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Bioproducts from *B. carinata*

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Departments and Information

AOCS Mission Statement
To be a global forum to promote the exchange of ideas, information, and experience, to enhance personal excellence, and to provide high standards of quality among those with a professional interest in the science and technology of fats, oils, surfactants, and related materials.

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Calendar

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

October

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

October 16–19, 2010. 9th International Symposium on the Role of Soy in Health Promotion and Chronic Disease Prevention and Treatment, Capital Hilton, Washington, DC, USA. Information: www.SoySymposium.org.

November

November 3–5, 2010. Cleaning Products 2010: Formulation, Innovation, Regulation, Hotel Monaco Alexandria, Alexandria, Virginia, USA. Information: www.cleaningproductsconference.com.

November 7–11, 2010. 30th Practical Short Course on Vegetable Oil Extraction, College Station, Texas, USA. Information: http://foodprotein.tamu.edu/extractionprotein/scvegoil.php.

November 9–10, 2010. Advanced Biofuels Markets, San Francisco, California, USA. Information: www.greenpowerconferences.com/advancedbiofuelsUSA.

November 9–12, 2010. 5th Annual Biofuels 2010 Meeting, Okura Hotel, Amsterdam, Netherlands. Information: www.wraconferences.com/2/4/articles/149.php?.

November 10, 2010. Developing Soy Seminar 2010: Connecting Product Development and Supply, Amsterdam, Netherlands. Information: http://bridge2food.com/Developingsoy2010.asp.

November 10–11, 2010. Bioenergy International Asia Expo & Conference, The Maya Hotel, Kuala Lumpur, Malaysia. Information: www.biofuelsinternationalexpo.com/asia/conf_prog.html.

November 10–12, 2010. 45th Southeastern Regional Lipid Conference 2010, High Hampton Inn & Country Club, Cashiers, North Carolina, USA. Information: www.musc.edu/BCMB/serlc.

November 11, 2010. 15th Soy Symposium: Adapting to New Market Forces, L'Enfant Plaza Hotel, Washington, DC, USA. Information: www.soyfoods.org/2010-soy-symposium.

November 16–18, 2010. Health Ingredients Europe, Madrid, Spain. Information: http://hieurope.ingredientsnetwork.com.

November 16–18, 2010. Food Ingredients Europe, London, United Kingdom. Information: www.fi-events.com.

November 17–19, 2010. 6th International Symposium on Biocatalysis and Biotechnology, Hoam Faculty House, Seoul National University, Seoul, Korea. Information: www.isbb2010.org.

November 21–24, 2010. 8th Euro Fed Lipid Congress, Munich, Germany. Information: email: info@eurofedlipid.org; www.eurofedlipid.org/meetings/munich.

November 23–24, 2010. Third International Seminar on Oil Seeds and Edible Vegetable Oils [sponsored by the Iranian Vegetable Oil Industry Association], Islamic Republic of Iran Broadcasting International Conference Center, Tehran. Information: email: Ms. Shahnas Banounam, shahnasorchid@yahoo.com; www.ivoi.ir.

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AOCS Meeting Watch

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

October 16–19, 2010. 9th International Symposium on the Role of Soy in Health Promotion and Chronic Disease Prevention and Treatment, Capital Hilton, Washington, DC, USA. Information: www.SoySymposium.org.

November 17–19, 2010. 6th International Symposium on Biocatalysis and Biotechnology, Hoam Faculty House, Seoul National University, Seoul, Korea. Information: www.isbb2010.org.

May 1–4, 2011. 102nd AOCS Annual Meeting and Expo, Duke Energy Convention Center, Cincinnati, Ohio, USA. Information: phone: +1 217-359-2344; fax: +1 217-351-8091; email: meetings@aocs.org; http://AnnualMeeting.aocs.org.

June 20, 2011. Oils and Fats World Market Update 2011, Izmir Hilton, Izmir, Turkey. Information: www.aocs.org/goto/WorldMarket.

June 21–23, 2011. World Conference on Oilseed Processing, Fats & Oils Processing, Biofuels & Applications, Izmir Hilton, Izmir, Turkey. Information: www.aocs.org/goto/Turkey2011.

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

November 24–26, 2010. 4th International Conference, Fat and Oil Industry 2010, Palmira Palace Hotel, Yalta, Ukraine. Information: email: promo@apk-inform.com, ozip@apk-inform.com; www.agrimarket.info.

November 25–26, 2010. Protein Summit, Amsterdam, Netherlands. Information: www.bridge2food.com/Mailings/PS2010.html.

November 29–December 1, 2010. 7th Annual Canadian Renewable Fuels Summit, Hilton Lac-Leamy Hotel, Gatineau, Québec, Canada. Information: www.greenfuels.org/en/industry-information/summit.aspx.

November 30–December 2, 2010. NextGenFuels 2010, Delhi, NCR, India. Information: http://growdieselevent.com/default.aspx.

December

December 3–5, 2010. 65th Annual OTAI Convention, International Symposium, and Expo on Oils, Fats & Oleochemicals; Food Security, Green Energy, and Environment, Hotel InterContinental Eros, New Delhi, India. Information: www.ota-i65agm.org.

December 6–8, 2010. World Algae Congress 2010 USA, San Francisco, California, USA. Information: www.terrapinn.com/2010/algae/.

December 10–11, 2010. Functional Foods for Heart Health: Continuum Between Science and Commercialization, Winnipeg, Canada. Information: www.bioactivesworld.com/winnipeg.html.

December 11–14, 2010. Pacific Rim Summit on Industrial Biotechnology & Bioenergy, Honolulu, Hawaii, USA. Information: www.bio.org/pacrim.

December 15–20, 2010. International Congress of Pacific Basin Societies (Pacifichem), Honolulu, Hawaii, USA. Information: www.pacifichem.org.

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December 16–17, 2010. HPCI [Home and Personal Care Ingredients] Congress, Mumbai, India. Information: www.hpci-congress.com.

January

January 12–17, 2011. Obesity, Keystone Resort, Keystone, Colorado, USA. Information: www.keystonesymposia.org/Meetings/ViewMeetings.cfm?MeetingID=1115.

January 30–February 4, 2011. Gordon Conference on Plant Lipids: Structure, Metabolism & Function, Hotel Galvez, Galveston, Texas, USA. Information: www.grc.org/programs.aspx?year=2011&program=plantlipid.

February

February 6–9, 2011. National Biodiesel Board Conference & Expo, Phoenix Convention Center and Venues, Phoenix, Arizona, USA. Information: www.biodiesel.org.

February 20–22, 2011. 16th National Ethanol Conference, JW Marriott Desert Ridge, Phoenix, Arizona, USA. Information: www.ethanolrfa.org or www.nationalethanolconference.com.

February 26–March 1, 2011. GEAPS [Grain Elevator and Processing Society] Exchange, Portland, Oregon, USA. Information: www.geaps.com/exchange/index.cfm.

February 27–March 4, 2011. Gordon Conference on Signal Transduction within the Nucleus, Four Points Sheraton, Ventura, California, USA. Information: www.grc.org/programs.aspx?year=2011&program=sigtrans.

March

March 1–4, 2011. DEUEL Conference on Lipids, Silverado Resort, Napa, California, USA. Information: www.deuelconference.org.

March 13–15, 2011. NIOP [National Institute of Oilseed Products] Annual Convention, Camelback Inn, Scottsdale, Arizona, USA. Information: niop@kellencompany.com; www.oilseed.org.

March 13–18, 2011. Pittcon 2011, Georgia World Congress, Atlanta, Georgia, USA. Information: www.pittcon.org/about.

March 14–15, 2011. Biowise 2011: Biofuels from Lab to Finance, The Crowne Plaza Hotel, Kuala Lumpur, Malaysia. Information: www.greenworldconferences.com.

March 22–24, 2011. World Biofuels Markets, Beurs–World Trade Center, Rotterdam, Netherlands. Information: http://greenpower.msgfocus.com/q/1NeTXkWKWk1ab2/wv.

March 23–24, 2011. Wellness 11, InterContinental Chicago O'Hare, Rosemont, Illinois, USA. Information: www.ift.org/meetings-and-events/wellness.aspx.

March 27–29, 2011. Congress on Steroid Research, Westin Chicago River North Hotel, Chicago, Illinois, USA. Information: www.steroidresearchcongress.com.

March 27–31, 2011. 241st American Chemical Society Meeting, Anaheim, California, USA. Information: www.acs.org.

March 30–31, 2011. BioEnergy World Africa 2011, Sandton Convention Centre, Johannesburg, South Africa. Information: www.terrapinn.com/2011/bioenergyza.

April

April 10–12, 2011. 15th International Conference on Hydrocolloids, Hyatt Regency Mission Bay, San Diego, California, USA. Information: phone: +1 858-451-6080; email: dseisun@hydrocolloid.com.

April 12–13, 2011. OFI Middle East 2011, InterContinental Citystars, Cairo, Egypt. Information: email: oilsandfats@quartzltd.co.uk; www.oilsandfatsinternational.com.

April 25–29, 2011. World Congress of Bioenergy, World Expo Center, Dalian, China. Information: www.bitlifesciences.com/wcbe2011. ■

AOCS Board Petition to Nominate

For each annual election of AOCS Governing Board officers, the membership may nominate up to four additional member-at-large candidates by petition. Petitioned candidates receiving at least 50 AOCS member signatures will be added to the ballot approved by the Governing Board. Preference will be given to the first four petitioned candidates meeting the eligibility requirements as outlined here. Petitioned nominations must be received at the AOCS Headquarters no later than **October 30, 2010**.

Petition forms can by obtained by visiting http://www.aocs.org/files/MembershipPDF/BoardPetition.pdf.

AOCS Since 1909 Your Global Fats and Oils Connection

Please mail completed petitions with at least 50 AOCS signatures to: AOCS Nominations and Elections Committee, P.O. Box 17190, Urbana, IL 61803-7190 USA or fax to: Amy Lydic, +1 217-693-4852.

Universal detectors for determination of lipids in biodiesel production

Marc Plante, Deanna C. Hurum, Ian Acworth, and Jeffrey S. Rohrer

In recent years, biodiesel has been promoted as a renewable and environmentally preferable fuel option to petroleum diesel. Biofuels, including biodiesel, are predicted to replace over 10 billion gallons (38 billion liters) of the petroleum currently used in the United States by 2030. Biodiesel is often produced by reacting plant or animal oils with an alcohol to form the desired alkyl esters as fuel, and this transesterification is typically achieved using a base. This also produces free glycerol and acylglycerols as impurities in the biodiesel that must be limited in the final fuel product because they form harmful deposits in engines and damage emissions control systems.

STANDARD REQUIREMENTS

To ensure reliable biodiesel quality, ASTM International has adopted ASTM D6751, which is largely equivalent to the European Union standard, EN 14214. D6751 applies to B100 biodiesel (i.e., fuel that is 100% biodiesel, with no petrodiesel) that is used for blending, ensuring that the source material and biodiesel blends are of high quality. Among the many parameters controlled by this standard are the residual concentrations of glycerol and acylglycerols in the product.

Many methods to determine glycerols in biodiesel samples exist. The currently recommended method is a high-temperature gas chromatography (GC) method, ASTM D6584. However, this GC method requires sample derivatization and the use of high-temperature columns, which degrade quickly. With the goal of simplifying sample preparation, HPLC (high-performance liquid chromatography) has been investigated for both acylglycerol and total glycerol determination in biofuels.

HPLC SOLUTIONS

Because acylglycerols are a broad class of compounds, gradient HPLC methods are preferred both to improve separation and shorten analytical run times. However, many of the solvents used to separate these analytes, such as tetrahydrofuran and ethyl acetate, absorb in the UV (ultraviolet) spectrum, causing large changes in the UV baseline, which makes UV detection of analytes challenging. Additionally, glycerols lack a strong chromophore, inherently limiting method sensitivity. For these reasons, other HPLC detection schemes have been investigated.

ELSD AND CAD

Nebulizer-based universal detectors are becoming more popular for the determination of acylglycerols in lipids and biofuels. These detectors do not rely on analyte chromophores. Instead, detection is based on analyte mass. For these detectors, the HPLC eluent is nebulized, creating an aerosol. Once the mobile phase is evaporated, solid analyte particles remain, from which the detector can determine the amount of analyte that is present. The two methods of detection that are commonly used are evaporative light scattering detection (ELSD) and charged aerosol detection (CAD). These detectors are limited to nonvolatile and some semivolatile compounds.

ELSD uses light scattering to determine analyte mass and therefore concentration in the original sample. Analyte response is nonlinear resulting from the contribution of different light-scattering mechanisms producing a sigmoidal response curve. ELSD instruments generally provide moderate sensitivity and precision.

In comparison, CAD charges the particles for analyte determination as depicted in Figure 1. Following mobile phase evaporation, the analyte particles collect charge from a stream of charged nitrogen molecules, formed when nitrogen gas passes over a charged corona wire. The charge on the particles is measured by a sensitive electrometer, which provides the signal (current). CAD typically shows similar inter-analyte response, uniform response

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FOR FURTHER READING:

- Plante, M., B. Bailey, and I. Acworth, The use of charged aerosol detection with HPLC for the measurement of lipids, in *Lipidomics: Vol. 1: Methods and Protocols,* Vol. 579 of series Methods in Molecular Biology, edited by D. Armstrong, Humana Press, New Jersey, 2009, pp. 469–482.

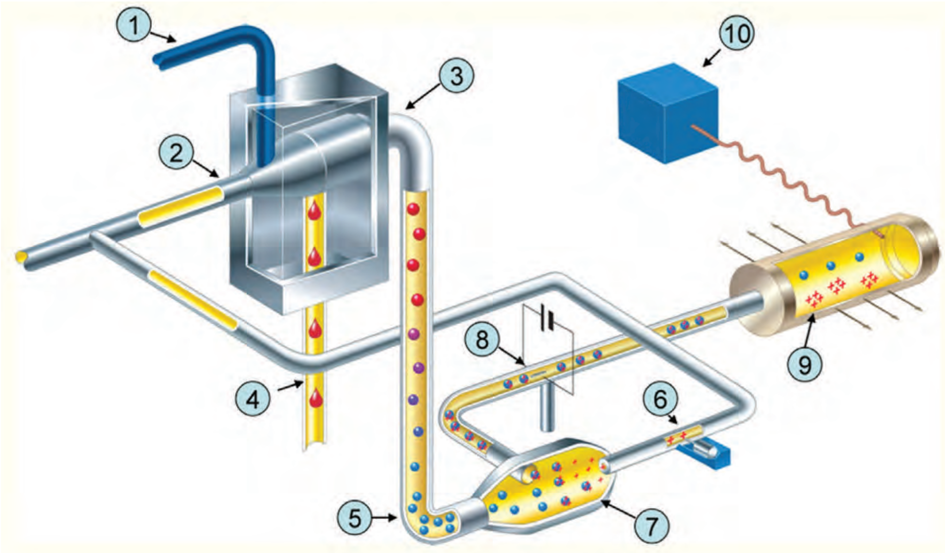

FIG. 1. *Illustration of how the Corona® ultra™ detector works. The liquid eluent from the HPLC (high-performance liquid chromatography) column enters the detector (1) where it undergoes pneumatic nebulization; (2) small droplets enter the drying tube and (3) form particles, while large drops exit the drain (4) to waste. Dried particles enter the mixing chamber (5). Another gas stream passes over a charged Corona Needle (6). Charged gas then mixes with the dried particles, forming charged particles (7). High-mobility species are removed by an ion trap (8) while the remaining charged particles pass to a collector where the charge is measured with a very sensitive electrometer (9). Signal is transferred to software (10).*

curves, and greater sensitivity, precision, accuracy, and wider dynamic range (>4 orders) than ELSD.

EXAMPLES OF ANALYTICAL SEPARATIONS

Many methods can be used to analyze lipids in biodiesel feedstocks and final products. The samples can be characterized with high resolution and with rapid analysis times,

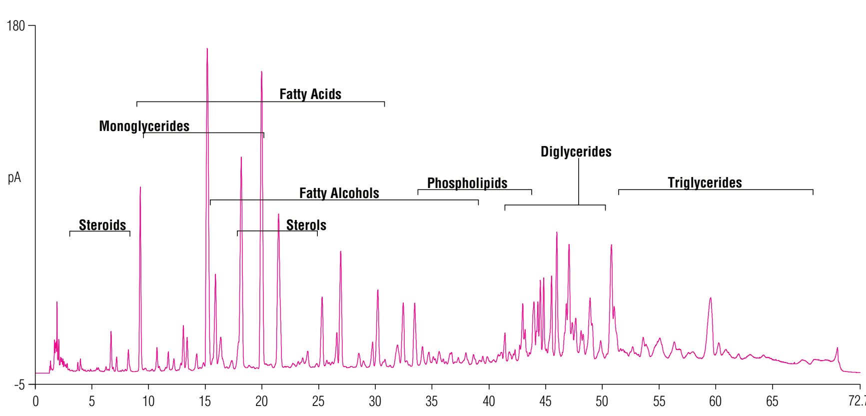

FIG. 2. *HPLC-CAD (charged aerosol detection) chromatogram of algal oil, diluted 100 µL into 900 µL methanol/chloroform (1:1), then separated on a Halo® C8, 2.7 µm, 4.6 × 150 mm column at 40°C with a gradient of methanol/water/acetic acid (750:250:4) and acetonitrile/methanol/tetrahydrofuran/acetic acid (500:375:125:4). See Figure 1 for other abbreviation.*

depending on the analytical needs. For example, Figure 2 illustrates the high-resolution separation of algal oil, as a representative fuel feedstock, using HPLC-CAD. This chromatogram clearly shows the high sensitivity of the detector for the minor lipids contained within the sample. This method can separate and quantify a wide variety of different lipid classes, from steroids to triacylglycerols.

Figure 3A shows a rapid (10 min) HPLC-ELSD separation of a B99 sample produced from recycled restaurant fryer oil. In this chromatogram, the fatty acid methyl esters elute first, followed by diacylglycerols, and finally triacylglycerols. The sensitivity of ELSD, with LOQ (limits of quantification) of 8–15 µg/mL, does allow for some acylglycerol determinations. However, it is difficult to determine acylglycerols in this sample under these conditions. In contrast, when the same sample is analyzed by Corona *ultra*, as shown in Figure 3B, the increased sensitivity easily allows glycerol oleate quantification. With CAD, the estimated LOQ for mono-, di-, and trioleoylglycerols are 1.5–2.4 µg/mL, showing ample sensitivity to determine acylglycerols below the EN limits. Additionally, for comparison, the Corona *ultra* peak area precision is dramatically improved compared to ELSD with relative standard deviations of 0.2–0.6% for 50 µg/mL standards compared to 2.3–4.8%, respectively. Tables 2 and 3 detail the improved calibration, LOQ, and precision values for the model acylglycerols with Corona *ultra* detection compared to ELSD.

An analyte that is of considerable importance in biodiesel analysis, which is not quantified with the above methods, is free glycerol. To determine free and bound acylglycerols in biodiesel, another HPLC-CAD method is available that will provide quantification of total glycerols in a single run. Although not presented here, readers are referred to Application Note #70-8305 on www.coronaultra.com for specific information.

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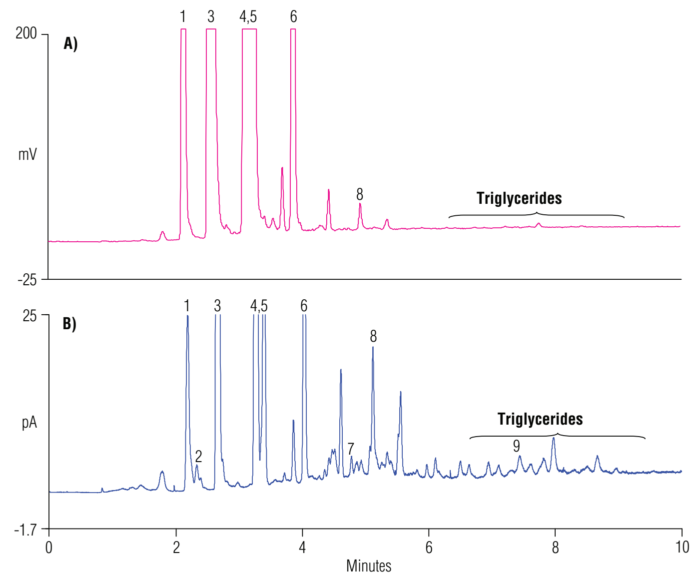

FIG. 3. *Chromatograms of a B99 (99% biodiesel from used fryer grease + 1% petrodiesel) sample detected by ELSD (evaporative light-scattering detection) with a 25°C nebulization temperature (A) and Corona* ultra *with a 15°C nebulization temperature (B). Separation was carried out on an Acclaim® RSLC 120 C18 column at 15°C with a gradient of acetonitrile and ethyl acetate. Peaks: (1) methyl linolenate, (2) 1-oleoyl-rac-glycerol, (3) methyl linoleate, (4) methyl oleate, (5) methyl palmitate, (6) methyl stearate, (7) dilinoleoyl-rac-glycerol, (8) methyl arachidate, (9) trioleoylglycerol.*

CAD, Corona, Acclaim are registered trademarks and *ultra* is a trademark of Dionex Corporation. Halo is a registered trademark of MAC-MOD Analytical, Inc., Chadds Ford, Pennsylvania, USA

Table 1: *Linearity and precision of acylglycerol determination by ELSD*[a]

Analyte	Range (µg/mL)	Correlation coefficients (r^2)	LOQ (µg/mL)	Peak area precision (RSD) (50 µg/mL standard, n = 3)
1-Oleoyl-*rac*-glycerol	15–150	0.9982	11	2.78
Oleic acid	15–150	0.9982	15	3.41
Dilinoleoyl-*rac*-glycerol	15–150	0.9922	10	4.36
1,3- and 1,2-Dioleoylglycerol	15–150	0.9993	10	2.25
Trioleoylglycerol	15–150	0.9985	8	4.78

[a]Abbreviations: LOQ, limits of quantification; RSD, relative standard deviation.

Table 2: *Linearity and precision of acylglycerol determination by Corona* ultra[a]

Analyte	Range (µg/mL)	Correlation coefficients (r^2)	LOQ (µg/mL)	Peak area precision (RSD) (50 µg/mL standard, n = 3)
1-Oleoyl-*rac*-glycerol	5–100	0.9998	2.4	0.58
Dilinoleoyl-*rac*-glycerol	5–100	0.9998	1.5	0.22
1,3- and 1,2-Dioleoylglycerol	5–100	0.9999	2.0	0.43
Trioleoylglycerol	5–100	0.9999	2.0	0.38

[a]For abbreviations see Table 1.

New very long chain fatty acid seed oils produced through introduction of strategic genes into *Brassica carinata*

David C. Taylor

Note: The following article is the second in a two-part series. The first part—"Surfactants based on monounsaturated fatty acids for enhanced oil recovery" by Paul Berger—appeared in the September 2010 issue of inform.

For the emerging global bioeconomy, crop development and enhancement of species diversity are essential. Equally important is maximizing crop value through total crop utilization. We are developing Ethiopian mustard (*Brassica carinata*) as a biorefinery and bioindustrial oils crop platform using traditional and molecular breeding techniques and tools (see review by Taylor *et al.*, 2010).

Very long chain fatty acids (VLCFA) containing more than 18 carbon atoms are common components of seed oils and plant waxes in a number of plant families including the Cruciferaceae, Limnanthaceae, Simmondsiaceae, and Tropaeolaceae.

