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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.*

November

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 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.

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.crf2010.com.

November 30–December 2, 2010. Next-GenFuels 2010, Delhi, NCR, India. Information: <http://growdieselevent.com/default.aspx>.

December

December 2–3, 2010. FOI 2010—Fats & Oils Istanbul International Conference & Exhibition, Ceylan InterContinental Istanbul, Istanbul, Turkey. Information: www.fatsandoilsistanbul.com.

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.otai-65agm.org.

December 6–8, 2010. World Algae Congress 2010 USA, Marines Memorial Club, San Francisco, California, USA. Information: email: michael.weinberg@terrapin.com; 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.

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

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AOCS Meeting Watch

April 30–May 1, 2011. Functionality of Lipids in Foods—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aoacs.org; <http://AnnualMeeting.org>.

April 30, 2011. Basics of Edible Oil Processing and Refining—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aoacs.org; <http://AnnualMeeting.org>.

May 1, 2011. New Technologies in Oilseed Extraction and Edible Oil Refining—AOCS Short Course, Hyatt Regency Hotel, Cincinnati, Ohio, USA. Information: email: meetings@aoacs.org; <http://AnnualMeeting.org>.



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

June 18, 2011. Sensory Evaluation of Olive Oil Short Course, Hilton Hotel, Izmir, Turkey. Information: email: meetings@aoacs.org; www.aoacs.org/goto/Turkey2010.

June 18–19, 2011. Basics of Oilseed Processing Short Course, Hilton Hotel, Izmir, Turkey. Information: email: meetings@aoacs.org; www.aoacs.org/goto/Turkey2010.

June 19, 2011. Edible Oil Refinery and Optimization and Maintenance Short Course, Hilton Hotel, Izmir, Turkey. Information: email: meetings@aoacs.org; www.aoacs.org/goto/Turkey2010.



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



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

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

January

January 12–17, 2011. Obesity, Keystone Resort, Keystone, Colorado, USA. Information: <http://www.keystone-symposia.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.national-ethanolconference.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 2, 2011. Practical Short Course on Biodiesel/Biofuel from Algae and Other Feedstocks—Industrial Applications of Vegetable Oil, Food Protein Research & Development Center, Texas Engineering Experiment Station, Texas A&M University System, College Station, Texas, USA. Information: <http://foodprotein.tamu.edu/fatsoils/scbiodiesel.php>.

February 27–March 4, 2011. Gordon Conference on Signal Transduction within the

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Nucleus, Four Points Sheraton, Ventura, California, USA. Information: www.grc.org/programs.aspx?year=2011&program=sigtrans.

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

March

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 Center, 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/INeTXkWKWklab2/wv>.

March 23–24, 2011. Wellness II, 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/index.asp.

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 10–13, 2011. 2nd Latino-American ICC [International Association for Cereal Science and Technology] Conference, WHotel, Santiago, Chile. Information: www.lacerealconference.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. ■

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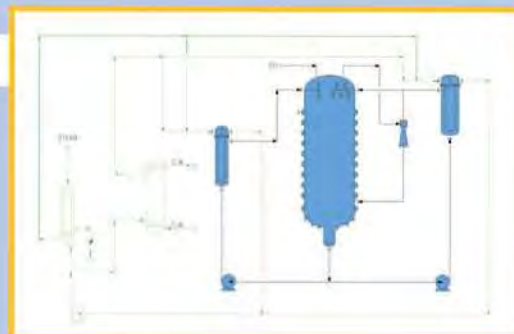
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Green trend drives personal care ingredients market

Anna Ibbotson

The natural personal care industry has continued to gain momentum over the past year despite a crippling global recession. Driven by consumer demand not only for natural products but also for sustainable manufacturing processes among brand marketers, the naturals market is expected to maintain a healthy growth rate over the next few years. This is great news for raw materials suppliers who now face a tremendous opportunity to innovate and develop key raw ingredients that not only meet formulators' and consumers' demand for naturalness but also offer the performance required to be on par with their synthetic counterparts.

On a global scale, the natural personal care market is approaching \$300 billion at the retail level, with the BRIC countries (Brazil, Russia, India, and China) and Argentina expanding their share at a rapid rate. In Europe, still the largest region, the natural personal care segment posted nearly 14% growth in 2009, compared to the overall market at just 4%. In the United States, the segment peaked at 8%—still quite robust considering the overall performance in the industry as a whole.

GREEN IS GROWING

A number of key drivers have converged to spur growth in the natural personal care market from the consumer, retailer, and brand marketer perspective. These forces make the naturals market quite attractive to ingredients suppliers:

1. Growing environmental awareness among consumers has lead to a global shift in their desire, behavior, and attitude toward natural products. Going green is no longer considered an eccentric behavior of a small but highly committed segment of the population. Now, the average consumer has become more aware of his or her impact on the planet and has begun taking steps to reduce that impact wherever possible.
2. Innovative product development in the naturals category has made green products more widely available, fueling consumers' demand for more environmentally friendly products. As green products become more accessible and affordable, it

becomes much easier for consumers to adopt them as a viable alternative to traditional synthetic formulations.

3. Mainstream acceptance of organics and "locavore" eating habits, whereby consumers source food products from their local region, has also prompted greater interest in natural personal care products. As consumers strive to avoid pesticides as well as synthetic growth supplements in their food, they have also begun reducing the incidence of other synthetic chemicals with which they come into contact.
4. Media hype and marketing have also played a significant role in the growing green trend. The powerful combination of brand marketing tactics, retail promotions, celebrity endorsements, and widespread media coverage has reinforced consumers' awareness of and desire for more sustainable products and practices. In Europe, where regulation under the REACH [Registration, Evaluation and Authorization of Chemicals] act makes available the certification seal for products that meet certain requirements, this adds to the marketing appeal of natural products.

As a result of these factors, major global marketers have stepped up efforts to meet consumer demand and capitalize on the market opportunity, as evidenced by key acquisitions that have brought some niche naturals brands mainstream. Estée Lauder's string of acquisitions that began with Aveda in 1997 has made the company a naturals powerhouse in the personal care market. L'Oréal, Colgate-Palmolive, and Clorox have also recognized the potential, throwing the power of their mega-marketing machines behind previously unknown small brands such as Tom's of Maine and Burt's Bees.

THE PROBLEM OF PERFORMANCE

Amid all of this attention, suppliers are working overtime to develop natural ingredients to meet the demand. While great strides have been made in some ingredient categories to deliver the natural positioning and the performance required, some categories remain a challenge.

- *Specialty surfactants.* Of the \$600+ million specialty surfactants market, only about 10% of the raw ingredients available in this category are naturally derived. Natural alternatives for these products, which reduce skin and eye irritation of commodity surfactants and boost foaming properties in hair and skin-care rinse-off products, are gaining traction particularly in the mass-market product categories. Growth in the naturally derived segment is expected to reach nearly 4% CAGR (compound annual growth rate) through 2013. The leading product in this segment is alkyl polyglucosides (APG), supplied by Cognis (the market leader), Clariant, and Croda.

APG are manufactured from plant-derived materials such as vegetable oils and starch.

- **Specialty emollients.** Among the most widely used ingredients in personal care, emollients are effective in facial creams and cleansers, wipes, and other skin-care products for their moisturizing, softening, and anti-aging properties. Here, naturally derived products have a stronger share at just over 50% of the market, which totals in excess of \$400 million, and this market is expected to grow by more than 3.5% CAGR through 2013. By their very nature, these ingredients are more readily available, accessible and affordable to derive from natural sources, such as mineral and vegetable oils, and there is a general movement in the industry away from synthetics and animal-based ingredients (such as lanolin).
- **Conditioning proteins.** Similarly in conditioners, there is a strong shift away from animal-based to plant-derived proteins for the likes of skin and hair products. Now more than 60% of the conditioning market consists of plant-derived products, supplied in large part by Croda and Cognis, the clear market leaders. Despite their broader acceptance, botanical proteins remain less economical to produce leading many manufacturers to consider fish-based proteins as possible alternatives, as well as milk- and silk-based proteins, which have also shown some potential.
- **Hair fixative polymers.** Even more than surfactants, fixative ingredients used in hair sprays and other hair styling products prove to be a significant challenge when it comes to developing an effective, viable natural alternative. Synthetics, such as vinyl, acrylic, and polyurethane polymers, make up 99% of the active ingredients on the market. It seems that, with the possible exception of cornstarch-based formulas, devising the fixative properties from natural ingredients to meet the hair-styling demands of consumers is a formidable challenge.
- **Substantiated specialty actives.** Members of this unique class of ingredients, backed by scientific testing, are 100% naturally derived and used by formulators specifically to make performance claims in the skin-care product category. Driven largely by the demand for anti-aging properties, this category is expected to post a healthy CAGR of 7% over the next three years as the enormous baby boomer population turns to these products to stave off the signs of aging. These ingredients, including peptides, bio-tech actives and enzymes, and their associated claims are key to formulators in the luxury, high-end mass market, professional, and specialty trade classes as they cater to this mature population, which typically enjoys a higher level of disposable income.

INNOVATION IS THE KEY TO GROWTH

The growth in the naturals market presents a unique opportunity for raw ingredients suppliers to carve out a strong position as a leader in this industry. To do so would likely require a blockbuster R&D [research and development] breakthrough to discover and develop a viable natural alternative to one of the more vexing performance issues, such as surfactants or fixatives. While just about every player in the supplier market has built a “green” portfolio, much work remains to be done to solve the problems of performance, availability, and pricing that make the naturals proposition a significant barrier, especially in the hair-care and cleansing product lines.

With the naturals trend well-entrenched around the globe, ingredients suppliers are eyeing the burgeoning opportunity in the Asia-Pacific region. Some, Cognis included, have already established production facilities, particularly in China, to leverage the anticipated growth here and compete directly with local domestic suppliers.

As suppliers and formulators strive to reduce the amount of “science” in their products to achieve a more natural slant, there is an overall movement toward a more collaborative, interactive relationship. Working together to develop multifunctional ingredients that solve multiple performance challenges not only helps reduce the number of ingredients in the product, which imparts a more natural position, but also works to reduce the overall cost of production—which benefits both parties, as well as, ultimately, the consumer.

Anna Ibbotson (Anna.Ibbotson@klinegroup.com) is industry manager with Kline & Company. Reprinted with permission.

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One person's response to a high omega-6 diet

Susan Allport

Editor's note: In a departure from the norm, *inform* presents a single-subject study from *Queen of Fats* author Susan Allport. In this first-person account, Allport writes about how a month-long experiment in radically altering her diet had almost immediate effects.

Research has shown associations between diets high in omega-6 fatty acids and weight gain, diabetes, heart disease, and depression. I decided to find out first-hand how such a diet could affect my personal well-being. For a month, I was planning to eat a diet with a gross imbalance of the two essential fats: omega-3s and omega-6s, fats that are called leaf fats and seed fats because omega-3s originate in the green leaves of plants and omega-6s are much more abundant in seeds. These two fats, both of which are polyunsaturates, are currently grouped together in most health recommendations, including the US *Dietary Guidelines for Americans*. But evidence is mounting that a balance between them is critical for good health.

The leaf fats, omega-3s, are the more dynamic of these fats. They speed up the activity of cells and are concentrated, not surprisingly, in all our most active tissues: brains, eyes, hearts, sperm. They originate in green leaves—including phytoplankton, the microscopic green leaves of the ocean—and accumulate in animals that eat green leaves: fish, of course, as well as grass-fed cows and other animals. Omega-6s, the seed fats, are slightly less dynamic and much more inflammatory. They help animals fight infections and store fat for the winter. In excess—as in the North American diet and the diet I was planning to go on—they've been implicated in everything from obesity to heart disease; cancer to Alzheimer's and other mental disorders.

To the casual observer, the foods in my experimental diet would look just like my normal fare: lots of whole grains, nut butters, vegetables, fruits, lean meats, fish, and salads (see sidebar on page 714). But they would differ in a small way that I, and a growing number of scientists, know to be very important: the fats I would cook with; the oils I would dress my salads with would be vegetable (or seed) oils that are very rich in omega-6s, oils such as safflower, sunflower, corn, and soybean oil, oils that constitute most of the added fats in the North American food supply.

Omega-3s and omega-6s compete for positions in our cells, as scientists have known since the 1950s, such that anyone consuming a diet too rich in omega-6s would have fewer omega-3s in all of her tissues—no matter whether she continued to eat fish. US consumers eat 10 times as many omega-6s as they do omega-3s, according to the Agricultural Research Service of the US Department of Agriculture. And it is that imbalance—not the amount of fish we eat—that is causing us to be deficient in omega-3s. Some experiments show a healthy balance is on the order of 4:1.

