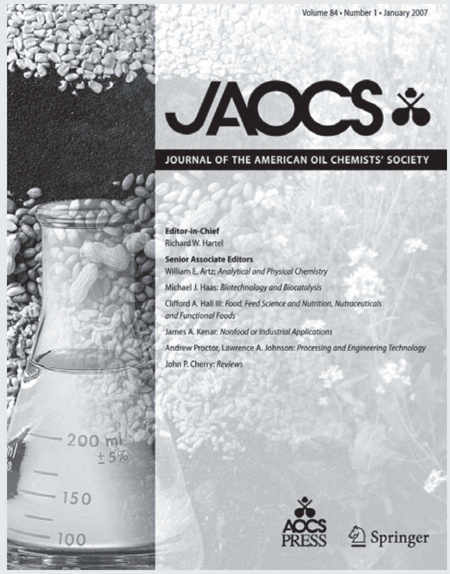
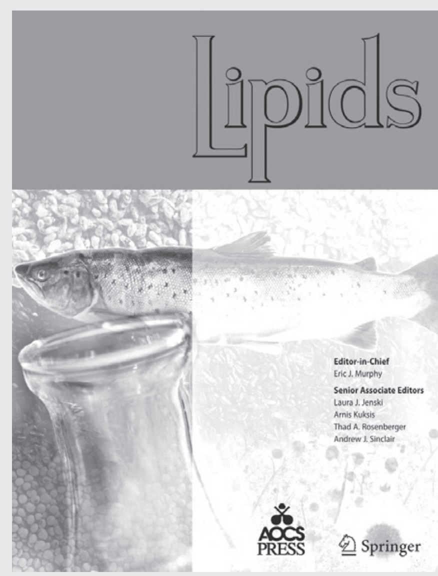


Journal of the American Oil Chemists' Society (November)

- Ratios of regioisomers of triacylglycerols containing dihydroxy fatty acids in castor oil by mass spectrometry, Lin, J.-T.
- Nutrition labeling: Rapid determination of total *trans* fats by using internal reflection infrared spectroscopy and a second derivative procedure, Mossoba, M.M., A. Seiler, J.K.G. Kramer, V. Milosevic, M. Milosevic, H. Azizian, and H. Steinhart
- Further lipid profiling of the oil from the mophane caterpillar, *Imbrasia belina*, Yeboah, S.O., and Y.C. Mitei
- Stability profile of fatty acids in yak (*Bos grunniens*) kidney fat during the initial stages of autoxidation, Zhang, H., Q. Wang, and E. Fan
- Lipid-soluble extracts as the main source of anticancer activity in ginseng and ginseng marc, Lee, S.D., G. Yoo, H.J. Chae, M.-J. In, N.-S. Oh, Y.K. Hwang, W.I. Hwang, and D.C. Kim
- Antioxidant activity of phytochemicals from distillers dried grain oil, Winkler-Moser, J.K., and S.F. Vaughn
- Changes in quality indices, phenolic content, and antioxidant activity of flavored olive oils during storage, Baiano, A., C. Terracone, G. Gambacorta, and E. La Notte
- Increased *in vitro* and *in vivo* digestibility of soy proteins by chemical modification of disulfide bonds, Wang, H., R.J. Faris, T. Wang, M.E. Spurlock, and N. Gabler
- Conversion of methyl oleate to branched-chain hydroxy fatty acid derivatives, Dailey, O.D., N.T. Prevost, and G.D. Strahan
- Clickable lipids: Azido and alkynyl fatty acids and triacylglycerols, Zerkowski, J.A., A. Nuñez, G.D. Strahan, and D.K.Y. Solaiman
- Liquid–liquid extraction of butanol from dilute aqueous solutions using soybean-derived biodiesel, Adhami, L., B. Griggs, P. Himebrook, and K. Taconi
- Response surface analysis and modeling of flaxseed oil yield in supercritical carbon dioxide, Özkal, S.G.
- Influence of vertical centrifugation on extra virgin olive oil quality, Masella, P., A. Parenti, P. Spugnoli, and L. Calamai



Lipids (November)

- Conjugated linoleic acid induces uncoupling protein 1 in white adipose tissue of *ob/ob* mice, Wendel, A.A., A. Purushotham, L.-F. Liu, and M.A. Belury
- Conjugated linoleic acid isomers, *t10c12* and *c9t11*, are differentially incorporated into adipose tissue and skeletal muscle in humans, Goedecke, J.H.,

D.E. Rae, C.M. Smuts, E.V. Lambert, and M. O'Shea

- Hepatic expression of long-chain acyl-CoA synthetase 3 is upregulated in hyperlipidemic hamsters, Wu, M., H. Liu, W. Chen, Y. Fujimoto, and J. Liu
- The effect of linseed on intramuscular fat content and adipogenesis-related genes in skeletal muscle of pigs, Luo, H.-F., H.-K. Wei, F.-R. Huang, Z. Zhou, S.-W. Jiang, and J. Peng
- Cocoa butter and safflower oil elicit different effects on hepatic gene expression and lipid metabolism in rats, Gustavsson, C., P. Parini, J. Ostojic, L. Cheung, J. Hu, F. Zadjali, F. Tahir, K. Brismar, G. Norstedt, and P. Tollet-Egnell
- Differential expression of lipid metabolism-related genes in porcine muscle tissue leading to different intramuscular fat deposition, Zhao, S.M., L.J. Ren, L. Chen, X. Zhang, M.L. Cheng, W.Z. Li, Y.Y. Zhang, and S.Z. Gao
- Long-chain ceramide produced in response to *N*-hexanoylsphingosine does not induce apoptosis in CHP-100 cells, Mancinetti, A., S. Di Bartolomeo, and A. Spinedi
- Analysis of phospholipids in rat brain using liquid chromatography–mass spectrometry, Norris, C., B. Fong, A. MacGibbon, and P. McJarrow
- Quantitative determination of geranyl diphosphate levels in cultured human cells, Holstein, S.A., H. Tong, C.H. Kuder, and R.J. Hohl
- Simple determination of deoxycholic and ursodeoxycholic acids by phenolphthalein-β-cyclodextrin inclusion complex, Cadena, P.G., E.C. Oliveira, A.N. Araújo, M.C.B.S.M. Montenegro, M.C.B. Pimentel, J.L. Lima Filho, and V.L. Silva
- Erratum to: Effect of bilayer phospholipid composition and curvature on ligand transfer by the α-tocopherol transfer protein, Zhang, W.X., G. Frahm, S. Morley, D. Manor, and J. Atkinson

indicated that unextracted oil is sequestered in an insoluble matrix of denatured protein and is released by proteolytic digestion of this matrix. In flour from flake, unextracted oil is contained as intact oil bodies in undisrupted cells, or as coalesced oil droplets too large to pass out of the disrupted cellular matrix. Our results suggest that emulsification is an important extraction mechanism that reduces the size of these droplets and increases yield. Protease and sodium dodecyl sulfate were both successful in increasing extraction yields. We propose that this is because they disrupt a viscoelastic protein film at the droplet interface, facilitating droplet disruption. An extraction model based on oil droplet coalescence and the formation of a viscoelastic film was able to fit kinetic extraction data well.

Measurement of conjugated linoleic acid (CLA) in CLA-rich soy oil by attenuated total reflectance–Fourier transform infrared spectroscopy (ATR–FTIR)

Kadamne, J.V., *et al.*, *J. Agric. Food Chem.* 57:10483–10488, 2009.