Erucic acid (*cis*-docosa-13-enoic acid, 22:1 Δ13) is the major VLCFA in the seed oil from HEAR (high erucic acid rapeseed) *B. napus* cultivars, accounting for 45–55% of the total fatty acids. HEAR cultivars are of high interest since 22:1 is a valuable feedstock with more than 1,000 patented industrial applications. Currently the major derivative of erucic acid is erucamide, which is used as a surface-active additive in coatings and in the production of plastic films as an anti-block or slip-promoting agent. Many other applications are foreseen for erucic acid and its hydrogenated derivative behenic acid, for example, in lubricants, detergents, photographic film-processing agents, coatings, cosmetics, and pharmaceuticals.

Studies have confirmed that HEAR oil and its derivatives have a higher energy potential than low erucic acid oil. HEAR oils are more suitable for biodiesel production than low erucic *Brassica* oils, because the iodine value is lower in the former (i.e., lower proportion of polyunsaturated fatty acids in the oil) and within the European Union specifications. US industry uses 18 million kg of HEAR oil annually, mostly from imports, but supplies are historically limited. Therefore, a large overall market potential exists for expansion and development of new, annually renewable domestic sources of erucic acid oil.

Nervonic acid (*cis*-tetracosa-15-enoic acid; 24:1 Δ15) is another strategic VLCFA. It exists in nature as an elongation product of oleic acid (18:1 Δ9), its immediate precursor being erucic acid. Nervonic acid has been identified in the triacylglycerols in the seeds of only a few plants: *Lunaria* spp. (money plant), borage, hemp, *Acer truncatum* (purple-blow maple), *Tropaeolum speciosum* (flame flower), and *Cardamine graeca* (bittercress). Nervonic acid is particularly abundant in the white matter of animal brains and in peripheral nervous tissue where nervonyl sphingolipids are enriched in the myelin sheath of nerve fibers.

Interest in dietary therapy with nervonic acid-containing fats and oils developed when a hypothesis was put forward that dietary nervonic acid could support the normal synthesis and functionality of myelin in brain and nerve tissues. Dietary supplementation with nervonic acid might be beneficial, for neurological development/function, in: (i) individuals with genetic disorders of lipid metabolism specifically associated with peroxisomes (adrenoleukodystrophy, Zellweger's syndrome, others); (ii) individuals with multiple sclerosis and other nervous disorders such as Parkinson's disease;

TABLE 1. *Industrial applications of oils highly enriched in VLCFA*[a]

Viscoelastic surfactants and high molecular weight anionic surfactants
Enhanced oil recovery surfactants
Paving bed polymers
Erucamide—slip-promoting, anti-blocking agent in manufacture of plastic films
Nylon 13,13 or Nylon 15,15
Polyurethanes, plastics, and foams
Coatings and adhesives
Modified epoxide gels and resins
Composite materials
Cosmetic formulations
Silver behenate emulsions to be used in film processing
High-temperature lubricants

[a]VLCFA, very long chain fatty acids.

FIG. 1. ***Left:*** Crambe abyssinica *(Abyssinian mustard), source of a ketoacyl-CoA synthase (KCS) gene expressed in* B. carinata *to enhance seed oil erucic acid content.* ***Right:*** Cardamine graeca *(bittercress), source of a KCS gene expressed in* B. carinata *to create a high nervonic acid oil.*

and (iii) infants, particularly prematurely born infants, receiving formula as a source of nutrition. Realization of these potential nutritional applications is limited by the lack of available sources of a nervonic acid-rich oil that has minimal amounts of erucic acid. Provided the erucic acid content is very low, dietary intake of oil with high proportions of nervonic acid is predicted to be nontoxic to humans and animals. Nervonic acid is therefore a strong candidate for further evaluation as a bioactive lipid supplement, similar to arachidonic acid, docosahexaenoic acid, and conjugated linoleic acids, for the promotion of human and animal health (see review by Taylor *et al*., 2009). Surprisingly, nervonic acid also has applications as an industrial feedstock, in a manner similar to erucic acid.

A strategic goal of our research is to modify seed oil composition in members of the Brassicaceae to increase the proportion of VLCFA. Specific genetic modifications have been made to produce *B. carinata* prototype lines delivering oils highly enriched in VLCFA; in

TABLE 2. *Potential pharmacological applications of high nervonic acid oils*

Demyelinating diseases such as multiple sclerosis (MS) and adrenoleukodystrophy (ALD): There is a marked reduction in nervonate sphingolipids in post-mortem MS and ALD patients.
Parkinsonian tremors: Defects in microsomal biosynthesis of VLCFA including nervonate in "jumpy" and "quaking" mice model systems are accompanied by impaired myelination.
Schizophrenia: Nervonic acid is very low in post-mortem brain matter in these patients.
HIV: Nervonic acid has been reported to inhibit HIV-1 reverse transcriptase activity in a dose-dependent manner.

TABLE 3. *Potential applications in dietary supplementation using high nervonic acid oils*

Infants or young children during the key "myelinating stage" of neurodevelopment (up to *ca.* age 5), e.g., baby food and infant formula supplementation
Supplements for women who intend to become pregnant, are pregnant, or are lactating (particularly important with pre-term babies)
High-level training/exercising adults whose nervonic acid levels are generally taken to be normal; provides neuroprotective effect
Supplement in cattle feed, e.g., to enrich cows' milk in 24:1 for provision of milk products to infants and adults; 24:1 partitions with the protein fraction in dairy processing (not the typical fat fraction) and thus it is available in non-fat dairy and whey products

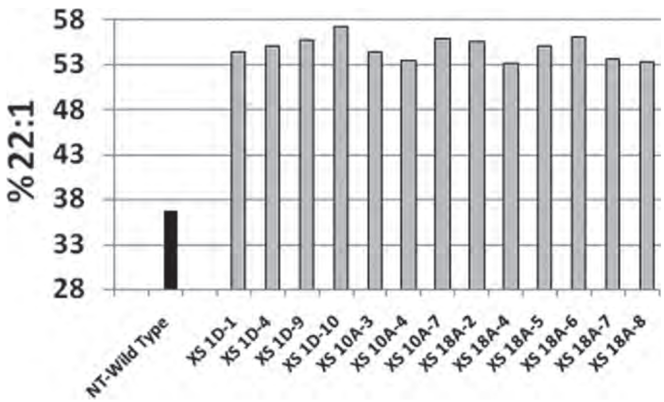

FIG. 2. *Erucic acid (22:1) proportions (% wt/wt) in mature seeds of non-transformed* B. carinata *wild type control (NT-Wild Type, black bar) and T_2 seeds of* B. carinata *transgenic lines carrying the* Crambe KCS *(lines XS 1D-1 through XS 18A-8; grey bars) under control of the seed-specific napin promoter.*

addition we have used transgene technology to enhance *B. carinata* seed oil content, which is 5–7% lower than *B. napus* (canola and HEAR cultivars). While we have HEAR cultivars seeded in May and harvested in August–September in western Canada and European winter varieties, seeded in the fall and harvested in late spring, we are advocating that *B. carinata* be developed as an alternative crop platform for industrial oil production and high VLCFA oils, in particular on the Canadian prairies. *Brassica carinata* is genetically transformed at a very high efficiency; the crop is highly disease resistant (e.g., to the fungus blackleg), is drought-tolerant, and is amenable to growth in hotter, drier regions.

Total crop utilization can be illustrated with two examples: High allyl glucosinolate meal from *B. carinata* can be used directly as a biopesticide; alternatively, the meal can be processed with a solvent wash to remove the glucosinolates so that the remaining low-fiber meal can be used as fish feed. We are currently working closely with *B. carinata* breeders at Agriculture and Agri-Food Canada, Saskatoon, to make sure that we can cross many of our oil-quality enhanced traits into their elite breeding lines.

Some of the many industrial and health-dietary supplement-related uses of VLCFA oils are shown in Table 1 and Tables 2 and 3, respectively. Specifically, the high-VLCFA feedstocks are essential components of new products developed by Paul Berger and associates at Oil Chem Technologies, Inc. (Sugar Land, Texas, USA), which include viscoelastic and high molecular-weight anionic surfactants. Some of these products show great potential in enhanced oil recovery (EOR) strategies as described recently in *inform* (*21*:542–543, 592, 2010).

Most transformation systems for introducing new genes into *B. carinata* rely on *Agrobacterium*-mediated infection of cotyledon (first leaf) petiole tissue with a genetic cassette containing the gene or genes of interest, promoter and terminator elements, and a selectable marker—usually a gene conferring resistance to a specific antibiotic or herbicide. The latter makes it possible to "screen" the putative transgenic petiole pieces for positive incorporation and integration of the cassette into the target plant tissue. Then the positive transgenic tissues are regenerated into whole transgenic plants by growth on root- then shoot-promoting medium and transferred to soil. These were the methods we used to introduce the transgenes into *B. carinata* as described next.

TARGET TRANSGENES AND BIOPRODUCTS

To enhance the 22:1 or 24:1 acid content of *B. carinata* oil, we selected two nontraditional sources of genes encoding ketoacyl-CoA synthases (KCS), the KCS being the first of four enzymes in an elongase complex that ultimately converts 18:1 Δ9 (oleoyl)-CoA to erucoyl-CoA and then nervonoyl-CoA by successive cycling of the complex, with malonyl-CoA providing the two carbons needed for each extension cycle. These gene sources were *Crambe abyssinica* and *Cardamine graeca* (Fig. 1).

When introduced into *B. carinata*, *Crambe KCS* and *Cardamine KCS* genes resulted in seed oils highly enriched in erucic acid and nervonic acid (Figs. 2 and 3, respectively).

OUTLOOK FOR B. *CARINATA* AS A PLATFORM CROP FOR DELIVERY OF BIOPRODUCTS

When considering potential platform crops for the delivery of bio-oils and industrial feedstocks, seed yield and oil and protein content are major considerations. Consequently, the plant must be more efficient in resource utilization than the usual cultivars while maximizing yield. *Brassica carinata* delivers high yields among the Brassicaceae (up to *ca.* 2,500 kg/ha). A key component of any new crop development is the question of whether it contributes positively to sustainable agriculture. This fledgling crop platform can meet or exceed many of the targets for sustainable agriculture. Specifically:

- Plant-produced VLCFA oils provide renewable, biodegradable, non-fossil fuel feedstocks for the production of polymers, plastics, waxes, pharmaceutical and nutraceutical oils.
- For example, high nervonic acid oil from *B. carinata* can find direct applications equally in polymers, paving substances, and surfactants for oil recovery/reclamation products, as well as potential new products for enhancing infant nutrition and fighting the symptoms of neurodegenerative diseases.
- *Brassica carinata* is well suited for growing in the drier southern regions of western Canada.
- Creation of a new crop platform adds genetic diversity. It creates a new delivery system for bioindustrial and pharmaceutical oils

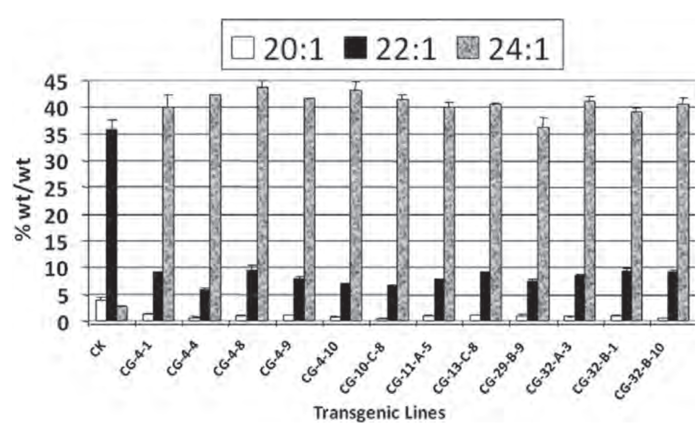

FIG. 3. *Fatty acid composition of T_3 seed oil of transgenic* B. carinata *transformed with the* Cardamine graeca KCS *gene. Proportions of 20:1 (white bars), 22:1 (black bars), and 24:1 (grey marbled bars) in seed oils from empty plasmid-only transgenic control line (CK), and the twelve best* B. carinata *T_3 transgenic lines (lines CG-4-1 through CG-32-B-10) expressing the* C. graeca KCS *gene (CG) under control of the seed-specific napin promoter.*

that do not impact/compete with the food sector, specifically canola.

- Growing *B. carinata* in areas not suitable for canola means that one is adding a new oilseed to crop rotations in those areas.
- *Brassica carinata* requires fewer inputs owing to its natural resistance to drought and blackleg; more robust architecture means crop stands are able to better compete with weeds.
- *Brassica carinata* provides the grower with enhanced yield (kg/ha) compared with other Brassicas (canola) and is therefore an attractive incentive for farmers as it could result in increased returns at the farmgate.
- The unique characteristics of *B. carinata* meal provide new opportunities as feedstocks for plastics and antigen delivery systems; the utility of both oil and meal is essential for complete utilization of the seed products, providing greater sustainability.

In conclusion, as indicated by the two case studies discussed here, *B. carinata* is well suited for genetic engineering, and the generation of transgenics will play a major role in designing this crop for the delivery of VLCFA-enhanced oil feedstocks for bio-products.

information

FOR FURTHER READING:

- Taylor, D.C., Y. Guo, V. Katavic, E. Mietkiewska, T. Francis, and W. Bettger, New seed oils for improved human and animal health and as industrial feedstocks: Genetic manipulation of the Brassicaceae to produce oils enriched in nervonic acid, in *Modification of Seed Composition to Promote Health and Nutrition*, edited by A.B. Krishnan, ASA-CSSA-SSSA Publishing, Madison, Wisconsin, USA, 2009, pp. 219–233.
- Taylor, D.C., K.C. Falk, C.D. Palmer, J. Hammerlindl, V. Babic, E. Mietkiewska, A. Jadhav, E.-F. Marillia, T. Francis, T. Hoffman, E.M. Giblin, V. Katavic, and W.A. Keller, *Brassica carinata*—a new molecular farming platform for delivering bio-industrial oil feedstocks: Case studies of genetic modifications to improve very long-chain fatty acid and oil content in seeds, *Biofuels, Bioproducts and Biorefining 4*:538–561,2010.

David Taylor has been active for 22 years in the field of oilseed biochemistry, biotechnology, and oil modification at the National Research Council of Canada (NRCC) Plant Biotechnology Institute in Saskatoon, Saskatchewan. His research focuses on the creation of value-added oils as industrial feedstocks or for human consumption using biotechnology. He is also actively involved in research to improve the oil content of a number of oilseed crops including canola, Brassica carinata, *and flax. He is a strong advocate for adoption of* B. carinata *as a new platform crop for delivery of customized bioindustrial oils. Email him at David.Taylor@nrc-cnrc.gc.ca. This is NRCC publication no. 50172.*

Formulation engineering: Opportunities and challenges

Edgar J. Acosta

Note: The following article is based on the address given by Edgar J. Acosta, the 2010 AOCS Young Scientist Research Award winner, at the 2010 AOCS Annual Meeting & Expo, held in Phoenix, Arizona, USA, May 16–19.

Systems containing surfactants, oil, and water (SOW) are relevant to our everyday life. They are involved in the emulsification of fats and oils in the intestine by naturally occurring surfactants (bile salts); in the removal of oily stains by detergents and hard surface cleaners; in the formulation of delivery systems for drugs, nutraceuticals, and agricultural chemicals; in paints; in cosmetics; and in the formulation of oil dispersants and other remediation technologies.

The formulation of SOW products and processes typically involves selecting the ingredients (e.g., surfactant type and composition) that would produce the desired performance (e.g., oil removal in detergency or oil solubilization in drug delivery) under a specific set of conditions (e.g., temperature, electrolyte), while guaranteeing that the final product is safe, stable, and appealing. SOW products and processes are designed considering physical, chemical, and biological principles, but the connection between these principles and the final ingredients is still indirect and depends on the experience, and abilities, of the formulator.

Increasing interest in biobased sustainable ingredients and in reducing water, energy, and chemical consumption further constrains the formulation of SOW systems. To address these needs, it is necessary to introduce an engineering approach to formulation. Formulation engineering of SOW systems involves connecting the molecular structure and composition of the ingredients to the properties of the formulation under a set of formulation conditions (which involves thermodynamics), and eventually to the performance of the formulation (involving fluid dynamics, mass and heat transport, and reaction kinetics).

The work of Jean-Louis Salager's group (Laboratorio FIRP [Laboratory of Formulation, Interfaces, Rheology and Processes], Mérida, Venezuela) on the hydrophilic-lipophilic difference (HLD) produced the first quantitative connection among the formulation conditions, the structure of the ingredients, and the type of microemulsion (SOW systems in thermodynamic equilibrium) obtained. The HLD equations, initially developed as empirical correlations in the late 1970s, were later shown to have thermodynamic significance. One of the interpretations of the HLD is that it represents the change in chemical potential when the surfactant partitions from the oil ($\mu_{s,o}$) into the aqueous phase ($\mu_{s,w}$). As an example, the HLD equation for ionic surfactants is presented in Equation 1:

$$\begin{aligned}\mathrm{HLD} &= (\mu_{s,w} - \mu_{s,o})/RT = \\ &\ln(S) - K \times \mathrm{EACN} - a_T \times (T - T_{\mathrm{ref}}) + \mathrm{Cc} - f(A)\end{aligned} \qquad [1]$$

(Equation symbols are defined in the next paragraph.)

Negative values of HLD imply that oil-swollen micelles, Winsor Type I (o/w) microemulsions, are formed. Positive values of HLD imply that water-swollen reverse micelles, Winsor Type II (w/o) microemulsions, are produced. Near-zero values of HLD are characteristic of bicontinuous systems in oil and water that are classified as Winsor Type III (if coexisting with excess oil and water) or Type IV. To illustrate the use of the HLD, consider the formulation of a bicontinuous microemulsion (HLD = 0) with methyl oleate, a biodiesel surrogate that has been found to be as hydrophobic as dodecane (equivalent alkane carbon number, EACN = 12), water containing 1 g NaCl/100 mL (where solubility of electrolyte $S = 1$), at room temperature ($T = T_{\mathrm{ref}} = 25°\mathrm{C}$, where R = Boltzmann constant), in the absence of cosurfactant or cosolvent (where $f(A)$, a function of cosurfactant type/concentration, = 0). In this case, Equation 1 can be used to calculate the required characteristic curvature (Cc) of the surfactant or surfactant mixture. The constants K and a_T can be found in the literature for different surfactants. In this case, using a linear mixing rule for surfactants of similar charge, a mixture of 15 parts (mole basis) sodium dodecyl benzene sulfonate (SDBS; Cc = –0.9, $K = 0.17$, $a_T = 0.01°\mathrm{C}^{-1}$) and 85 parts of Aerosol OT (AOT; Cc

FIG. 1. *Remediation of oil-contaminated soil with methyl oleate (biodiesel surrogate) emulsions prepared with mixtures of Aerosol-OT (AOT) and sodium dodecyl benzene sulfonate in aqueous solutions containing 1 g NaCl/100 mL. Maximum oil removal obtained with 75% (molar basis) of AOT.*

= +2.5, K = 0.17, a_T = 0.01°C^{-1}) can be used to produce a surfactant mixture with the required Cc of 2.0. The reason to formulate at HLD = 0 is because at this condition ultralow interfacial tension (~10^{-3} mN/m) is obtained, which is beneficial in cleaning processes. This SDBS-AOT formulation was used in cleaning oil-contaminated soil using methyl oleate as solvent. The performance of this cleaning formulation is presented in Figure 1 for different compositions of SDBS-AOT. Although the predicted optimal composition was 85 parts of AOT, the best performance was obtained with 75 parts of AOT (darker oil phase, less stable particle suspension), and while not perfect, the HLD produced a reasonable prediction of the optimal formulation.

In the example above we bypassed two connections: the connection between HLD and interfacial tension, and the connection between interfacial tension and the capacity for oil removal. On its own, the HLD does not predict interfacial tension and other properties of microemulsions. To predict microemulsion properties, one must introduce the concepts of net and average curvatures (NAC). The HLD-NAC model was developed using critical scaling theory. Applying this theory requires a scaled thermodynamic variable (the net curvature of the interface), a critical state (the net zero curvature point), the chemical potential difference from a given state and the critical state (the HLD), a scaling exponent (1, justified by Kelvin's curvature equation), and a scaling constant (see Acosta *et al.*, 2003, for details). A new statistical description of curvature was proposed in order to apply this scaling model, whereby any system containing a given volume fraction of oil and water, and a given mass of surfactant (fixed interfacial area), could be described by the average between two coexisting continuum states. In one of the states oil is the internal phase (with a radius R_o) and water the continuous phase, and in the other water is the internal phase (with a radius R_w). The NAC model uses two curvature descriptors; the first is the average curvature Ha = ½($1/R_o + 1/R_w$), and the second is the net curvature Hn = ($1/R_o - 1/R_w$). The inverse of the average curvature describes the size of the microemulsion drop, which can only grow to a maximum value known as the characteristic length (ξ). The net curvature describes the curvature of the interface, and scales to the HLD as Hn = –HLD/L, where the scaling constant, L, was found (experimentally) to be proportional to the length of the surfactant tail group. Recently, Hn for ionic microemulsions has been compared with an expression of curvature derived using double layer theory and it was confirmed that L is approximately equal to the extended length of the surfactant (see Appendix in Kiran and Acosta, 2010).

For a given set of formulation conditions (T, EACN, S, Cc), the HLD-NAC model can be used to predict the radius (R_o or R_w) and solubilization of the internal phase of the microemulsion considering the mass of the continuous phase (water or oil) and the mass of surfactant. Figure 2 illustrates an example where the HLD-NAC model was used to predict oil and water solubilization in lecithin microemulsions. Figure 2 also illustrates the Type II-IV-I transition obtained upon increasing the concentration of the hydrophilic surfactant, sodium octanoate, and a schematic of the coexisting continuum approximation. Furthermore, HLD-NAC can be used to predict interfacial tension, phase transitions, drop shape, density, and the viscosity of microemulsions.

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Briefs

The French Agency for Food, Environmental, and Occupational Health Safety (ANSES) became a legal and operational entity on July 1, 2010. The new agency merges the missions, resources, and personnel of the former French food safety agency and the French agency for environmental and occupational health safety.

■■■

China's soybean imports via the port of Dalian in northeast China maintained rapid growth during the first seven months of 2010, according to the Xinhua Economic News Service. Some 2.5 million metric tons of soybeans were imported through the port, an increase of 35.1% year on year.

In related news, China reportedly was working with authorities in Argentina to establish a bilateral working mechanism for addressing the soy oil trade disputes between the two countries, the Chinese Ministry of Commerce (MOC) told Xinhua in August 2010. At that time, the MOC did not specify when China would resume soy oil imports from Argentina. China suspended soy oil imports from Argentina in March 2010 because of quality issues.

■■■

The University of Northern Iowa's National Ag-Based Lubricant Center (NABL; Waverly, USA) has received a $370,000 grant to conduct a study on the use of biobased products in the freight and passenger rail industry. According to NABL, as much as 10 million pounds (4,500 metric tons) of petroleum-based railroad grease used in the United States could readily be converted to soybean oil-based lubricants each year.