So why was I doing this? Because no one, as far as I know, had ever done it before—and the results might



just convince a few skeptics that the balance of omega-6s to omega-3s is really important. No one has ever taken an individual with healthy amounts of omega-3s in her tissues, and then switched her to a diet high in omega-6s—while monitoring the results.

This is very different from putting people with large amounts of omega-6s in their tissues on a high-omega-3 diet—something researchers do all the time by giving fish oil to average subjects. Because we store large amounts of omega-6s (but not omega-3s) in our fat tissue, it can take years to see the benefits of those omega-3s. So the results of many of those studies have been equivocal or confusing.

But going in the opposite direction might be very quick, I hypothesized. If animals, as I have suggested in my book *The Queen of Fats*, use the differences between omega-3s and omega-6s to prepare for the changing seasons—for periods of activity and reproduction when the faster fats of green leaves are available and periods of hunkering down and survival when the slower fats of seeds are more abundant, then the response to a high-omega-6 diet would have to be pretty quick if it were going to be useful.

The scientists I told about this project were enthusiastic (it was my body, after all, not theirs!). Doug Bibus, an AOCS member at the University of Minnesota, agreed to test my blood on a daily basis with his home omega-3 kit and monitor how the omega-3s and omega-6s changed over the course the month. Bibus also put me in touch with Jeff Volek, an associate professor in the Human Performance Laboratory at the University of Connecticut, who offered to measure my resting metabolic rate (RMR), the amount of energy my body expended at rest, before and after the diet.

I drove to the University of Connecticut, where preliminary medical tests were carried out before I began the diet. The first thing

was to determine my RMR. Next, five vials of blood were drawn, which would be divided at the end of the month between Volek and Bibus. And then a body composition scan was carried out using a state-of-the-art dual-energy X-ray machine to determine the amount, and distribution, of fat and lean tissue throughout my entire body.

The scan was followed by an ultrasound of the artery in my arm (the brachial artery) and an assessment of how well this artery responded to an increase in flow—what scientists call shear stress. This test, called Flow-Mediated Vasodilation, was developed in the 1990s and is a good measure of overall vascular health and a good predictor of the risk of developing atherosclerosis, hypertension, and heart failure.

Omega-6s have been implicated in all these conditions (because of their inflammatory nature and because they also increase blood pressure and promote blood clotting and constriction of the blood vessels), and Volek thought it would be interesting to see if my month-long diet would produce a change in my arteries. I doubted it, but was impressed by how quickly I was taken through this, and all the tests.

The morning ended with breakfast at the inn where I had stayed. I ordered scrambled eggs and whole wheat toast, something my omega-3 self would rarely ask for in a restaurant. Eggs are high in omega-3s when they are laid by chickens that forage for greens and insects—or chickens that have been fed a high omega-3 diet, such as flax and fish meal. But commercial eggs, of the kind that would be served in a restaurant, are sure to be high in omega-6s. The chickens that laid them are sure to have been fed on corn and soy.

And thus this month of omega-6 eating began. I won't bore you with the details of every meal, but the sidebar summarizes the kinds of changes I made. It wasn't an unhealthful diet—by most people's

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standards. What would happen if I kept the quantity, and the kind, of food the same, but just changed the essential oils?

Most medical organizations, as I've said, wouldn't see anything harmful in this change, but a large number of scientists believe that our reliance on cheap, high omega-6 vegetable oils is the underlying cause of many of our health problems. Both omega-3s and omega-6s are essential: We can't make them ourselves and must consume them in our diet. But a balance between them creates tissues with just the right amount of speed and activity, inflammation, and blood flow. Ever since vegetable oil consumption began to skyrocket in the 1950s (replacing butter and lard) so has the incidence of inflammatory diseases, such as heart disease, and metabolic diseases, such as obesity and diabetes.

My temporary shift to a high omega-6 diet didn't result in any of these diseases (I hope), but I did experience an almost immediate thickening in my belly area. I know from the literature that omega-6s promote the development of fat tissue; still I was amazed it was happening to me. I didn't weigh myself during the diet since I feared that any weight gain might send me on a secret, subversive diet, but I felt sure that I was putting on pounds. Any other symptoms were more fleeting and hard to attribute to diet alone. My stomach felt on fire after several meals, and I flushed more and longer after drinking alcohol. My husband thought my body smell was different; and I was short of breath on several of my daily walks.

Flash forward 30 days, and I was thrilled to be at the end of my diet. By the time I returned to the University of Connecticut, I had a large, unpleasant wad of belly fat that I could grab in one hand. I was certain I had gained at least five pounds. I was shocked, there-

fore, when I found that my weight was exactly as it had been a month before—56 kilograms or 124 pounds.

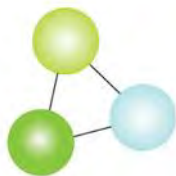
Later that morning—after all the tests were completed—I learned from Volek just how profound the changes to my body had been. Yes, my weight was almost the same, but what weight I had gained—5.6 ounces or just under half a pound—was almost entirely fat and in my abdominal area, as the follow-up body scan showed—exactly as I had experienced it. Just as interesting, and the cause, perhaps, of this gain, was that my RMR had fallen by 5%. This drop was within the day-to-day variation for this test (6.2%), but it was in the direction predicted by the diet and the magnitude to explain my small gain in weight.

In just one month, it seems, I had reduced the number of calories I needed to maintain my body at rest by 5%, the equivalent of 76 calories. This may not sound like a lot, but over time, those calories—the amount in a one-ounce piece of mozzarella, for example, or eleven whole almonds—would add up. If I didn't reduce my food intake in order to compensate for this decrease (go on a diet, in other words), I would put on a pound in about 46 days; eight pounds in a year. And this 5% drop in metabolic rate was after just one month. What if I kept to this high-omega-6 diet for six months? Or a year? Or a lifetime, as many people do?

The change in RMR wasn't all. At the same time my RMR was falling, my arteries were becoming stiffer, or less able to expand and contract, as revealed by the follow-up ultrasound. In just 30 days, the amount of dilation my brachial artery was capable of had dropped by 22%, a change much larger than the day-to-day variation of this test.

CONTINUED ON PAGE 714

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Glycerophospholipids—what they do for us

William W. Christie

The common glycerophospholipids consist of a 1,2-diacyl-*sn*-glycerol backbone to which a phosphate moiety is linked to position *sn*-3, and this in turn can be linked to a base or to another organic moiety, such as inositol or serine. For example, phosphatidylcholine or 1,2-diacyl-*sn*-glycerol-3-phosphorylcholine (or “lecithin,” although the term is now used more often for the mixed phospholipid by-products of seed oil refining) is usually the most abundant phospholipid in animal tissues, and it is often a substantial lipid component of plants. A major function of phospholipids in tissues is to serve as the building blocks of membranes, but it is now recognized that each phospholipid also has distinctive biological properties.

For example, phospholipids provide a matrix for the assembly and function of a wide variety of enzymes, they participate in the synthesis of macromolecules, and they act as molecular signals to influence metabolic events. Anionic lipids such as phosphatidylinositol and its phosphorylated derivatives, which are concentrated on the cytoplasmic leaflet of membranes, exert a control on the properties of the membrane–cytosol interface and consequently on many aspects of membrane trafficking. Specific lipids of this kind are associated with each cellular organelle, where in combination with other signaling molecules they can recruit proteins required for specific functions in that cellular compartment.

PHOSPHOLIPIDS IN MEMBRANES

Cellular membranes are semipermeable barriers that enclose and define the cell and its organelles. They control the transport of materials, including signaling molecules, and many reactions that occur within membranes, including energy production and biosynthesis of cellular components. In addition, they can deform to enable budding, fission, and fusion. It is evident that the specific lipid compositions of membranes have evolved to provide a barrier to the diffusion of ionic solutes and other molecules into cellular compartments where they may not be required. At the same time, the membrane environment provides a stable molecular platform for essential metabolic events and for intense signaling activity. Cellular membranes are the first site for receipt of extracellular signals, they recruit and activate effector molecules, and they are the launch pad for activated effector molecules throughout the cell.

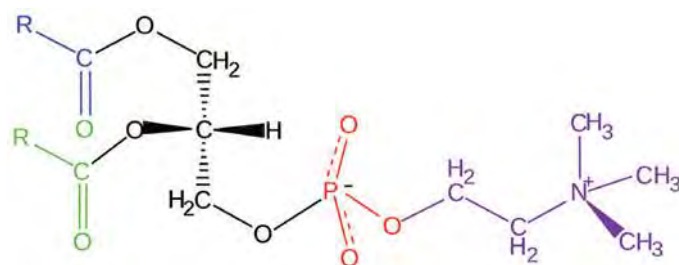


FIG. 1. Phosphatidylcholine, or 1,2-diacyl-*sn*-glycerol-3-phosphorylcholine (lecithin).

The characteristic feature of membrane lipids, which are essential for all of these functions, is that they contain both hydrophobic and hydrophilic constituents, that is, they are amphiphilic. As such, they are weak surfactants and they tend to form aggregates in bilayer or hexagonal-II arrangements in aqueous media in the normal temperature ranges that prevail in living cells. However, in natural membranes, there is a mixture of lipid types, which determine that bilayer structures predominate.

Glycerophospholipids, such as phosphatidylcholine, phosphatidylethanolamine and so forth, together with sphingolipids, such as sphingomyelin, and cholesterol, are essential structural elements of all biological membranes. In the conventional model, polar lipids form a bilayer with the polar head groups oriented toward the aqueous phase while the hydrophobic fatty acyl moieties are arranged internally.

Proteins, such as enzymes, transport systems or signaling receptors, can span the bilayer and take up a considerable proportion of the membrane surface. They interact through their basic amino acid residues with the ionic groups of polar lipids via electrostatic interactions, generating a net charge that is mainly negative or zwitterionic. In the process, their biological properties may be modified.

These membrane structures are not static, and free movement is possible within each leaflet (lateral diffusion) and between leaflets (vertical or flip-flop diffusion). In addition, lipid molecules can rotate around their principal axis (rotational diffusion). The lateral and rotational diffusions are responsible for the liquid characteristics of membranes, with the constraint that the hydrophobic chains remain parallel to each other and perpendicular to the surface of the bilayer.

The distribution of lipids in each of the membrane leaflets is asymmetric with phosphatidylcholine and sphingolipids located in the outer leaflet of the plasma membrane, for example, while phosphatidylethanolamine and anionic phospholipids such as phosphatidylinositol (and polyphosphoinositides) and phosphatidylserine occur primarily in the inner leaflet. Cholesterol occurs in roughly equal proportions in both faces, where it modulates the fluidity of membranes by its interaction with phospholipids. A membrane translocation machinery, which consumes large amounts of energy, is required to maintain this asymmetry.

Each glycerophospholipid with its distinctive polar head group and characteristic fatty acid composition modifies the properties of a membrane in a unique manner and contributes to its overall

properties. Phosphatidylcholine is often the most abundant lipid in membranes, and it has a cylindrical shape, which does not induce curvature. On the other hand, an increased concentration of cone-shaped lipids on one side and inverted cones on the other side of a membrane will bring about curvature, which may be required for membrane transport and fusion processes.

The balance between saturated, monoenic, and polyunsaturated fatty acids is important in maintaining the optimum degree of fluidity of a given membrane. Docosahexaenoic acid, for example, adopts a more flexible and compact conformation than more saturated chains with an average length only 60% of that for oleic chains, and this in turn increases the conformational disorder of saturated chains in mixed-chain phospholipids. In bacterial membranes, branched-chain and cyclopropane fatty acids modify the fluidity in an analogous manner. When ether and plasmalogen forms of lipids are also taken into account, membranes can contain a thousand distinct molecular species of phospholipid. As it is impossible to quantify the relative importance of each of these to the physical and biological properties of membranes, general assessments only are possible.

While the need to form stable bilayers is a primary prerequisite for all membranes, there is also a requirement for a potential ability of the lipids to form non-bilayer structures for some membrane-associated cell processes. For example, short-lived non-bilayer structures with specific lipid components are probably formed in the processes of fusion and fission of lipid bilayers and for cell division, while the activities of certain membrane-associated proteins can be modulated by lipids that do not form lamellar layers.

Further complexity is imposed by specific associations of phospholipids with membrane proteins. Defined lipid species are required to stabilize protein structures, to control the insertion and folding of proteins in membranes, and even to assemble or polymerize enzyme complexes with direct effects on their functions. In addition, many proteins are directed to membranes by covalent linkages to phospholipids such as the glycosyl phosphatidylinositol anchors. The sphingolipids together with cholesterol arrange themselves into distinct sub-domains or “rafts” with certain membrane enzymes, and they act to compartmentalize these and their different biochemical functions.