Conjugated linoleic acid (CLA) isomers in oils are currently measured as fatty acid methyl esters by a gas chromatography–flame ionization detector (GC–FID) technique, which requires approximately 2 h to complete the analysis. Hence, we aim to develop a method to rapidly determine CLA isomers in CLA-rich soy oil. Soy oil with 0.38–25.11% total CLA was obtained by photo-isomerization of 96 soy oil samples for 24 h. A sample was withdrawn at 30 min intervals with repeated processing using a second batch of oil. Six replicates of GC–FID fatty acid analysis were conducted for each oil sample. The oil samples were scanned using attenuated total reflectance–Fourier transform infrared spectroscopy (ATR–FTIR), and the spectra were collected. Calibration models were developed using partial least-squares (PLS-1) regression using Unscrambler software. Models were validated using a full cross-validation technique and tested using samples that were not included in the calibration sample set. Measured and predicted total CLA, *trans,trans*-CLA isomers, total mono-*trans*-CLA isomers, *trans*-10,*cis*-12 CLA, *trans*-9,*cis*-11 CLA and *cis*-10,*trans*-12 CLA, and *cis*-9,*trans*-11 CLA had cross-validated coefficients of determinations (R^2_v) of 0.97, 0.98, 0.97, 0.98, 0.97, and 0.99 and corresponding root-mean-square error of validation (RMSEV) of 1.14, 0.69, 0.27, 0.07, 0.14, and 0.07% CLA, respectively. The ATR–FTIR technique is a rapid and less expensive method for determining CLA isomers in linoleic acid photo-isomerized soy oil than GC–FID.

Microbial production of conjugated fatty acids

Kishino, S., *et al.*, *Lipid Technol.* *21*:177–181, 2009.

Conjugated fatty acids have attracted much attention as a novel type of biologically beneficial functional lipid. Some isomers of conjugated linoleic acid (CLA) reduce carcinogenesis, atherosclerosis, and body fat. In considering the use of CLA for medicinal and nutraceutical purposes, a safe isomer-selective process of production is required. The introduction of biological reactions for CLA production could be an answer. We screened microbial reactions useful for CLA production and found several unique reactions in microorganisms. Lactic acid bacteria produced CLA from linoleic acid. The CLA, which was obtained as the free fatty acid form, comprised a mixture of *cis*-9,*trans*-11-octadecadienoic acid (18:2) and *trans*-9,*trans*-11-18:2. Furthermore, lactic acid bacteria transformed ricinoleic acid [12-hydroxy-*cis*-9-octadecenoic acid (18:1)] to CLA (a mixture of *cis*-9,*trans*-11-18:2 and *trans*-9,*trans*-11-18:2). Castor oil, rich in the triacylglycerol form of ricinoleic acid, was also found to act as a substrate for CLA production by lactic acid bacteria with the aid of lipase-catalyzed triacylglycerol hydrolysis. Filamentous fungi transformed *trans*-vaccenic acid (*trans*-11-18:1) to *cis*-9,*trans*-11-18:2 by Δ9 desaturation. This CLA was obtained as a triacylglycerol. In addition, lactic acid bacteria produced conjugated trienoic fatty acids from α- and γ-linolenic acid. The trienoic fatty acids produced from α-linolenic acid were *cis*-9,*trans*-11,*cis*-15-octadecatrienoic acid (18:3) and *trans*-9,*trans*-11,*cis*-15-18:3. Those produced from γ-linolenic acid were *cis*-6,*cis*-9,*trans*-11-18:3 and *cis*-6,*trans*-9,*trans*-11-18:3.

The use of alternative lipid resources for bioenergy

Zyaykina, N., *et al., Lipid Technol. 21*:182–185, 2009.

Alternative resources such as animal fats, used cooking oils, and side streams from oil refining can be used for the production of biodiesel. The quality of the biodiesel is largely dependent on the quality and properties of the feedstock. A number of technologies involving pretreatment of the feedstock, posttreatment of the biodiesel, and new production processes have been developed to meet biodiesel standards.

Lipid analysis via HPLC with a charged aerosol detector

Moreau, R.A., *Lipid Technol. 21*:191–194, 2009.

Most lipid extracts are a mixture of saturated and unsaturated molecules. Therefore, the most successful high-performance liquid chromatography (HPLC) detectors for the quantitative analysis of lipids have involved the use of "universal" or "mass" detectors such as flame ionization detectors and evaporative light scattering detectors. Recently a new type of HPLC "universal" detector, a charged aerosol detector (CAD), was developed and is now commercially available. This detection method involves nebulizing the HPLC column effluent, evaporating the solvents, charging the aerosol particles, and measuring the current from the charged aerosol flux. During the approximately four years that the CAD has been commercially available, several publications have described HPLC-CAD methods for lipid analysis. The most common lipids can be quantitatively analyzed via HPLC-CAD except for some volatile lipids such as common fatty acid methyl esters and short-chain free fatty acids ($<C_{16}$). The major results of these publications will be summarized in this report.

Impact of surfactant properties on oxidative stability of β-carotene encapsulated within solid lipid nanoparticles

Helgason, T., *et al., J. Agric. Food Chem. 57*:8033–8040, 2009.

The impact of surfactant type on the physical and chemical stability of solid lipid nanoparticle (SLN) suspensions containing encapsulated β-carotene was investigated. Oil-in-water emulsions were formed by homogenizing 10% wt/wt lipid phase (1 mg/g β-carotene in carrier lipid) and 90% wt/wt aqueous phase (surfactant + cosurfactant) at pH 7 and 75°C and then cooling to 20°C. The impact of surfactant type was investigated using aqueous phases containing different water-soluble surfactants [2.4% wt/wt high-melting (HM) lecithin, 2.4% wt/wt low-melting (LM) lecithin, and 1.4% wt/wt Tween 60 or 1.4% wt/wt Tween 80] and a cosurfactant (0.6% taurodeoxycholate). The impact of the physical state of the carrier lipid was investigated by using either a high melting-point lipid (tripalmitin) to form solid particles or a low melting-point lipid (medium-chain triglycerides; MCT) to form liquid droplets. A higher fraction of α-crystals was detected in solid particles prepared with high-melting surfactants (HM-lecithin and Tween 60) than with low-melting surfactants (LM-lecithin and Tween 80). With the exception of the HM-lecithin-coated solid particles, the suspensions were stable to particle aggregation during 21 days of storage. β-Carotene degradation after 21 days of storage was 11, 97, 100, and 91% in the solid particles (tripalmitin) and 16, 21, 95, and 90% in the liquid droplets (MCT) for HM-lecithin, LM-lecithin, Tween 80, and Tween 60, respectively. These results suggest that β-carotene may be stabilized by (i) LM- or HM-lecithin when liquid carrier lipids are used and (ii) HM-lecithin when solid carrier lipids are used. The origin of this latter effect is attributed to the impact of the surfactant tails on the generation of a crystal structure better suited to maintain the chemical stability of the encapsulated bioactive.

CALENDAR (CONTINUED FROM PAGE 741)

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, Inter-Continental 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 24–28. 2010. Lipid Interactions in Physiology and Disease: American Society for Biochemistry and Molecular Biology Annual Meeting, Anaheim Convention Center, Anaheim, California, USA. Information: www.asbmb.org/Meetings_01/2010mtg/2010mtgint.aspx?id=3158.

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

May

May 3–6, 2010. BIO [Biotechnology Industry Organization] International Convention, McCormick Place, Chicago, Illinois, USA. Information: http://convention.bio.org.

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 1–4, 2010. AchemAsia, 8th International Exhibition, Congress on Chemical Engineering and Biotechnology, Beijing, P.R. China. Information: www.achemasia.de.

June 3–4, 2010. Third European Workshop on Lipid Mediators, Pasteur Institute, Paris, France. Information: http://workshop-lipid.eu.

June 6–11, 2010. Bioactive Lipids: Biochemistry and Diseases, Westin Miyako Kyoto, Kyoto, Japan. Information: www.keystonesymposia.org/Meetings/ViewMeetings.cfm?MeetingID=1024 .

June 15–17, 2009. 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.