■■■

An undercover investigation found that dietary supplements are being sold fraudulently as part of misleading genetic tests, according to a report published by the US Government Accountability Office (GAO). As part of its investigation, GAO purchased a number of direct-to-consumer genetic

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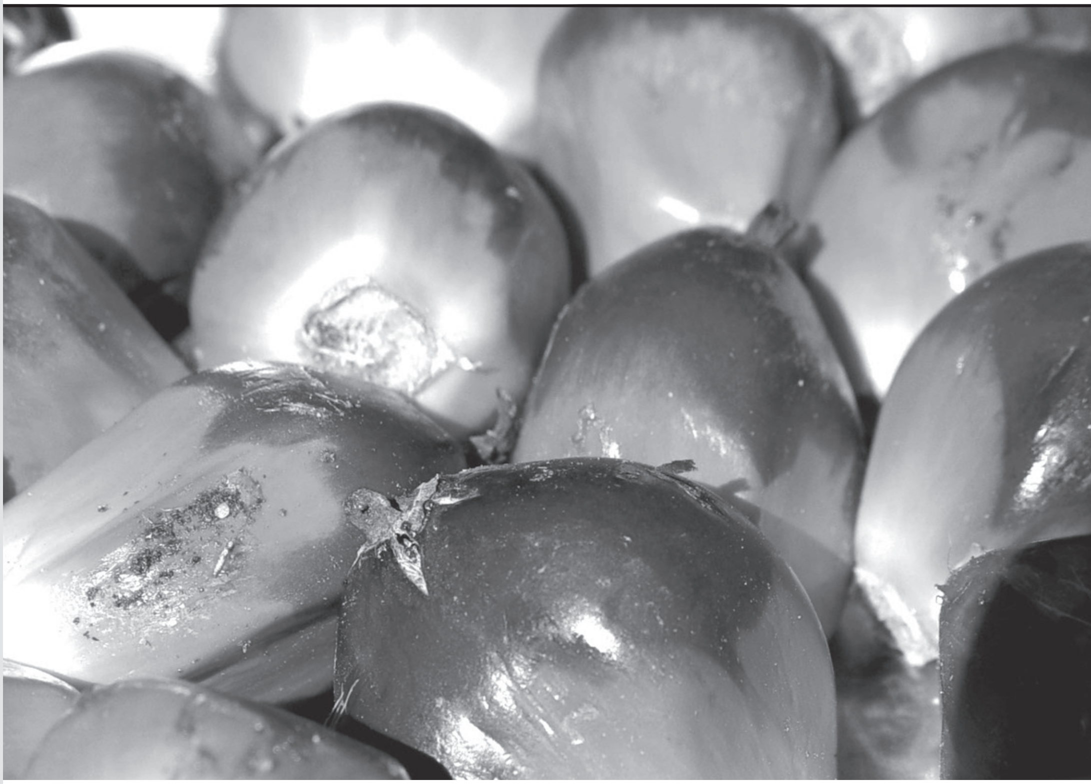
News & Noteworthy



First smallholder sustainability certification

Smallholders at Cargill's oil palm plantation, PT Hindoli, in South Sumatra, Indonesia, have received Roundtable on Sustainable Palm Oil (RSPO) certification. This is the world's first smallholder scheme to be certified under the RSPO's Smallholder Principles and Criteria, according to Cargill.

Smallholder oil palm producers represent roughly 30% of Indonesian and 40% of Malaysian oil palm producers. "The rule of thumb is holdings below 40 hectares are considered smallholders," according to the RSPO website.

Cargill's PT Hindoli's crush mills in South Sumatra process fresh fruit bunches from its owned oil palm estates and the fruit bunches it purchases from the smallholders' scheme. The smallholders' scheme at Cargill plantation consists of 8,800 smallholders organized in 17 cooperatives with 17,594 hectares planted with oil palm. The RSPO smallholder certification by the Executive Board of the RSPO was independently audited by BSi Management Systems.

Cargill's owned palm estates at PT Hindoli received RSPO certification in 2009, and the company is working toward getting RSPO certification for its other palm plantations, PT Harapan Sawit Lestari and PT Indo Sawit Kekal. Cargill's European and Malaysian refineries also have received approval to offer RSPO products. The company has its own policies in place for responsible palm production on its owned plantations, it said, including commitments not to plant on high conservation value forests, not to develop new plantations on deep peat land or land whose use for agriculture would threaten biodiversity, and not to make exceptions to a strict no-burn policy for land preparation.

Cargill's refined oils business and its PT Hindoli palm plantation have recently received official certification for its sustainable palm oil supply chain according to the International Sustainability and Carbon Certification standards—which the company said is the world's first palm oil plantation to receive such certification.

In addition, in July 2010 Cargill announced a collaboration with the World Wildlife Fund–US (WWF) to undertake an assessment of its palm oil suppliers in Indonesia as part of its continued commitment to sustainable palm oil production. The tests that claimed to identify which health conditions buyers risked developing. As part of the sale, the marketers of these tests offer "personalized" dietary supplements to help prevent the onset of these conditions. A full copy of the report is available at www.gao.gov/new.items/d10847t.pdf.

■■■

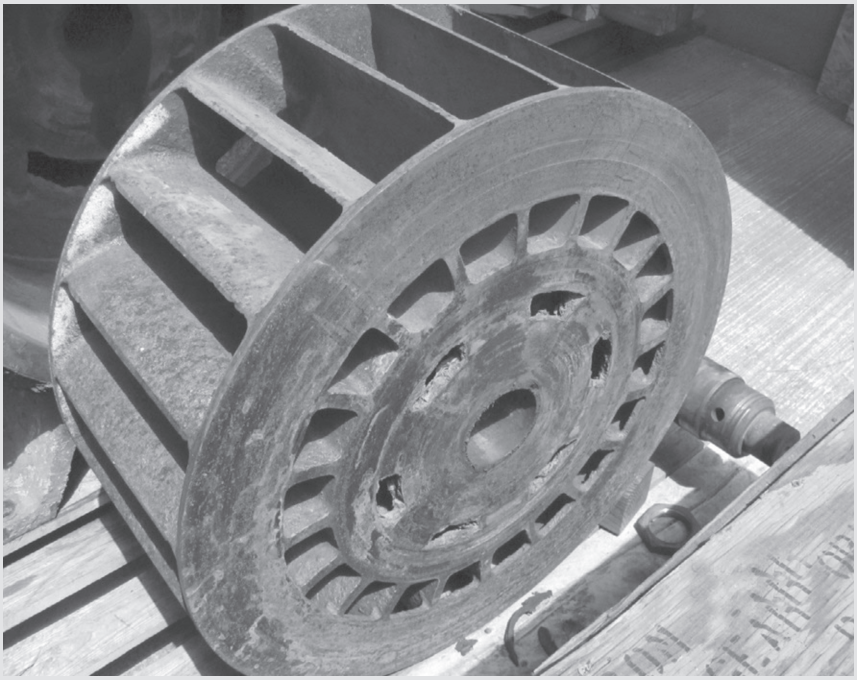
Sustainability experts Paul T. Anastas and Julie B. Zimmerman (www.sustainabilityatoz.com) have recognized Cognis' commitment to sustainable development by certifying the company's "Green Carrier Management Tool" for compliance with the 24 Principles of Green Chemistry and Green Engineering, according to Cognis. The tool is designed to check that the company's products and processes are aligned with these principles. (Anastas currently is science advisor and assistant administrator for the Office of Research and Development and science advisor at the US Environmental Protection Agency. Zimmerman is an assistant professor with the Department of Chemical Engineering, Environmental Engineering Program and the School of Forestry and Environment at Yale University in New Haven, Connecticut, USA.) ■

What is the retirement age for a pump?

Like people, most liquid ring vacuum pumps retire after 30 or 40 years. They get tired, or the younger generation takes over. This Nash Hytor #6 pump (below), however, worked for 82 years before giving way to a younger model.

The #6 pump worked on the paper pulp dryer machine at the Simpson Tacoma Kraft Co. (Washington, USA). Built in 1928 by the Union Bag Co., the #6 was there from the start. During its 82 years of employment, the pump has seen the company change hands a number of times, but it kept on doing its job. Until old age finally caught up with it, that is.

Meanwhile, the manufacturer of the pump, Gardner Denver Nash, is running a contest to see what other elderly pumps are still in operation. For more information, see www.GDNash.com/oldestpump.aspx.



assessment will help gauge current progress among Cargill's suppliers to implement the principles and criteria established by the RSPO.

Researcher tackles aflatoxin poisoning in Africa

Despite a bumper harvest of maize [corn] just a few months ago, many residents in the eastern part of Kenya are facing hunger and starvation. While granaries in the region may be full, the grain cannot be sold, let alone be eaten.

"It is said to be contaminated. Government experts have warned us that it has aflatoxins," said Judith Mwende from Mutomo village, in the Kitui district in east Kenya.

Aflatoxins, locally known in the region as mbuka, have affected nearly all the residents of Kenya's Eastern Province. [Aflatoxins are toxic as well as carcinogenic compounds produced by the fungal genus *Aspergillus* that colonize maize and groundnuts, among other crops. It is poisonous to humans and animals.]

With tears rolling down her cheeks, Mwende recalls how she lost her mother and daughter six years ago. They were just two of the 123 residents in the area who died after they consumed aflatoxin-contaminated maize in 2004.

"When we harvested it, we thought it was food. Little did we know it was poison. And now here it comes again. We planted maize for food, yet what we have is poisonous stuff in our granaries," said the middle-aged mother of three, who is among several other seasonal farmers in the area. Mwende only plants crops when the rains come, and in this area, rainfall has been elusive; after three years of drought it only rained in this region in 2009.

The plight of Mwende and other farmers like her is the reason why one woman has decided to try to find a way to combat the fungal contamination.

Sheila Okoth, a Kenyan research scientist, is in the process of finding a sustainable solution to fungal contamination and mycotoxin production in foods, including aflatoxins. She leads an interdisciplinary and farmer participatory project on Conservation and Sustainable Management of Belowground Biodiversity (CSM-BGBD).

"We are assessing all the avenues for a locally acceptable and effective method of controlling the contamination," said Okoth.

Her quest to find a solution for fungal contamination comes after research findings revealed that African countries do not have cost-effective technologies that can be used to reduce the risk of human and animal exposure to aflatoxin contamination.

The International Food Policy Research Institute (IFPRI) has also launched a research project to find cost-effective methods of handling aflatoxin contaminations. According to Felicia Wu, an IFPRI researcher and assistant professor at the University of Pittsburgh (Pennsylvania, USA), there is little awareness of aflatoxin contamination in Africa. And knowledge about technologies to reduce it is extremely limited.

Currently, there is no procedure that can combat aflatoxins after they have been produced. However, irrigation during pollination has been shown to reduce the levels of infection. Harvesting corn early and then drying it quickly has also reduced the lifespan of the aflatoxin-causing fungus. Developed countries like the United States have installed common drying systems that are easily controlled and monitored.

The CSM-BGBD project has to date come up with biological control methods (fungi that prey on fungi that cause plant diseases) to combat the *Fusarium* sp. fungus that causes food poisoning.

"I have to develop biocontrol methods that would be more cost effective and sustainable especially in Kenya," said Okoth, who is currently at the University of Stellenbosch in South Africa on a fellowship sponsored by the African Women in Agricultural Research and Development program.

In collaboration with the university's Department of Plant Pathology, Okoth is studying possibilities of developing aflatoxin-resistant maize lines. "I am determined to be part of the solution to a problem that makes poor farmers even poorer," she said.

Aflatoxin contamination is a common problem all over the world. But since its accumulation is highly dependent on the prevailing weather conditions, the burden in Africa has been enhanced by climate change. This year's aflatoxin-contaminated harvest in Kenya came following the 2009/2010 flooding, which severely affected the region after a three-year drought.

"We cannot afford to run away from such challenges. We have to (tackle) them head on," said Okoth.

Together with South African experts, Okoth is in the process of identifying fungi that can prey on aflatoxins. If it works, it will be used as a bio-control method for the poisonous fungi.

"We are making good progress. And in five weeks' time, we hope to start trials of the bio-control method in Kenya," she said.

She also hopes to come up with postharvest techniques ideal to local farmers. "The most important thing to do is to accurately identify the fungi, and factors leading to toxigenic strain dominance. After this, the next step is to develop management procedures" said Okoth.

In Africa, Kenya and Mali have been most affected by aflatoxin contamination. While contaminated maize is being destroyed by the Kenyan government, not everyone wants to see their grain destroyed. In Kwamonga village in Mwala, Kenya, Eunice Mutinda is still holding onto her produce. She does not want to sell it off to the government's Cereal and Produce Board at a drastically reduced price.

CONTINUED ON PAGE 613

Acquisitions/ mergers

Kerry Group of Tralee, Ireland, has acquired Lancashire, UK-based infused oils maker Springthyme Oils, according to FoodManufacture.co.uk. "Springthyme recently scored an industry first with the development of unusual semisolid infused fats (bakery shortenings) that have been heated up, infused with fresh herbs and spices, and then cooled down again," the site noted.

Commodities

CACAO/CHOCOLATE

Nestlé chocolate products recorded double-digit growth in emerging markets, AP-FoodTechnology.com reported in August 2010, driven partly by the performance of the lowest-priced products in its portfolio. The company said revenue climbed 5.9% from the same period a year ago, noting strong performances for the group in the South Asia region, including India, Vietnam, Thailand, Indonesia, and China, as well as gains in the Central/West Africa region. Growth in Oceania and Japan, however, was flat.

CANOLA/RAPESEED OIL

"Poorer quality of 2010 new rapeseed, lowered oil production rate, coupled with insufficient oil storage capacity and sluggish rapeseed meal prices, will push up the cost of storage" in China, according to the Xinhua Economic News Service. Further, "[A]ffected by droughts, China saw declining rapeseed production and quality this year. The rate of oil production per metric ton of rapeseed has [been] reduced by one to two percentage points to 33–35%."

COCONUT OIL

Philippine coconut oil production in 2010 has increased for the third year in a row "and will probably reach the second-highest level on record," according to the Oil World ISTA Mielke GmbH forecasting service. "Following a long period of above-average yields, the productivity of coconut trees will inevitably suffer a setback next season."

FISH OIL/MEAL

Peruvian fish meal producer **Copeinca ASA** reported lower production during the first half of 2010 because of a moderate "El Niño" event during January and February 2010. The company also noted that it is constructing three new vessels that are expected to be launched in 2011.

■■■

Cultivated *Laminaria digitata* (brown kelp) has been grown "very successfully" on heavy fishing lines in Roaring Water Bay, Southwest Ireland, according to the Irish Fisheries Board BIM (Bord Iascaigh Mhara). The pending harvest will be the first to be undertaken on a pilot scale in Europe. Two red seaweeds with potential nutritional benefits, *Palmaria palmata* and *Porphyro* sp., are also being cultivated in the trial. Seaweed holds "great potential" as a functional ingredient, according to www.nutraingredients.com.

OLIVE OIL

A new study looks at the phenolic profiles of two different virgin olive oils after heating treatments by microwave or conventional oven. "The only compounds that showed a clear increase with heating, in particular by conventional oven, were the dialdehydic form of elenolic acid (EDA) and *p*-hydroxyphenylethanol linked to the dialdehydic form of elenolic acid (*p*-HPEA-EDA)." The researchers concluded, "The results showed a good agreement of these two high-resolution techniques." The findings appeared in the *Journal of Agricultural and Food Chemistry* (*58*:8158–8166, 2010).

PALM OIL

Cargill announced in July 2010 that it will supply Unilever's European operations with 10,000 metric tons of fully segregated refined palm oil certified by the RSPO. (Whether that is an annual figure or over another time period was not released.)

■■■

From the second quarter of 2010 forward, **Unilever** will source fully segregated sustainable palm oil from Malaysia's **IOI Group**. The oil is 100% traceable, all the way back to the plantation, and certified by the standards of the Roundtable on Sustainable Palm Oil (RSPO) as part of a multiyear agreement signed by both companies. Unilever said it plans to achieve 100% sustainably sourced palm oil by 2015 and that more than 35% of its supply already is RSPO-certified.

SOY OIL/PROTEIN

The **European Food Safety Authority (EFSA)** has rejected an application for a health claim for soy protein and cholesterol reduction. The application was made by **HarlandHall Ltd.** on behalf of the Soya Protein Association, the European Vegetable Protein Federation, and the European Natural Soyfood Manufacturers Association. The complete scientific opinion is available at http://tinyurl.com/EFSASoy.

■■■

DelTron, Inc. (Garden Grove, California, USA) says that sales of its high-performance soy-based polyurethane wheels for skateboards have increased "substantially." The wheels are manufactured by DelTron's wholly owned subsidiary, Elasco, Inc.

■■■

Israel's **Solbar Industries Ltd.** is expanding its US operations by purchasing a manufacturing facility, Green Planet Farms, in South Sioux City, Nebraska, for $5.5 million. Solbar said in its announcement that it intended "to produce at the plant the advanced products that it had lately produced for the US market, and at the same time to meet the developing demand for the proteins as the sole supplier of these products in the US."

SUNFLOWER OIL

Small sunflowerseed producers in Mexico will obtain up to 2,000 microloans from Agrofinanzas S.A., a local financial institution, with support from a partial credit guarantee of up to $5 million from the Inter-American Development Bank (IDB). The operation is part of a supply chain project, which includes the commitment of the food & beverage company PepsiCo Mexico to purchase the production of sunflower oil produced by the network of small farmers. ■

The government offered to purchase all the contaminated maize harvested from the region at less than half the market price, in order to destroy it. But it is something Mutinda does not want to do. So instead, she has mobilized 38 female farmers to store their produce in a common cereal bank.

"We have heard of aflatoxin contamination in cereals found within our province. But we cannot afford to lose our produce before it is properly analyzed. Not after enduring a long starvation period," said Mutinda referring to the three-year drought that proceeded the 2009/2010 flooding.

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New science blog aggregator

Scienceblogs.com has for four years been one of the biggest and most popular science blogging networks in the world.

"For many people, The Last 24 Hours page at Scienceblogs.com was their browser's homepage," writes Bora Zivokovic in his blog. "They would start their day by checking the page out, to see what is new in the world of science. That page was a one-stop-shopping page for all things science-bloggy."

Now comes http://Scienceblogging.org, which aggregates RSS (Really Simple Syndication) feeds from science blogging networks, group blogs, aggregators, and services. "As the site develops further, it will also encompass other online (and offline) science communication efforts, including Twitter feeds, links to major scientific journals and magazines, ScienceOnline annual conference, and the Open Laboratory annual anthology of the best writing on science, nature, and medical blogs," Zivokovic says.

USB/Soy Checkoff pass inspection

The Office of Inspector General (OIG) of the US Department of Agriculture found insufficient evidence to support charges brought by the American Soybean Association (ASA) against the United Soybean Board (USB), the US Soybean Export Council (USSEC), and the Washington, DC-based law firm representing both USB and USSEC.

"It is our conclusion that we found insufficient evidence to support ASA's allegations; although we do recommend closer oversight by USB of USSEC, in the future. This concludes our review of the matter," wrote OIG Inspector General Phyllis Fong in a letter sent to Sen. Charles Grassley (Republican-Iowa). Grassley officially submitted the ASA petition for an investigation in January 2009.

Fong also noted that most of the charges either had been dealt with appropriately or were outside of the OIG's authority. The entire letter is available at http://tinyurl.com/OIGsoy.

In a statement, the farmer-leaders of the USB/Soybean Checkoff said they "are encouraged that the OIG found no basis for any of the allegations regarding USB operations. The OIG report speaks for itself."

The ASA, for its part, stated that it "is pleased that the OIG has completed its review and found that the soybean checkoff is operating as it should. We are pleased that we can put this issue behind our industry."

CONTINUED ON PAGE 652

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I hereby subscribe to the above Code of Ethics. Signature of Applicant ______

Briefs

The Biofuel Research Centre of Edinburgh's Napier University announced in August the filing of a patent for a new biofuel made from whisky by-products. Diageo's Glenkinchie Distillery in Tranent, East Lothian, which makes single malt whisky, supplied materials for experiments leading to the application. Two main by-products—"pot ale," the liquid from the copper stills, and "draff," the spent grains—were used as feedstocks in developing a process to produce butanol, which then can be added to gasoline or diesel at a level of 5–10%. The whisky industry produces 1.6 billion liters of pot ale and 187,000 metric tons of draff annually. The university plans to create a spin-off company to develop the fuel for commercial sale.

■■■

In a panel discussion held during the Center for Automotive Research 2010 Management Briefing Seminars (August 2–5, 2010; Traverse City, Michigan, USA), Johannes-Joerg Rueger, senior vice president of diesel engineering for global parts supplier Robert Bosch LLC, predicted that internal combustion engines will hold 80% market share through 2020.

■■■

The largest soy exporter in Argentina, Cargill (Minneapolis, Minnesota, USA), announced in August that it is investing $113.6 million to build a biodiesel plant and an electricity generator in Argentina. Both projects will be sited in Villa Gobernador Galvez in the province of Sante Fe, next to a Cargill port terminal and Cargill's 13,000 metric-tons-per-day soy processing plant. Both are scheduled to come online in September 2011. The biodiesel plant is being designed to produce 240,000 tons annually. According to the company, as cited by the *Latin American Herald Tribune* (August 12), more than 90% of the production of the new plant is destined for export to markets in Europe, Asia, South America, and Africa.

■■■

CONTINUED ON NEXT PAGE

Biofuels News

GENERAL

FreeWays to Fuel

In 2007, the state of Utah (USA) Department of Transportation (UDOT), in cooperation with Utah State University (USU), initiated a project to use non-traditional agronomic lands—such as roadside rights-of-way, military bases, and airports—for the growth of biofuel feedstock crops. The underlying premise of the idea, as explained by its initiator Dallas Hanks, a doctoral student at USU, was that nearly all highway areas (in the United States) have monetary costs for maintenance. UDOT estimated its highway mowing and weed-spraying costs in 2006 were $300 per mile ($186 per kilometer). Growing biofuel crops could improve efficiency and produce cleaner burning fuel for the state's transportation fleet.

The idea caught on, and 10 land-grant universities formed the FreeWays to Fuel National Alliance (www.freewaystofuel.org): Utah State University, Washington State University, University of Idaho, Montana State University, Iowa State University, Michigan State University, North Carolina State University (NCSU), Auburn University, Penn State University, and the State College of New York-Cobleskill.

Utah produced its first economically viable harvest in 2009, breaking even on what it otherwise would have paid to mow the test plots on which the experiment was conducted. But before that, project participants in Utah had to solve start-up problems, including determining what oilseed crops would grow best in Utah's dry climate; safflower, canola, and camelina were the winners.

The North Carolina Department of Transportation, working with NCSU, is also moving ahead with plans to grow biofuel feedstock crops on state highways. In 2009, the NCDOT and NCSU ran experiments with sunflowers, producing yields of about 550 pounds of sunflower seed per acre (615 kg/ha), which is equivalent to about 40 gallons of biodiesel from each acre of sunflowers (370 liters per hectare). They also ran trials with canola in the winter of 2009–2010. Among other things, the amount of tillage and quantities of herbicide and fertilizer necessary for good crop production must be determined.

New York City has adopted legislation requiring all heating oil sold from October 2012 to include at least 2% biodiesel. The city uses more than a billion gallons of heating oil each year. Thus 20 million gallons (~80 million liters) of biodiesel will be consumed annually in the city.

■■■

The Toro Company, of Bloomington, Minnesota, USA, has recalled about 38,000 single-stage snow blowers in the United States and Canada, after reports of carburetor leaks. The company said exposure to ethanol in gasoline can corrode the carburetor needle in these machines. In turn, the corroded needle can stick in the open position and allow fuel to leak, posing a fire hazard to consumers.

■■■

In August a research team co-led by scientists associated with the J. Craig Venter Institute and the Institute for Genome Sciences of the University of Maryland School of Medicine (Baltimore, USA) published the sequence and analysis of the castor bean (*Ricinius communis*) genome in *Nature Biotechnology* (doi:10.1038/nbt.1674). The genome has an estimated 31,237 genes. Particular effort was devoted to identifying genes involved in the production and storage of oils in the castor bean and in ricin production. The analyses could allow for genetic engineering of castor bean to produce oil without ricin.