BIOLOGICAL FUNCTIONS OF PHOSPHOLIPIDS

All phospholipids have unique biological functions, and it is only possible to give a few examples here. Thus, phosphatidylcholine is a zwitterionic lipid and is usually the most abundant phospholipid in membranes of animal and plants. It is also an integral component of the lipoproteins in plasma. However, it may serve as a source of diacylglycerols with a signaling function, while the plasmalogen form especially may provide arachidonate for eicosanoid production. In addition, phosphatidylcholine is the biosynthetic precursor of sphingomyelin (and many other signaling molecules) and thus has an influence on innumerable metabolic pathways. Platelet-activating factor or 1-alkyl-2-acetyl-*sn*-glycero-3-phosphocholine, a closely related lipid, was the first biologically active phospholipid to be discovered. Among the innumerable activities that have been documented, it effects the aggregation of platelets at concentrations as low as 10^{-11} M, it is a mediator of inflammation, and it is involved in the mechanism of the immune response.

Phosphatidic acid, in which phosphoric acid only is esterified to a diacylglycerol, is the simplest diacyl glycerophospholipid, and it

is generally a minor component of cells. However, it is a key intermediate in the biosynthesis of all other phospholipids. It is known to have signaling functions in animal cells, by binding to particular proteins, and it may be even more important in higher plants where it is formed rapidly in response to stresses of all kinds. The “lyso analogue,” lysophosphatidic acid, is present at very low levels only in animal tissues, but it is extremely important biologically, influencing many biochemical processes by binding to specific receptors. It is significantly elevated in the plasma of ovarian cancer patients, compared to healthy controls, especially in the first stages, and may represent a useful marker for early detection of the disease.

Phosphatidylinositol is an acidic or anionic phospholipid, a high proportion of which in animal membranes consists of the 1-stearoyl,2-arachidonoyl molecular species that is of considerable biological importance. It is the primary donor of 1,2-diacylglycerols with specific signaling functions, and of inositol phosphates with many different biological activities. For example, they function as second messengers in many cellular processes, modulating vital biochemical mechanisms by activating members of the protein kinase C family of enzymes. In addition, phosphatidylinositol is the main source of arachidonic acid for the production of eicosanoids and of endogenous cannabinoids. In all eukaryotes, phosphatidylinositol serves as an anchor that links a variety of proteins to the external leaflet of the plasma membrane via complex glycosyl bridges, that is, glycosyl-phosphatidylinositol (GPI)-anchored proteins.

A further acidic lipid, phosphatidylserine, contributes substantially to nonspecific electrostatic interactions in the inner leaflet of membranes. This normal distribution is disturbed during platelet activation and in cellular apoptosis (the process of regulated cell death) when the lipid is transferred from the inner to the outer leaflet of the plasma membrane to act as a signal to scavenger cells to remove the constituents of the dying cell for re-use. Phosphatidylserine chelates with calcium to act as the foundation for bone growth. It is also an essential cofactor for the activation of many enzymes, including protein kinase C, a key enzyme in signal transduction.

Cardiolipin or diphosphatidylglycerol is a unique acidic phospholipid with four acyl groups. In the mitochondria of cells, its primary location, many biological functions of this lipid have been identified, but the main ones involve activation of those enzymes concerned with oxidative phosphorylation. Indeed, it is integrated into their quaternary structure, where it is an essential component of the interface between the enzymes and their environment and may stabilize the active sites. In higher plants, cardiolipin is an integral constituent of the photosystem II complexes, which are also involved in oxidative processes, and where it may be required for the maintenance of structural and functional properties.

Many other phospholipids could be discussed in this manner. Nor should it be forgotten that phospholipids are also of great importance technologically. They are used in innumerable food applications, in cosmetics and as drug delivery systems.

This article is adapted from one in the AOCs Lipid Library, where further information is available (<http://lipidlibrary.aocs.org/Lipids/whatdo/index.htm>).

William W. Christie was formerly head of the Chemistry Department at The Scottish Crop Research Institute and is a consultant to Mylnefield Lipid Analysis, where he continues to dabble in the analysis of lipids. He may be contacted at billchristie@blueyonder.co.uk.

Briefs

India and Argentina will formally exchange information on best agriculture practices and technologies and cooperate on research and development. India's Agriculture Minister Sharad Pawar and Argentine Agriculture Minister Julian Andres Dominguez signed an agreement during Pawar's visit to Argentina in September 2010, according to the Targeted News Service.

Argentina is the largest source of soy oil imported by India. In the first seven months of this year, India imported soy oil worth US\$1.4 billion, the report noted. India is also importing sunflower oil and other agro-products from Argentina, which is the largest exporter of soy and sunflower oils in the world.



The deal that Unilever struck with palm oil supplier Unimills in September 2010 for segregated certified sustainable palm oil brings the company closer to its goal of using only certified palm oil by 2015. Unimills' parent company is Sime Darby, which is based in Kuala Lumpur, Malaysia.



POS Pilot Plant (Saskatoon, Saskatchewan, Canada) has changed its name to POS Bio-Sciences. "This change has been made to reflect our new strategic direction and transformation to 100% self-sufficiency," the company said in a statement.



Marshall Edwards, Inc. (San Diego, California, USA), an oncology company focused on the clinical development of novel anticancer agents, is acquiring Novogen Ltd's (North Ryde, New South Wales, Australia) entire iso-flavone-related intellectual property portfolio in a stock-based transaction. Specific terms of the proposed agreement were not disclosed. ■

News & Noteworthy



Reprinted with permission from the September 2010 issue of Olea Newsletter, published by the California Olive Oil Council.

ISHS update: Decoding the olive genome

Liliana Scarafia

The International Society of Horticultural Science (ISHS; Leuven, Belgium) held its 2010 annual meeting in Lisbon, Portugal, from August 23–27. With over 7,000 members representing some 150 countries, ISHS is the world's leading independent organization of horticultural scientists. Olive is a major horticultural crop studied by many ISHS members.

Here are some highlights from presentations that covered olive cultivation, oil quality, and *Olea* genetic resources.

Mauricio Servili from the University of Perugia, Italy, ardently advocated for the creation of a higher grade of olive oil,

premium extra virgin olive oil, intended "to distinguish the Ferraris from the Ladas" [*sic*] sold as extra virgin olive oil.

In a workshop on olive genomics and breeding, Victoriano Valpuesta from Universidad de Salamanca in Spain reported on ongoing efforts supported by a private consortium to sequence the entire *Olea* genome. The expectation is that the release of genome sequence data, which might be publicly accessible once consortium members secured their own intellectual property, will be an important watershed in *Olea* breeding.

Research groups mainly in Israel, Spain, and Portugal reported the collection and study of wild and ancient *Olea* trees to preserve the genetic diversity within the genus for future breeding programs.

Other topics in several symposia covered olive tree architecture (for mechanical harvesting), salt and frost tolerance, measurement of olive maturity, and prediction of flowering to name a few. Abstracts of a number of presentations are available at <http://tinyurl.com/ISHS2010>.

As the founder and senior scientist of Agbiolab in Durham, California, USA, Liliana E. Scarafia has over 20 years of experience in molecular

biology with an emphasis on biochemical and molecular research. Most recently, she was a senior scientist at Roche, where she led projects in gene discovery and genomic analysis. She has an M.S. from Michigan State University (East Lansing, USA), where she majored in plant breeding, and a B.S. in agronomy from the National University in Argentina. She can be reached at Liliana.Scarafia@agbiolab.com.

Soy-grease manufacturing breakthrough

University of Northern Iowa (UNI; Waverly, USA) researchers working with an Iowa-based industrial microwave company have new reasons to celebrate. Their idea to make biobased grease by using microwaves has proven successful beyond their expectations and has recently been implemented in a biobased grease production facility.

When a fire destroyed the Environmental Lubricants Manufacturing Inc. (ELM) Plainfield, Iowa, production facility in 2007, Lou Honary and Wes James, both researchers at UNI's National Ag-Based Lubricants Center (NABL), began to search for alternative methods of making grease. They found a solution using microwaves to heat the greases in production.

Typically, the grease-making process requires heat transfer oils that are heated up to 600°F (300°C). These oils are used to “cook” the grease materials at temperatures of 350–400°F. If any heat transfer oil escapes the system at such high temperatures it could start a fire, such as that at ELM.

The research showed that heating by microwave does not damage the vegetable oils to the extent of other heating methods. Microwave energy uniformly heats the oil, thus preventing hot spots and premature oxidation of the oil. Also, vegetable oils have been shown to absorb microwave energy efficiently and heat up faster than petroleum-based oils. Most importantly, the grease-making process can be performed in approximately one-third as much time as the conventional method and in a much smaller space.

Honary and James were joined by experts from AMTek, a major industrial microwave equipment manufacturer, and began to scale up what had shown to be a

safer, more efficient, and more effective production method. Using larger microwave units at AMTek, the research team tested the concept with gallon-size batches, a step up from milliliter batches tested in the laboratory trials.

Using the patent-pending technology created by UNI-NABL, a new production-quantity 800-gallon microwave-based grease reactor became operational in September at ELM's grease and lubricant manufacturing facility in Grundy Center, Iowa.

The safety factor “has increased many times” said Honary, UNI professor and UNI-NABL director and co-inventor of this new process.

“We were excited to see that our theories were on the mark when we went from a 1.75 kW laboratory microwave to a 150 kW industrial microwave,” said James, UNI-NABL associate director and co-inventor. “Since the microwave heating is uniform, the end product is more predictable. The microwave energy can be pulsed through programmable logic controllers (PLCs), resulting in accurate heating and more uniform and consistent chemical reactions.”

Tim Sheurs, president and chief executive officer of AMTek, said, “We have been marketing our large industrial microwave units mostly within the food processing industry. But learning that the process can increase safety while actually making the chemical manufacturing more competitive is very promising.”

Alan Burgess, manager of operations at ELM, supervised the first production quantity biobased grease produced using microwaves. He was “pleasantly surprised” by the accuracy and speed of the heating.

“We completed a production batch in about two hours when in the past, even with much larger gas or electric operated heat system, it would take six to eight hours to complete the same process,” Burgess said. “The grease is lighter in color because we are sure we are not burning the product as in conventional methods and the process does not damage the product because the heating is uniform and quick.”

Stephen Rogers, chief financial officer of AMTek, is not surprised at the efficiency of the process.

“Industrial microwave systems can



Representatives of CropLife International and CropLife China met with members of the AOCs Technical Services unit on Wednesday, September 22, 2010, at AOCs headquarters in Urbana, Illinois, USA. The delegation learned about AOCs and its work with Certified Reference Materials.

Seen here on a bright afternoon are (from left) Changming Lu (Oil Crops Research Institute, Wuhan, Hubei, China); Jingwen Chen (Syngenta, Morrisville, North Carolina, USA); Ray Shillito (Bayer CropScience, Research Triangle Park, North Carolina); Richard Cantrill, Amy Johnson (AOCs); David Grothaus (Monsanto Co., St. Louis, Missouri, USA); Gina Clapper (AOCs); Boqiang Fu (National Institute of Metrology, Beijing, China); Angela McKean (BASF, Research Triangle Park, North Carolina); Shiping Zhang (Syngenta, Beijing); Greg Dana (DuPont/Pioneer, Johnston, Iowa, USA); Jun Meng (Nanjing Institute of Environmental Sciences, China); Xin Huang (Chinese Academy of Inspection and Quarantine, Beijing); Yinglong Cao (Oil Crops Research Institute, Wuhan, Hubei).

CropLife is a global federation representing the plant science industry.

Direct methods for analysis of esters of both 3-MCPD and glycidol advance

Catherine Watkins

Industry is closer to having validated methods for analysis of esters of both glycidol and 3-MCPD (3-monochloropropane-1,2-diol).

TECHNICAL SERVICES **AOCS** 

In mid-October 2010, AOCS began the formal process to adopt a direct liquid chromatography (LC)-mass spectrometry (MS) method for analysis of glycidyl esters (GE) as a recommended practice of the AOCS. Simultaneously, the search for collaborators began for the validation of the method according to ISO (International Organization for Standardization) principles. The ensuing official method will be issued as a joint method of the Japan Oil Chemists' Society and AOCS.

In addition, AOCS is recruiting participants for a collaborative study on a direct LC-time of flight-MS method for esters of 3-MCPD.