June 19–24, 2010. HPLC 2010: 35th International Symposium on High Performance Liquid Phase Separations and Related Techniques, The Hynes Convention Center, Boston, Massachusetts, USA. Information: www.casss.org/displayconvention.cfm?conventionnbr=6136.

June 20–25, 2010. Lipoprotein Metabolism, Gordon Research Conference, Waterville Valley Resort, Waterville Valley, New Hampshire, USA. Information: www.gordonresearchconferences.org/programs.aspx?year=2010&program=lipopro.

June 23–24, 2010. Symposium on Breeding for Disease Resistance, Krasnodar, Russian Federation. Information: www.isa.cetiom.fr/event.htm.

June 27–30, 2010. World Congress on Industrial Biotechnology and Bioprocessing, Washington, DC, USA. Information: www.bio.org/events.

June 27–July 2, 2010. Tribology, Gordon Research Conference, Colby College, Waterville, Maine, USA. Information: www.gordonresearchconferences.org/programs.aspx?year=2010&program=tribology. ■

Campaign for Technology a global success

Catherine Watkins

Donors to the AOCS Foundation's Campaign for Technology, which officially ends on December 31, participated in one of the most successful campaigns ever undertaken by the Foundation.

Why? Because of the impact on the global fats and oils community the campaign has had and will continue to have over the coming years.

"Updating the technology available to members and nonmembers alike will create new opportunities for networking and information sharing, some of which haven't even been dreamed up yet," said Amy Lydic, development manager of the AOCS Foundation. "And it is particularly fitting that we focus on modernizing our information delivery systems as we continue to celebrate the AOCS centennial."

Updating technology also fits into the strategic plan developed by the AOCS Governing Board. In that plan, the first strategy states, "AOCS should be the primary source of fats and oils information on the web."

Over the years, visitors to www.aocs.org have come to expect delivery of a range of information, from daily news stories on the home page to online purchase of new books and CD-ROMs from AOCS Press. In May 2010, however, a completely redesigned website will debut.

"We not only aim to be the primary source of information about fats and oils on the web, we are also making usability our No. 1 priority for the new site," Lydic noted.

To that end, campaign funds have allowed AOCS to contract with a web content management system provider. As part of the redesign project—a massive one, given that the current site houses more than 2,000 pages of content—every page presently posted is being rewritten.

Beyond reader-friendly writing, the content management system will allow for the use of sophisticated information-sharing technology such as RSS feeds, or real-time delivery of new content. Currently, there is no way to share late-breaking news stories on the home page. Come May, visitors will be able to share content with colleagues with one click and even see what news stories are receiving the most attention. Plans are also in progress to present *inform* in a new and dynamic manner, with embedded multimedia files on occasion.

The AOCS Store is also undergoing an overhaul. The redesign will allow for instant delivery of PDF files as well as helpful tips about related resources (both free of charge and for sale). For example, buying a book chapter on biodiesel will bring up links to information about related materials such as the AOCS method for determining biodiesel quality and *inform* Biodiesel Supplements.

Another exciting development involves the Lipid Library (www.lipidlibrary.co.uk/), the in-depth online resource created by AOCS member Bill Christie. Christie has generously donated the site, which provides a wealth of information on lipid chemistry, biology, and analysis, to AOCS. He will continue to serve as editor-in-chief of the site content for several years and will oversee the editorial board, which will function under the umbrella of the AOCS Publications Steering Committee. (Interested in serving on the editorial board? If so, email Christie at billchristie@blueyonder.co.uk.)

A further website upgrade will be the addition of listservs. Although automatic mailing lists that broadcast emails to everyone on the list are not new, the upgraded AOCS website will allow for organized discussions on topics yet to be determined. The addition will create a new way to build community, exchange information, and solve problems.

"None of this would have been possible without our generous donors. We are very grateful," said Lydic.

Catherine Watkins is associate editor of inform *and can be reached at cwatkins@aocs.org.*

*inform*ation

Three ways your Campaign for Technology donation has made the global fats and oils community more competitive:

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- Online membership renewal—www.aocs.org/member/login.cfm
- AOCS Connect—http://aocsconnect.ning.com/

Thank You

Thank you for being part of our 100th anniversary celebration.

Our members play a major role in our growth, success, and longevity. We look forward to serving you and the industry for another 100 years.

Special Thanks to our Centennial Advisory Committee:

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And to George Willhite,
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The AOCS Foundation gratefully acknowledges the following individuals, universities, and companies for their contributions in 2009* to the Campaign for Technology, Annual Fund, the Honored Student Program, and the Silent Auction. Thank you also to the many donors who made a gift while renewing their membership.

Thank You

(As of November 9, 2009)

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Distillers' dried grains with solubles (DDGS)—A key to the fuel ethanol industry

Kurt A. Rosentrater

Modern societies face many challenges, including growing populations and increasing demands for food, clothing, housing, and consumer goods and for the concomitant raw materials and energy required to produce all of these. Additionally, there is an overwhelming reliance on fossil fuels for energy. Transportation fuel accounted for 28% of all energy consumed in the United States during 2008, 95% of which came from petroleum sources. And domestic production of crude oil was 4.96 million barrels per day, whereas imports were 9.76 million barrels per day (nearly two-thirds of the total US demand).

FIG. 1. *A typical dry-grind corn-to-ethanol manufacturing plant.*

Biofuels, which are renewable sources of energy, can help meet some of these increasing needs. Potentially, they can be produced from a variety of biomass materials, including agricultural residues, corn stover, grasses, and legumes. Currently, however, corn grain is the most heavily used feedstock in the United States, because alcohol production from corn is readily accomplished at a lower cost compared to other biomass substrates. The corn-based fuel ethanol industry is well poised to help extend and augment the nation's supply of transportation fuels. And, over the last decade, many innovations have occurred in the industry, not only in production processes used and final products produced but also in terms of optimizing raw materials and energy consumed. Due to many advantages, including lower capital and operating costs (including energy inputs), most new ethanol plants are dry grind facilities (Fig. 1), as opposed to the older style wet mills (see also *inform 18*:658–660, 2007).

Questions regarding the energy balance of ethanol, especially about resource and energy inputs and outputs, economics, impacts of manufacture, and the performance of ethanol in vehicles, have led to many Life Cycle Assessment studies to examine the overall costs and benefits of this biofuel. Examples of the more prominent studies include Kaltschmitt *et al*. (1997), Kim and Dale (2004), Pimentel and Patzek (2005), Shapouri *et al*. (2003), and Sheehan *et al*. (2004). Farrell *et al*. (2006) presented a thorough review and synthesis of this debate. However, new questions have arisen, including water consumption and land use change. Answers are now being developed.

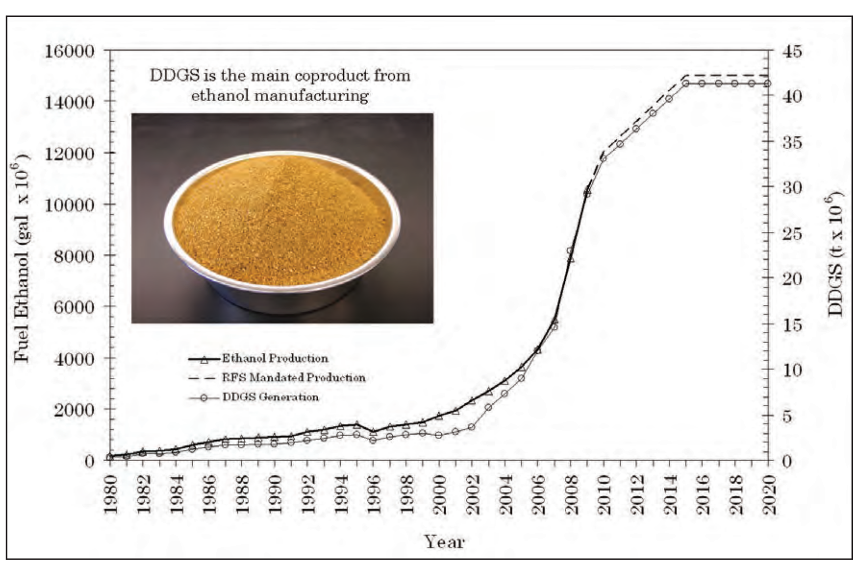

FIG. 2. *Trends in production of fuel ethanol and generation of DDGS (distillers dried grains with solubles). RFS denotes the mandate due to the Renewable Fuel Standard (adapted from Renewable Fuels Association, Washington, DC, 2009; available online at www.ethanolrfa.org)*