■■■

The United States Environmental Protection Agency was expected to rule in October whether to approve a petition to increase the blend of ethanol in gasoline from E10 (10% ethanol, 90% gasoline) to E15. Pursuant to the possible increase, the EPA proposed requiring labels on gasoline pumps selling E15 "to ensure that consumers do not fuel their vehicles or engines with unapproved fuels." On September 21, Reuters quoted analyst Mark McMinimy, senior vice president of Washington Research Group, as saying "[This label proposal] sounds like what you would expect if EPA was moving toward some kind of limited approval for E15." ■

North Carolina mows its roadsides three to five times a year, costing about $18 million, according to Ted Sherrod, an environmental field operations engineer with the NCDOT (*Charlotte Observer*, August 8, 2010). The state wants to plant a crop that can produce enough biodiesel to offset the time and fuel costs of mowing.

The concept of using roadsides for agriculture is not necessarily new. For example, Kansas, among other states, has used its rights-of-way to produce hay for decades. The *Fayette Observer* (North Carolina) reported on July 5 that Minnesota, Wisconsin, and Tennessee are also exploring the possibility of growing crops for biofuels on highway rights-of-way.

BIODIESEL

EC reopens investigation of biodiesel imports

Following allegations by the European Biodiesel Board (EBB) in June, the European Commission (EC) initiated an anti-circumvention investigation of US biodiesel exports to the European Union (EU).

The EBB has long contended that US biodiesel manufacturers are dumping their products on the European market. These complaints culminated in March 2009 with the EU imposition for five years of extensive anti-dumping and countervailing measures on imports of US biodiesel (see *inform* *20*:219, 2009; *21*:556–557, 2010).

According to an EBB statement released August 12, "Soon after March 2009, new patterns in the transatlantic biodiesel trade emerged, with US biodiesel being increasingly exported to the EU via third countries, in particular Canada and Singapore, in order to fraudulently conceal its US origin. In parallel, important volumes of US biodiesel are still being exported directly to the EU in the form of blends not covered by the EU duties (typically B19). These practices do not reflect normal commercial practice but are a mere attempt to evade the anti-dumping and countervailing duties."

The EBB said this investigation is crucial to ensure the maintenance of the remedial effects of EU duties on US B99. This circumvention may represent more than €100 million ($128 million) of unpaid import duties, according to EBB estimates.

Supercritical/solid catalyst for making biodiesel

Discarded and environmentally unfriendly wastes can be converted into biodiesel using a supercritical/solid catalyst (SSC). Idaho National Laboratory (Idaho Falls, USA) scientists Dan Ginosar, Bob Fox, Lucia Petkovic, and Dan Wendt worked to find ways to create liquid fuels from a variety of waste streams, including municipal wastewater and food processing waste. Using this SSC entails mixing fat or oil feedstock with supercritical fluid solvents and alcohols at specific temperatures and pressures to completely dissolve the materials in a single supercritical phase. This approach overcomes a key barrier—the polar liquid phase—in conventional biodiesel production, which requires multiple steps.

R&D Magazine chose this technology in July for one of its R&D 100 Awards for 2010. Since 1963, the R&D 100 Awards have identified revolutionary technologies newly introduced to the market. Recipients of the awards will be recognized at a dinner in November.

Europe accused of discriminating against palm oil

In a talk presented on August 4 at the Palm Oil Leadership Award 2010 Event, entitled "The Moral Case of Palm Oil," Fredrik Erixon considered "European Green Protectionism in the Biofuels Sector: A Case for the WTO?" The event was organized by the Malaysian Palm Oil Council

Erixon, who is director and chief executive of the European Centre for International Political Economy (Brussels, Belgium), contended that Malaysia has a strong case against the requirements of the European Union's Renewable Energy Directive (EU RED) for palm oil use as biofuel if it should choose to file a discrimination claim with the World Trade Organisation (WTO).

Palm oil advocates (e.g., http://palmhugger.org) argue that "it is certainly not inconceivable that the source of funds for . . . anti-palm oil activism by green groups like Greenpeace and Friends of the Earth would have come from parties that would want palm oil's inexorable growth on the world market to be checked."

Advocates also point out that palm oil is much more productive than other edible oil-producing plants such as rape and soybean, producing as much as 10 times the oil yield of its nearest competitor. (By-products such as soybean meal seem not to be included in this equation, however.) Another point in favor of palm oil is that the trees, which are perennials, have a productive life span of 20–30 years, unlike annuals such as soybean.

According to Erixon, Europe is campaigning to regulate forests and forestry, and the European Union (EU) is targeting biodiesel production. He said, "Previous regulations addressed product-quality standards," whereas "New regulations focus on process and production methodology."

As one of his conclusions, Erixon said, "It is not a coincidence that the EU designs a standard that will give EU rapeseed oil producers the protection they need to have to expand (and subsidies and tariffs cannot give) and utilize invested capital by blocking possible expansion for palm oil, the main competitor to rapeseed oil."

An outline of Erixon's talk may be downloaded at http://tinyurl.com/2c3umod.

Laboratory completes BQ-9000 accreditation

The Iowa Central Fuel Testing Laboratory (ICFTL) in Fort Dodge, Iowa, USA became the first to complete accreditation as a BQ-9000 laboratory at the end of the second quarter, 2010. BQ-9000 is a voluntary biodiesel quality assurance program overseen by the National Biodiesel Accreditation Commission (Jefferson City, Missouri, USA). The program is a combination of the ASTM standard for biodiesel, ASTM D6751, and a quality systems program that includes storage, sampling, testing, blending, shipping, distribution, and fuel management practices.

In a statement from the National Biodiesel Board (NBB), Don Heck, director of ICFTL, was quoted as saying that achieving this accreditation was attributable to the lab's desire to earn the business of the Iowa Department of Agriculture's Weights and Measures Bureau. The agency is charged with monitoring fuel quality, including biodiesel; and it is required by law to work with an accredited facility for testing fuel from retail pumps.

The NBB reports that 62 biodiesel producers and marketers are now BQ-9000 certified, representing 75–80% of the US biodiesel production volume.

JATROPHA

SG Biofuels expands jatropha R&D

SG Biofuels, Inc. (San Diego, California, USA), a bioenergy crop company developing elite seeds of *Jatropha curcas*, announced plans in August to construct a 42,000 square foot (3,900 square meter) greenhouse in San Diego. Research and development (R&D) on the company's large and diverse collection of *Jatropha* genetic material will be carried out there.

The greenhouse space will help accommodate the company's expanding library of *Jatropha* genetic resources, which now includes more than 6,000 unique genotypes and an array of genetic traits, including traits important for enhanced fruit yield, soil adaptation, and improved harvesting. In late February, SG Biofuels introduced its first elite jatropha cultivar—JMax 100—with projected yields 100% greater than existing commercial varieties of the crop (*inform 21*:221–222, 2010).

Jatropha in space

Vecenergy, a company located in West Palm Beach, Florida, USA, is working with mutant jatropha plants to see how they produce oil. The company, in cooperation with the University of Florida-Gainesville, sent jatropha specimens prepared at the Kennedy Space Center to the International Space Station in February and again in May, to be exposed to microgravity, which activates dormant genes.

Eighty-six jatropha samples remain in orbit on the station, but 72 samples have returned to earth and are growing into plants that may exhibit special characteristics released from their genes by microgravity.

The researchers hope to develop a strain or strains of jatropha that grow to a standard size, produce more oil, tolerate dry weather, and ripen uniformly.

According to *Florida Today* (August 24), several large growers have expressed an interest in the plant. James Fletcher, director of the Brevard County Extension office, said, "If we could get to where we had some markets, you would probably be looking at some of the older orange groves that aren't being tended being planted in jatropha."

ETHANOL

European ethanol production/ consumption in 2009

In a report released in the third quarter of 2010, the European Bioethanol Fuel Association said the European Union (EU) production of ethanol in 2009 was 3.7 billion liters, up from 2.8 billion liters in 2008. The biggest single producer was France, at 1,250 million liters in 2009, an increase of 25% over 2008. The second-largest producer was Germany, followed by Spain as third.

Total EU consumption of fuel ethanol in 2009 was about 4.3 billion liters, up from 3.5 billion liters in 2008. Germany consumed the most, at 1,143 million liters, followed by France (799 million liters) and Sweden (377 million liters).

Brazil was the most important importer of ethanol to Europe, but there were also strong increases in ethanol imports from Nicaragua, Costa Rica, and the United States. EU import statistics do not distinguish between ethanol imports by end use, so it is not possible to tell how much of the imported ethanol went into fuel.

The entire report may be downloaded at www.ebio.org/press_releases.php.

POET starts biomass harvest

Project Liberty Biomass Kickoff was held August 17 at POET Biorefining in Emmetsburg, Iowa, USA. Farmers and POET officers and employees celebrated the impending collection and delivery of 56,000 tons (51,000 metric tons) of baled corn cobs and light stover in the first commercial harvest for Project Liberty.

Eighty-five farmers in the Emmetsburg area signed up to participate in this project. Through the Farm Service Agency of the US Department of Agriculture, the Biomass Crop Assistance Program (BCAP) will provide an incentive program that goes directly to farmers that harvest biomass for biofuels. It is a dollar-for-dollar match up to $5 per ton. POET hopes to enlist another 100 farmers next year to increase the amount of feedstock available for processing into cellulosic ethanol. Area farmers have already received $100,000 in incentive payments to establish the new harvest system on their farms.

Biomass harvested for Project Liberty will come to a new biomass storage facility in Emmetsburg, which is currently under construction. The 22-acre site will have the capacity to house 23,000 tons (21,000 metric tons) of biomass bales. According to a statement from POET, removing approximately one ton of biomass out of the average 4.26 tons available per acre from a field of corn will not require any drastic changes in fertilizer management for producers choosing to participate in the program.

Construction of the planned 25 million gallons (95 million liters) per year cellulosic ethanol plant, the ultimate goal of Project Liberty, is slated to begin in early 2012 pending approval of a loan guarantee from the US Department of Energy.

RENEWABLE DIESEL

Renewable diesel's advantages touted

In a conference call with investors summarizing second-quarter activities of Syntroleum, Jeff Bigger, senior vice president of business development, discussed the ongoing commissioning of its Geismar, Louisiana (USA) site, a joint venture with Tyson Foods operating under the name Dynamic Fuels (see *inform 21*:559, 2010). Among other things, he said, "Our renewable diesel has greater ability to penetrate a broader range of markets at lower handling and transportation costs compared to biodiesel because of its ability to utilize existing infrastructure. We're in the process of qualifying renewable diesel for shipment on pipelines, first in segregated batches and ultimately as a blend with petroleum diesel. We expect approval for shipment on certain key pipelines in segregated batches by the end of this year, and approval for shipments of blended batches in early 2011."

He added, "Our long-term marketing plan includes niche markets that value cold flow properties and reduce tailpipe emissions. Cold flow markets include northern states such as Minnesota and Illinois, and export markets such as Canada and Europe. We are also exploring markets with severe emission restrictions, such as underground mines."

ALGAE

Powdered algae proposed as jet fuel

Compact Contractors for America (CCA), based in Cedar City, Utah (USA), announced in August the initial sale of an undisclosed amount of powdered algae jet fuel to the US Air Force Research Laboratory at the end of July 2010. It will be evaluated as a solid fuel propellant for aircraft engines or aero-derivative gas turbine power systems.

Dry process biofuels are essentially powders that can be fluidized and combusted (http://algaeaviationfuel.com). Dry process fuels have been around for a long time—consider pulverized coal power plants. And running engines on burnable powders is a recognized technology. CCA claims, however, to have identified the most effective feedstocks, processing methodology, and fuel delivery process to make dry process biofuels scalable to military operations.

PetroAlgae plans IPO

PetroAlgae, located in Melbourne, Florida, USA, plans to raise up to $200 million in an initial public offering (IPO), according to a report on August 22 in the newspaper *Florida Today* (Brevard County). The report also indicated that skeptics were expressing misgivings, in part because the company's main product is just a patented technique to accelerate the growth of algae that would ultimately be used as a source of protein and of biodiesel.

The four-year-old company plans to license its technology to others, who will sell the protein and biofuel products they generate with that technology. PetroAlgae will not itself manufacture a product.

Patrick Peterson, author of the *Florida Today* piece, wrote: "Several financial commentators . . . complain that the company has no revenue and that in the place of income, it relies too heavily on five memoranda of understanding with clients who promise to pay royalties if they use PetroAlgae's technology."

Another biofuel from algae

Over the past five years, researchers at Old Dominion University (ODU; Norfolk, Virginia, USA) have found ways to cultivate and harvest microalgae, then convert them into biodiesel in a one-step process. They now hope to patent another process that produces an algae-based liquid similar to crude oil. Patrick Hatcher of ODU, director of the project, said the new oil can be refined into gasoline and jet fuel, as well as diesel fuel.

Furthermore, the new oil is derived from a biopolymer called algaenan, which is located in the algal cell wall, and not from the fatty lipids that are extracted for biodiesel. Hatcher believes the biopolymer is a type of polyester. According to a statement from ODU, algaenan is "similar to a skeleton or shell" that enables algae to show up in the fossil record." Not all algae contain algaenan.

Scenedesmus spp., the organism with which Hatcher's group works, contains algaenan, although the species was chosen mostly because its lipid content is adequate and is found naturally in Virginia and North Carolina. Algaenan can be pyrolyzed to produce gases that can be condensed into hydrocarbons for use in fuels.

Further information is available at www.odu.edu/ao/news/index.php?todo=details&id=23549. ■

Briefs

Content on the European Food Safety Authority (EFSA) website is now available through RSS (Really Simple Syndication) feeds. To sign up, visit www.efsa.europa.eu/en/rss.htm.

■■■

Omega-3 supplements of the future aimed at controlling blood clots may be formulated differently for males and females if the results of a recent study hold up.

"Interactions between sex hormones and omega-3 fatty acids exist to differentially reduce platelet aggregation. For healthy individuals, males may benefit more from EPA supplementation while females are more responsive to DHA," wrote the researchers, who were led by Monohar Garg of the University of Newcastle in Australia.

The study appeared in *Nutrition, Metabolism and Cardiovascular Diseases* (doi:10.1016/j.numecd.2010.04.012).

■■■

Has the focus on fortifying processed foods with selected micronutrients gone too far? That is the opinion of two Harvard Medical School researchers, Dariush Mozaffarian and David Ludwig. Their commentary ("Dietary Guidelines in the 21st Century—a Time for Food") appeared recently in the *Journal of the American Medical Association 304*:681–682, 2010.

■■■

Twitter increasingly is playing a role in keeping people honest about their diets. Witness Brian Stelter, a writer for *The New York Times*, who credits tweeting about his diet—and the 600 friends and strangers who signed up to follow his progress—for his eventual 70 pound (roughly 32 kilogram) weight loss. Or blogger Drew Magary, who gained attention for what he called the "Public Humiliation Diet." He posted his weight daily on Twitter and lost 60 pounds in five months.

■■■

Japanese researchers reported that high consumption of fish among teenage boys was linked to as much as a 27% decreased risk for depression. The findings did not hold true for teen girls, however. The study appeared in *Pediatrics* (*126*:e623–e630, 2010). ■

Health & Nutrition

Brain training reverses cognitive decline

Specialized brain training targeted at the regions of a rat's brain that process sound reversed many aspects of normal, age-related cognitive decline and improved the health of the brain cells, according to a new study from researchers at the University of California, San Francisco (UCSF; USA).

The results indicate that persons who experience age-related cognitive decline, including slower mental processing and decreased response to new stimuli, might also benefit from specially designed mental exercises.

"From middle age onward, there are universal changes in the brain affecting perceptual processing," said Etienne de Villers-Sidani, a neurologist and post-doctoral fellow with the UCSF Department of Otolaryngology who was the lead author on the study. "We used to think these were permanent changes and now are beginning to think maybe they are not."

The study found that intense auditory training greatly improved sound perception and processing among rats that had previously experienced normal, age-related sensory-processing degradation. Findings appeared in the *Proceedings of the National Academy of Sciences* (doi: 10.1073/pnas.1007885107).

Collaborators Rick C.S. Lin and Kimberly Simpson, along with graduate student Loai Alzghoul at the University of Mississippi Medical Center (UMMC), documented physical changes in the brains of the trained, aging rats. They found that myelin density and neuron health improved in the primary auditory brain regions to nearly the level seen in young rats.

"These results are encouraging because as Baby Boomers age, we will have more and more elderly people," said Lin, a professor of anatomy at the UMMC. "They indicate that you shouldn't just stick to your routine. Challenge yourself and don't stop doing something just because you might take longer at it."

The study builds on extensive previous research in the laboratory of Michael M. Merzenich, UCSF professor of otolaryngology and physiology and senior author on the paper. Merzenich's research had demonstrated how cognitive training can powerfully rewire brain circuits. De Villers-Sidani said he and collaborators are in the first stages of designing programs and figuring out which training strategies will be most effective in humans.

For a month, researchers spent an hour a day giving two groups of rats—young and old—intense auditory training. Two other groups of aging and young rats, used as controls, received no training. Aging rats between 26 and 32 months are equivalent to humans aged 65 to 85, de Villers-Sidani said, an age range at which cognitive and sensory processing have degraded.

Specifically, the researchers targeted the rats' primary auditory cortices, the sound-processing areas of their brains. In their training, rats heard a rapid sequence of six notes, five of the same pitch and one different, oddball pitch. The oddball note came at random on any one of the sequence's final four notes.

When a rat recognized the oddball note, it received a food reward. The researchers progressively upped the difficulty by stepping the oddball's pitch from a half-octave above the base note to ultimately only one-fiftieth of an octave difference. Both young and aging rats steadily improved.

At the end of the month, the researchers used electrophysiology to test for a range of characteristics related to auditory cortex response. In the trained aging rats, they found partial to complete recovery in the ability to discriminate between frequencies. That improvement held true across the entire frequency spectrum on which they had been trained.

Compared with the aging controls, the trained aging rats also showed an improved ability to process successive signals, suppress false-positive responses, and suppress background noise while deciphering novel stimuli, a skill, for example, important to humans trying to hold a conversation in a noisy room.

"One of the most striking findings of this study is that every aspect of sound processing we examined in the aging primary auditory cortex was degraded and then substantially reversed with a simple training strategy," de Villers-Sidani wrote in the study's results.

Post-mortem analysis of the rats' auditory cortices showed surprising physical changes in the aged-trained group.

Lin, who holds a co-appointment in the UMMC Department of Psychiatry and Human Behavior, said the cortices of trained aging rats showed not only an increased number of inhibitory neurons—specialized cells crucial for sensory perception and synaptic plasticity—but also normal-looking inhibitory neurons that resembled those found in young rats.

The untrained aging rats showed on average 25% fewer inhibitory neurons compared with the untrained young rats. Training the aging rats partially reversed that trend. The aging trained rats showed an average 20% increase, while myelin density also improved.

"The neurons looked young again. They were full and robust. It is like [how] a hose without water going through it appears collapsed. Run the water and it expands to its original size. Recovery happens," Lin said. "It indicates the brain is a lot more plastic. The training exercises reopen the hose and the rats recovered almost to the point of young rats."

De Villers-Sidani, who trained as a neurologist at McGill University, Canada, said he became interested in aging and dementia while doing clinical work at the UCSF Memory and Aging Center.

"Since I started my training, I saw hundreds of patients who had difficulty dealing with noisy situations. Almost everyone, if you measure it, experiences declines in visual and auditory-discrimination tasks. That is normal. That is universal," de Villers-Sidani said. "They may be slower to process information or more sensitive to interference, like the patient who, as he aged, had trouble riding his motorcycle on the highway because he couldn't keep track of all the cars around him."

The scientific context was that these changes occur over time and are may not be permanent, de Villers-Sidani said.

"We're arguing that if they're plastic, maybe they're reversible, rather than being permanent," he said. "If you're a violinist you have to practice to keep up your skills. You stop and everyone in the orchestra will notice if you have not practiced for a year. It is the same with the brain. If you don't practice, your brain will degrade into a less precise machine, one less able to process signals."

Age-related cognitive decline is a big concern with people, de Villers-Sidani said.

"If we can sort out what normal brain aging is, then that will help us sort out pathological age-related diseases like Alzheimer's," he said.

The study was funded by a National Institutes of Health Conte grant.

Co-author Xiaoming Zhou, in the School of Life Sciences, Institute of Cognitive Neuroscience, East China Normal University, Shanghai, China, also contributed to the paper.

How berries clean house

Scientists reported the first evidence that eating blueberries, strawberries, and acai berries may help the aging brain stay healthy in a crucial but previously unrecognized way. Their study, presented at the 240th National Meeting of the American Chemical Society (ACS), concluded that berries, and possibly walnuts, activate the brain's natural "housekeeper" mechanism, which cleans up and recycles toxic proteins linked to age-related memory loss and other mental decline.

Shibu Poulose, who presented the report, said previous research suggested that one factor involved in aging is a steady decline in the body's ability to protect itself against inflammation and oxidative damage. This leaves people vulnerable to degenerative brain diseases, heart disease, cancer, and other age-related disorders.

"The good news is that natural compounds called polyphenolics found in fruits, vegetables, and nuts have an antioxidant and anti-inflammatory effect that may protect against age-associated decline," said Poulose, who is with the US Department of Agriculture-Agricultural Research Service (USDA-ARS) Human Nutrition Research Center on Aging in Boston. Poulose did the research with James Joseph, who died June 1. Joseph, who headed the laboratory, pioneered research on the role of antioxidants in fruits and nuts in preventing age-related cognitive decline.

Their past studies, for instance, showed that old laboratory rats fed for two months on diets containing 2% high-antioxidant strawberry, blueberry, or blackberry extract showed a reversal of age-related deficits in nerve function and behavior that involves learning and remembering.

In the new research, Poulose and Joseph focused on another reason why nerve function declines with aging. It involves a reduction in the brain's natural house-cleaning process. Cells called microglia are the housekeepers. In a process called autophagy, they remove and recycle biochemical debris that otherwise would interfere with brain function.

"But in aging, microglia fail to do their work, and debris builds up," Poulose explained. "In addition, the microglia become overactivated and actually begin to damage healthy cells in the brain. Our research suggests that the polyphenolics in berries have a rescuing effect. They seem to restore the normal housekeeping function. These findings are the first to show these effects of berries."

The findings emerged from research in which Joseph and Poulose have tried to detail factors involved in the aging brain's loss of normal housekeeping activity. Using cultures of mouse brain cells, they found that extracts of berries inhibited the action of a protein that shuts down the autophagy process.

Poulose said the study provides further evidence to eat foods rich in polyphenolics. Although berries and walnuts are rich sources, many other fruits and vegetables contain these chemicals—especially those with deep red, orange, or purple colors. Those colors come from pigments known as anthocyanins, which are good antioxidants. He emphasized the importance of consuming the whole fruit, which contains the full range of hundreds of healthful chemicals. Frozen berries, which are available year round, also are excellent sources of polyphenolics, he added.

New evidence that chili pepper ingredient fights fat

Capsaicin, the stuff that gives chili peppers their kick, may cause weight loss and fight fat buildup by triggering certain beneficial protein changes in the body, according to a new study on the topic. The report could lead to new treatments for obesity.

Jong Won Yun and colleagues point out that obesity is a major public health threat worldwide, linked to diabetes, high blood pressure, heart disease, and other health problems. Laboratory studies have hinted that capsaicin may help fight obesity by decreasing calorie intake, shrinking fat tissue, and lowering fat levels in the blood. Nobody, however, knows exactly how capsaicin might trigger such beneficial effects.