Esters of both glycidol and 3-MCPD are process contaminants that have been found in heat-processed vegetable oils. Glycidol and 3-MCPD, in their free states, are potential carcinogens. The International Agency for Research on Cancer (IARC) classifies glycidol as a genotoxic carcinogen (IARC group 2A, "probably carcinogenic to humans"). On the other hand, 3-MCPD has not been found to be genotoxic *in vivo*, although ingestion of free 3-MCPD induced cancerous and benign tumors in experimental animals after long-term intake.

On October 8, 2010, the US state of California, through its Office of Environmental Health Hazard Assessment, added 3-MCPD and 1,3-DCP (1,3-dichloro-2-propanol) to the list of chemicals "known to the State to cause cancer for purposes of the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65)."

The lack of a validated method of analysis for the esters of these two compounds has complicated toxicological research as well as mitigation efforts by industry. Therefore, AOCS formed an Expert Panel on Process Contaminants in December 2009. The panel next met in Japan in February 2010. The group's third meeting was held during the 101st AOCS Annual Meeting & Expo (AM&E) in Phoenix, Arizona, USA, in May 2010. There, panel members heard a number of presentations (available at <http://tinyurl.com/AMPresentations>) and agreed to share standards and study materials.

The most recent meeting of the panel was held on September 9, 2010, at AOCS headquarters in Urbana, Illinois, USA. There, one panel member reported on his work on a direct LC/MS "dilute and shoot" method for 3-MCPD ester determination using ammonium adduct formation. A review of his progress will be presented at the fifth meeting of the Expert Panel on November 21, in Munich, Germany.

A second panel member presented work on a direct method for GE analysis that does not involve sample clean-up by solid-phase extraction. The panel will follow the development of this method because it may be suitable for process control.

The method that will be studied collaboratively is a direct LC-MS method for determination of GE. Two companies already have supplied study materials, and a number of others are in discussion regarding sample supply. AOCS planned to send out collaborative trial samples in November 2010; results will be due back by the end of January 2011. A study report with statistics is scheduled for evaluation by the relevant AOCS methods committees in March 2011. The outcome of the study will be a major topic of discussion at an Expert Panel meeting during the 102nd AOCS AM&E in Cincinnati, Ohio, USA, May 1-4, 2011.

AOCS has developed a web-based resource, including a reference list, on process contaminants. It is available at <http://tinyurl.com/AOCSresource>. For more information about adding information to the resource or participating in the collaborative study and/or the Expert Panel, contact AOCS Technical Director Richard Cantrill (email: Richard.Cantrill@aoacs.org; phone: +1 217-693-4820).

offer important economic and safety advantages to the chemical industry," Rogers said, "but the technology and its economics are not clearly understood. The demonstrated production of grease manufacturing will help highlight these benefits."

The grease-making process is sped up so much that the process is almost continuous, according to Mike Jensen, ELM product manager.

"We make different batches of grease in the microwave-based reactor quickly and then feed them into various finishing vessels, one after the other," he said. "The time and energy savings are bound to revolutionize the chemical processing if implemented nationwide."

The research team is compiling various technical and economic data on the performance of the microwave-based system. Preliminary information indicates that the process time could be reduced to about one-third of what it takes to heat with equivalent-sized conventional methods. The energy losses are significantly lower according to ELM, and the accuracy of the heating is improved.

According to Burgess, "Once we turn the microwave input off, the energy input ceases completely, making the process much safer. Now all that's left is to build more history and experience with the system and determine the true economic benefits."

Tainted oil in China

Health officials in Hunan, China, admitted in September 2010 to hiding the fact that camellia oil (tea tree oil) manufactured by Hunan Jinhao Camellia Oil Co. Ltd. was contaminated with benzo[a]pyrene. The compound is carcinogenic and has been shown to accumulate within the human body, causing long-term health problems.

"State officials said they conducted a secret recall of the product after discovering levels of benzo[a]pyrene in the oil in March this year," according to AP-FoodTechnology.com. "Chinese media reported that the contamination occurred during the processing of the oil, but that the issue had now been resolved after the company updated its equipment."

The firm reportedly twice recalled the product without explanation; AP-Technology quoted one magazine as saying benzo[a]pyrene levels in the oil were 60 µg/kg, or five times the permitted amount.

CONTINUED ON PAGE 676

inform Associate Editor Catherine Watkins can be reached at cwatkins@aoacs.org.

Commodities

CACAO/CHOCOLATE

Better-tasting chocolate and a more stable supply of cacao beans are in the future now that candy maker **Mars, Inc.** has publicly released 92% of the genome sequence of the cacao tree (*Theobroma cacao*). Mars completed the work with help from the US Department of Agriculture's Agricultural Research Service and IBM. Competitor **Hershey** has also been working on the cacao sequence along with The Pennsylvania State University and French laboratories, according to *The New York Times*. For more, see Biotech News on page 686.

■■■

Chocolate supplier **Barry Callebaut** (Zurich, Switzerland) said it will invest 51 million euros to expand production capacity in North America, the Ivory Coast, Malaysia, and Europe because of achieving a long-term supply contract with **Kraft Foods, Inc.** (Northfield, Illinois, USA). Barry Callebaut told FoodNavigator.com that the additional production volumes will be built up gradually over three years, starting immediately. "Industry sources estimate that the planned capacity expansion could boost current production volumes for the Swiss firm by 4–5%, FoodNavigator.com noted.

■■■

Mars Inc. (McLean, Virginia, USA) announced in late August that it has reformulated its candy bars in the United Kingdom to use 15% less saturated fat per bar. The company said the reduction will remove more than 600 metric tons of saturated fat per year from the UK diet.

■■■

In September 2010, **Cargill** (Minneapolis, Minnesota, USA) announced a three-year, \$5 million commitment to support sustainable cocoa in Côte d'Ivoire and Ghana. "This includes a partnership with **CARE** [the international relief organization] to sponsor a new program of activities to improve the livelihoods of cocoa farmers and their families in Ghana and Côte d'Ivoire," the company said in a statement.

CANOLA/RAPESEED OIL/PROTEIN

Canada's **BioExx Specialty Proteins Ltd.** said in September that it has produced commercial-scale canola protein isolate in its first complete end-to-end protein production run at its Saskatoon plant. The protein produced was tested in the BioExx lab for purity, which was corroborated at the independent testing facilities of **POS Bio-Sciences**.

■■■

The US Food and Drug Administration has issued a letter of "no objection" to **Burcon NutraScience Corp.** (Vancouver, British Columbia, Canada) for its request for GRAS status for its canola protein extracts, the company announced in September 2010. The company has been developing the patented protein ingredients since 1999, but commercial applications for the functional ingredients have hinged on their GRAS (Generally Recognized as Safe) status.

■■■

India's **Jivo Wellness**, a venture of **Akal Information Systems Ltd.**, opened a new canola oil bottling plant in September 2010 in Delhi. On hand were representatives from the Canadian Wheat Board, the Canadian government, and the Canola Council of Canada. The plant was said in one press report to be the first of its kind in India.

OLIVE OIL

In only 15 years, the Australian olive (and olive oil) industry has grown into a \$180 million/year industry. In September 2010, the **Rural Industries Research and Development Corp.** (Barton, Australian Capital Territory) released its third five-year plan for the Australian olive industry. The 91-page report (pdf) identifies the research expertise required in future years and provides guidance to research institutions. Download the report at <http://tinyurl.com/AusOlive>.

■■■

Research published in the journal *Food Chemistry* (doi: 10.1016/j.foodchem.2010.08.041) suggests that antioxidant-rich solutions could be extracted from olive oil mill waste and could then

be used to enrich antioxidant levels of foods and oils. "Phenolic extracts from olive oil mill waste can be used as alternatives to synthetic antioxidants in order to increase the stability of foods," wrote the researchers, led by Evangelos Lazos at the Technological Educational Institution in Athens, Greece.

■■■

Spanish customs announced in late August that exports of olive oil to the United States had increased by 17% in the first half of the year, according to the *Olive Oil Times*.

PALM OIL

Malaysia's **Federal Land Development Authority (FELDA)**, the world's largest unlisted plantation operator, received Roundtable of Sustainable Palm Oil (RSPO) certification after independent audits showed the agency had complied with stringent and sustainable plantation practices for palm oil cultivation, the country's state news agency Bernama reported. The agency said FELDA's two palm oil mill complexes in Pahang as well as 11 estates that supply fresh fruit bunches to the mills were RSPO-certified on July 22.

■■■

The **government of Liberia** and **Golden Veroleum Inc. (GVL)** are working together to cultivate sustainable palm oil by both GVL and by Liberian smallholders, farmers, and refiners. The investment is expected to total \$1.6 billion, creating more than 35,000 direct jobs and building a completely new economic sector in Liberia's southeastern counties. GVL is incorporated in Liberia and is a subsidiary of the Verdant Fund LP. Verdant's initial and lead investor for this project is **Golden Agri-Resources** (Singapore).

SOYBEAN OIL/MEAL

Crops responded positively to predicted future levels of atmospheric carbon dioxide (CO₂), but soil tillage practices had little effect on this response, according to a US Department of Agriculture (USDA) study. The six-year study comparing tillage practices under high CO₂ levels showed that elevated CO₂ caused soybeans to increase photosynthesis by 50%, while

reducing transpiration, or the amount of water the plants release. This resulted in increased water use efficiency, whether the crops were grown with no-till or conventional tillage.

SUNFLOWER OIL

A submerged ship dating from 130 BCE that was found off the coast of Tuscany, Italy, 20 years ago has revealed some of its secrets just recently to researchers. The ship's cargo included medicines; DNA analyses of pills prepared by physicians of ancient Greece showed that the pills are mixtures of more than 10 different plant extracts, from hibiscus to celery, according to the *New Scientist* magazine. The analyses also suggest the pills contain sunflower, which is not thought to have existed in the Old World before Europeans discovered the Americas in the 1400s. The finding could be the result of recent contamination; more research is needed.



The export of flax, rapeseed, and rapeseed oil was prohibited by Belarus on September 15, 2010. The ban will be in force until March 15, 2011, according to various reports from the CIS. This is the latest ban to occur as a result of the poor harvest in the former Soviet states. Russia banned the export of wheat on August 15; Russian Prime Minister Vladimir Putin announced in September that he was extending Russia's ban on grain exports through the 2011 harvest. The ban was originally set to expire at the end of this year.

As *inform* went to press, the Ministry of Agriculture of the Russian Federation was said to be considering the possibility

of imposing an export ban on sunflowerseed and sunflower oil. The final decision was to be made after the completion of the 2010 harvest.

New ventures

Martek Biosciences Corp. (Columbia, Maryland, USA) will enter new territory when it introduces "a number" of branded products for consumers in 2011, the company announced in September 2010. Martek produces docosahexaenoic acid and arachidonic acid derived through fermentation from microalgae. ■

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ISU gets oil spill clean-up grant

Finding greener methods to clean up the oil spill in the Gulf of Mexico is the focus of a US National Science Foundation (NSF) Rapid Response grant.

The grant was awarded to two Iowa State University (ISU; Ames, USA) faculty members who are collaborating with scientists and engineers from Modular Genetics, Inc. (Woburn, Massachusetts), Columbia University (New York, New York), and Louisiana State University (LSU; Baton Rouge). The grant will fund the production and testing of biodispersants that may replace petrochemical dispersants used currently for oil spill management.

"The project will use engineered microorganisms to convert biobased media into biodispersants using fermentation. These biodispersants could be used to clean up oil spills such as the Gulf oil spill," said Buddhi Lamsal, assistant professor of food science and human nutrition, Center for Crops Utilization Research affiliate and lead

investigator at ISU.

ISU will produce biodispersants using *Bacillus* strains engineered by Modular Genetics. The biodispersants will then be evaluated by Columbia University and LSU. The researchers hope to use soy hulls as the biobased starting material for large-scale production.

Charles Glatz, ISU professor of chemical and biological engineering, will work to develop green methods to purify the products from the fermentation broth.

"This project will extend the potential impact of a related project we're doing that aims to convert the by-products of aqueous processing of soybeans into biosurfactants," Glatz said.

"We expect the project to characterize the properties of about 100 potential biodispersants and the toxicity of about 20



of these," said Kevin Jarrell, chief executive officer of Modular Genetics.

The Global Organization for EPA and DHA (GOED), a trade association based in Salt Lake City, Utah, USA, has introduced a "proud member" logo program for member companies who have made a commitment to comply with GOED's voluntary monograph standard. A listing of those companies is available at www.goedquality.com. EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) are omega-3 fatty acids much valued for their presumed heart- and brain-health benefits.

of these," said Kevin Jarrell, chief executive officer of Modular Genetics.