To help meet the demand for more motor fuel, the number of US ethanol plants has risen rapidly in the past 15 years, as has the quantity of fuel ethanol produced (Fig. 2). As of July 2009, 197 manufacturing plants in the United States have an aggregate production capacity of over 12.7 billion gallons/year (48.1 billion liters/yr). Moreover, 20 plants are currently under construction or are undergoing expansion, all of which will contribute an additional 1.8 billion gallons/yr (6.8 billion liters/yr). As production volume increases, the processing residues (known as distillers grains) will increase in tandem (Fig. 2).

PROCESS

Briefly, dry grind ethanol manufacturing typically results in three products: ethanol, the primary end product; residual nonfermentable corn kernel components, which are sold as distillers grains; and carbon dioxide. A common rule of thumb is that for each 1 kg of corn processed, approximately 1/3 kg of each of the constituent streams will be produced. Another rule of thumb states that each bushel of corn (~56 lb) will yield nearly 2.9 gallons (~18 lb) of ethanol, 18 lb of distillers grains, and 18 lb of carbon dioxide. The overall production process (Fig. 3) consists of several unit operations. Grinding, cooking, and liquefying release and convert the starch, so that yeast can ferment it into ethanol. After fermentation, the ethanol is separated (via distillation) from the water and nonfermentable residues. Downstream separations, mixing, and drying are then used to remove water from the solid residues and to produce a variety of co-product streams (distillers grains) that are wet or dry, with or without the addition of condensed soluble materials.

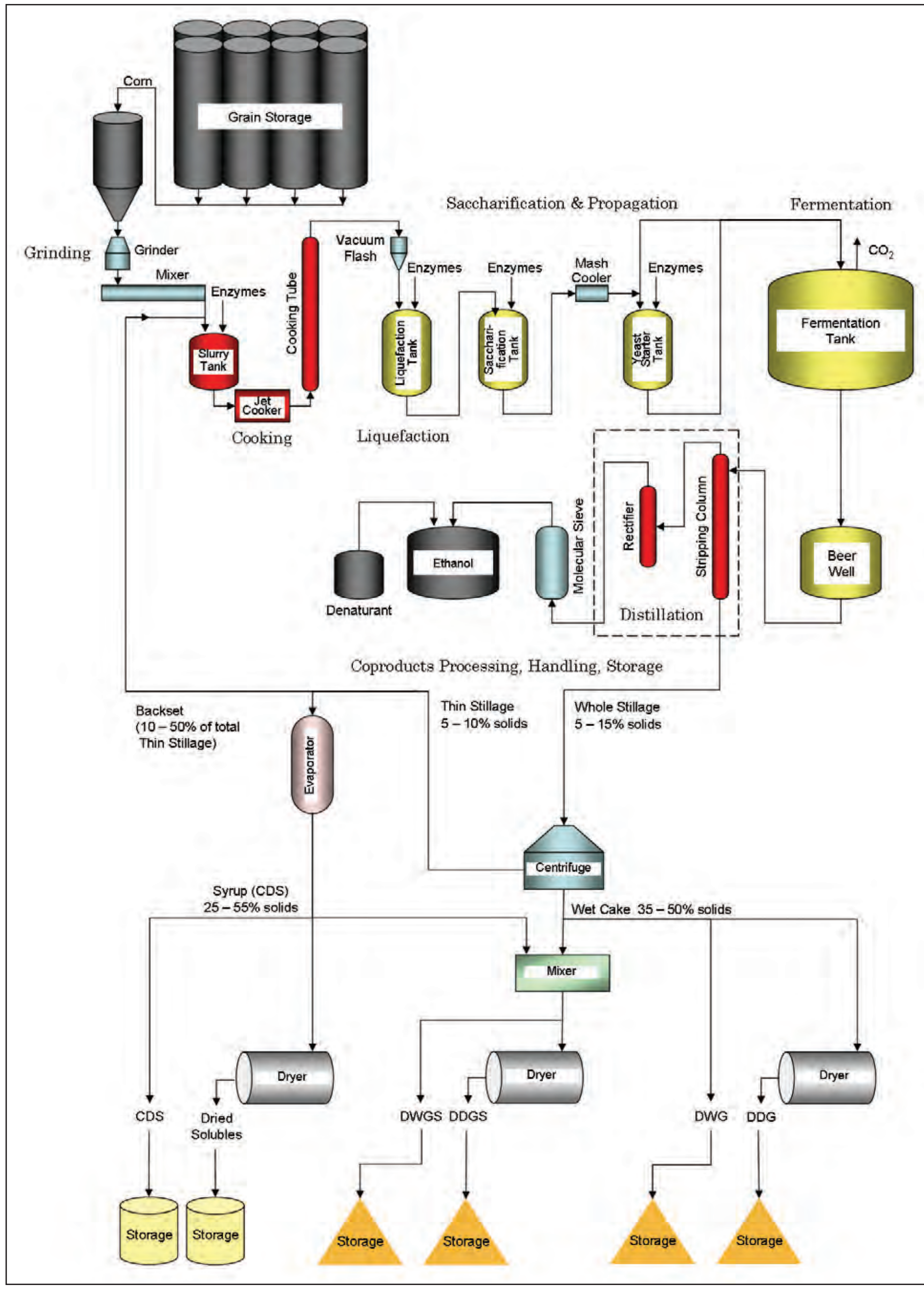

FIG. 3. *Process flow diagram for a typical dry-grind corn-to-ethanol manufacturing plant. CDS, condensed distillers solubles; DWGS, distillers wet grains with solubles; DDGS, distillers dried grains with solubles; DWG, distillers wet grains; DDG, distillers dried grains.*

TABLE 1. *Analysis (% db) of DDGS from South Dakota*[a]

Plant no.	Protein[b,c]	Lipid[b,c]	NDF[b,c]	ADF[b,c]	Starch[b,c]	Ash[b,c]
1	28.33[b] (1.25)	10.76[a] (1.00)	31.84[b] (4.02)	15.56[a] (2.29)	11.82[a] (1.20)	13.27[a] (3.10)
2	30.65[a] (1.20)	9.75[a] (1.05)	39.90[a] (3.95)	15.21[a] (3.95)	9.81[a] (1.52)	12.84[a] (2.56)
3	28.70[a] (1.32)	10.98[a] (0.95)	38.46[a] (4.01)	17.89[a] (4.01)	11.59[a] (1.42)	11.52[a] (3.05)
4	30.65[a] (1.23)	9.4[b] (0.16)	36.73[a] (1.07)	15.28[a] (0.49)	9.05[b] (0.33)	4.13[b] (0.21)
5	31.78[a] (0.63)	9.50[b] (0.41)	38.88[a] (0.86)	17.24[a] (1.12)	10.05[a] (0.65)	4.48[b] (0.22)

[a]Abbreviations: db, dry basis; DDGS, distillers dried grains with solubles; NDF, neutral detergent fiber; ADF, acid detergent fiber.
[b]Mean (standard deviation).
[c]Mean values in the same column with different superscript letters show statistically significant differences (α = 0.05, LSD).