In an effort to find out, the scientists fed high-fat diets with or without capsaicin to lab rats used to study obesity. The capsaicin-treated rats lost 8% of their body weight and showed changes in levels of at least 20 key proteins found in fat. The altered proteins work to break down fats. "These changes provide valuable new molecular insights into the mechanism of the anti-obesity effects of capsaicin," the scientists say.

The study appeared in the *Journal of Proteome Research* 9:2977–2987, 2010. ■

Surfactants, Detergents, & Personal Care News

EPA acts on NP/NPE

In August 2010, the US Environmental Protection Agency (EPA) released action plans to address what it calls the "potential health risks" of nonylphenol (NP) and nonylphenol ethoxylates (NPE) used in industrial laundry detergents.

The plans identify a range of actions the agency is considering under the Toxic Substances Control Act (TSCA). The range of actions includes adding NP/NPE to EPA's new Chemicals of Concern list and issuing significant new use rules for the chemicals.

Other chemicals identified by EPA as problematic include benzidine dyes and hexabromocyclododecane (HBCD). Benzidine dyes are used in the production of consumer textiles, paints, printing inks, paper, and pharmaceuticals. HBCD is used as a flame retardant in expanded polystyrene foam in the building and construction industry, as well as in some consumer products.

In addition to EPA's efforts, the Textile Rental Services Association, which represents 98% of the industrial laundry facilities in the United States, has committed to voluntarily phase out the use of NPEs in industrial liquid detergents by December 31, 2013, and in industrial powder detergents by the end of 2014.

"While EPA intends to address the potential risks associated with these chemicals," said Steve Owens, assistant administrator for EPA's Office of Chemical Safety and Pollution Prevention. "We are pleased that the industrial laundry industry has decided to not wait for regulatory action to be completed by the agency and is voluntarily taking steps now to phase out the use of NPEs."

EPA first announced that it planned to develop the Chemicals of Concern list last December, which indicates that the chemicals may present an unreasonable risk of injury to health and the environment.

EPA's complete NP/NPE Action Plan is available at http://tinyurl.com/NP-NPEPlan.

Lipo Chemicals merger

Specialty chemicals producer Vantage Specialty Chemicals (Chicago, Illinois, USA)

Briefs

ICIS.com reports that India's Godrej Industries Ltd. will build a $49.4-million oleochemicals manufacturing facility at Ambernath in Maharashtra state. The new facility is expected to produce around 100,000 metric tons/year of fatty acids and 30,000 metric tons/year of surfactants, or double the company's existing manufacturing capacity, ICIS says. The new facility should come online by 2013.

■■■

Stepan Co. (Northfield, Illinois, USA) announced that it has increased its ownership in its Philippine joint venture, Stepan Philippines Inc. (SPI), from 50.0% to 88.8%. SPI operates a surfactant manufacturing plant south of Manila, producing laundry and cleaning products, fabric softeners, and functional surfactants for the Philippines and other Asian markets. United Coconut Chemicals Inc. (UCCI) will remain as the other, 11.2% owner. UCCI operates an alcohol plant adjacent to SPI capable of supplying feedstock raw materials for production of surfactants.

In other Stepan news, the company has acquired the manufacturing assets of Peter Cremer GmbH's 100,000-metric-tons-per-year methyl ester plant located on Singapore's Jurong Island. The company said it plans to restart production by the end of 2011 after adding fractionation capabilities to the plant's current production capabilities.

■■■

Philippines-based Pan Century Surfactants restarted full operations at its fatty alcohol plant in Quezon in early August after a signing a toll-manufacturing agreement with US-based Magna-Kron Corp. Ltd., according to ICIS.com. The plant can produce 30,000 metric tons (MT)/year of fatty alcohol, 35,000 MT/year of fatty acids, and 6,500 MT/year of glycerine, the report noted.

■■■

Rhodia (Cranbury, New Jersey, USA) has introduced a new ingredient for development of water-based industrial and institutional cleaning formulations. Commercially available worldwide, Rhodia's new Rhodiasolv® INFINITY has merged with Lipo Chemicals, Inc. (Paterson, New Jersey, USA) and its affiliates.

The affiliates include Ruger Chemicals, Inc. (Linden, New Jersey), Lipo Technologies, Inc. (Vandalia, Ohio), and Lipo's companies that are incorporated in Argentina, Brazil, Chile, China, Colombia, Costa Rica, France, Guatemala, Mexico, Peru, South Africa, and Venezuela.

Vantage Specialty Chemicals includes Vantage Oleochemicals of Chicago, a fatty acid and glycerin manufacturer, and Lambent Technologies (Gurnee, Illinois), a North American oleochemical derivatives supplier specializing in nonionic surfactants.

Lipo provides ingredients and ingredient technologies to the personal care industry. Ruger Chemical is a distributor of pharmaceutical and cosmetic ingredients.

The merger creates a diversified US-based specialty chemicals company with sales approaching $500 million, and more than 550 employees at 17 locations across 13 countries.

Oil dispersants have relatively low toxicity

US government scientists are reporting that eight of the most commonly used oil dispersants used to fight oil spills, such as the massive episode in the Gulf of Mexico, appear unlikely to act as endocrine disrupters—hormone-like substances that can interfere with reproduction, development, and other biological processes. The tested dispersants also had a relatively low potential for cytotoxicity (cell death). The scientists are with the US Environmental Protection Agency and the National Institutes of Health Chemical Genomics Center.

Richard Judson and colleagues note that more than 1.5 million gallons (about 5.7 million liters) of dispersants have been used so far in the Deepwater Horizon spill. These detergent-like chemicals break up oil slicks into small drops. Scientists are concerned that some dispersants contain ingredients that turn into endocrine disrupters in the environment and could harm marine mammals, fish, and humans. But only limited toxicity testing data are available on dispersants, and these data are results from only the first round of EPA dispersant testing, they state.

With an urgent need for such information in the Deepwater Horizon spill, the scientists applied a rapid screening method using mammalian cells to determine the eight dispersants' potential to act as endocrine disrupters and their relative toxicity to living cells. None of the substances showed significant endocrine disruption activity, and cytotoxicity was not seen until dispersants were tested at concentrations above 10 parts per million, the scientists said. However, they note that "there are other routes by which chemicals can cause endocrine disruption, as well as other types of toxicity that have not been tested for here."

The study appeared in *Environmental Science & Technology* (*44*:5979–5985, 2010).

ACI responds to studies

The American Cleaning Institute (ACI) has challenged accusations leveled in a study that links cleaning products to breast cancer. ACI, formerly The Soap and Detergent Association, is a trade association based in Washington, DC, USA.

Research by the Silent Spring Institute, an advocacy group based in Newton, Massachusetts, USA, far overreaches in its conclusions based on self-reported uses of cleaning products by persons diagnosed with breast cancer, according to ACI. The study appeared in *Environmental Health* (doi:10.1186/1476-069X-9-40).

The case-control study included interviews with 787 women who had breast cancer and 721 who did not. Researchers, led by Ami R. Zota of the Silent Spring Institute, asked all the women about pesticide use but found little association with breast cancer risk.

The researchers did find a possible connection between breast cancer risk and use of mold and mildew cleaners and air fresheners. Surface and oven cleaners were not associated with increased risk. Risk of breast cancer was highest among women who reported the most use of cleaning products and air fresheners; it was double the risk for those who reported low use of the products. Study subjects were part of the Cape Cod Breast Cancer and Environment Study, which had financial support from the state of Massachusetts.

"Although there seems to be an association between cleaning products and cancer,

is a micro-emulsion based on biodegradable ingredients.

■■■

The relation between the characteristics of soiled hard surfaces (mainly in food applications) and their cleanability is the focus of an article in *Critical Reviews in Food Science and Nutrition* (*50*:583–604, 2010). The study also examines some examples of existing easy-to-clean and self-cleaning surfaces.

■■■

The latest consumer survey from Ipsos Marketing (Paris, France) involved 21,623 adults from 23 countries. It found that 39% of consumers would opt for personal care products to achieve youthful-looking skin, as compared to 23% who would choose supplements and 19% who would choose foods and beverages.

Conducted between November 2009 and January 2010, the survey involved consumers in the following countries: Argentina, Australia, Belgium, Brazil, Canada, China, France, Germany, Hungary, India, Italy, Japan, Mexico, Poland, Russia, South Korea, Spain, Sweden, Czech Republic, the Netherlands, Great Britain, United States, and Turkey.

■■■

Ecolab Inc. (St. Paul, Minnesota, USA) has received the Best Corporate Citizen for Driving Sustainability in China 2009–2010 Award at the first China Sustainability Leaders Symposium held in Beijing, China, in August 2010. The *Economic Observer*, a weekly Chinese newspaper, organized the award and event. Ecolab was one of 21 global companies selected to receive the top sustainability award through a comprehensive selection process that included public online voting and expert committee assessments.

■■■

Datamonitor.com notes that the leading category of new household goods products introduced in South and Central America between March and May 2010 was disinfectants and multipurpose cleaners, with laundry detergents and pump and aerosol air fresheners following in second and third places. However, compared to the same period of 2009, all three of these categories recorded a decline in introductions. ■

that's a long way from saying, 'Cleaning products cause breast cancer,'" Charles Shapiro, director of breast medical oncology at the Ohio State University Comprehensive Cancer Center told *The Columbus-Dispatch* newspaper.

"I wouldn't take too much from it," Shapiro continued, noting that the study was relatively small and that it is impossible to draw conclusions about cause and effect. He also cautioned that laboratory results in animal models do not necessarily generalize to humans.

"To our knowledge, this is the first published report on cleaning product use and risk of breast cancer," said Julia Brody, executive director of Silent Spring Institute

She also noted that women with breast cancer who believed that chemicals and pollutants contribute "a lot" to the risk of developing the condition were more likely to report high product usage. Speaking about this potential bias to the study, Brody said, "When women are diagnosed with breast cancer, they often think about what happened in the past that might have contributed to the disease. As a result, it may be that women with breast cancer more accurately recall their past product use or even overestimate it. Or, it could also be that experience with breast cancer influences beliefs about its causes. For example, women diagnosed with breast cancer are less likely to believe heredity contributes 'a lot,' because most are the first in their family to get the disease."

In order to avoid possible recall bias, the researchers recommend further study of cleaning products and breast cancer using prospective self-reports and measurements in environmental and biological media.

"Simply put, this research is rife with innuendo and speculation about the safety of cleaning products and their ingredients," said Richard Sedlak, ACI's senior vice president of technical and international affairs. "This is all based on the most cursory look at the scientific literature and the recollection of breast cancer survivors as to the products they used 15 to 20 years ago.

"Although the authors recognize the potential bias in their results, present conflicting findings, and have no real gauge as to the products used by the interviewees so long ago, they proceed to make unscientific assumptions on a very shaky foundation," Sedlak continued. "Unfortunately, this work sheds little light on the real causes of breast cancer. The safe and responsible manufacture and use of cleaning products

The battle heats up over The Safe Cosmetics Act of 2010

Tom Branna

The introduction in the US Congress of The Safe Cosmetics Act of 2010 (H.R. 5786) is renewing debate between activists and the personal care industry. According to industry experts, if passed, the bill would significantly change the regulatory structure of cosmetics in the United States, by more closely aligning it with other US Food and Drug Administration (FDA)-regulated products, such as drugs, biologics, and medical devices. For example, The Safe Cosmetics Act of 2010 would maintain current FDC (Food, Drug and Cosmetic) Act §§ 601-603 concerning adulterated and misbranded cosmetics, but would amend the FDC Act to add a new subchapter on the regulations of cosmetics. Specifically, H.R. 5786 would, among other things:

Require domestic and foreign establishments that manufacture, package, or distribute cosmetics to register annually with FDA, including providing FDA with contact information, a description of the establishment's activities, gross receipts, the number of employees, and the name and address of any company that supplies a cosmetic manufacturing establishment with ingredients for its products. FDA would be required to make its registration list publicly available, but not the registration documents. Establishments would also be required to provide detailed product-specific information to FDA;

- Require FDA to establish a "schedule of fees . . . to provide for oversight and enforcement" of the new FDC Act subchapter on the regulation of cosmetics. Such fees would be prorated based on an establishment's gross receipts or sales, and would only be assessed on companies with annual gross receipts or sales of more than $1 million;
- Require, within one year after the date of enactment of the Safe Cosmetics Act of 2010, "the label on each package of cosmetics, including cosmetics distributed for retail sale and professional use, to bear a declaration of the name of each ingredient in such cosmetic in descending order of predominance." A similar requirement applies to internet vendors with respect to providing ingredient information;
- Require manufacturers and distributors of cosmetics and ingredients to submit (in an electronic format) to FDA, not later than one year after the date of enactment of the Safe Cosmetics Act of 2010, "all reasonably available information in the possession or control of the manufacturer or distributor that has not previously been submitted to [FDA] regarding the physical, chemical and toxicological properties of single or multiple chemicals listed on the cosmetic labels," including function and uses, tests of cosmetics and exposure information;
- Require FDA to issue regulations not later than two years after the date of enactment of the Safe Cosmetics Act of 2010 that include lists of ingredients identified by the Agency as "prohibited ingredients," "restricted ingredients," or "safe without limits" for use in cosmetics. The FDA must also develop a "priority assessment list of not less than 300 ingredients" that cannot be included on the above-referenced lists "because of a lack of authoritative information on the safety of the ingredient." FDA must make safety determinations for these ingredients.
- Prohibit companies from manufacturing, importing, distributing, or marketing a cosmetic or cosmetic ingredient if the company failed to provide information to FDA as required under the bill or if the company's products contain non-permitted ingredients;
- Require responsible parties to notify FDA if a marketed cosmetic "is adulterated or misbranded in a manner that presents a reasonable probability that the use or exposure to the cosmetic (or an ingredient or component used in any such cosmetic) will cause a threat of serious adverse health consequences or death to humans." FDA may request a voluntary recall of the affected products, issue an

order for the company to cease distribution, and, under certain circumstances, require a recall or issue an emergency recall order;

- Give FDA the authority to require that cosmetics containing "nano-scale" materials be labeled as such;
- Mandate the reporting of adverse health effects associated with the use of a cosmetic; and
- Require FDA to publish a list of "alternative testing methods" that do not involve the use of animals to test a chemical substance and that must be used in product testing where practicable.

But according to Lezlee Westine, president and chief executive officer of the Personal Care Product Council, the Safe Cosmetics Act of 2010 as written is not based on credible and established scientific principles, would put an enormous if not impossible burden on FDA, and would create a mammoth new regulatory structure for cosmetics, parts of which would far exceed that of any other FDA-regulated product category including food or drugs.

"We urge Congress to carefully consider our recently announced proposals to strengthen FDA cosmetics oversight, including FDA ingredient reviews, and encourage the passage of the FDA Globalization Act of 2009, sponsored by Rep. John Dingell, which also includes enhanced FDA regulations of cosmetics manufacturers," said Westine in a statement. "Our proposals and Rep. Dingell's legislation constitute the strongest, most efficient, and viable approach to modernizing the FDA regulation of cosmetics, increasing transparency and enhancing existing consumer safeguards as science and technology evolve."

For its part, The Personal Care Products Council has offered its own five-point plan to ensure the safety of cosmetics.

- *Enhanced FDA Registration.* It requires that personal care products manufacturers that market their products in the United States comply with the following: Register with FDA all facilities where those products are manufactured. File with FDA product ingredient reports disclosing all of the ingredients used in those products; and report to FDA any serious unexpected adverse event with a personal care product experienced by consumers.
- *New Process to Set Safety Levels for Trace Constituents.* When requested or on its own initiative, FDA would be required to establish safe levels for trace constituents in cosmetic ingredients and products;
- *New FDA Ingredient Review Process.* Once a request has been made, or FDA unilaterally determines action is warranted, the agency would be required to review the safety of any ingredient intended for use in a personal care product and set safety use levels for such ingredient on a specified timetable;
- *New FDA Oversight of CIR Findings.* FDA would be required to review current and future findings on the safety of cosmetic ingredients by the Cosmetic Ingredient Review (CIR) Expert Panel and determine if these findings are correct. If there are instances in which it determines a CIR finding is not correct, FDA would determine by guidance or regulations if, or under what conditions, the ingredient can be used safely in personal care products;
- *FDA-Issued Good Manufacturing Practices.* FDA would establish industry-wide "Good Manufacturing Practices" requirements.

"Strong federal safety requirements already govern cosmetics and personal care products sold in the U.S. The safety of cosmetic and personal care products in the U.S. is overseen by the U.S. Food and Drug Administration under the Federal Food, Drug, and Cosmetic Act (FD&C Act), which requires that all cosmetics be substantiated for safety before they are marketed, contain no prohibited ingredients, and that all labeling and packaging must be in compliance with U.S. regulations," noted Westine. "Under the FD&C Act it is a crime to market an unsafe cosmetic product. Our proposed measures would further enhance the effectiveness of the FDA cosmetic regulatory structure."

Tom Branna is editorial director of HAPPI *[Household and Personal Products Industry magazine]. Contact him at tomb@rodpub.com.*

is an absolute top priority within our industry," Sedlak added. "Further, the plausibility of avoiding cleaning products, as put forth by the researchers, in a world where hygiene and cleanliness are the first barriers to disease prevention, is theoretically plausible, but the adverse effect on public health would be real."

ACI also responded recently to interpretations of data published by the journal *Pediatrics* (doi:10.1542/peds.2009-3392), which reported that "early childhood injuries from household cleaning products dropped by almost half over the past two decades."

ACI pointed to the importance of supervision and storage to ensuring safe and effective use of household cleaning products.

"Any injury that occurs from unintended exposures is always one too many," said Nancy Bock, ACI vice president of consumer education. "When it comes to cleaning products, parents and caregivers truly have safety in their hands."

Bock noted that numerous products have safety caps and other child-resistant packaging, but that adherence to the time-honored message on the product label will help reduce injuries from unintended uses: "Keep out of the reach of children." ■

UNIVERSAL DETECTORS

(CONTINUED FROM PAGE 600)

CONCLUSIONS

Determining lipids is a challenge in any matrix. Low UV absorbance and low volatility of larger lipids limit the sensitivity of existing HPLC and GC methods. Universal HPLC detectors are showing promise for the determination of these analytes, as compounds need not possess a chromophore, and they do not require derivatization. By using HPLC-CAD, both biofuel feedstocks and products can be analyzed quickly, with good precision, and with the necessary sensitivity to meet existing standards. CAD is the preferred detector owing to its sensitivity, wide dynamic range, and similar inter-analyte response.

Marc Plante, Deanna C. Hurum, Ian Acworth, and Jeffrey S. Rohrer are all with Dionex Corp. (Sunnyvale, California, USA). Contact Marc Plante via email at marc.plante@dionex.com.

People News/ Inside AOCS

Parmentier recognized

In its 6th Euro Fed Lipid Congress held in Athens in 2008, the General Assembly installed the award of Fellow of Euro Fed Lipid (FEFL). In August 2010 Euro Fed Lipid announced its first fellow, **Michel Parmentier,** of Vandœuvre-lès-Nancy, France. Fellows of Euro Fed Lipid are recognized for their achievements in the science and technology of lipids, fats, and oils or for unusually important service to the Federation or to the profession.

Parmentier is an emeritus professor of the Institut National Polytechnique de Lorraine in Nancy, where he has spent the majority of his working life studying extractions involving animal fats, fish oils, and vegetable oils. His research led to the development of an enzymatic process to extract polar lipids from fish without an organic solvent.

In 2000, Parmentier was instrumental in co-founding Euro Fed Lipid, a European federation devoted to lipid science and technology.

Symposium honoring Milton Rosen

Brooklyn College (New York City, USA) is conducting a symposium on October 29 to honor AOCS member **Milton J. Rosen** on the occasion of his 90th birthday. Presentations will be made from 9:30 am to 4:30 pm that day on the topic of "Surfactants and Chemistry."

Rosen is an emeritus professor of chemistry and director of the Surfactant Research Institute at Brooklyn College. He has long been an active supporter of AOCS, publishing many papers on surfactants and detergents in the *Journal of the American Oil Chemists' Society* and later in *Journal of Surfactants and Detergents.* He has also published texts such as *Industrial Utilization of Surfactants: Principles & Practice* through AOCS Press. Rosen and the Surfactants and Detergents Division of AOCS sponsor the Samuel Rosen Memorial Award, in memory of his father. The award is presented at the Annual Meeting & Expo to recognize a surfactant chemist for significant advancement or application of surfactant chemistry principles.

Medical Hypotheses names Manku

At the end of June, AOCS member **Mehar Manku** (Amarin Neuroscience Ltd., Birmingham, England) was named editor-in-chief of the Elsevier journal *Medical Hypotheses.* He will be responsible for implementing a new form of peer review that is unique to *Medical Hypotheses* submissions. According to a statement by Elsevier, *Medical Hypotheses* aims to give open-minded consideration to novel, radical new ideas and speculations in medicine that would probably be rejected by most conventional journals.

Manku has been in biomedical sciences for 35 years, developing medicine based on fatty acids and lipids. He has also been executive editor for 26 years and editor-in-chief (since 2003) of the journal *Prostaglandins, Leukotrienes and Essential Fatty Acids*.

Scalzo promoted at Dean Foods

Joseph Scalzo was promoted to president and chief operating officer of Dean Foods (Dallas, Texas, USA) at the end of August. He is tasked with overseeing Dean Foods' operational turnaround and near-term strategic initiatives, as well as its business units and key functions. The WhiteWave-Morningstar Division of Dean Foods makes Silk soymilk, and in Europe Dean Foods owns Alpro, which sells soy-based food and drink products.

AAK appoints new head, chocolate/ confectionery fats

AAK (Aarhus, Denmark) announced the appointment of **Torben Friis Lange** as new vice president for their chocolate and confectionary fats business area in August. Lange comes from a position as group managing director for Pfizer (Wyeth) Nutrition Asia Pacific Operations (Singapore). Before that, he worked for 17 years for Arla Foods in different international managerial positions. In the company announcement of his appointment, Lange emphasized the availability of opportunities in health and nutrition and in cocoa butter replacement for the vegetable oils industry.

Lange will assume his new duties in early November.

OBITUARY

BRUNO BERRA

Born in Milan, Italy, in 1937, Bruno Berra died there on April 22, 2010. He received his first degree, in chemistry, from the University of Pavia in 1961, and his Ph.D. in biochemistry in 1969. He joined the University of Milan, and became professor of biological chemistry in the Faculty of Pharmacy in 1981, professor of molecular biology (1984–1998), and director of the Institute of General Physiology (1989–2000). He originated a master's degree program at the University in Technology and Toxicology of Cosmetics.

He was author or co-author of over 180 papers. His research interests included topics such as the role of gangliosides in human meningioma,

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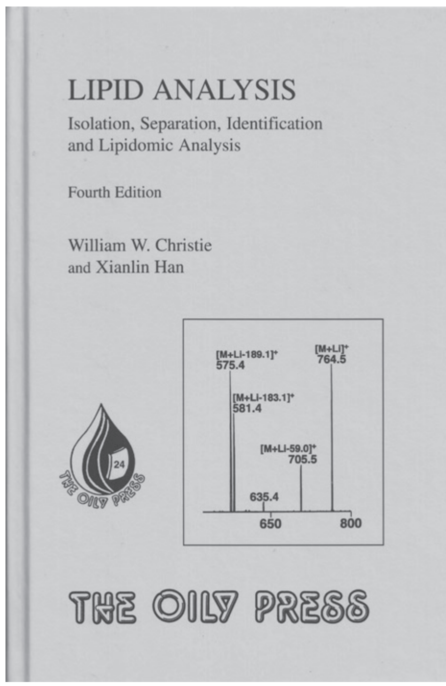
Book Review

Lipid Analysis: Isolation, Separation, Identification and Lipidomic Analysis—Fourth Edition
William W. Christie and Xianlin Han, The Oily Press, 2010
428 pages, £85 or $174, ISBN 978-0-9552512-4-5

Robert A. Moreau

William W. Christie is considered by many to be the most prominent international authority on lipid analysis. He was the recent recipient of the 2010 Supelco/Nicholas Pelick-AOCS Research Award, presented at the AOCS Annual Meeting in Phoenix, Arizona, USA. In addition to writing and editing a total of 13 books, Christie also has spent much of the last 10 years creating a very valuable website, which he recently donated to AOCS and renamed The AOCS Lipid Library (http://lipidlibrary.aocs.org). The co-author, Xianlin Han, is a pioneer in the emerging field of lipidomics.