ISU will receive \$98,988 to conduct its portion of the project. The team expects to complete the project during the next year.

Turbulence in hydrocolloids

The market for many hydrocolloids will experience "more turbulent times," according

CONTINUED ON PAGE 716



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Briefs

Russian Technologies intends to construct Russia's first biofuel factory in 2011, according to the state corporation's chief, Sergei Chemezov. The factory, which will be located in the town of Tulun in the Irkutsk region of Siberia, will convert wood, wood chips, and other timber by-products into biobutanol for blending with gasoline. Construction is scheduled to begin in March-April.

■■■■

GreenHunter announced that its biodiesel plant, located along the Houston Ship Channel (Texas, USA), was put into receivership by a lender in August after no buyer could be located for it. In 2008, less than 60 days after the plant started up, the plant took a direct hit from Hurricane Ike (*inform* 19:452, 673, 2008). Since then, it has struggled with poor economics, including the expiration of the \$1/gallon federal tax credit at the end of 2009.

■■■■

Bio-Lípidos de Puerto Rico and the state-owned power utility AEE (English name: PREPA) announced plans in September to build a plant that will produce a pure fuel based on tropical marine microalgae. According to AEE's executive director, Miguel Cordero, "The goal is to produce fuel to generate electricity in Puerto Rico." At present, most of Puerto Rico's electricity comes from burning oil.

The facility will be constructed in Dorado and Toa Baja, towns on the northern coast of Puerto Rico. Plans are to produce 6 million liters of vegetable oil during the first year of operation. The dried by-products will be used as feed for farmed tilapia and shrimp. Starting dates have not been announced yet.

■■■■

The Times of Zambia reported that the country's Finance Minister Situmbeko Musokotwane said the Zambian government will produce half of the country's annual diesel consumption once production of jatropha oil

CONTINUED ON NEXT PAGE

Biofuels News



ETHANOL

Petrobras to move ethanol by barge trains

On September 10, Petrobras, Brazil's state-led oil company, announced it had chosen Estaleiro Rio Tiete to build a fleet of 20 river-barge trains—encompassing 20 pushertugs and 80 ethanol barges—for transporting bioethanol on the country's Parana-Tiete river system. This river runs through the center of Brazil's main sugarcane- and ethanol-producing region.

Estimated cost for these river-barge trains is reals 432.3 million (\$251 million) according to Platts. Shipyard construction is expected to begin in early 2011, with first units to be delivered by late 2011 and operation of the system expected to start in 2013.

At present ethanol transport in Brazil is dominated by trucks on highways. These new one-tug, four-barge trains will be able to carry 7.6 million liters each. The 20 trains

together will be able to move more than a sixth of Brazil's total ethanol output in 2009–2010 annually.

TMO Renewables to make cellulosic ethanol from household waste in US

On the basis of its bioengineered form of heat-loving *Geobacillus* bacteria found in compost heaps, TMO Renewables (Guildford, UK) signed a \$500 million contract (\$25 million per year for 20 years) in September with Maryland (USA)-based Fiberight LLC to make cellulosic ethanol from household waste.

Craig Stuart-Paul, chief executive of Fiberight, told *The Guardian* newspaper, "With TMO's bacteria on board . . . the efficiency with which we convert rubbish into bioethanol will rise by around 35%." The bacteria can grow at temperatures of around 60°C.

begins, adding significantly to economic growth of the country.



Brazil's Mines and Energy Minister Marcio Zimmerman predicted his country's ethanol fuel production will reach 64 billion liters in 2019, more than twice the 26 billion liters produced today. At present, more than 47% of Brazil's energy comes from renewable sources, based largely on sugarcane products, which are responsible for 18% of the country's energy. ■

Fifteen plants will be designed and built within five years, with construction on the first one anticipated in 2011. Fiberight is a privately held company founded in 2007 with current operations in Virginia, Maryland, and Iowa. The company focuses on transforming post-recycled municipal solid wastes and other organic feedstocks into next-generation renewable biofuels, with cellulosic ethanol as the core product.

Glycos Biotechnologies creates biofuels from fatty acids

In mid-September Glycos Biotechnologies, Inc. (Houston, Texas, USA) announced its creation of a microbial platform for the efficient synthesis of biofuels and biochemicals from fatty acids. The work was carried out in cooperation with Rice University (Houston) and was recently published in *Applied and Environmental Microbiology* (76:5067–5078, 2010).

In a company statement, Paul Campbell, chief science officer for Glycos Biotechnologies, said, "Until now, microbial platforms to enable the biological production of fuels and chemicals from fatty acids have been nearly nonexistent. Through our research, we were able to prove the effectiveness of fatty acids to produce higher-value chemicals . . . with an empirical ethanol yield double that which is usually achieved with sugars." He added, "These results demonstrate that fatty acids can be a great alternative to cellulosic sugars."

The researchers metabolically

engineered native and heterologous fermentation pathways to function in *Escherichia coli* bacteria under aerobic conditions, to create a respiro-fermentative metabolic mode for the efficient catabolism of fatty acids and the synthesis of fuels and chemicals in *E. coli*.

In this fashion, the researchers have synthesized biofuels—including ethanol and butanol—and biochemicals—including acetate, acetone, isopropanol, succinate and propionate—from fatty acids at yields exceeding those achieved with the comparable sugar-based fermentation processes.

Risks of using E15

The Detroit Technical Center (Van Buren Township, Michigan, USA) of London, UK-based Ricardo, Inc. recently evaluated the potential impact of mandating the use of E15 fuel (containing 15% ethanol plus 85% gasoline) in light-duty vehicles manufactured in the United States between 1994 and 2000. Cars and light trucks in these model years represent 62.8 million vehicles, or about 25% of the total US vehicle fleet presently in operation. Ricardo, a consulting firm specializing in the research, design, development, prototyping, and manufacture of internal combustion engines and systems for the automotive industry, considered vehicles from the six top-selling automotive manufacturers during that period.

Kent Niederhofer, president of Ricardo, Inc., said in a company report (<http://tiny.cc/azc3k>), "While many previous studies by Ricardo and others have evaluated the impact of higher ethanol blends on newer vehicles, this study demonstrates for the first time that raising the blend ceiling to E15 [from the present E10] is likely to have a negligible impact on vehicles manufactured between 1994 and 2000" in terms of performance and durability based on normal specifications and usage profile.

The *Des Moines Register* (<http://tinyurl.com/2dauc8m>) reported that the US Environmental Protection Agency would announce by October 15 whether to allow use of E15 in vehicles built in 2007 and later, based on US Department of Energy evaluations. Similar data on vehicles for model years 2001–2006 are due in November, with a decision expected in December as to the usability of E15 in those vehicles.

US government agencies have scheduled no tests on vehicles older than 2001, so

labeling restrictions may be established by the EPA to alert motorists about what model year cars can use E15.

BIODIESEL

Malaysia's biodiesel industry stagnant

Malaysian Biodiesel Association (MBA) vice president U.R. Unnithan declared in September that the biodiesel industry in Malaysia was going nowhere. He attributed the standstill to high costs of production and the lack of incentives and subsidies from the government.

According to statistics from the Malaysian Palm Oil Board, biodiesel exports in July dropped to 137 metric tons (MT), a 95% decline from June. The country has a total installed production capacity of 2.6 million MT.

The Malaysian government intends to implement its much delayed mandatory B5 (5% biodiesel blended with 95% petrodiesel) by June 2011. The slow action of the government, said Unnithan, has put the 22 biodiesel producer members of MBA into negative margins.

Unnithan pointed out that the governments of countries such as Thailand, Indonesia, the Philippines, Argentina, and Colombia subsidize their own biodiesel products. Colombia for example, is already moving to B10 and plans to implement B20 soon.

MBA members have had to switch to formulating other products from crude palm oil than biodiesel, such as palm oil phytonutrients and oleochemical products.

In an interview, Managing Director and Chairman David Ho of Carotech Bhd. (which extracts phytonutrients and phytosterols from virgin crude palm oil), told The Star Online (www.asianewsnet.net/home/news.php?id=14108), "Without subsidy, local biodiesel will not be able to compete efficiently in terms of pricing with the existing subsidized petroleum diesel by the Government." He added that replacing 5% of petroleum diesel with biodiesel would add about RM300 million (almost US\$100 million) per year to the government's subsidy bill, which already stands at RM20 billion to RM 25 billion.

RENEWABLE DIESEL

Joule receives patent for renewable diesel process

US Patent No. 7,794,969 was issued on September 14 to Joule Unlimited, Inc. (Cambridge, Massachusetts) for "Methods and compositions for the recombinant biosynthesis of *n*-alkanes." The patent covers the use of engineered photosynthetic cyanobacteria (blue-green algae) for the direct synthesis of diesel molecules. The organism converts waste CO₂ and sunlight directly into diesel and secretes the hydrocarbons into the surrounding medium. No agricultural land, fresh water, or downstream processing is used.

The company estimates it will be able to generate renewable diesel at costs as low as \$30 per barrel equivalent. Construction of a commercial plant is scheduled to begin in 2011, with operations to begin in 2012.

A report from the company also indicates that it has "proven the direct production of ethanol via the same process at a rate of 10,000 gallons/acre/year (about 100,000

L/ha/year), which is 40% of its ultimate productivity target. Pilot operations to produce ethanol are underway in Leander, Texas."

US Air Force C-17 flies on biofuel blend

Alternative fuels certification tests were conducted at Edwards Air Force Base (California, USA) August 23–27 with a C-17 Globemaster III. All engines were fueled with jet fuel blended with a combination of traditional petroleum-based fuel (JP-8), biofuel derived in part from beef tallow, and synthetic fuel derived from coal (Fischer-Tropsch process).

Initial tests were performed with three of four engines fueled by JP-8 and one with 50% biofuel/50% JP-8. Subsequent tests fueled all four engines with 50% biofuel/50% JP-8, then a final round with all engines fueled by 50% JP-8/25% hydrotreated renewable jet fuel (HRJ), and 25% Fischer-Tropsch.

According to Lt. Gen. Mark D. Shackelford, the military deputy to the assistant secretary of the Air Force for acquisition, "The C-17 fleet is the biggest Air Force consumer of jet fuel annually."

He added, "This is a big step forward in achieving the Air Force's energy goal of



increasing the available supply of fuel by acquiring half of the Air Force's domestic jet fuel requirement from domestically derived, environmentally friendly alternative sources by 2016."

The HRJ used by the C-17 can be made from either animal fats or plant extracts such as camelina oil from *Camelina sativa*.

ALGAE

Aurora Biofuels becomes Aurora Algae

Aurora Biofuels (Alameda, California, USA) announced its new name, Aurora Algae, in mid-September. With this change, it will now target a broader set of products than just biodiesel. New applications will



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include pharmaceuticals, in the form of high concentrates of omega-3 fatty acids; health foods and beverages, for which Aurora will supply algal protein extracts; and fish meal, as a feed source for aquaculture.

Aurora will continue to develop and expand biodiesel production from algae. The company is presently operating a 20-acre (8-hectare) demonstration facility that uses brackish water in central Florida to grow high oil-producing algae.

In a company release, Greg Bafalis, chief executive officer, said, "For the past four years we have focused on developing high-performance, versatile strains of algae in preparation for full-scale commercialization—and to be able to say we have reached the end of that development process is exciting."

Company co-founder and managing director Matt Caspari has relocated to Aurora's new regional headquarters in Perth, Australia, to oversee the upcoming development of the company's first full-scale production facility. Plans are to have algae growing there in eight 1-acre ponds by the end of 2010, using CO₂ from natural gas and fertilizer as nutrients. Commercial-scale production is scheduled for the first quarter of 2013.

BASF, Solix Biofuels to produce chemicals from algae

In mid-September BASF SE (Ludwigshafen, Germany) and Solix Biofuels (Fort Collins, Colorado, USA) signed an agreement to investigate the use of algae to produce unnamed chemicals for BASF.

Solix is a developer of algae cultivation technology systems and will test multiple algae species in its proprietary growth system, AGS™, for BASF.

In a company statement, Harald Lauke, president of specialty chemicals research at BASF, said, "This collaboration with Solix Biofuels demonstrates BASF's commitment to generate growth from industrial biotechnology." He added, "Algae represent a fascinating addition to BASF's technology portfolio as they offer the potential to produce a number of exciting specialty products."

Doug Henston, chief executive officer of Solix Biofuels, commented, "This

Crop residues as feedstock for renewable fuels

Nutrient removal and net costs weigh on decisions to use crop residues as biofuel feedstocks.