Carbon dioxide, which arises from fermentation, is generated during the yeast's metabolic conversion of sugars into ethanol. This by-product can be captured and sold to compressed gas markets, such as beverage or dry-ice manufacturers. Often, however, location and/or logistics make the sales and marketing of this gas economically unfeasible. Releasing it to the atmosphere may eventually become untenable owing to greenhouse gas emission constraints.

DDGS PROPERTIES AND APPLICATIONS

Only the starch is converted during the fermentation process; the nonfermentable materials consist of corn kernel proteins, fibers, oils, and minerals. These are then used to produce a variety of feed materials, the most common of which is distillers dried grains with solubles (DDGS). DDGS are dried to approximately 10% moisture content, to ensure an extended shelf life, and then sold to local livestock producers or shipped via truck or rail to various destinations throughout the nation, and even globally. Distillers wet grains (DWG) are popular with livestock producers near ethanol plants. But because the moisture contents are generally greater than 50 to 60%, their shelf life is very limited, and shipping economics can be cost prohibitive.

Currently, the ethanol industry's primary outlet for distillers grains, most often in the form of DDGS (and, to a lesser degree, in the form of DWG), has been as livestock feed (the other co-products are sold in much lower quantities). As with many food and organic processing wastes, feeding ethanol co-products to animals is a viable method of utilizing these materials because they contain high nutrient levels. DDGS typically contain about 30% protein, 10% fat, more than 40% neutral detergent fiber, and up to 10% starch. Composition, however, can vary between plants and even within a single plant over time. For example, Table 1 summarizes composition of DDGS samples collected from five ethanol plants in South Dakota during 2008.

More than 80% of DDGS are used in beef and dairy diets, but their inclusion in swine and poultry diets is increasing their consumption as well. Use of DDGS in animal feeds (instead of corn) helps to offset the corn that has been redirected to ethanol production, although this fact is not widely recognized. Over the years, numerous research studies have been conducted on co-product use in livestock diets. Even so, much work remains to be carried out in order to optimize co-product use in animal feeds.

The co-products are essential to the economic sustainability of the fuel ethanol industry. The sale of distillers grains contributes substantially to the economic viability of each ethanol plant (often between 10 and 40% of a plant's total revenue). That is why these process residues are referred to as "co-products," instead of "by-products." Because of the dynamics of the free market economy, the growing quantity of co-products that will be produced as the industry continues to expand may substantially influence the future of the industry. The increased supply of distillers grains may impact potential feed demand and thus sales prices, because ethanol co-products compete against other feed materials in the marketplace.

CONSTRAINTS

Several key issues are currently associated with the value and utilization of distillers grains, both from the ethanol production standpoint and from a livestock feeding perspective. Some of the most pressing include:

- the large quantities of energy required to remove water during drying, coupled with the high cost of energy itself;
- variability in nutrient content, quality, and associated quality management programs at each plant;
- costs associated with transporting DDGS to diverse and distant markets;
- international marketing and export challenges;
- prevention of mycotoxin contamination;
- inconsistent product identity and nomenclature;
- lack of standardized methodologies to measure DDGS quality;
- lack of education and technical support for the industry.

Poor flowability and material handling behavior are still challenges as well. All of these issues ultimately impact the end users—the livestock producers. The industry is currently working to address each of these, and in so doing will increase the value and thus utilization of these co-products.

RECENT PROGRESS

The ethanol industry is continually evolving. The modern dry grind plant is vastly different from a gasohol plant of the 1970s. New developments, to name only a few, include better enzymes, higher starch conversion efficiencies, cold cook technologies, decreased energy consumption throughout the plant, increased water efficiency, and more value streams from both the corn kernel (i.e., upstream fractionation) and the resulting distillers grains (i.e., downstream fractionation). Additionally, much research has focused on modifying existing processes in order to improve the

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For further reading:

- Farrell, A.E., R.J. Plevin, B.T. Turner, A.D. Jones, M. O'Hare, and D.M. Kammen, Ethanol can contribute to energy and environmental goals, *Science 311*:506–508 (2006).
- Kaltschmitt, M., G.A. Reinhardt, and T. Stelzer, Life cycle analysis of biofuels under different environmental aspects, *Biomass and Bioenergy 12*:121–134 (1997).
- Kim, S., and B.E. Dale, Cumulative energy and global warming impacts from the production of biomass for biobased products, *Journal of Industrial Ecology 7*:147–162 (2004).
- Pimentel, D., and T. Patzek, Ethanol production using corn, switchgrass, and wood; biodiesel production using soybean and sunflower, *Natural Resources Research 14*:65–76 (2005).
- Shapouri, H., J.A. Duffield, and M. Wang, The energy balance of corn ethanol revisited, *Transactions of the ASAE 46*:959–968 (2003).
- Sheehan, J., A. Aden, K. Paustian, K. Killian, J. Brenner, M. Walsh, and R. Nelson. Energy and environmental aspects of using corn stover for fuel ethanol, *Journal of Industrial Ecology* 7(3–4):117–146 (2004).

A phospholipids primer

Moghis U. Ahmad

Phospholipids are prime building blocks of all life. The history of phospholipids begins with the isolation from chicken eggs of lecithin, a crude mixture of various phospholipids and other lipids, by the French researcher Maurice Gobley around 1847. The word is derived from "lekithos," Greek for egg yolk.

In the 1920s, technological advances in Germany made the large-scale production of lecithin from soybeans possible. Lecithin found applications as a nutritional supplement (i.e., a preparation intended to provide nutrients that are missing or not consumed in sufficient quantities in a person's diet). The same properties that make phospholipids so important for all life forms make them important for food preparation, and today lecithin is widely used in the food industry as an emulsifier, a wetting agent for food instantizing, a flow agent for chocolate manufacture, a baking stabilizer and pan-release slip agent, a flour improver, and an animal feed additive. Modern industrial processing of soy lecithin enriches its content of selected phospholipids that form the basis for commercially available nutraceutical phospholipid formulations. Currently, three phospholipids are commercially cost effective for nutritional supplements: phosphatidylserine (PS), phosphatidylcholine (PC), and glycerophosphatidylcholine (GPC). All are safe to consume long-term, while offering valuable proven benefits for health, such as enhancing brain health, protecting liver function, and serving as a source of choline.

Egg yolks are the major source of phospholipids used by the pharmaceutical industry for parenteral nutrition, but for nutritional supplements egg phospholipids play no significant role because they have a relatively high cholesterol level and an unfavorable saturated fatty acid profile. At one time, PS produced from bovine brains was a widely used product in Europe. However, the incidence of bovine spongiform encephalitis (BSE, or mad cow disease) made this product unusable and challenged researchers to find ways to isolate PS from an alternative source, such as soybean.

In the last few years, phospholipids made from marine sources have started to enter the nutritional supplement market. The first product of this kind was made from krill, a small crustacean fished from cold Antarctic waters (for more on krill, see *inform 18*:588–592, 2007). New phospholipid products entering the nutritional supplement market are now made from the roe of Pacific and Atlantic Ocean cold-water fish species.

Structurally, phospholipid molecules consist of a hydrophilic polar head group and a hydrophobic nonpolar tail (see Fig. 1). The polar head group contains one or more phosphate groups. The hydrophobic tail is made up of two fatty acyl chains. When many phospholipid molecules are placed in water, their hydrophilic heads tend to "face" into the water and the hydrophobic tails are forced to stick together at the surface, forming a bilayer. Most biologically important phospholipids are phosphoglycerides, which contain glycerol joining the head and tail. Examples of phosphoglycerides include PC, PS, phosphatidylethanolamine, and phosphatidylinositol.