The first, second, and third editions of *Lipid Analysis* were published in 1973 (325 pages, 612 references), 1982 (207 pages, 874 references), and 2002 (417 pages, 664 references). I had the privilege of reviewing the third edition (*inform 14*:507–508, 2003), and I was happy to accept the invitation to review this fourth edition.

In the Preface, the authors accurately describe the scope of the new edition: "The first edition of this book appeared in 1973 when gas chromatography and thin-layer chromatography were the main techniques available to lipid analysts. Indeed, lipid analysts were at the forefront in the development of these techniques. The main spectroscopic techniques available were infrared and ultraviolet spectrophotometry, while nuclear magnetic resonance spectroscopy and mass spectrometry were new techniques just becoming established in the wealthier laboratories. With successive editions, high-performance liquid chromatography became a significant part of the text and mass spectrometry, especially with electron-impact ionization, assumed greater importance. There were also remarkable improvements in many other older chromatographic techniques. Now, this fourth edition has become necessary because of the pace of developments in mass spectrometry of intact lipids, which has given recognition of lipid analysis and 'lipidomics' as a distinct science. This has been defined briefly as: 'The analysis of lipids on the systems-level scale together with their interacting factors.'"

Chapters 1–12 have similar titles to those in the third edition, but each chapter has been extensively updated to include papers published during 2003–2010. Chapters 13–16 are totally new and focus on mass spectrometry and lipidomics.

The first chapter, "Lipids: their structure and occurrence," includes descriptions and figures of all of the major fatty acids and the major acyl lipid classes.

Chapter 2 describes the principles behind the various types of modern chromatographic methodologies employed for lipid analysis. These include gas chromatography (GC), high-performance liquid chromatography (HPLC), thin-layer chromatography (TLC), and supercritical fluid chromatography (SFC). The topic of mass spectrometry (MS) of lipids (including MS interfaces to gas chromatography, GC-MS, and high-performance liquid chromatography, HPLC-MS or LC-MS) is introduced in this chapter but is covered in much more detail in Chapters 13–16. Nuclear magnetic resonance (NMR) spectroscopy of lipids is covered in later chapters.

The third chapter covers some often-overlooked topics, including lipid extraction, storage, and sample handling. In nature, most lipids are deposited in complex biological matrices that include proteins and insoluble carbohydrate polymers, and their complete extraction can sometimes be very challenging. Also, most lipids are susceptible to oxidation, and the 21% oxygen in the atmosphere is a major problem for the lipid analyst. Without skillful sample preparation and storage, the most accurate analytical procedures are of little value.

Chapter 4 includes detailed descriptions of chromatographic methods (including low-pressure open column liquid chromatography with sorbents such as silicic acid or Floricil™, TLC, HPLC, and GC) for the separation and analysis of simple lipid classes. Specific methods are presented for the analysis of the following lipids classes: cholesterol and sterols, free fatty acids, diacylglycerols, alkyldiacylglycerols and neutral plasmalogens, wax esters and other wax components, fatty alcohols, glycerol, and oxidized fats and oils. Chromatographic methods for complex lipid classes are covered individually in later chapters.

Chapter 5 includes analytical methods for phospholipids (including the common glycerophospholipids and sphingomyelin)

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and glycosyldiacylglycerols (such as the plant galactolipids). Topics include low-pressure column adsorption chromatography with silica gel, ion exchange chromatography with DEAE-cellulose, solid-phase extraction chromatography, and one- and two-dimensional TLC, including a detailed description of selective TLC spray reagents. Other topics include isocratic and gradient HPLC methods, a comparison of detection via UV vs. evaporative light-scattering detection, quantification of lipid classes via hydrolysis and GC analysis of fatty acids, phosphorus NMR methods for phospholipids analysis, and a discussion of some of the strategies that have been employed for the analysis of polyphosphoinositides.

Chapter 6 focuses on glycosphingolipids. Glycosphingolipids from brain and nervous tissue present special challenges because they often contain two or more sugar residues, making them very polar and challenging to extract. The amide and glycosidic bonds in all glycosphingolipids require skill to achieve their quantitative acid hydrolysis, which is required to ensure the accurate analysis of their sphingosine (sometimes called long-chain base, or sphingoid base), fatty acid, and sugar moieties.

Chapter 7 covers various derivitization methods for fatty acids, mainly as preparation for their analysis via GC. Although converting free fatty acids to fatty acid methyl esters has been the most popular derivitization method, other methods can provide valuable information about double bond position or hydroxyl group identification.

Chapter 8 includes detailed information about the GC analysis of fatty acid derivatives. This is one of the most popular areas of lipid analysis, and this chapter compares many of the modern columns for the analysis of common and unusual fatty acids.

Chapter 9 covers other methods (in addition to GC) for fatty acid analysis including various HPLC methods, spectroscopy (infrared, ultraviolet, and NMR), and MS.

Chapters 10 and 11 describe various methods for the analysis of molecular species of various lipid classes, including tri- and diacylglycerols, sterol esters, wax esters, phospholipids, and glycolipids. Molecular species are defined as specific alkyl or acyl moieties in all the relevant portions of the molecule (an example of a molecular species is triolein, molecular weight 886, which is the most common triacylglycerol molecular species in olive oil).

Chapter 12 describes various methods for positional distribution of fatty acids on glycerolipids. These include mainly enzymatic methods (with lipases and phospholipases) but also include chemical and NMR methods.

As mentioned previously, Chapters 13–16 are totally new and are labeled "Part 5: Mass Spectrometric Analysis of Lipids in Lipidomics."

Chapter 13 describes the principles of the major methods of "soft ionization" MS techniques that have been employed for the analysis of lipids and for lipidomics. Although electrospray ionization has been the main ionization method for lipidomics, the authors also describe the other traditional and modern ionization methods that have been valuable for lipid structural characterization and lipid analysis.

Chapter 14 explains how data from electrospray ionization MS can be used to analyze phospholipids, sphingolipids, glycerolipids, and glycosyldiacylglycerols.

Chapter 15 provides practical advice on which types of instruments are needed for lipidomics and how samples are prepared. It also compares LC-MS-based methods to identify individual molecular species of lipid classes with the "shotgun lipidomics" approach to the identification of individual molecular species. Shotgun lipidomics is an MS-MS (direct infusion electrospray ionization tandem MS) technique developed by one of the co-authors, Han. Instead of using chromatography to separate molecular species, shotgun lipidomics uses the first MS stage to identify a characteristic ion (such as the neutral loss of 183 amu identifying the phosphocholine group of phosphatidylcholine and sphingomyelin) and the second MS stage to separate all molecular species that contain that ion.

Chapter 16 concludes the book by describing the types of calibrations that are necessary to use electrospray ionization MS (with either HPLC or direct infusion methods) to accurately quantify the levels of individual molecular species of common lipid classes of phospholipids, sphingolipids, glycerolipids, and glycosyldiacylglycerols.

In conclusion, these two experts have teamed up to produce a book that is an excellent compilation of the most useful modern analytical methods for lipid analysis. It also helps readers understand

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Patents

Published Patents

Detergent composition or component therefor

Krijgsman, A., *et al.*, The Sun Products Corp., US7674762, March 9, 2010.

A particulate detergent composition or component therefore that comprises a bi- or trivalent carboxylic acid salt, preferably magnesium stearate, which, without the carboxylic acid salt being present has a hygroscopicity value of greater than 25%.

Stable pigment dispersions

Louwet, F., *et al.*, Agfa Graphics NV, US7674843, March 9, 2010.

A pigment dispersion includes a pigment with at least one carboxylic acid group and a block copolymer including aromatic monomers having at least one carboxylic acid group or a salt thereof and aromatic monomers having at least one sulfonic acid group or a salt thereof. The pigment dispersions can be used for manufacturing inkjet inks and for the coating of colored layers.

Esterification and transesterification systems, methods and apparatus

Lichtenberger, P.L., *et al.*, Four Rivers Bioenergy Inc., US7678340, March 16, 2010.

Esterification and transesterification methods, systems, and apparatus are disclosed that increase the efficiency of esterification reactions. The methods comprising utilizing an annular gap reactor comprises a rotor rotating within a stator to provide an annular flow passage comprising a flow path containing a high-shear treatment zone in which the passage spacing is smaller than in the remainder of the zone to provide a subsidiary higher-shear treatment zone. In exemplary embodiments the reactor is modified to include an evaporator portion including an opening in the stator near the end of the reactor and a series of fins placed in the opening. Increase in the rates due to the annular gap reactor allows for the use of less catalyst, poorer catalysts, lower temperature, and reduction in unwanted side reactions at more economically favorable conditions.

Processes for making chocolate

Kealey, K.S., *et al.*, Mars, Inc., US7678407, March 16, 2010.

Cocoa components having enhanced levels of cocoa polyphenols, processes for producing the cocoa components while conserving a significant amount of the cocoa polyphenols, compositions containing the cocoa components or the cocoa polyphenols, and methods of using the cocoa components or the cocoa polyphenols for improving the health of a mammal are described. The cocoa components include partially and fully defatted cocoa solids, cocoa nibs, and fractions derived therefrom, cocoa polyphenol extracts, cocoa butter, chocolate liquors, and mixtures thereof. The invention provides processes for extracting fat from cocoa beans and for otherwise processing cocoa beans to yield a cocoa component having conserved concentrations of polyphenols relative to the starting materials.

Process for decreasing the amount of cholesterol in a marine oil using a volatile working fluid

Sondboe, S., and O. Thorstad, Pronova Biopharma Norge AS, US7678930, March 16, 2010.

The invention relates to a process for decreasing the amount of cholesterol in a marine oil. The process comprises adding a volatile working fluid to the oil, where the volatile working fluid comprises at least one of a fatty acid ester, a fatty acid amide, and a hydrocarbon, and a stripping step in which at least some cholesterol is separated with the volatile working fluid. The present invention also relates to a volatile cholesterol decreasing working fluid, and a health supplement and a pharmaceutical, based on a marine oil, prepared according to the process mentioned above.

Process for producing carboxylic acid

Miura, H., and H. Kojima, Daicel Chemical Industries Ltd., US7678940, March 16, 2010.

A process for producing a purified carboxylic acid having "n + 1" carbon atoms comprises feeding a carboxylic acid stream containing a carboxylic acid having "n + 1" carbon atoms, a hydrogen halide, a lower boiling point (bp) component, a higher bp component, and others to a first distillation column; separating a lower bp fraction containing part of the lower bp component and a higher bp fraction containing part of the higher bp component in the first column; withdrawing a side stream containing at least the carboxylic acid by side cut from the first column; feeding the side stream to a second distillation column; separating a lower bp fraction containing part of the lower bp component and a higher bp fraction containing part of the higher bp component in the second column; and withdrawing a side stream containing the carboxylic acid by side cut from the second column to recover a purified carboxylic acid; and the process further comprises feeding at least one first component (A) selected from the group consisting of an alcohol corresponding to the carboxylic acid having "n" carbon atom(s) and an ester of the alcohol with the carboxylic acid to the first column and, if necessary, water. Such a process ensures reduction of the concentration of the hydrogen halide in the purified carboxylic acid. ■

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

Microbial conversion of olive oil mill wastewaters into lipids suitable for biodiesel production

Yousuf, A., *et al.*, *J. Agric. Food Chem. 58*:8630–8635, 2010.

Lipomyces starkeyi were able to survive and proliferate in the presence of olive oil mill wastewaters (OMW), a medium difficult to process by biological treatments due to the antimicrobial activities of their phenolic components. The microorganisms were grown in the presence of undiluted OMW, without external organic supplements, producing a significant reduction of both the total organic carbon (TOC) and the total phenols content. The OMW treated by *L. starkeyi* showed a significant increase of the germination index. The preliminary dilution of OMW enhanced the reduction of polluting components of OMW, leading to a complete TOC removal, as well as to lower levels of residual phenols. The activities of extracellular lipases and esterases significantly increased in the course of the OMW fermentation. A significant increase in lipid yield was observed in *L. starkey* in the course of the OMW treatment, particularly when the feedstock was preliminarily diluted. The fatty acid distribution showed a prevalence of oleic acid, demonstrating the potential of *L. starkeyi* as a source of lipids to be used as a feedstock for the synthesis of second-generation biodiesel.

Effect of chemical randomization on positional distribution and stability of omega-3 oil triacylglycerols

Wang, J., *et al.*, *J. Agric. Food Chem. 58*:8842–8847, 2010.

Randomization has been commonly used to modify the chemical and physical properties of natural fats and oils. In this study, seal blubber oil (SBO) and menhaden oil (MHO) were modified through chemical randomization using sodium methoxide, and the effect on positional distribution of fatty acids was investigated using gas chromatography (GC) and ^{13}C nuclear magnetic resonance (NMR) spectroscopy. The effect of randomization on the stability of the original oils and their randomized counterparts was analyzed by comparing conjugated dienes and thiobarbituric acid-reactive substances (TBARS) values after accelerated oxidation at 60°C for 4 days. The omega-3 polyunsaturated fatty acids (PUFA) were distributed more evenly among the terminal *sn*-1,3 positions and the middle *sn*-2 position in chemically randomized oils when compared to the starting oils. The effect was more pronounced for SBO with omega-3 PUFA attached preferentially to *sn*-1,3 positions of triacylglycerols before randomization, and it was less pronounced for MHO, which contained omega-3 PUFA more evenly distributed before randomization. However, different levels of commonly known omega-3 fatty acids, namely, docosahexaenoic acid (DHA), docosapentaenoic acid (DPA), eicosapentaenoic acid (EPA), and stearidonic acid (STA), were obtained in both original and randomized oils from GC and ^{13}C NMR spectroscopy. The stability of the randomized oils was also affected to different degrees, depending on the storage time.

Refining of high free fatty acid rice bran oil and its quality characteristics

Raja Rajan, R.G., and A.G. Gopala Krishna, *J. Food Lipids 16*:589–604, 2009.

Commercial rice bran contains 15–20% oil and also an endogenous lipase, which degrades the oil and produces free fatty acids (FFA). This study was undertaken to examine the quality of refined oil prepared from crude oil after the action of endogenous lipase in bran. The oil, which was degraded by lipase to low-, medium-, and high–FFA contents, upon extraction in the rice bran oil industry were obtained and were refined in the laboratory, and quality of the oils was studied. The crude oils had FFA of 6.5, 36.0, and 87.0%; oryzanol content of 1.52, 1.55, and 1.65%; color of 32.0, 65.0, and 65.0 Lovibond units; unsaponifiable matter of 3.2, 4.2, and 4.9%; phytosterol content of 4,600, 4,000, and 1,900 ppm; and sum of tocopherols and tocotrienols of 962, 56, and 96 ppm, respectively. After refining these three crude oils (6.5, 36.0, and 87.0% FFA), the resultant oils had an FFA content of 0.4, 2.4, and 4.8%; oryzanol content of 1.13, 2.5, and 6.35%; color of 20.0, 55.0, and 50.0 Lovibond units; unsaponifiable matter of 3.5, 6.5, and 33.4%; phytosterol content of 4,900, 6,100, and 13,800 ppm; and the sum of tocopherols and tocotrienols of 1,050, 880, and 740 ppm, respectively. The refined oils produced from high-FFA crude oil had high amounts of unsaponifiable matter, oryzanol, phytosterols, and sum of tocopherols and tocotrienols than the permitted level for refined rice bran oil. Refined rice bran oil obtained from fresh rice bran (without lipase action) contained about 90% triacylglycerols, whereas the refined oil obtained from high-FFA bran oil showed about 10% triacylglycerols. Hence the latter cannot be used as an edible oil, but instead can be used at low levels as a nutraceutical in foods.

Stabilization of soybean oil bodies by enzyme (laccase) cross-linking of adsorbed beet pectin coatings

Chen, B., *et al.*, *J. Agric. Food Chem. 58*:9259–9265, 2010.

Soybean oil bodies are naturally coated by a layer of phospholipids and oleosin proteins, which protect them from *in vivo* environmental stresses. When oil bodies are incorporated into food products, they encounter new environmental stresses such as changes in pH, ionic strength, and temperature. Consequently, additional protection mechanisms are often needed to stabilize them. The purpose of this study was to determine whether soybean oil bodies could be stabilized by coating them with a layer of cross-linked anionic polysaccharide (beet pectin). The beet pectin layer was cross-linked via its ferulic acid groups using laccase (an enzyme that catalyzes the oxidation of phenolic groups). Oil body suspensions were prepared that contained 1 wt% oil and 0.06 wt% beet pectin at pH 7 and were then adjusted to pH 4.5 to promote electrostatic deposition of the beet pectin molecules onto the surfaces of the oil bodies. Laccase was then added to promote cross-linking of the adsorbed beet pectin layer. Cross-linked pectin-coated oil bodies had similar or better stability than uncoated oil bodies to pH changes (3 to 7), NaCl addition (0 to 500 mM), and freeze-thaw cycling (–20°C for 22 h; +40°C for 2 h). These pectin-coated oil bodies may provide a convenient means of incorporating soybean oil into food and other products.

Quantification of glycolipids in cereal and dairy matrices

Cotting, C., and F. Giuffrida, *Lipid Technol. 22*:183–186, 2010.

Glycolipids are currently divided into three main classes: glycerolipids, containing a glycerol backbone; glycosphingolipids, containing a sphingosin backbone; and polyisoprenoid glycolipids. Glycolipids are well known for their excellent emulsifier properties and health benefits. However, they represent a small fraction of lipid compounds and because of their amphiphilic nature, their precise quantification is not straightforward.

Occurrence and distribution of non-extractable glycerol dialkyl glycerol tetraethers in temperate and tropical podzol profiles

Huguet, A., *et al.*, *Org. Geochem. 41*:833–844, 2010.

Glycerol dialkyl glycerol tetraethers (GDGT) are high molecular weight lipids present in the membranes of archaea and some bacteria. lsoprenoid GDGT with acyclic or ring-containing dibiphytanyl chains are known to be synthesised by archaea. In soil, another type of GDGT, which can be distinguished from tetraethers of archaeal origin by way of the branched nature of the alkyl chain, was discovered recently. Alkyl-branched GDGT were suggested to be produced by anaerobic bacteria and can be used to reconstruct past air temperatures and soil pH. Lipids in soils can take two broad forms: extractable, that is, recoverable via solvent extraction, and non-extractable, linked to the mineral or organic matrix. The present study aimed at comparing the abundance and distribution of these two pools of GDGT in two contrasting podzol environments: a temperate podzol 40 km north of Paris (France) and a tropical podzol from the Amazon basin (Brazil). Five samples were collected from the whole profile of the temperate podzol. Five additional samples were obtained from three profiles of the tropical soil sequence, which are representative of the transition between a latosol and a well developed podzol. For the first time, we showed that substantial amounts of non-extractable GDGT can be released after acid hydrolysis of solvent-extracted soils, non-extractable GDGT representing 25 ± 15% of the total (i.e., extractable + non-extractable) bacterial GDGT and 29 ± 17% of the total archaeal GDGT in podzol samples. This implies that extractable GDGT can be incorporated into the organic and/or mineral matrix of soil. In addition, we observed that extractable and non-extractable GDGT could present different distribution patterns, notably suggesting that some extractable GDGT might be preferentially transferred to the non-extractable pool and/or might be preferentially degraded by soil microorganisms. The relative abundances of bacterial and archaeal GDGT were compared along the temperate soil profile and the tropical soil sequence. The relative amount of bacterial vs. archaeal GDGT was shown to be much higher in the extractable than in the non-extractable fraction in the surficial horizons of the temperate podzol and in the well-developed part of the tropical podzol, implying that extractable archaeal GDGT could be preferentially transferred to the non-extractable lipid pool compared to extractable bacterial GDGT in these horizons. This might be due to the fact that the types of polar head groups associated with bacterial GDGT differ from, and are more labile than, those associated with archaeal GDGT.

Analysis of intact ladderane phospholipids, originating from viable anammox bacteria, using RP-LC-ESI-MS

Lanekoff, I., and R. Karlsson, *Anal. Bioanal. Chem. 397*:3543–3551, 2010.

Since the discovery of the anaerobic ammonium-oxidizing (anammox) bacteria, many attempts have been made to identify these environmentally important bacteria in natural environments. Anammox bacteria contain a unique class of lipids, called ladderane lipids and here we present a novel method to detect viable anammox bacteria in sediments and waste water treatment plants based on the use of a ladderane lipid biomarker. Intact ladderane phosphatidylcholine (PC) lipids are analyzed using reversed-phase liquid chromatography-electrospray ionization-mass spectrometry (RP-LC-ESI-MS). Following extraction from the complex sediment matrix, RP LC is used to separate ladderane PC lipids based on their tail group hydrophobicity as well as their ether or ester link to the glycerol backbone in the *sn*-2 position. We investigate the presence of intact ladderane lipids in natural sediments displaying anammox activity and illustrate the use of a specific intact membrane-forming PC lipid as a biomarker for viable anammox bacterial cells. The presented method can be used to elucidate the whereabouts of viable anammox bacteria, subsequently enabling an estimation of anammox activity. This will greatly increase the knowledge of anammox bacteria and their importance in the global nitrogen cycle.

Hopanoid enrichment in a detergent resistant membrane fraction of *Crocosphaera watsonii*: Implications for bacterial lipid raft formation

Sáenz, J.P., *Org. Geochem. 41*:853–856, 2010.

Hopanoids are bacterial membrane lipids with close structural and evolutionary ties to sterols. Extraction of hopanoid-containing membranes of *Crocosphaera watsonii* in a non-ionic detergent demonstrates that a hopanoid identified as bacteriohopanetetrol cyclitol ether (BHT-CE) is enriched in a detergent-resistant membrane (DRM) fraction. Detergent resistance indicates that hopanoids, like sterols in eukaryotes, are likely associated with putative lipid rafts in bacterial membranes. These results are consistent with previous work suggesting analogous roles of hopanoids and sterols and may imply that hopanoids are essential to the physiology of putative lipid rafts in hopanoid-producing bacteria.

Potential role of the lipoxygenase derived lipid mediators in atherosclerosis: Leukotrienes, lipoxins and resolvins

Hersberger, M., *Clin. Chem. Lab. Med. 48*:1063–1073, 2010.

Atherogenesis is an inflammatory process with leukocytes infiltrating the arterial intima. The lipoxygenase pathways play a role in leukocyte recruitment through the generation of two classes of arachidonic acid lipid mediators, the leukotrienes and the lipoxins, and one class of omega-3 fatty acid metabolites, the resolvins. There is evidence from animal studies and human genetic studies that the leukotrienes and the enzymes necessary for their generation play a role in atherosclerosis, and possibly even in the development of the vulnerable plaque. Less is known about the effect of the anti-inflammatory lipid mediators in atherosclerosis, the lipoxins and the resolvins. Studies modulating the activity of an enzyme necessary for the production of these lipid mediators, 12/15-lipoxygenase, showed discrepant results in several animal models. Also, human genetic studies have not clearly dissected the effect of the enzyme on atherosclerosis. However, stable forms of the lipoxins and the resolvins protect animals from inflammatory diseases. Whether blocking the leukotrienes or applying anti-inflammatory lipoxins and resolvins will be effective in attenuating human atherosclerosis needs to be demonstrated in future studies. In this review, the biosynthesis of these lipid mediators, their biological effects, and the evidence for their possible role in atherosclerosis are discussed with an emphasis on human disease.