Marguerite Torrey

The US Department of Energy's Office of Biomass Programs is encouraging the use of crop residue as a feedstock for production of renewable fuels. However the residue is processed to produce energy, one thing is certain, according to Fabián Fernández, University of Illinois extension specialist in soil fertility and plant nutrition: "It needs to be taken out of the field."

The amount of corn stover (all above-ground corn plant material except the grain) that can be removed without adverse consequences to the soil's level of organic matter, to physical and chemical properties of the soil, or to successive crop yields is not immediately apparent, according to Fernández. "Removing grain means removing nutrients from the soil. The export of plant nutrients from a field when crop residue is being removed is also an important point to consider."

Fernández pointed out that removing only the corncobs may be a way to increase bioenergy feedstock production while minimizing the long-term effect of residue removal on soil productivity. Corncobs represent only 20% of the total residue pro-



duced in a corn field, and their density and moisture content are more consistent than other parts of the crop residue. Furthermore, they can be collected in one operation during grain harvest, and they are easier to store because they are less susceptible to decomposition.

"Ultimately, the amount of phosphorus and potassium present in corncobs is far less than that in stalks and leaves," Fernández added, "so removal of corncobs represents less removal of nutrients from the field."

Methods to calculate the amount of stover produced, the amount of stover being removed, nutrient content of stover, and the estimated value of stover are available at <http://tinyurl.com/UIUCstover>.

Agricultural economist Wallace Tyner and graduate student Matthew Erickson of Purdue University (West Lafayette, Indiana, USA) are also interested in the economics of using corncobs as a feedstock for biofuels. They are investigating the question a bit further downstream than the University of Illinois work, looking at what economic incentives will make farmers decide to harvest corncobs. They calculated that farmers would need to receive about \$100 per dry ton from biofuels companies to persuade most to add a cob-collection operation during fall corn harvest.

CONTINUED ON PAGE 715

partnership affords us the opportunity to work with a leader in the chemical industry to produce some unique chemical products from algae while continuing to pursue the production of fuel from algae.”

Solazyme delivers algal-derived fuel to US Navy

Solazyme, Inc. announced that it completed delivery of 20,000 gallons (75,000 liters) of algal-derived shipboard fuel to the US Navy on September 15. The company, based in South San Francisco, California, USA, said this constituted the world’s largest delivery of 100% microbial-derived nonalcohol advanced biofuel. Honeywell UOP and their proprietary UOP/Eni Ecofining process technology were also part of the completion of the contract.

On the same day, Solazyme announced they had signed a new contract with the US Department of Defense (DOD) for a research and development project that will produce 150,000 more gallons in 2010–2011.

According to BusinessWire.com, Solazyme’s Chief Executive Officer Jonathan Wolfson said, “Our renewable oil production technology, which results in a 100% military-spec, drop-in replacement fuel from algae, can be a significant component of the Navy’s long-term strategy to supply 50% of its energy from renewables by 2020.”

Solazyme has also supplied the DOD with 1,500 gallons of algae-derived jet fuel for testing and certification by the Navy. That contract was completed in July 2010 during the Farnborough International Air Show. Honeywell UOP was again the refining partner, with their Green Jet Fuel process technology.

Israeli firms to improve algal strains for biofuel

Rosetta Green (Rehovot), a company specializing in the identification of unique genes in plants and algae for the cleantech and plant biotech industries, and Seambiotic (Ashkelon), a company specializing in the growth of algae at industrial scale, announced in the third quarter their agreement to collaborate to develop and test

improved algal strains for the biofuel industry. According to the agreement, Rosetta Green will be responsible for the development of the strains, and Seambiotic will be in charge of large-scale algal growth and biofuel production.

The companies will initially focus on increasing the oil content of the algae and producing strains that can better withstand contamination. The proof of concept phase of the collaboration is anticipated to last about two years, during which the companies will explore the development of facilities for producing biofuel from algae on an industrial scale.

Rosetta Green is focused on the identification of unique genes that function as main control bio-switches; the company will make use of these technologies to develop algal strains with improved traits for biofuel production. Seambiotic is focused on industrial-scale algal cultivation using flue gas from power stations to accelerate growth rates.

JATROPHA

Second thoughts on jatropha in India

India established a mandate in 2009 that by 2017 it would be able to supply at least 20% of its oil consumption with home-grown biofuels. To this end, the government has been encouraging the cultivation of *Jatropha curcas* as a source of biodiesel feedstock.

The Inter Press Service (IPS) reports, however, that Suneel Parasnis, Asia coordinator of Private Financing Advisory Network, said, “Biofuels have failed because of unavailability and high price of stock feed for biodiesel processing plants all over India.”

Federal planners in India initially bought into the idea that jatropha can grow well and produce oil-rich seeds when grown on waste land. The idea was attractive because it avoids the question of using land for growing food vs. growing fuel. In 2003, potentially 36 million hectares of land were identified as being ideal for jatropha growth in India, much of it government waste and forest land, land in railroad rights of way, and in hedges and windbreaks around private farms.

In response to governmental land and tax incentives, many Indian farmers and oils

companies were growing jatropha by 2006. Enthusiasm has waned, however, as farmers have found that jatropha produces better yields on fertile, irrigated land. Application of fertilizer increases yields still further.

Smallholders are finding that jatropha can survive on “waste” land, but not in volumes that produce enough yield to support the needed inputs. Another issue is impatience. The IPS interviewed K. Koteswar Rao of Nandan Biomatrix Ltd. (Hyderabad, India), which has developed patents on higher oil-yield genotypes of jatropha. He said, “One of the biggest problems is having farmers pull out of jatropha before fruit-bearing starts by the third year. . . . For the next 35 years they need only tend and harvest but they run out of patience.”

The report is available at <http://ipsnews.net/news.asp?idnews=52890>.

GENERAL

Obesity’s effects on fuel efficiency

A September article in the *Oil & Gas Journal* points out that efforts to enhance fuel economy in US cars and trucks with better engineering are being subverted by the increasing prevalence of obesity in the nation (for recent data on US obesity see <http://tinyurl.com/August-CDC>).

Sheldon Jackson, director of the simulation and optimization laboratory in the computer science department at the University of Illinois (Urbana-Champaign, USA), and doctoral student Douglas King said, “Growing overweight and obesity rates in the United States continue to increase fuel consumption by adding extra passenger weight to vehicles. . . . More than 1 billion gallons of fuel consumed each year can be attributed to this excess weight.” (See <http://tinyurl.com/25wcod9>.)

Losses in fuel economy come not just from weight gain of drivers and passengers. Rather, portly drivers are more likely to choose heavier, full-size vehicles offering more room and comfort, thus exacerbating the weight-economy issue.

In a 2009 discussion paper sponsored by Washington, DC-based Resources for the Future, Shanjun Li, Yanyah Liu, and Junjie Zhang wrote, “Without taking into consideration the growth trend of overweight and

CONTINUED ON PAGE 715

MEMBERSHIP APPLICATION

11inf

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

Briefs

Scientists in Europe and the United States have made the latest call for an increase in the recommended daily amount of vitamin D. Writing in *Experimental Biology and Medicine* (235:1034–1045, 2010), the authors note that higher intake could help protect against conditions such as childhood rickets, adult osteomalacia, cancer, autoimmune type-1 diabetes, hypertension, cardiovascular disease, obesity, and muscle weakness.

“It is high time that worldwide vitamin D nutritional policy, now at a crossroads, reflects current scientific knowledge about the vitamin’s many benefits and develops a sound vision for the future,” said Anthony Norman, a professor emeritus of biochemistry and biomedical sciences at the University of California, Riverside (USA).



Continuing on the vitamin D theme, evidence keeps mounting about the importance of vitamin D to health. Recently, scientists have mapped the points at which vitamin D interacts with our DNA—and identified over 200 genes that it directly influences (*Genome Research*, doi: 10.1101/gr.107920.110). Despite the wealth of evidence, however, physicians persist in fearing vitamin D toxicity.

Why? The Vitamin D Council presents an online examination of the research from the 1930s and 1940s that scared the medical world into underprescribing this important vitamin (<http://tinyurl.com/VitDCouncil>).



And now for something completely unrelated to dietary fats or fat-soluble vitamins. A study by a division of the US National Institutes of Health found that a single 45-minute session of Swedish massage caused biological changes in the 53 subjects taking part in the study. Positive changes included significant decreases in levels of the stress hormone cortisol in blood and saliva as well as a reduction in levels

CONTINUED ON NEXT PAGE

Health & Nutrition



Cost, time are barriers to healthful eating

Eating healthfully is a goal that for many people often is difficult to achieve. In the developed world in particular, time is at a premium and restaurants and prepared ready-to-eat meals beckon.

The Nielsen Co., a global market research firm based in New York, New York, USA, recently gauged the world’s view of healthful eating, organic food, and other related issues as part of a global online survey. To do so, the company polled more than 27,000 consumers in 55 markets from Asia Pacific, Europe, Middle East/Africa (including Saudi Arabia, Pakistan, United Arab Emirates, Egypt, and South Africa), North America, and Latin America. The views were diverse, but at the very least, “most people want to do right when it comes to the foods they consume,” Nielsen said.

Financial concerns (33%) proved to be a major, but not the primary, obstacle to healthful eating around the world. The biggest barrier was a perceived time crunch

by survey respondents, with 35% of consumers agreeing to the statement that “I don’t always eat healthfully because I haven’t got time.” Availability (26%), confusion about which foods are healthful (24%), standard taste (25%), and the desire to treat oneself (41%) were the other main considerations preventing healthful eating.

Latin Americans were the most likely to cite time constraints as an issue—5% more than the global norm. Higher cost deterred North American consumers from healthful food choices, with an 11% higher score on this factor than the global average. Lack of ready availability and confusion about healthful food was an issue for about one-third of consumers in the regions of Middle East/Africa/Pakistan and Asia Pacific. North Americans were the most likely to avoid healthful foods because of a belief that they do not taste as good. Europeans and North Americans both scored highest at 44% and 45%, respectively, for opting for tasty, non-healthful treats in place of more healthful choices.

“What is clear from this survey is that consumers’ hearts are in the right place: They generally want to eat more nutritiously and purchase foods that are grown, raised,

of arginine vasopressin, a hormone that can lead to increases in cortisol. (It would be interesting to know how long the reduction lasted.)

The study appeared online in *The Journal of Alternative and Complementary Medicine* (doi:10.1089/acm.2009.0634). Mark Hyman Rapaport, chairman of psychiatry and behavioral neurosciences at Cedars-Sinai Medical Center in Los Angeles, California, USA, led the research. ■

and produced in responsible ways,” Nielsen noted. That said, when finances are tight, consumers tend to turn to those products that offer the most value, whether they are healthful and environmentally responsible or not.

To access the complete Nielsen article, see <http://tinyurl.com/NielsenTrends>.

Is fat fattening?

Is fat fattening? That was the broad question asked by a research group from the University of Alabama at Birmingham (USA) led by James M. Shikany.

The goal of their research was to separate and articulate questions that had clear meaning, were empirically addressable, and were germane to the broad question. After developing four questions addressing the effect of varying the proportion of dietary fat on body weight and body fat, the group conducted a comprehensive review of electronic citation databases to identify studies that addressed each question.

Next, the scientists tabulated and summarized the results of the studies, and formulated an answer for each question. “The results indicated that whether ‘fat is

fattening’ depends on exactly what one means by the question,” they write in *Critical Reviews in Food Science and Nutrition* (doi: 10.1080/10408398.2010.491057). “It is apparent that under conditions of energy deficit, high-fat diets lead to greater weight loss than low-fat diets, but under *ad libitum* feeding conditions, instructing persons to follow a low-fat diet promotes loss of body weight and body fat.” Studies were few but convincing, the team notes, that changing the proportion of energy from fat in daily snacks has no effect on weight.

The gist: “General recommendations to reduce dietary fat to promote weight loss or maintenance in all circumstances may merit reconsideration.”

Low levels of n-3 fatty acids and Alzheimer’s disease

University of California Irvine (USA; UCI) researchers have discovered that markedly depleted amounts of docosahexaenoic acid (DHA) in brain tissue samples from Alzheimer’s patients may be due to the liver’s inability to produce the complex fat. Their study appeared in *PLoS ONE* (doi:10.1371/journal.pone.0012538).

Low levels of DHA previously had been associated with this chronic neurodegenerative disease affecting millions of persons worldwide, but no cause had been identified.

In the current study, the UCI team examined postmortem liver tissue from Alzheimer’s patients and found a defect in the liver’s ability to synthesize DHA from shorter-chain molecules present in leafy

plants and other foods. (Previous studies have shown that most brain DHA is manufactured in the liver.)