The most abundant phospholipid in cell membranes is PC, and therefore it is the most important building block for making replacement membrane mass. PC has exceptional emulsifying properties, on which the liver draws to produce the digestive bile

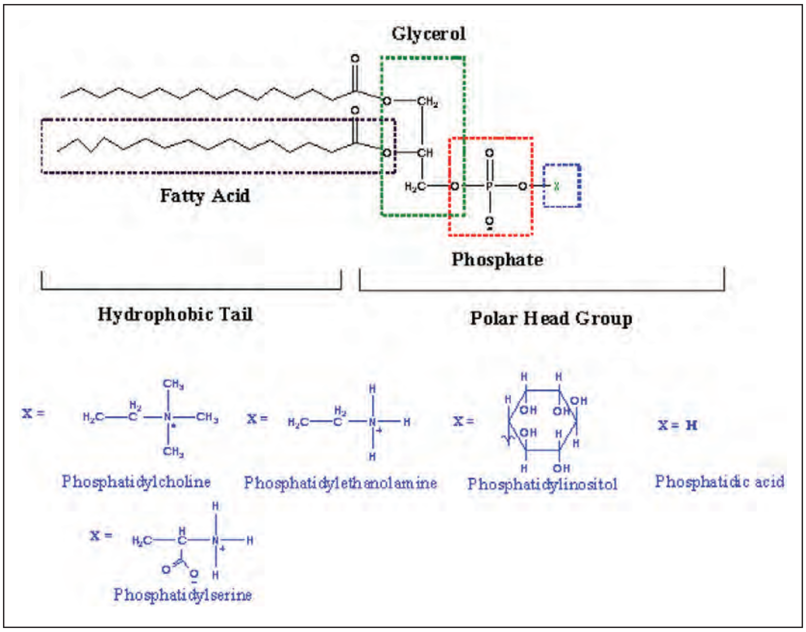

FIG. 1. *Chemical structure of selected phospholipids.*

fluid. The lining cells of the lung and intestines use PC to make the surfactant coatings essential to their gas and fluid exchange functions, and PC is the predominant building block for the circulating lipoproteins.

FUNCTIONS

Phospholipids have many functions in biological systems, including as fuels, as membrane structural elements, as signaling agents, and as surfactants. For example, pulmonary surfactant is a mixture of lipids (primarily dipalmitoyl PC) and proteins that controls the surface tension of the fluid lining of the inner lung (the site of gas exchange), allowing rapid expansion and compression of this lining during the breathing cycle. Phospholipids are the major lipid constituent in cell membranes, thus maintaining structural integrity between the cell and its environment and providing boundaries between compartments within the cell.

Many intracellular structures also are made from phospholipids. These vital phospholipid components are under constant attack from free radicals, pathogens, and toxins. To repair the structural damage caused by these agents, our body requires a constant supply of phospholipids. The body can synthesize some phospholipids, but others must be supplied by the diet. Phospholipids that can only be obtained through dietary intake are called "essential phospholipids." PC is the most important of the essential phospholipids. It can be consumed safely from milligram to gram levels per day without adverse effects.

The human body also uses phospholipids as emulsifiers (in the bile digestive fluid) and as surface-active wetting agents (in the lungs, intestines, and kidneys, for example). Additionally, phospholipids are used to assemble the circulating lipoproteins (low density lipoprotein [LDL] and high density lipoprotein [HDL]) that transport fat-soluble nutrients around the body.

APPLICATIONS OF PHOSPHOLIPIDS

Pharmaceuticals. PC is an amphiphilic and zwitterionic molecule, making it a multifunctional ingredient in pharmaceutical preparations. PC can be used singly or in combination with cholesterol to produce a wide variety of carrier systems that improve the solubility, stability, and delivery of active pharmaceutical ingredients (API). The carrier system may be micelles, mixed micelles, and liposomes. (Broadly defined, liposomes are lipid bilayers surrounding an aqueous phase.) The emulsifying properties of PC currently are being used to produce self-emulsifying drug delivery systems, microemulsions for oral administration, and emulsions for injectable use. Many new drug molecules that are hardly soluble in any pharmaceutically acceptable solvents can be solubilized in the presence of PC, thus improving the absorption of API. Researchers in pre-formulation or generic development make use of PC to modify and improve the dissolution profile of their drug, thereby optimizing absorption and bioavailability. Also, PC is well known for its ability to reduce the side effects of certain drugs administered via the oral, topical, or injectable route.

The application of both synthetic and natural phospholipids in liposomes (see Fig. 2) has been extended to a variety of drugs, such as antineoplastic agents, antimicrobial agents, and immunomodulators. Liposomes are microscopic vesicles consisting of one or more membrane-like phospholipid bilayers surrounding an aqueous medium. The lipid components of liposomes used in pharmaceuticals are predominantly PC, either synthetic or derived from egg or soybean lecithins. Due to their biphasic character, liposomes can act as carriers for both lipophilic and hydrophilic drugs. Depending on their solubility and partitioning characteristics, the drug molecules are located differently in the liposomal environment. Lipophilic drugs are generally entrapped almost completely in the lipid bilayers of liposomes. Hydrophilic drugs may be entrapped inside the aqueous core of liposomes.

Using liposomes as a drug delivery system for antitumor drugs may lessen the toxicity of encapsulated compounds by altering their pharmacokinetics or tissue distribution. The half-life of liposomes *in vivo* can range from a few minutes to hours depending on their size and the lipid composition. A promising example of liposomal delivery system for an antitumor drug has been the use of doxorubicin in liposome-encapsulated form. Doxorubicin, an anthracycline antibiotic, is useful in the treatment of a variety of solid tumors,

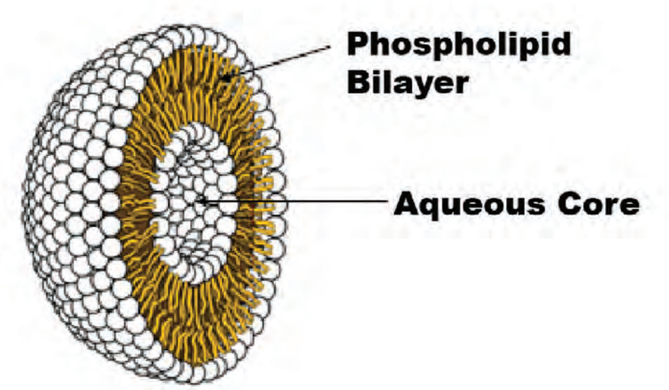

FIG. 2. *Liposome cross section. The interior of liposomes is filled with water (aqueous core) where water-soluble molecules are encapsulated. Most commonly, water-insoluble compounds are entrapped in phospholipid bilayer. Therefore, liposomes can serve as carriers for both water-soluble and water-insoluble compounds. In fact, a single liposome can carry both types of molecules.*

*inform*ation

- Gobley, M., Examen comparatif du jaune d'œufe et de la matiere cerebrale, *J. Pharm. Chim. 11*:409 (1847).
- Guo, Z., A.F. Vikbjerg, and X. Xu, Enzymatic modification of phospholipids for functional applications and human nutrition, *Biotechnol. Adv. 23*:203–259 (2005).
- Kidd, P.M., Dietary phospholipids as anti-aging nutraceuticals, in *Anti-Aging Medical Therapeutics*, edited by R.A. Klatz and R. Goldman, Quest Publications, Chicago, Illinois, USA, 2000, pp. 282–300.
- Newsletter, Phospholipid Research Center/Egg Lecithin for Pharmaceutical Applications, Phospholipid Research Center, Heidelberg, Germany, Vol. 3, May 2008.
- Schneider, M., Phospholipids for functional food, *Eur. J. Lipid Sci. Technol. 103*:98–101 (2001).