Transcellular biosynthesis of eicosanoids

Sala, A., *et al.*, *Pharmacol. Rep. 62*:503–510, 2010.

The metabolism of arachidonic acid into biologically active compounds involves the sequential activity of a number of enzymes, sometimes showing a unique expression profile in different cells. The main metabolic pathways, namely, the cyclooxygenases and the 5-lipoxygenase, both generate chemically unstable intermediates: prostaglandin (PG) H_2 and leukotriene (LT) A_4, respectively. These are transformed by secondary enzymes into a variety of chemical structures known collectively as the lipid mediators. Although some cells express all the enzymes necessary for the production of biologically active compounds, it has been shown that eicosanoids are often the result of cell-cell interactions involving the transfer of biosynthetic intermediates, such as the chemically reactive PGH_2 and LTA_4, between cells. This process has been defined as the transcellular pathway of eicosanoid biosynthesis and requires both a donor cell to synthesize and release one component of the biosynthetic cascade and an accessory cell to take up that intermediate and process

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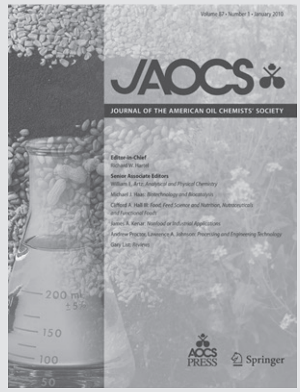

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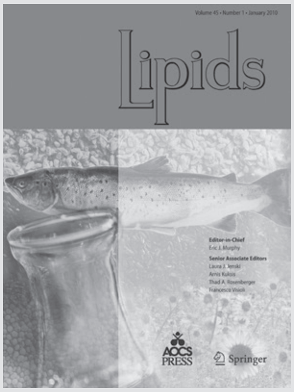

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it into the final biologically active product. This review will summarize the evidence for transcellular biosynthetic events, occurring in isolated cell preparations, complex isolated organ systems, and in vivo, that result in the production of prostaglandins, leukotrienes, and lipoxins.

Subcellular organelle lipidomics in TLR-4-activated macrophages

Andreyev, A.Y., *et al.*, *J. Lipid Res. 51*:2785–2797, 2010.

Lipids orchestrate biological processes by acting remotely as signaling molecules or locally as membrane components that modulate protein function. Detailed insight into lipid function requires knowledge of the subcellular localization of individual lipids. We report an analysis of the subcellular lipidome of the mammalian macrophage, a cell type that plays key roles in inflammation, immune responses, and phagocytosis. Nuclei, mitochondria, endoplasmic reticuli (ER), plasmalemmas, and cytoplasm were isolated from RAW 264.7 macrophages in basal and activated states. Subsequent lipidomic analyses of major membrane lipid categories identified 229 individual/isobaric species, including 163 glycerophospholipids, 48 sphingolipids, 13 sterols, and 5 prenols. Major subcellular compartments exhibited substantially divergent glycerophospholipid profiles. Activation of macrophages by the Toll-like receptor 4-specific lipopolysaccharide Kdo_2-lipid A caused significant remodeling of the subcellular lipidome. Some changes in lipid composition occurred in all compartments (e.g., increases in the levels of ceramides and the cholesterol precursors desmosterol and lanosterol). Other changes were manifest in specific organelles. For example, oxidized sterols increased and unsaturated cardiolipins decreased in mitochondria, whereas unsaturated ether-linked phosphatidylethanolamines decreased in the ER. We speculate that these changes may reflect mitochondrial oxidative stress and the release of arachidonic acid from the ER in response to cell activation.

MALDI-TOF/MS analysis of archaebacterial lipids in lyophilized membranes dry-mixed with 9-aminoacridine

Angelini, R., *et al.*, *J. Lipid Res. 51*:2818–2825, 2010.

A method of direct lipid analysis by matrix-assisted laser desorption/ionization (MALDI) mass spectrometry (MS) in intact membranes, without prior extraction/separation steps, is described. The purple membrane isolated from the extremely halophilic archaeon *Halobacterium salinarum* was selected as model membrane. Lyophilized purple membrane was ground with 9-aminoacridine (9-AA) as dry matrix, and the powder mixture was crushed in a mechanical die press to form a thin pellet. Small pieces of the pellet were then attached to the MALDI target and directly analyzed. In parallel, individual archaebacterial phospholipids and glycolipids, together with the total lipid extract of the purple membrane, were analyzed by MALDI-TOF (time of flight)/MS using 9-AA as the matrix in solution. Results show that 9-AA represents a suitable matrix for the conventional MALDI-TOF/MS analysis of lipid extracts from archaeal microorganisms, as well as for fast and reliable direct dry lipid analysis of lyophilized archaebacterial membranes. This method might be of general application, offering the advantage of quickly gaining information about lipid components without disrupting or altering the membrane matrix

Long-term fatty acid stability in human serum cholesteryl ester, triglyceride, and phospholipid fractions

Matthan, N.R., *et al.*, *J. Lipid Res. 51*:2826–2832, 2010.

Fatty acid profiles of biological specimens from epidemiological/clinical studies can serve as biomarkers to assess potential relationships between diet and chronic disease risk. However, data are limited regarding fatty acid stability in archived specimens following long-term storage, a variable that could affect result validity. Our objective was to determine the effect of prolonged storage at −80°C on the fatty acid profiles of serum cholesteryl ester (CE), triglyceride (TG), and phospholipid (PL) fractions. This was accomplished by determining the fatty acid profile of frozen, archived, previously unthawed serum samples from 22 subjects who participated in a controlled feeding trial. Initial analysis was performed after trial completion and the repeat analysis after 8–10 years of storage using gas chromatography (GC). No significant differences were observed among the majority of fatty acids regardless of lipid fraction.

Reliability coefficients were high for the fatty acid classes (saturated fatty acid, 0.70: monounsaturated fatty acid, 0.90; polyunsaturated fatty acid, 0.80). When differences were identified, they were limited to low-abundance fatty acids (≤1.5 mol%). These differences were quantitatively small and likely attributable to technical improvements in GC methodology rather than sample degradation. Thus, our data demonstrate that storage at −80°C up to 10 years does not significantly influence serum CE, TG, or PL fatty acid profiles.

Analysis of triacylglycerols in refined edible oils by isocratic HPLC-ESI-MS

Zeb, A., and M. Murkovic, *Eur. J. Lipid Sci. Technol. 112*:844–851, 2010.

A simple, fast, and reproducible reversed-phase high-performance liquid chromatography (HPLC) method coupled to electrospray ionization mass spectrometry (ESI-MS) for the analysis of triacylglycerol (TAG) species in commercial edible oils has been developed. The TAG species were separated using isocratic 18% isopropanol in methanol and a Phenomenex C18 column. The ESI-MS conditions were optimized using flow injection analysis of standard TAG. Fifteen, fourteen, and sixteen TAG were separated and identified in corn oil, rapeseed oil, and sunflower oil, respectively. The presence of intense protonated molecular ($M+H^+$), ammonium ($M+NH_4^+$), and sodium ($M+Na^+$) adducts ions and their respective diacylglycerols ions in the ESI-MS spectra showed correct identification of TAG. Some minor potassium adducts ($M+K^+$) were also found. In addition, the identity of the fatty acid, position of each fatty acid, and the location of the double bond in the fatty acid moiety were explained. It was found that this isocratic method is useful for fast screening and identification of triacylglycerols in lipids.

Determination of double bond location in fatty acids by manganese adduction and electron induced dissociation

Yoo, H.J., and K. Håkansson, *Anal. Chem. 82*:6940–6946, 2010.

Double bond locations in fatty acids can be determined from characteristic charge-remote fragmentation patterns of alkali metal-adducted fatty acids following high-energy collision-activated dissociation (CAD). With low-energy CAD, several chemical derivatization methods, including ozonization, epoxidation, and hydroxylation, have been used to generate characteristic fragments. However, high-energy CAD is not universally available and involves a high degree of scattering, causing product ion loss. Further, derivatization reactions involve side reactions and sample loss. Here, we analyzed metal-adducted fatty acids to investigate the utility of electro-induced dissociation (EID) for determining double bond location. EID has been proposed to involve both electronic excitation, similar to high-energy CAD, and vibrational excitation. Various metals (Li, Zn, Co, Ni, Mg, Ca, Fe, and Mn) were investigated to fix one charge at the carboxylate end of fatty acids to promote charge-remote fragmentation. EID of metal-adducted fatty acids allowed determination of all double bond locations of arachidonic acid, linolenic acid, oleic acid, and stearic acid. For Mn(II)-adducted fatty acids, reduced characteristic charge-remote product ion abundances at the double bond positions are indicative of double bond locations. However, other metal adducts did not generally provide characteristic product ion abundances at all double bond locations.

1*H*-Pteridine-2,4-dione (lumazine): A new MALDI matrix for complex (phospho)lipid mixtures analysis

Calvano, C.D., *et al.*, *Anal. Bioanal. Chem. 398*:499–507, 2010.

Nowadays, matrix-assisted laser desorption/ionization (MALDI) time-of-flight mass spectrometry represents an emerging and versatile tool for analysis of lipids. However, direct (i.e., with no previous separation of lipid classes) analysis of crude extracts containing a complex mixture of lipids (a problem typically encountered in shotgun lipidomics) is still a quite challenging task using a conventional MALDI matrix such as 2,5-dihydroxybenzoic acid (DHB). Indeed, in the presence of phospholipids containing quaternary ammonium groups, such as phosphatidylcholines and sphingomyelins, strong ionization-suppression effects are experienced especially in positive ion mode. To overcome this limitation, lumazine (1*H*-pteridine-2,4-dione) was evaluated as an alternative matrix. Lumazine in the solid state shows an absorption maximum at 350 nm, ionizes/desorbs without appreciable decomposition and extensive cluster formation, and can be used in both ion modes. In positive ion mode, the main species were $M^{\bullet +}$ and $2M^{\bullet +}$ radical cations and cationized species ($[M+H]^+$, $[M+Na]^+$, $[M+2Na+2Li–3H]^+$). In negative ion mode, the main signals observed were the deprotonated molecular ion and the radical anion. The signal-to-noise ratio for phosphatidylglycerols and phosphatidylethanolamines using lumazine was almost one order of magnitude higher than that observed for DHB. Lumazine was successfully used for MALDI analysis (positive and negative ion modes) of crude lipid extracts of milk, soymilk, and hen egg, where phosphatidylethanolamines, phosphatidylserines, and phosphatidylinositols could additionally be detected.

Characterization of microalgal carotenoids by mass spectrometry and their bioavailability and antioxidant properties elucidated in rat model

Ranga Rao, A., *et al., J. Agric. Food Chem. 58*:8553–8559, 2010.

Of the total carotenoids in respective algal samples, β-carotene in *Spirulina platensis* was 69.5%, astaxanthin and its esters in *Haematococcus pluvialis* were 81.38%, and lutein in *Botryococcus braunii* were 74.6%. The carotenoids were characterized by mass spectrometry. A time-course study of carotenoids in rats after administration of microalgal biomass showed peak levels in plasma, liver, and eyes at 2, 4, and 6 h, respectively. β-Carotene accumulation in *Spirulina*-fed rats was maximum in eye tissues at 6 h. Similarly, levels of astaxanthin and lutein in *Haematococcus*- and *Botryococcus*-fed rats were also maximal in eye tissues. Astaxanthin from *H. pluvialis* showed better bioavailability than β-carotene and lutein. The antioxidant enzymes, catalase, superoxide dismutase, peroxidase, and thiobarbituric acid-reactive substances were significantly high in plasma at 2 h and in liver at 4 h, evidently offering protection from free radicals. This study implies that microalgae can be a good source of carotenoids of high bioavailability and nutraceutical value. ■

2009–2010 AOCS Laboratory Proficiency Program winners

The AOCS Laboratory Proficiency Program (LPP), formerly the Smalley Check Sample Program, is the world's most extensive and respected collaborative proficiency testing program for oil- and fat-related commodities, oilseeds, oilseed meals, and edible fats. More than 500 chemists participate to verify their lab's quality control. Participants use AOCS or similar methods for sample analysis and then compare their results with those from a large cross-section of other laboratories using the same methods and samples. For more information, contact Evelyn King at AOCS Technical Services (phone: +1 217-693-4815; fax: +1 217-693-4859; email: evelynk@aocs.org).

Aflatoxin Corn Meal

First Place
Bung Han Song
CJ CheilJedang Corp.
Incheon, Korea

Honorable Mention
Martha Chinakwe
Alabama Dept. of Agriculture
Auburn, Alabama, USA

Aflatoxin Corn Meal Test Kit

First Place
Eric Stone
Illinois Dept. of Agriculture
Springfield, Illinois, USA

Honorable Mention
Dennis Hogan
SDK Laboratories
Hutchinson, Kansas, USA

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

Honorable Mention
Cindy McCormick
Office of the Texas State Chemist
College Station, Texas, USA

Aflatoxin Cottonseed

First Place
John Wetmore
Wetmore Enviro Lab
Casa Grande, Arizona, USA

Aflatoxin Milk

First Place
Roger Mc Daniel
Food & Drug Protection Dev NCDA&CS
Raleigh, North Carolina, USA

Aflatoxin Peanut Butter

First Place
Diana Kavolis
Andy Yehl
The Hershey Co.
Hershey, Pennsylvania, USA

Aflatoxin Peanut Paste

First Place
Marisel Corelli
Lab 2
JLA Argentina SA
General Cabrera, Cordoba
Argentina

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

Honorable Mention
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Jeff Vidanes
Blue Diamond Growers
Sacramento, California, USA

Aflatoxin Peanut Paste Test Kit

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Silliker Canada Co.
Markham, Ontario, Canada

Honorable Mention
Louisville Quality Assurance Team
Algood Food Co.
Louisville, Kentucky, USA

Honorable Mention
Anna Quain
Neogen Corporation
Lansing, Michigan, USA

Honorable Mention
John H. Songer
Golden Peanut Co.
Headland, Alabama, USA

Cholesterol

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Maxxam Analytics
Mississauga, Ontario, Canada

Honorable Mention
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Paulette Manemann
Hormel Foods LLC
Austin, Minnesota, USA

Cottonseed

First Place
Tammy Kahlich
PYCO Industries
Lubbock, Texas, USA

Cottonseed Oil

First Place
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ConAgra Grocery Products
Memphis, Tennessee, USA

Edible Fat

First Place
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Golden Foods/Golden Brands
Louisville, Kentucky, USA

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

Honorable Mention
Tarina Hollon
Ag Processing Inc.
St. Joseph, Missouri, USA

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

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

Feed Microscopy

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Second Place
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Santurce, Puerto Rico, USA

Third Place (tie)
Victoria Ashcraft
Div. of Consolidated Labs of Virginia
Richmond, Virginia, USA

Third Place (tie)
Marion Smith
Canadian Food Inspection Agency
Ottawa, Ontario, Canada

Fish Meal

First Place
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SGS del Peru S A C
Callao 1, Peru

Honorable Mention
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N.J. Feed Lab Inc.
Trenton, New Jersey, USA

Fumonisin in Corn

First Place
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Office of the Texas State Chemist
College Station, Texas, USA

Gas Chromatography

First Place (tie)
Pete Cartwright
N.J. Feed Lab Inc.
Trenton, New Jersey, USA

First Place (tie)
Linda S. McLaren
Loders Croklaan
Channahon, Illinois, USA

First Place (tie)
Analytical Team
Bunge Oils
Bradley, Illinois, USA

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

Honorable Mention
Owensboro Grain Edible Oils Laboratory
Owensboro Grain Edible Oils
Owensboro, Kentucky, USA

Honorable Mention
Tracy Hildebrand
ADM Quincy
Quincy, Illinois, USA

Honorable Mention
Ricardo Arevalo
Numar Co.
San Jose, Costa Rica

GOED/AOCS Nutraceutical Oils

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Roger K. Barnhill, Shaun Huynh, Tiffany James
Eurofins Central Analytical Labs
Kingstree, South Carolina, USA

Honorable Mention
Pete Cartwright
N.J. Feed Lab Inc.
Trenton, New Jersey, USA

Marine Oil

First Place
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Tiffany James, Shaun Huynh
Eurofins Central Analytical Labs
Kingstree, South Carolina, USA

Honorable Mention
Chemistry Laboratory
Tyson Foods Inc.
Joslin, Illinois, USA

Marine Oil Fatty Acid Profile

First Place
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Honorable Mention
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Thionville Laboratories, Inc.
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Honorable Mention
Cecilia Palomino
SGS del Peru S A C
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Mumtaz Haider
Inspectorate America Corp.
Galena Park, Texas, USA

Honorable Mention
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Admiral Testing Services Inc.
Luling, Louisiana, USA

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N.P. Pet Care Co.
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Honorable Mention
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First Place (tie)
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Shani Jolly, A. Thionville, Nancy Trosclair, Boyce Butler
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New Orleans, Louisiana, USA

Honorable Mention
Ramesh Patel
Mumtaz Haider
Inspectorate America Corp.
Galena Park, Texas, USA

Honorable Mention
Pete Cartwright
N.J. Feed Lab Inc.
Trenton, New Jersey, USA

Honorable Mention
Trevor Meredith
Solbar Hatzor
Ashdod, Israel

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

Oilseed Meal 100% Crude Fiber

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ATC Scientific
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Thionville Laboratories, Inc,
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Carolina Analytical Services
Bear Creek, North Carolina, USA

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Oilseed Meal 100% Moisture

First Place
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Fieldale Farms Corp.
Baldwin, Georgia, USA

Honorable Mention
Trevor Meredith
Solbar Hatzor
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Honorable Mention
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John Dillard
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Oilseed Meal 100% Nitrogen Ba 4d-90

First Place
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Oilseed Meal 100% Nitrogen Ba 4e-93

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Honorable Mention
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Memphis, Tennessee, USA

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K-Testing Lab Inc.
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Oilseed Meal 100% Oil

First Place
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SGS Thailand Ltd.
Bangkok, Thailand

Honorable Mention
Renato M. Ramos
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Honorable Mention
Dennis Hogan
SDK Laboratories
Hutchinson, Kansas, USA

Honorable Mention
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Shani Jolly, A. Thionville, Nancy Trosclair, Boyce Butler
Thionville Laboratories, Inc.
New Orleans, Louisiana, USA

Olive Oil Part A

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

Honorable Mention
Giorgio Cardone
Chemiservice S.R.L.
Monopoli, Bari, Italy

Olive Oil Part B

First Place
Giorgio Cardone
Chemiservice S.R.L.
Monopoli, Bari, Italy

Olive Oil Part C

First Place
Giorgio Cardone
Chemiservice S.R.L.
Monopoli, Bari, Italy

Palm Oil

First Place
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PGEO Edible Oils Sdn Bhd (Prai Div.)
Prai, Malaysia

Honorable Mention
Laboratory Department
PGEO Edible Oils Sdn Bhd
Johor, Malaysia

Honorable Mention
Kooi Eng Tan
PGEO Edible Oils Sdn Bhd (Lumut Div.)
Sitiawan, Perak, Malaysia

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Honorable Mention
Brownfield Analytical Team
JLA USA
Brownfield, Texas, USA

Phosphorus in Oil

First Place
POS Bio-Sciences
Saskatoon, Saskatchewan, Canada

Solid Fat Content by NMR

First Place
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Bunge Canada
Hamilton, Ontario, Canada

Honorable Mention
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J. Pickle, D. David/H. Sidhu, R. Manalang, D. Simmons
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Eurofins Central Analytical Labs
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Soybean Oil

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Honorable Mention
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Honorable Mention
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Channahon, Illinois, USA

CONTINUED ON PAGE 656

Malaysia's golden crop

In July 2010, inform *Associate Editor Catherine Watkins attended the 30th Palm Oil Familiarization Programme (POFP) organized by the Malaysian Palm Oil Board (MPOB) in Kuala Lumpur. The weeklong meeting included several days of lectures, followed by visits to a plantation, refinery, and MPOB research facilities.*

Clearly, sustainability has been a major initiative of the Malaysian government and palm oil industry for quite some time. This photo-essay looks at some of the many sustainability measures currently in place in the context of the country's development as a whole.

Catherine Watkins

The Petronas Twin Towers in Kuala Lumpur, pictured right, are a symbol of Malaysia's rapid development. (Petronas—short for Petroliam Nasional Bhd.—is the Malaysian government-owned international oil and gas company, which was founded in 1974.)

The towers were designed by Argentine architects César Pelli and Djay Cerico under the consultancy of Julius Gold. They were the world's tallest buildings from 1998 to 2004, when the Taipei Financial Center surpassed them. They remain the tallest twin buildings in the world at a height of 452 meters (1,483 feet) above street level.

And now for the dry facts, which cannot fully communicate the vitality of the country and its people. Malaysia is a federal constitutional monarchy that achieved independence from Great Britain in 1957 and was established as a unified state in 1963. It has a total landmass of almost 330,000 square kilometers, which is slightly larger than the US state of New Mexico. The South China Sea separates the country into two regions—Peninsular Malaysia and Malaysian Borneo (also known as East Malaysia).

No longer considered as a developing economy, Malaysia had a gross domestic product (GDP) of $222 billion in 2008, according to the World Bank—the second-highest GDP per capita in Southeast Asia after Singapore. Malaysia also ranked among the top 10 most competitive economies for the first time in 2010, according to the 2010 World Competitiveness Yearbook published by the Swiss-based Institute for Management Development. In addition, the country's oleochemical industry continues to lead the world in production of basic oleochemicals and derivatives, manufactured mainly from palm and palm kernel oil.

The country's multicultural citizenry (largely native Malay, Chinese, Indian, and a wealth of indigenous tribes) take great pride in their country's growth and in the country's "golden crop" of oil palm. In 2009, 4.69 million hectares (ha) of land were devoted to oil palm production in Malaysia. Of that area, roughly 60% constituted large estates and 40% represented smallholdings, each with about 2 ha in production. (By comparison, fewer than 100,000 ha were planted with oil palm in 1960.)

Approximately 50–55% of the country is under forest; these forests must be preserved by virtue of a forward-looking government mandate enacted in 1990. Therefore, most of the increase in production of oil palm has come as a result of a shift from production of other tree crops such as rubber, cacao, and coconut.

Sustainability involves a balance among the three Ps of people, planet, and profit. It is impossible to overstate the importance of oil palm in alleviating poverty in Malaysia (as well as in Indonesia, the world's top producer of palm oil). Malaysia's Federal Land Development Authority (FELDA), which was created in 1956, has worked to eradicate poverty through the transformation of the rural sector from subsistence-based agriculture to smallholdings. According to MPOB, FELDA has uplifted approximately one million people from poverty.

The oil palm tree is unique among oilseeds because of its inherent high productivity and efficient carbon assimilation. Under current practices, the oil palm is the highest-yielding oil crop in the world, and is a perennial crop that continues to produce oil for 20–25 years, unlike annual oil crops that must be planted year after year.

The high yields of the oil palm (average 4.09 metric tons (MT) oil/ha/year) are 11 times that of soybean (0.37 MT oil/ha/year) and almost six times that of rapeseed (0.75 MT/ha/year), according to MPOB. Hence, oil palm, which comprises about 5% of the world's total area planted with the seven major oil-bearing crops, accounts for over 30% of the global production of oils from these crops. In comparison, rapeseed production—which covers about 13% of the planted area—accounts for about 16% of the oil produced from the seven major crops, MPOB notes. (Those crops are palm, soy, rapeseed, sunflower, cottonseed, peanut (groundnut), and coconut.)