The livers of subjects without Alzheimer’s did not have this defect, noted Daniele Piomelli, the Louise Turner Arnold Chair in the Neurosciences and director of the Center for Drug Discovery at UCI, who led the research with Giuseppe Astarita, project scientist in pharmacology.

“We all know Alzheimer’s is a brain disease, but our findings—which were totally unexpected—show that a problem with liver fat metabolism can make people more vulnerable,” Piomelli said. “They also suggest a reason why clinical trials in which Alzheimer’s patients are given omega-3 fatty acids to improve cognitive skills have had mixed results.”

“Additionally, we found that the greater the amount of Alzheimer’s-related cognitive problems experienced in life by the patients, the lower were their liver DHA levels,” Astarita said. “So we do see a connection.”

Piomelli added that the results point to new diagnostic and dietary approaches to Alzheimer’s: Specific blood lipid profile tests might identify at-risk persons, and dietary supplements with a chemically enhanced form of DHA may benefit early-stage patients.

“Our research isn’t advocating that liver metabolism is a key to Alzheimer’s,” he noted. “The factors causing the disease are many and complex, but we feel this is another piece in the Alzheimer’s puzzle.”

Delaying fat digestion to curb appetite

Scientists at the UK’s Institute of Food Research (IFR; Colney, Norfolk) have discovered an unexpected synergy that helps break down fat. The discovery provides a focus to find ways to slow fat digestion, and ultimately to create food structures that induce satiety.

“Much of the fat in processed foods is eaten in the form of emulsions such as soups, yogurt, ice cream, and mayonnaise,” said study leader Peter Wilde of IFR. “We are unpicking the mechanisms of digestion used to break them down so we can design fats in a rational way that are digested more slowly.”



If the digestion of fat is delayed and fatty acids are able to reach the ileum, the final section of the small intestine, their presence stimulates satiety-inducing hormones. Thus, the IFR scientists have been experimenting with using protein layers to stabilize emulsions and delay fat digestion.

In their latest study, they found that a normally stable whey protein is partially broken down when it is attached to the surface of an emulsion. When a surfactant is introduced, this acts synergistically with the fat, breaking down the protein layer even more effectively. With the barrier weakened, access is improved for the enzymes and bile salts that break down fat.

"We are now experimenting with heat and enzyme treatments to reduce the synergistic effect and make the protein barrier stronger," said Wilde.

The research appeared in *Soft Matter* (6:4908–4915, 2010).

NIH centers fund research on botanicals

The US National Institutes of Health is funding five new research centers to further study the safety, effectiveness, and biological action of botanical products. The competitive awards, approximately \$1.5 million each per year for five years, are part of the Botanical Research Centers Program, which is entering its third five-year cycle.

The centers are:

- Pennington Biomedical Research Center, Louisiana State University System, Baton Rouge. Study leader: William Cefalu. This center will focus on the potential of botanicals to reduce the risk of developing conditions that often lead to metabolic syndrome and of developing metabolic syndrome itself.
- University of Illinois at Chicago. Study leader: Norman Farnsworth. This center will focus on botanical dietary supplements for women's health, with an added emphasis on the safety of supplements like black cohosh and licorice.
- University of Illinois at Urbana-Champaign. Study leader: William Helferich. This center will focus on botanical estrogens, such as soy, wild yam, and dong quai, and their safety, efficacy, and mechanism of action.

- University of Missouri at Columbia. Study leader: Dennis Lubahn. This new center will look at the safety and efficacy of botanical dietary supplements, such as elderberry and garlic, particularly in relation to signaling pathways.
- Wake Forest (North Carolina) University Health Sciences. Study leader: Floyd Chilton, III. This center will focus on botanical lipids, such as borage oil, and their role in preventing or affecting disease, especially relating to immunity and inflammation.

Mediterranean diet on UNESCO list

UNESCO reportedly has recommended that the Mediterranean diet have a place on the organization's Intangible Cultural Heritage List. The ratifying vote was expected to occur at the UN agency's November 14–19, 2010, meeting in Nairobi.

The Intangible Cultural List began in 2003 and now comprises some 166 entries, including Croatian lacemaking, the Argentine tango, and Tibetan opera, according to the *Olive Oil Times*, which originally reported on the UNESCO action.

"The initiative to include the Mediterranean diet on the Intangible Cultural Heritage List began four years ago when Italy, Spain, Greece, and Morocco put it forth. It did not meet UNESCO's guidelines and the initiative was rejected," the *Times* reported. "Last August the four countries, with Italy coordinating, reworked their submission request."

EVOO helps bone mass?

A little-known reason to use extra virgin olive oil (EVOO) in the kitchen is the potential beneficial effect of the olive polyphenol oleuropein on bone health.

A new study suggests oleuropein stimulates the cells responsible for bone formation. The research, which appeared in *Osteoporosis International* (doi: 10.1007/s00198-010-1270-x), used the BonOlive ingredient manufactured by BioActor (Ghent, Belgium).

Scientists at the University of Cordoba, Spain, led by R. Santiago-Mora, studied

the effects of a range of oleuropein concentrations on the formation of osteoblasts in stem cells from human bone marrow. (Osteoblasts are cells from which bone is formed; osteoclasts are cells that break down bone, leading to resorption and weakening.)

When oleuropein was included in the culture media, the researchers noted an "increase in osteoblast differentiation and a decrease in adipocyte [fat cell] differentiation." Increases in the expression of certain genes were also observed related to production of osteoblasts.

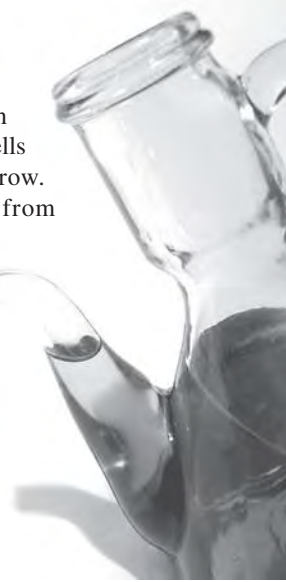
"Our data suggest that oleuropein, highly abundant in olive tree products included in the traditional Mediterranean diet, could prevent age-related bone loss and osteoporosis," the researchers concluded.

HowMuchFish.com has new calculator

A website run by the nonprofit Center for Consumer Freedom (CCF) has a new version of its HowMuchFish.com seafood calculator.

The calculator includes 24 seafood species and provides nutrient content information for standard-sized fish servings, detailing amounts of omega-3 fatty acids, cholesterol, sodium, and calories. The site also serves up information about how much of any given fish one would have to eat in a week to ingest more than the US Environmental Protection Agency's benchmark daily limit dose for methylmercury. For example, the response for a six-ounce serving of sardines reads: "Health problems associated with [methyl]mercury in commercial fish are theoretical and highly unlikely unless your weekly intake of sardines is more than 1750 ounces or 109.38 pounds [almost 50 kilograms]."

The CCF website says that it is "devoted to promoting personal responsibility and protecting consumer choices" and is funded by "restaurants, food companies, and consumers." ■



Briefs

Products made from soy oil stand to benefit from two new germplasm lines that produce high levels of oleic acid, according to US Department of Agriculture (USDA) and scientists from the University of Missouri (Columbia) and Kyungpook University (Daegu, South Korea). Kristin Bilyeu, with USDA's Agricultural Research Service (ARS; Columbia, Missouri), and colleagues Anh Pham Tung, Jeong Dong Lee, and J. Grover Shannon reported their identification and use of a mutant pair of alleles, or gene copies, to bolster soy's oleic acid production in *BMC Plant Biology* (doi:10.1186/1471-2229-10-195).

Typically, soy oil is 13% palmitic acid, 4% stearic acid, 20% oleic acid, 55% linoleic acid, and 8% linolenic acid. But the new beans contain more than 80% oleic acid.

According to Bilyeu, increasing soy oil's level of the monounsaturated fat can avoid resorting to hydrogenation. Besides converting liquid oil into a solid, like margarine, hydrogenation helps to improve shelf life and product quality. However, it also generates *trans* fats. Other research groups have successfully used transgenic methods such as gene silencing to increase soy's oleic acid levels. But the ARS–university team used classical plant breeding instead, “endowing” their soy lines with two mutant alleles for the gene *FAD2* (fatty acid desaturase 2).

Field trials in Missouri and Costa Rica indicate the soy lines' oleic acid production can remain fairly constant across diverse growing conditions. Additional tests are planned.

■ ■ ■

The International Life Sciences Institute (ILSI; Washington, DC, USA) released Version 4.0 of the Crop Composition Database, ILSI's comprehensive public database providing information on the natural variability in composition of conventionally grown crops. Originally launched in 2003, the Crop Composition Database now has

Biotechnology News



Cocoa beans in a cacao pod. Courtesy USDA; photo by Keith Weller.

Sequenced cacao genome sees preliminary release

In mid-September, the US Department of Agriculture (USDA) announced the preliminary release of the sequenced genome of the cacao tree. The effort is the result of a partnership between USDA's Agricultural Research Service (ARS); Mars, Inc. (McLean, Virginia, USA), one of the world's largest manufacturers of chocolate-related products; scientists at IBM's Thomas J. Watson Research Center (Yorktown, New York, USA); and researchers from the Clemson University Genomics Institute, the HudsonAlpha Institute for Biotechnology, Washington State University, Indiana University, the National Center for Genome Resources, and PIPRA (Public Intellectual Property Resource for Agriculture) at the University of California-Davis.

Cocoa comes from the cacao tree, *Theobroma cacao*. The seeds are processed into cocoa beans that are the source of cocoa,

cocoa butter, and chocolate. Fungal diseases can destroy seed-bearing pods and wipe out up to 80% of the crop. Additionally, worldwide demand for cacao now exceeds production, and hundreds of thousands of small farmers and landholders throughout the tropics depend on cacao for their livelihoods. An estimated 70% of the world's cocoa is produced in West Africa. Scientists worldwide have been searching for years for ways to produce cacao trees that can resist evolving pests and diseases, tolerate droughts, and produce higher yields. ARS researchers have been testing new cacao tree varieties developed with genetic markers. But having the genome sequenced is expected to speed up the process of identifying genetic markers for specific genes that confer beneficial traits, enabling breeders to produce superior new lines through traditional breeding techniques.

Sequencing cacao's genome also will help researchers develop an overall picture of the plant's genetic makeup, uncover the relationships between genes and traits, and broaden scientific understanding of how the

interplay of genetics and the environment determines a plant's health and viability.

Currently, 92% of the genome sequence has been released into the public domain, with access to these data online via the Cacao Genome Database (www.cacaogenomedb.org) prior to formal peer-reviewed publication. This release will enable the sequence data to be applied immediately to cacao genetic improvement.

Team leaders from the USDA included molecular biologist David Kuhn and geneticist Raymond Schnell, both at the ARS Subtropical Horticulture Research Station (Miami, Florida), as well as ARS computational biologist Brian Scheffler at the Jamie Whitten Delta States Research Center (Stonerville, Mississippi).

"Because of the talent and dedication brought together by this unique partnership, researchers and plant breeders will be able to accelerate the genetic improvement of the cacao crop now cultivated in tropical regions around the world," said Edward B. Knipping, ARS administrator. "This will benefit not only the chocolate industry, but also millions of small farmers who will be able to continue to make their living from cacao."

"Compact" offers framework for biodiversity claims, remediation

CropLife International (Brussels, Belgium) announced in September that The Compact, a "clearly defined, efficient, and fair process" for countries to file and process claims related to damage to biological diversity caused by living modified organisms (LMO), is now in force. Members of The Compact include the six major plant biotechnology providers—BASF, Bayer CropScience, Dow AgroSciences, DuPont, Monsanto, and Syngenta.

The Compact was introduced in May 2008 to national governments and food value chain stakeholders as a first: A private sector-established option to domestic and international liability laws that provides redress and financial security in the event of damage to biological diversity caused by LMO. Since 2008, The Compact's founding members have developed the framework and guidelines for filing and arbitrating claims. The

Compact defines a science-based process for resolving claims alleging damage to biological diversity where binding decisions are made by independent commissioners and arbitrators under the auspices of the Permanent Court of Arbitration (PCA), located in The Hague.

Today, biotech crops are grown on 134 million hectares in 25 countries, including several major agricultural exporting countries. Guidelines on the import, transfer, handling, and domestic use of LMO, including how to address damage to biological diversity, can have significant impact on international trade. According to CropLife, the introduction of The Compact provides assurance to states of an objective and independent procedure for evaluating and arbitrating claims of, and remedying damage to, biological diversity. The implementation of such a framework supports smooth trade transactions in the agricultural community.