TABLE 1. *Marketed drugs containing phospholipids*

Products	Phospholipids used[a]	Treatment
Abelcet® (amphotericin B)	DMPC, DMPG	Systemic fungal infection
AmBisome® (amphotericin B)	HSPC, DSPG, CHOL	Systemic fungal infection
Doxil® (doxorubicin)	HSPC, DSPE-MPEG2000, CHOL	Ovarian cancer, AIDS-related Kaposi's sarcoma
Myocet® (doxorubicin)	Egg-PC, CHOL	AIDS-related Kaposi's sarcoma
Visudyne® (verteporfin)	Egg-PC, DMPC	Age-related macular degeneration; myopia
Junovan® (muramyl tripepeptide phosphatidylethanolamine)	POPC, DOPS	Osteosarcoma
DepoCyte® (cytarabine)	DOPC, DPPG	Lymphomatous meningitis
DepoDur® (morphine sulfate)	DOPC, DPPG, CHOL	Pain killer (epidural administration)

[a] Abbreviations: DMPC: 1,2-dimyristoyl-*sn*-glycero-3-phosphocholine; DMPG: 1,2-dimyristoyl-*sn*-glycero-3-phosphoglycerol; HSPC: hydrogenated soy phosphatidylcholine; CHOL: cholesterol; DSPE-MPEG2000: N-(carbonyl-methoxypolyethyleneglycol 2000)-1,2-distearoyl-*sn*-glycero-3-phosphoethanolamine; Egg-PC: egg phosphatidylcholine; POPC: 1-palmitoyl-2-oleoyl-*sn*-glycero-3-phosphocholine; DOPS: 1,2-dioleoyl-*sn*-glycero-3-phospho-L-serine; DPPG: 1,2-dipalmitoyl-*sn*-glycerol-3-phosphoglycerol; DSPG: 1,2-distearoyl-*sn*-glycerol-3-phosphoglycerol; DOPC: 1,2-dioleyol-*sn*-glycero-3-phosphocholine.

lymphoma, and leukemia. Liposomes also have been used as carriers of amphotericin B in the treatment of mycotic infections such as histoplasmosis, cryptococcosis, and candidiasis.

The US demand for drug delivery systems using phospholipids is projected to increase more than 10% annually, reaching about $130 billion in 2012. The advantages of accurate targeting in the treatment of cancer and other debilitating diseases can lead to the development of less toxic, more cost-effective drug delivery systems. Such reduced toxicity benefits would broaden the usage of liposome-encapsulated drugs (see Table 1), especially in the areas of cancer, neurological disorders, and anti-infective therapy.

Dietetics. Three phospholipids are commercially cost-effective for dietetics use: PS, PC, and GPC. PS is a natural brain component, comprising up to 20% of membrane phospholipids in brain cells. Due to its prevalence in brain tissues, most researchers have concentrated their work on identifying the effects of PS on brain function. PS positively influences the synthesis of the neurotransmitter acetylcholine and restores its release back to a normal level in aged people. As a result, PS from vegetable sources (lecithin) produces beneficial effects in neuronal transmission and may improve age-related memory deficiencies. PS has been demonstrated to influence the ratio of cholesterol and phospholipids in brain cell membranes, thereby ensuring sufficient membrane fluidity.

PC acts as a biosurfactant in human lipid metabolism. It is responsible for nutrient absorption from food by functioning as a natural emulsifier for ingested lipids. PC interacts with lipoprotein in the blood; it binds specifically to HDL, thereby increasing their surface and transport capacity for free cholesterol. Also, PC activates an enzyme (LCAT: lecithin:cholesterol-acyltransferase) that catalyzes the conversion of free cholesterol to cholesteryl linoleate, which is easier to metabolize and, as result, less prone to stick to arterial walls. Being an essential constituent of the human gastric mucosa, PC supplied by the oral route has been shown to protect from gastric lesions and ulcers induced by stress, malnutrition, and nonsteroidal anti-inflammatory drugs. PC is a source of choline, and choline is an essential nutrient that has been shown to counteract and protect against liver intoxication.

GPC produced from vegetable source is the only water-soluble phospholipid and, therefore, it may be used in liquid dietetic formulas as well as in solid oral forms like hard capsules. Many health benefits from GPC are known, such as its function as a precursor in the synthesis of PC and choline and its ability to stimulate the synthesis and release of the neurotransmitter acetylcholine and the secretion of the human growth hormone.

Cosmetics. As components of cell membranes, phospholipids are important constituents of human skin cells. Their natural occurrence in the skin decreases toward the outer tissues, allowing these tissues to become more rigid and crystalline and to form an effective barrier against environmental influences.

Phospholipids are perfect base substances for cosmetic products. Phospholipids meet the following requirements: (i) They support the physiology of the skin; (ii) their chemical features correspond to those of endogenous substances; (iii) in terms of physical features, they build up the same structure (bilayers) as the skin; and (iv) they are powerful active agents. PC has long been used in cosmetics and cosmeceuticals as a delivery vehicle for active ingredients such as vitamins A and E, coenzyme Q10, whitening agents, and anti-inflammatory ingredients. PC improves chemical stability, uptake and efficacy of actives, and because of its high water-binding capacity, is an efficient external moisturizer to help keep the skin supple, firm, and healthy. PC containing unsaturated fatty acids may be rich in so-called essential fatty acids (EFA). Some EFA cannot be synthesized by human cells and need to be supplied via the oral or topical route. EFA deficiency in humans is often associated with skin aging and can lead to a dry, scaly appearance and a loss of elasticity and barrier integrity. Thus, PC is an important tool for the external supply of EFA to aging skin or for persons suffering from malnutrition, acne, and other diseases affecting the skin lipid metabolism.

Molecules of PC containing saturated fatty acids are more crystalline and less flexible than molecules of PC containing unsaturated fatty acids and are beneficial in cosmetics for their

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World Soybean Research Conference VIII, Beijing

Keshun Liu

The 8th World Soybean Research Conference (WSRC) was held on August 10–15, 2009. The 2,176 participants from 38 countries set a new attendance record for the conference. The meeting included 19 plenary talks, 329 symposia presentations, 34 forum presentations, and 693 posters. These presentations covered all aspects of the soybean value chain, including germplasm, breeding, molecular biology, biotechnology, physiology, cultivation, field management, crop protection, storage, processing, utilization, and supply and trade. There were soy industry forums and soy producer forums, as well as more than 40 industrial exhibitors.

BACKGROUND

WSRC has run every five years since its inception in 1975. The conference is aimed at promoting international exchanges and cooperation on soybean science and technology. A Continuing Committee consisting of representatives from different regions of the world offers guidance to the conference planners as they develop each event. Previous meetings focused mostly on breeding and production. Since the sixth meeting, however, there has been more coverage on processing, utilization, and global trade.

The Chinese Academy of Agricultural Sciences (CAAS) and Crop Science Society of China hosted this year's conference. Primary organizers included the Institute of Crop Science and CAAS; co-organizers included a number of national soybean associations. The conference also received support from the Ministries of Agriculture and of Science and Technology, the People's Republic of China; and a few other institutions or associations. Corporations sponsoring the conference included Shengfeng Technology Co., Vitasoy, Monsanto, Bayer Crop Science, Jouyang Co., Dalian Commodity Exchange, American Soybean Association International Marketing/United Soybean Board, Pioneer, Syngenta, Wilmar International, Chinese Seed Industry, and China-Agri Seed Co.

PLENARY SESSIONS

The welcoming ceremony on Monday evening was followed by the opening ceremony Tuesday morning, and then a number of plenary sessions. Additional plenary sessions ran in the early morning session each day.

In the plenary session on Tuesday morning, Eric A. Kueneman of the Crop Production and Protection Division, Food and Agricultural Organization, discussed the conference theme, "Developing a global soy blueprint for a safe, secure, and sustainable supply." He said that agricultural productivity must double by 2050 to meet growing food needs and that soybeans will contribute to satisfying this need. While soybeans are less economically viable as a biofuel feedstock as compared with some

Opening ceremonies for the 8th World Soybean Research Conference (WSRC).

other oilseeds, market expansion for soy oil and meal will be driven by strong income growth in developing countries, especially in Asia. At the same time, opportunities exist for expansion of the total area devoted to soybean production, particularly in South America and in the favorable savannahs of Africa. Increased yield, though, will be the principal means of meeting future demand.