Various agronomic practices have increased the maximum yield of oil palm in Malaysia to about 4 MT/ha (compared to 3 MT/ha in Indonesia). MPOB researchers told the POFP participants that they believe the yield can eventually be increased to as much as 8 MT/ha/year.

Above: Malaysia's capital city of Kuala Lumpur, seen here from the vantage point of the observation bridge of the Petronas Twin Towers, has a population of about 7 million in its metropolitan area. The country itself has a population of approximately 28 million, including 2 million migrant workers from other countries in Southeast Asia.

Note the metallic edge at the top of the photo. This marks the beginning of the upper level of the double-decker pedestrian sky bridge connecting the Petronas Twin Towers.

The photograph above shows seedlings at three, six, nine, and 12 months. The photograph to the right reveals the interior of an oil palm fruit, with its bright orange palm oil-producing mesocarp and palm kernel, the source of palm kernel oil. Each fruit is about 5 cm long.

When palm fronds are removed during harvest, they are stacked in piles to be chipped and then applied as fertilizer (left). Likewise, when palm trees are taken out of production, the trunks are chipped (as are empty fruit bunches) and used as fuel for mills or to produce fiberboard, particle board, or paper. In addition, empty fruit bunches and palm oil mill effluent can be composted.

Complete use of oil palm biomass is the goal of both MPOB and the oil palm industry in Malaysia.

Mechanization is one of MPOB's primary areas of focus. Development of agricultural and processing machinery not only will increase yields and decrease costs, it will also reduce Malaysia's reliance on foreign laborers.

Below left, a collection vehicle works its way down a row of palm trees as its driver (below right) carefully places newly harvested fresh fruit bunches (FFB) into the vehicle. (Bruised or overripe fruits produce highly acidic, low-quality oil.) Each FFB weighs 20–30 kilograms and holds between 1,000 and 3,000 fruits.

Male (above left) and female (above right) flowers (inflorescences) open at different times on the same tree. Agronomic stress increases the number of males and affects yield adversely.

*The primary pollinating agent of oil palm is a tiny weevil (*Elaeidobius kamerunicus*) imported from Cameroon and introduced to Malaysia in 1981. Prior to that time, pollination was an expensive and time-consuming manual operation. After introduction of the weevil, yield increased dramatically. The weevil seen here (right) fortuitously landed on a plantation worker's hand and obligingly held still throughout the photographic process.*

Malaysian palm oil producers also practice integrated pest management through the cultivation of beneficial plant species that attract natural enemies and predators of the bagworm and nettle caterpillar, two pests that can devastate large areas of oil palm. In lieu of chemically controlling field rats, many plantations depend on barn owls like the one seen here (right). Owls are housed in wooden boxes placed among the oil palms.

Additional sustainable practices used on oil palm plantations include the planting of cover crops to control erosion, a zero-burn policy for land clearing, conservation of areas alongside rivers, land use and management with environmental impact assessments, methane abatement through composting, and social impact assessments to protect surrounding communities.

Oil palm plantations themselves are richly biodiverse, teeming with mono- and dicotyledons—which together make up the flowering plants—ferns and brackens, arthropods, mammals, birds, reptiles, and amphibians. ■

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Nutrient variation of common ingredients—Part 2

Dale Hill, Jolene Hoke, Ryan Taylor, and Tom Sliffe

Editor's note: This article has been adapted from the talk given by Dale Hill of ADM Alliance Nutrition, Inc. (Quincy, Illinois, USA) on May 17 at the 101st AOCS Annual Meeting & Expo in Phoenix, Arizona, USA.

Part 1, which ran in the September 2010 issue of inform, *presented average nutrient values for a number of standard ingredients in livestock feed and pet foods. This month, we present data for the same ingredients, this time obtained by near infrared (NIR) spectroscopy.*

Marge McCutcheon, a seed analyst/feed microscopist for the West Virginia (USA) Department of Agriculture and a past chairperson of the AOCS Agricultural Microscopy Division, explains the value of these data: "Microscopists take a finished product and break it down into its individual components. Manufacturing, transportation, origin of bulk ingredients, handling, and storage may all affect the finished product; these effects can often be seen under the microscope.

"Knowing where feed ingredients originate can help microscopists understand nutrient variation and its effects on cost savings through significant gains in productivity in livestock," McCutcheon continues. "It can also help answer questions about why livestock producers are or are not getting significant gains in their animals. Ingredients from different areas or origins are not and should not be assumed to all be equal in value. Thus, the old feed adage: 'Junk in equals junk out.'"

The use of computer programs for formulation of livestock and pet food diets has resulted in significant gains in productivity for livestock producers and significant cost savings for manufacturers. Using the complex mathematical equations in these programs requires the use of specific nutrient values. The use of these precise formulas and nutrient levels often leads us to ignore normal biological variation of these nutrients. With today's transportation infrastructure, the origin of bulk ingredients can be challenging to track, and greater variability may be encountered. This increases the importance of laboratory testing and knowing what the biological variation may be. Lab results are only as good as the sample received, so proper sampling methods and complete sample descriptions are essential. Nonuniformity in ingredients, mixed products, and sampling methods will lead to errors that contribute to nutrient variability.

Part 2 of this article focuses on results obtained with equations developed from near infrared (NIR) analyses carried out by Perten Instruments Inc. NA, Springfield, Illinois, USA (+1 217-585-9440.) Most ingredients are summarized over a period of two years. Sample descriptions did not allow for identification by variety, processing method, geographic area, or crop year. Analyses are by NIR readings as correlated with wet chemistry methods. The accuracy of the NIR data depends on the accuracy of the reference method that is used for comparison.

Data are presented as average (Ave), correlation (*R*), number of samples (N), lowest value, and highest value for that analysis. Correlation is an indication of linear relationship of wet chemistry results with NIR results. NDF, neutral detergent fiber; ADF, acid detergent fiber.

Barley (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	9.21	0.98	300+	6.8	19.6
Crude protein, %	10.59	0.98	300+	6.8	15.8
Starch, %	51.20	0.96	200+	46.1	58.8
Crude fiber, %	4.10	0.93	200+	2.9	5.9

Canola full-fat (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	8.74	0.98	600+	3.9	15.3
Protein, %	19.21	0.98	300+	15.3	26.6
Oil, %	36.44	0.96	600+	29.0	52.8
Ash, %	3.81	0.65	<100	3.3	4.5
Palmitic acid, %	4.1	0.88	<100	3.5	5.6
Stearic acid, %	2.0	0.81	<100	1.6	2.7
Oleic acid, %	61.02	0.96	<100	55.8	67.1
Linoleic acid, %	19.22	0.95	<100	16.0	25.4
Linolenic acid, %	8.25	0.89	<100	5.9	11.7

Canola meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	11.21	0.98	600+	7.4	14.4
Crude protein, %	35.23	0.97	600+	32.0	40.7
Oil, %	4.54	0.97	600+	0.5	10.8
Crude fiber, %	10.62	0.89	600+	8.3	16.5

Chicken by-product meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	13.85	0.94	100+	11.3	16.5
Crude protein, %	63.71	0.82	100+	57.6	69.8
Crude fat, %	19.11	0.97	100+	10.2	27.9
Ash, %	3.01	0.88	100+	2.2	4.5

Corn (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	15.24	1.00	2500+	7.4	37.6
Crude protein, %	8.29	0.97	1500+	4.9	15.3
Crude fat, %	5.21	0.97	1500+	2.2	13.5
Starch, %	62.25	0.81	200+	57.7	67.6

Corn gluten feed (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	11.20	0.98	100+	8.0	14.3
Crude protein, %	47.29	0.96	100+	42.1	53.0
Crude fat, %	1.28	0.94	100+	0.1	2.2

Corn gluten meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	8.28	0.96	<100	5.4	13.7
Crude protein, %	60.91	0.99	<100	51.9	68.1

Corn distillers grains (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	9.61	0.99	500+	2.3	16.3
Crude protein, %	29.44	1.00	400+	23.5	38.4
Crude fat, %	10.31	0.92	200+	7.5	12.6
Crude fiber, %	7.27	0.94	<100	6.1	11.9
Ash, %	5.04	0.94	100+	3.0	6.5
ADF, %	13.32	0.84	<100	10.3	17.6
Starch, %	8.23	0.94	100+	0.5	9.4

Cottonseed hulls (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	6.79	0.97	200+	5.2	9.7
Crude protein, %	14.42	0.96	200+	3.2	20.07
Crude fat, %	2.19	0.97	200+	0.66	4.62
Crude fiber, %	37.16	0.96	200+	25.44	52.6

Cottonseed meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	12.25	0.97	200+	6.7	17.35
Crude protein, %	41.29	0.97	200+	37.31	46.33
Crude fat, %	2.95	0.97	200+	0.5	6.88
Crude fiber, %	10.92	0.94	200+	6.15	16.09

Feather meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	5.49	0.96	100+	1.8	13.3
Crude protein, %	84.12	0.93	100+	76.9	90.3
Crude fat, %	7.66	0.95	100+	2.9	12.1
Ash, %	2.12	0.49	100+	1.3	5.7

Fish meal (air-dry basis)

Lab test	Ave	R	N	Low	High
Moisture, %	7.82	0.98	400+	4.0	11.3
Crude protein, %	66.24	0.92	500+	56.4	78.9
Crude fat, %	9.11	0.97	100+	5.2	14.1
Ash, %	17.38	0.95	<100	8.3	26.4

Meat and bone meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	4.41	0.98	1000+	1.0	12.2
Crude protein, %	53.2	0.96	1000+	4.9	61.6
Crude fat, %	10.42	0.96	1000+	4.3	22.7
Ash, %	25.87	0.97	1000+	13.3	42.5

Oats (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	10.21	0.96	<100	7.8	14.6
Crude protein, %	11.20	0.91	<100	9.4	13.9
Ash, %	3.10	0.75	<100	2.7	4.1
NDF, %	27.5	0.71	<100	22.1	36.2

Poultry meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	4.56	0.98	1000+	2.0	9.5
Crude protein, %	65.39	0.97	1000+	10.1	73.2
Crude fat, %	12.64	0.96	1000+	9.8	16.5
Ash, %	13.91	0.97	1000+	6.6	25.9

Rice flour (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	9.90	0.96	100+	8.1	13.0
Crude protein, %	6.71	0.91	100+	4.4	8.8
Crude fat, %	1.82	0.86	100+	0.1	2.4
Ash, %	0.49	0.95	100+	0.1	1.2

CONTINUED ON NEXT PAGE

Rice, white polished (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	13.4	0.98	100+	11.9	16.6
Crude protein, %	8.90	0.99	100+	6.5	13.8
Starch, %	88.29	0.89	100+	83.6	94.2

Rye (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	14.21	0.97	<100	12.6	17.2
Crude protein, %	8.91	0.93	<100	6.0	11.8
Ash, %	2.17	0.82	<100	1.3	2.6

Sorghum grain (milo) (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	14.21	0.86	200+	11.5	19.4
Crude protein, %	11.29	0.92	200+	9.3	12.8
Starch, %	63.42	0.97	200+	58.6	73.6

Soybean meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	11.71	0.95	400+	9.0	14.3
Crude protein, %	47.97	0.95	400+	42.4	51.6
Crude fat, %	1.38	0.95	400+	0.2	2.2
Crude fiber, %	3.33	0.95	400+	2.7	9.3
Ash, %	6.44	0.81	400+	5.4	6.9
Lysine, %	3.44	0.91	100+	2.8	3.7
Methionine, %	0.76	0.60	100+	0.6	0.8
Threonine, %	2.06	0.77	100+	1.8	2.2
Tryptophan, %	0.74	0.88	100+	3.2	4.1

Soy hulls (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	6.72	0.99	300+	4.0	13.9
Crude fat, %	3.45	0.97	200+	0.6	5.3

Sunflower meal (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	8.29	0.95	200+	4.6	13.5
Crude protein, %	35.42	0.95	100+	28.4	40.6
Crude fat, %	3.56	0.98	<100	0.6	7.8
Crude fiber, %	19.24	0.76	<100	12.8	23.0

Sunflower seeds (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	6.2	0.92	100+	4.3	9.2
Crude fat, %	43.29	0.92	100+	37.4	52.1

Triticale (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Dry matter, %	88.90	0.93	<100	87.9	90.4
Crude protein, %	9.89	0.95	<100	8.6	12.8
Ash, %	1.79	0.82	<100	1.3	2.6

Wheat (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	13.52	0.99	1000+	8.0	22.0
Crude protein, %	15.20	0.99	1000+	9.2	22.2
Starch, %	68.29	0.94	200+	61.5	72.7
Crude fiber, %	2.80	0.44	200+	2.0	4.0
NDF, %	11.27	0.81	<100	7.2	18.2
Ash, %	1.23	0.77	<100	0.8	2.10

Wheat distillers grains (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	9.28	0.98	<100	4.6	17.5
Crude protein, %	32.19	0.98	<100	28.2	37.8
Starch, %	7.86	0.94	<100	5.9	11.5
ADF, %	15.0	0.89	<100	10.0	24.0

Wheat midds (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	12.10	0.92	100+	10.7	14.4
Crude protein, %	15.2	0.98	100+	13.8	18.8
Crude fat, %	3.10	0.82	<100	1.7	4.7
Crude fiber, %	6.9	0.91	<100	3.7	10.3
Ash, %	4.50	0.88	<100	3.6	5.7

Poultry fat (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	0.16	0.91	700+	0.0	1.33
Fat, %	98.8	0.92	<50	94.8	99.6
Free fatty acids, %	2.40	0.96	700+	0.87	41.21
Insol. impurities, %	0.24	0.92	700+	0.2	1.90
Unsapon. matter, %	0.68	0.89	<50	0.32	1.68
Peroxide value	0.20	0.73	<50	0.08	0.56

CONTINUED ON NEXT PAGE

Tallow (air-dry basis)

Lab test	Ave	*R*	N	Low	High
Moisture, %	0.10	0.84	<100	0.01	0.23
Insolubles, %	0.05	0.89	<100	0	0.11
Unsapon. matter, %	0.43	0.37	<50	0.32	0.51
Total MIU, %[a]	0.61	0.74	<50	0.44	0.75
Total MI, %	0.08	0.73	<50	0.02	0.25
Free fatty acids, %	1.10	0.96	<100	0.19	4.50

[a] MI, % moisture + % insoluble impurities; MIU, % moisture + % insoluble impurities + % unsaponible material.

Those of us who work with this biological variation on a daily basis are familiar with typical nutrient values and know that nutrient testing is part of daily business. Commercial livestock feed manufacturers generally take advantage of nutrient variability and frequently adjust complete diets based on the nutrient levels of incoming ingredients. By primarily focusing and formulating on the major nutrients, there is still some degree of uncertainty and variability in micronutrient levels. Pet food manufacturers work from fixed formulas and have less opportunity to adjust manufacturing formulas to maintain specific multiple nutrient levels within a very narrow range. Thus, there is a greater degree of uncertainty and variability of nutrient levels in complete diets when fixed formulas are used.

Dale Hill and Jolene Hoke are with ADM Alliance Nutrition, Inc., Quincy, Illinois, USA. Ryan Taylor and Tom Sliffe are with Perten Instruments, Springfield, Illinois. Hill my be contacted at Dale.Hill@adm.com.

NEWS & NOTEWORTHY (CONTINUED FROM PAGE 613)

ASA also noted that "substantial management and board changes" had been made at the USSEC after ASA called for an investigation.

Jerry Slocum, president of the US Soybean Federation and a farmer from Coldwater, Mississippi, said in a news release, "I wish I could say this was a good process for USB to go through, but the bottom line is we already knew that USB was acting within the letter of the law. And now farmers had to spend nearly a million dollars in checkoff funds to respond to this petition. It's money that should have been used for countless better things—from new use research to protecting domestic animal agriculture."

The soybean checkoff is funded by one-half of 1% of the net value per bushel that a farmer receives at the first point of sale, according to the USB. State checkoff boards retain 50% of the collection and the USB collects the other 50%.

Insta-Pro and General Mills to partner

Insta-Pro International (Des Moines, Iowa, USA) and General Mills, Inc. (GMI; Minneapolis, Minnesota, USA) announced a new partnership in August 2010.

The partnership "supports the work General Mills is doing in Africa that links the technical and business expertise of volunteer employees at General Mills to small- and medium-sized mills and food processors in Africa," the companies said in a statement.

GMI said its goal is to improve the ability of those African companies to produce high-quality, nutritious, and safe food at affordable prices and increase demand for the crops of small farmers who supply these businesses.

Insta-Pro provides extrusion and oil-pressing processes and equipment.

New Springer website

Springer has redesigned its online platform, SpringerLink (www.springerlink.com), which hosts nearly five million documents, including eBooks, journals, and reference works. Springer Science+Business Media began publishing AOCS' three journals in 2007.

The redesigned site includes newly integrated software that presents links to related content within journal articles and eBook chapters. When users perform a search, the technology analyzes each search result and compares its digital fingerprint to all other documents. This determines which documents are most similar to that article or chapter, ensuring that readers discover content that best meets their research needs. ■

BOOK REVIEW (CONTINUED FROM PAGE 630)

the new field of lipidomics and appreciate its value among other more traditional methods for lipid analysis. As with the previous three editions, I am confident that the fourth edition will serve for many years as a valuable reference tool to all oil chemists who are involved in the analysis of lipids from animals, plants, or microbes.

Robert A. Moreau is a research chemist at the Eastern Regional Research Center (US Department of Agriculture, Agricultural Research Service) in Wyndmoor, Pennsylvania, USA. His research interests have focused on methods development for lipid analysis (including functional lipids such as phytosterols, tocotrienols, and carotenoids) and their use to solve problems in agriculture and food science. He is an associate editor of Lipids, *a contributing editor of* inform, *and is chair of the AOCS Publications Steering Committee. He can be reached at robert.moreau@ars.usda.gov.* ■

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).

FORMULATION ENGINEERING (CONTINUED FROM PAGE 608)

The connection between the properties of microemulsions and the performance of SOW systems requires applying the principles of fluid mechanics (e.g., detergency, soil washing, enhanced oil recovery, environmental remediation), heat and mass transport (e.g., metal-working fluids, drug delivery systems), and even reaction kinetics (e.g., latex production, predicting oxidation rates). In enhanced oil recovery, for example, capillary curves (capillary number, $Ca = \mu V/\gamma$) are used to determine the appropriate interfacial tension (γ) and viscosity (μ) that formulation should have, for a given fluid velocity (V), to obtain the desired oil removal. A similar concept can be applied for the removal of oily stains from fabrics. For suspensions, the balance of inertial and surface tension forces, as described by the Weber number, defines the process of emulsification and washing of oil-contaminated soil particles.

While the connection between molecular structure and performance is still far from complete, the fact that these links have been established for selected examples suggests that the framework could be used in other applications. Some of these areas of opportunities include design of delivery systems, separation processes, aqueous extraction of vegetable oils, and cold temperature cleaning,. However, there are some challenges ahead, particularly the lack of a concerted effort to develop databases of HLD-NAC parameters, training of formulators on the proper use and limitations of the framework, user-friendly software, and further molecular bases for the HLD equations. Fortunately, there is will and enthusiasm among colleagues in industry and academia to embrace these concepts to harness their potential and tackle the challenges ahead.

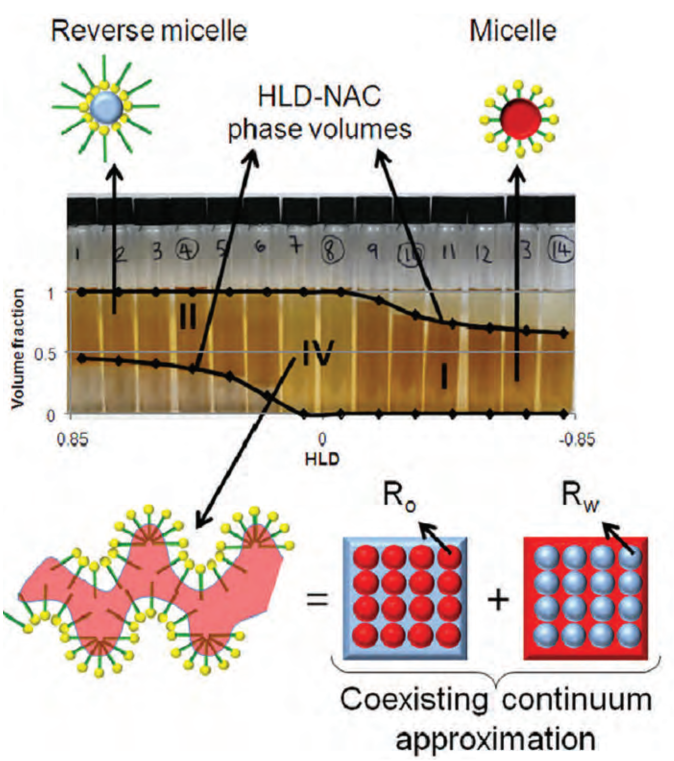

FIG. 2. *Lecithin microemulsions formulated with sorbitan mono-oleate and sodium caprylate (1–14% in the aqueous phase) and isopropyl myristate as the oil phase, using an oil-to-water ratio of 1:1. HLD-NAC, hydrophilipic-lipophilic difference–net and average curvatures; R_o, internal radius for emulsion in which oil is the internal phase; R_w, internal radius for emulsion in which water is the internal phase.*

*inform*ation

FOR FURTHER READING:

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Edgar Acosta obtained a bachelor's degree in chemical engineering from Universidad del Zulia (Venezuela, 1995), and M.A.Sc. and Ph.D. degrees in chemical engineering from the University of Oklahoma in 2000 and 2004, respectively. He is currently an associate professor at the University of Toronto where he leads the Laboratory of Colloids and Formulation Engineering (LCFE) group. His research interests include microemulsion phase behavior, cleaning technologies, drug delivery, cosmetic formulations, lung surfactants, biosurfactants and bio-based surfactants, recovery of value-added products from waste, surfactant-based separations, and environmental remediation technologies. Contact him at edgar.acosta@utoronto.ca.

2009–2010 AOCS LPP WINNERS (CONTINUED FROM PAGE 640)

Honorable Mention
Yasuhiro Fujii
George Weston Technologies
Enfield, New South Wales, Australia

Honorable Mention
Wakako Tsuzuki
National Food Research Institute
Tsukuba, Ibaraki, Japan

Honorable Mention
William Lillycrop
Health Canada
Scarborough, Ontario, Canada

Honorable Mention
QA/QC Laboratory ADM Mankato Refinery
ADM Refinery
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trans by IR

First Place
QA/QC Laboratory ADM Mankato Refinery
ADM Refinery
Mankato, Minnesota, USA

Unground Soybean Meal

First Place
Frank Hahn
Hahn Laboratories Inc.
Columbia, South Carolina, USA

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

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

Vegetable Oil Color Only

First Place
Brian Cooke
Dallas Group
Jeffersonville, Indiana, USA

PEOPLE NEWS (CONTINUED FROM PAGE 628)

biochemical diagnosis of sphingolipidosis, skin glycolipids, nutritional biochemistry, minor components of olive oil and their effect on nutrition, and the effect of omega-3 fatty acids on emotions and moods of astronauts/cosmonauts in the Space Shuttle.

Berra was an active member of the International Conference on the Bioscience of Lipids (ICBL), contributing as a member of the steering committee. He organized the meetings of the ICBL held in Stresa (Lake Maggiore), Italy, in 1989, and in Washington, DC, in 1995.

Berra had been a member of AOCS since 1986. ■


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