In another plenary session on Tuesday, Philippe de Lapérouse of HighQuest Partners gave a presentation entitled "The U.S. soybean industry, production and processing to meet world demand." He stated that, although the United States continues to be the world's largest producer and exporter of soybeans, in recent years the leading producers in South America, Brazil, and Argentina, have been steadily gaining, both in terms of production and exports of soybeans and soy products. The US soy industry faces challenges and opportunities, including ethanol-fueled demand for corn (which competes with soybeans for acreage), volatility in the value of the US dollar (which affects the competitiveness of US commodities in export markets), rapid consumer adoption of *trans*-fat-free edible oils, a dramatic increase in the use of vegetable oils for biodiesel production, volatility in dry bulk shipping markets, and continued growth in world demand for vegetable oils and proteins.

SOY NUTRITION, PROCESSING, AND UTILIZATION

As in the last two conferences, this year's event included a number of presentations addressing the areas of processing and utilization, as well as nutrition and health benefits. There were also sessions on specialty soybeans and their processing, exemplifying the interaction between quality trait breeding and end use values. There were three sessions covering the nutritional significance and health benefits of soy.

In the Wednesday plenary session, Susan Ho of the Chinese University of Hong Kong showed the importance to bone health of fortifying soymilk with calcium. In the Thursday plenary session, C.M. Chen emphasized that increased consumption of soy foods in China has dual benefits, reducing malnutrition for the poor and preventing chronic disease for the rich. Also on Thursday, M.C. Fung showed the potential of soy as anticancer drug, and Mark Messina stated that women who consume soy foods at young ages have preventive effects on breast cancer in their later lives.

In the area of processing and utilization, strong emphases were placed on industrial use of soy, soy and aquaculture, modern processing technology, and traditional processing and modernization. In the session on industrial use of soy held Friday evening, speakers showed that through modification, soy can be used as a cosmetic ingredient, plywood glue, industrial lubricant, plastic, and biodiesel. Many of these products have been commercialized successfully in the United States and Europe.

In the soy and aquaculture session, several speakers, including the author of this report, talked about the reasons for and success of using soy proteins to replace fishmeal in raising various species of fishes. Clearly, development of plant protein, particularly soy protein, for fish feed is an emerging issue in the global feed industry.

Modern processing technologies, such as extrusion, hydrolysis of soy protein into peptides, alternative protein extraction methods, and methods for extracting nutraceuticals were well covered, while modernization of traditional soy foods such as soymilk and tofu was also discussed. In addition, for the two sessions on processing and value-added utilization of specialty soybeans, various types of modified soybeans, obtained through traditional breeding or biotechnology, were discussed. These included soybeans with modified fatty acid composition, soybeans with modified oligosaccharides, isoflavones, lipoxygenase-null beans, natto beans, and edamame beans.

FIELD TRIP, SOCIAL EVENTS, AND AWARDS

A field trip on the afternoon of the 13th allowed participants to visit the campus of CAAS and tour the soybean research fields, laboratories for molecular genetics and breeding, and facilities for

One of a number of entertaining performances during the WSRC's Beijing Night.

germplam storage. The Beijing Night on the evening of 14th was a showcase for Chinese foods and cultures. Participants tasted a variety of delicious food while watching performances that included Shaolin martial arts, magic, acrobatics, Beijing opera, a face-changing show, and traditional Chinese or modern dances. One of the most enjoyable moments of the event came when the audience was invited to dance on stage with the performers.

During the closing ceremony on the 15th, WSRC for the first time recognized some meeting attendees with awards. Those recognized included Richard Bernard, a retired ARS soybean breeder, for his contribution in collecting and breeding edible soybeans.

For more information on the next conference—which will next be held in Durban, South Africa, in 2013—visit www.wsrc2009.cn/en/index.asp.

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Attendees visit the exhibit area at WSRC.

INDUSTRIAL OIL CROPS (CONTINUED FROM PAGE 751)

Although it is unlikely that there will be a sudden surge in industrial demand for plant oils over the next few years, it is virtually certain that the coming decades will see a gradual but steady increase in the use of oleochemical feedstocks across all sectors.

This developmental timescale—measured in decades rather than months or years—is ideal for a series of new programs to develop improved industrial oil crops using the many new biotechnologies now at our disposal. It may take another decade or so to resolve the problem of producing transgenic crops with 70–90% levels of a given FA. Recent progress in this area of research has been encouraging, but we still have a long way to go from typical current best levels of 25–30%.

Increasing oil yields will be equally challenging. The best temperate oilseed crops currently yield about 1 metric ton (MT)/ha, but that figure is based on a seed oil content of 40%, which could be increased toward values of 60–70% already found in some nuts. Oil yields of the major global crop, oil palm, are currently about 4 MT/ha, but trees are available that can yield more than 10 MT/ha. If we can increase global oil yields by 50% and improve FA purity in plant oils, there will be sufficient production to meet demand for edible oils and also to sustain a significant growth in price-competitive feedstocks for a widening range of industrial uses.

To meet these aspirations, it will be desirable to make use of all available plant breeding methods, as well as to continue with efforts to understand the biochemical and cellular processes that underlie oil accumulation, and related aspects of nonstorage lipid metabolism in plant tissues. As we have learned over the past two decades, none of our current breeding or engineering methods are particularly rapid, but neither is the required timescale for commercializing the new generation of industrial oil crops. By investing relatively modest sums now in applied breeding R&D for new oil crops and in basic lipid metabolism studies, we could lay the groundwork for the development of sustainable and environmentally friendly plant-based hydrocarbon feedstocks. Such feedstocks will surely become increasingly needed as fossil carbon resources become depleted during the rest of the 21st century.

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DDGS (CONTINUED FROM PAGE 791)

quality of co-products. As these process modifications are validated and commercially implemented, improvements in the generated co-products will be realized, and unique materials (such as high-protein, low-fat, and/or low-fiber distillers grains) will be produced as well.

CONCLUSION

Ethanol is not the entire solution to our energy needs, but it is a key component to the bigger picture of energy independence. Support for ethanol has been growing over the years, and the industry has been rapidly expanding in response to increased demand. This means there will be many opportunities for those involved in process and product development to help add value to the processing residues—the co-products known as distillers grains.

Kurt A. Rosentrater is lead scientist, Agricultural and Bioprocess Engineer, US Department of Agriculture, Agricultural Research Service, North Central Agricultural Research Laboratory (Brookings, South Dakota, USA). Contact him at kurt.rosentrater@ars.usda.gov.

A PHOSPHOLIPIDS PRIMER (CONTINUED FROM PAGE 795)

stabilizing and regenerating effects on the skin-lipid barrier. PC helps to maintain or restore normal barrier function in dry or sensitive skin. Further, incorporation of PC containing saturated fatty acids into organic sunscreens improves their water resistance.

SUMMARY

Every phospholipid has its own specific application profile. Extensive scientific studies have demonstrated the effects on the human body that can result from the nutritional action of phospholipids, such as PS as a brain cell nutrient, PC for liver cell regeneration, soy phospholipids for lipid-reducing effect, and hydrogenated phospholipids as a basis for production of stable liposomes. Further tailor-made products produced from natural phospholipids, in combination with other active substances, are offering new potential markets.

Moghis Ahmad's expertise is in synthetic lipid chemistry. Currently he is the vice president of Chemical Technology and Manufacturing at Jina Pharmaceuticals Inc. (Libertyville, Illinois, USA). He has been an active member of AOCS for more than 30 years. At present he is chairperson of Phospholipid Division and vice president of the International Lecithin and Phospholipid Society (ILPS). He can be reached at Moghis@jinapharma.com.

Cracking Mill