"CropLife International believes The Compact plays a critical role in providing financial security and supplementing other liability and redress frameworks involving LMO. It clearly demonstrates our industry's confidence in the safety of its products," said Denise Dewar, executive director of plant biotechnology at CropLife International.

In October, CropLife welcomed the negotiations that took place at the fifth Meeting of the Parties (MOP-5) to the Cartagena Protocol on Biosafety (BSP) to the Convention on Biological Diversity (CBD), in particular the Nagoya-Kuala Lumpur Protocol on Liability and Redress. According to CropLife, progress made during these negotiations will help ensure transboundary movement of LMO, protect biological diversity, and maintain international trade.

The Nagoya-Kuala Lumpur Protocol establishes international rules and procedures for liability and redress in case of damage to biological diversity resulting from LMO. CropLife considers The Compact as a complement to this protocol.

Research: GM corn materials found in adjacent streams

A study by University of Notre Dame (Indiana, USA) ecologist Jennifer Tank and colleagues has found that streams throughout the US Midwest are receiving transgenic

more than 113,000 data points representing 94 compositional components in corn, soybean, and cotton. Version 4.0 presents an intuitive graphical-user interface, with significantly increased performance, added security, new features such as unit conversion and multiple output options, and a Summary of Search Results tool that allows users to view data instantly and provides guidance on preparing output reports. The enhancements to Version 4.0 are described in detail in R. Alba *et al.*, *J. Food Comp. Anal.*, 2010; doi:10.1016/j.jfca.2010.03.007.

The database is available (free of charge) online at www.cropcomposition.org.

■■■

In September, Linnaeus Plant Sciences Inc. (Vancouver, British Columbia, Canada) announced that it had entered into a licensing agreement with DuPont (Wilmington, Delaware, USA) to use oil gene intellectual property, advanced gene technologies, and biotechnology expertise developed by DuPont to accelerate development and commercialization of value-added camelina oil. Camelina, a drought-tolerant, nonfood oilseed crop, has the potential to reduce global carbon dioxide emissions by offering renewable, biodegradable feedstocks that can substitute for petroleum in a variety of applications.

"Gaining access to intellectual property and biotechnology expertise from DuPont and Pioneer will greatly accelerate our efforts to improve Camelina for industrial uses," said Jack Grushcow, president and chief operating officer of Linnaeus Plant Sciences Inc. "Camelina will provide an additional revenue opportunity for farmers as a nonfood rotation crop that can be grown with low inputs."

■■■

A report presented in late September by European Union (EU) Health and Consumer Policy Commissioner John Dalli to the Agriculture Council concluded that specific measures relating to storage and involving the application of isolation distances can help limit or avoid the co-mingling of genetically modified (GM) maize with conven-

tional and organic maize. In particular, the Best Practice Document, prepared by the European Coexistence Bureau (ECoB) and published by the European Commission's Joint Research Centre, notes that storing seeds adequately and applying spatial isolation are the best ways to limit or avoid co-mingling. Alternative practices based on temporal isolation (shifting flowering times of GM and non-GM fields) are possible in several EU countries with specific climatic conditions.

To download the Best Practice Document, visit: <http://ecob.jrc.ec.europa.eu/documents.html>. For more information, visit: http://ec.europa.eu/food/food/biotechnology/index_en.htm.



The European Commission announced in October that it would propose a temporary suspension of animal cloning for food production in the EU. The Commission also plans to temporarily suspend the use of cloned farm animals and the marketing of food from clones. All temporary measures will be reviewed after five years. The establishment of a traceability system for imports of reproductive materials for clones, such as semen and embryos of clones, is also envisaged. The system will allow farmers and industry to set up a database with the animals that would emerge from these reproductive materials.

Commissioner in charge of Health and Consumer Policy John Dalli said: "The Communication adopted today is a response to calls from the European Parliament and Member States to launch a specific EU policy on this sensitive issue. I believe that the temporary suspension constitutes a realistic and feasible solution to respond to the present welfare concerns."

Dalli underlined that the proposal will not suspend cloning for uses other than food, such as research, conservation of endangered species, or use of animals for the production of pharmaceuticals. In conclusion, he expressed the hope that "with the adoption of this report, the Council, the Parliament, and the Commission will move forward on the proposal on Novel



materials from corn crop by-products, even six months after harvest. Transgenic maize (corn) has been genetically engineered to produce its own insecticide, a delta endotoxin from the bacterium *Bacillus thuringiensis* (Bt). Bt endotoxins deter crop pests, such as the European corn borer.

In a 2007 paper in the *Proceedings of the National Academy of Science* (PNAS 104:16204–16208), Tank and a group of researchers demonstrated that transgenic materials from corn (pollen, leaves, cobs) do, in fact, enter streams in the agricultural Midwest and can be subsequently transported to downstream water bodies. In a new paper (Occurrence of maize detritus and a transgenic insecticidal protein (Cry1Ab) within the stream network of an agricultural landscape, PNAS 107:17645–17650, 2010), Tank and colleagues investigated the fate and persistence of the material and its associated Cry1Ab insecticidal protein using a synoptic field survey of 217 stream sites in northwestern Indiana six months after crop harvest.

"We found that corn crop by-products were common in agricultural streams and that 86% of sites contained corn leaves, cobs, husks, and/or stalks in the active stream channel," Tank said. "In addition, using a sensitive laboratory test that specifically measures the amount of Cry1Ab protein from Bt corn, we detected Cry1Ab in corn collected from 13% of the stream sites. We also detected Cry1Ab dissolved in stream water samples at 23% of the sites, even six months after crop harvest."

Tank points out that a majority of streams in the Midwestern Corn Belt are located in close proximity to corn fields.

"Our . . . analyses found that 91% of the more than 200,000 kilometers of streams

and rivers in Indiana, Iowa, and Illinois are located within 500 meters of a corn field, suggesting that corn crop by-products and any associated insecticidal proteins may enter streams across the Corn Belt states," she said.

"Our study demonstrates the persistence and dispersal of crop by-products and associated transgenic material in streams throughout a Corn Belt landscape even long after crop harvest," Tank concluded. This research emphasizes that there is a tight link between streams and adjacent agricultural fields and dispersal of crop by-products could affect natural ecosystems beyond field boundaries.

Work on *Chlorella* microalgae genome completed

In September, the Centre National de la Recherche Scientifique (French National Center for Scientific Research; CNRS) announced that the analysis of the entire genome of *Chlorella* microalgae, a potential genus for biofuel production, had been completed by their Laboratoire Information Génomique et Structurale, in collaboration with American and Japanese laboratories. The detailed elucidation of the genome for *Chlorella*, also widely used as a food supplement, will make it possible to rationalize its industrial use. The work was published online by *The Plant Cell* (*Chlorella variabilis* NC64A genome reveals adaptation to photosymbiosis, coevolution with viruses and cryptic sex, doi: 10.1105/tpc.110.076406).

Microalgae are prime targets for research on biofuels. Leading candidates as alternative sources of biodiesel, their culture has the unquestionable advantage, compared to oleaginous land plants, of not competing with cultivated land necessary for human food. Producing fuel from water, sunlight, and carbon dioxide from the atmosphere appears as a possible solution that has fostered numerous research programs since the 1970s.

Chlorella is particularly interesting for the development of second-generation biodiesel thanks to its high lipid content. Although several genomes of green algae (Chlorophyta) have already been sequenced (*Chlamydomonas*, *Micromonas*, and *Ostreococcus*), *Chlorella* had not been analyzed until now, despite its long-established role as a food supplement. The analysis of the *Chlorella* genome, coordinated by Guillaume Blanc, CNRS researcher, predicts 9,791 protein genes, a total comparable to that of its cousin *Micromonas*. Unexpectedly, the analysis of the *Chlorella* genome has also revealed numerous genes governing the synthesis of flagellar proteins, which suggests that this species could have a sexual cycle that has gone unnoticed until now. Last but not least, the ability of *Chlorella* algae to synthesize chitin could have been inherited from a virus (itself endowed with chitinase activity) having secured exclusive use of its host against other viruses incapable of piercing through its protective shell.

GMO regulations and the biofuels industry

Faster development of the promising field of cellulosic biofuels—the renewable energy produced from grasses and trees—is being hampered by a “deep and thorny regulatory thicket” that makes almost impossible the use of advanced gene modification (GM) methods, researchers say. In a study published in October in the journal *BioScience* (60:729–741, 2010), scientists argue that major regulatory reforms and possibly new laws are needed to allow cellulosic bioenergy to reach its true potential as a form of renewable energy, and in some cases help reduce greenhouse gas emissions that cause global warming.

“It’s extraordinary that gene modification technology, which has been adapted

more rapidly than any other technology in the history of agriculture and had some profound environmental and economic benefits, has been regulated virtually out of existence for perennial cellulosic biofuels crops,” said Steve Strauss, a professor of forest biotechnology at Oregon State University (Corvallis, USA) and lead author of the paper.

In the report, the authors noted that exotic plant species pose a serious risk of spread and ecosystem impacts, but face much less stringent regulation than GM crops. A GM plant in which one or a few genes have been changed is treated as more of a risk than an invasive species that has thousands of new genes.

Traits that could be improved with GM include enhanced stress tolerance, reduced costs of conversion to liquid fuels, reduced use of water and fertilizer in cultivation, as well as reduced dispersal of fertilizer into the environment.

Strauss and colleagues argue that the current GM environment poses enormous legal risks that can and have cost some companies millions of dollars in civil lawsuits, sometimes for damages that were “more of perception and market issues” than of safety or environmental impact.

“Even research on traits expressly intended to reduce environmental impacts face[s] the same legal risks and regulatory barriers as other traits,” Strauss said. “Our own federally funded research on means to promote ecological containment of gene-modified and exotic biofuel crops has been brought to a standstill by regulations.”

The scientists said that the end result of a GM project—the trait produced, and whether it is safe and beneficial or not—should be the primary consideration for regulation, not the process used to produce it. Low-level risk and high-benefit projects should be identified and allowed to move forward with much less stringent regulation or none at all. They also made several other suggestions for reform to make the overall system less costly, and uncertain.

“It is essential that we create an intelligent regulatory system that does not indiscriminately penalize the gene modification process and obstruct essential field research,” Strauss said. “The one-size-fits-all style system of today treats the process of genetic modification as inherently dangerous, although many high-level science panels have concluded that the process is at least as safe as conventional breeding methods.” ■

Foods which is an important contribution to consumer protection and innovation.”

The debate about cloning for food purposes started a few years ago when cloned embryos were imported into the EU. According to the current EU Regulation, only food produced from clones is considered “novel food” as it is not produced via traditional breeding techniques. Therefore, such food falls under the scope of the Regulation on Novel foods, which is now under discussion at the EU level. Novel foods are foods and food ingredients that were not used in significant quantities for human consumption within the EU before May 15, 1997.

■■■

In October, Monsanto Co. (St. Louis, Missouri, USA) and the Makhteshim Agan Group (Airport City, Israel) announced an agreement that made Makhteshim Agan key partner of selected off-patent molecules to support Monsanto’s Roundup Ready PLUS™ weed management platform. Under the agreement, Monsanto will license its Roundup Ready PLUS trademark for use with select products from Makhteshim Agan, meaning farmers who use Makhteshim Agan products will benefit from Roundup Ready PLUS programs such as Cotton Performance Plus. Those products, combined with glyphosate, offer multiple modes of action to combat weeds that have developed resistance to glyphosate. Used together, the multiple molecules also can reduce the risk of developing weed resistance.

In related news, Monsanto, Sumitomo Chemical Co., Ltd. (SCC; Tokyo, Japan), and SCC’s wholly-owned subsidiary, Valent U.S.A. Corporation (Walnut Creek, California), also announced a long-term agreement that made the companies strategic partners in Monsanto’s Roundup Ready PLUS weed management platform in the United States. In addition, Monsanto and SCC have agreed to seek further collaboration on weed management opportunities with SCC’s flumioxazin products in other countries such as Brazil and Argentina. ■

Briefs

The Clorox Co. (Oakland, California, USA) announced in September 2010 that it will sell its global auto care businesses to an affiliate of Avista Capital Partners for approximately \$780 million. The transaction, pending regulatory approvals, is expected to close by the end of 2010.

Included in the transaction are substantially all of Clorox's global auto care businesses, the majority of which are in the United States, Australia, Canada, and Europe, including the worldwide rights to distribute the market-leading Armor All® and STP® brands.



Univar, a global chemical distributor based in Redmond, Washington, USA, and PCCA (Professional Compounding Centers of America) of Houston, Texas, USA, have announced that Univar will be the exclusive distributor for PCCA's NataPres™, an "all-natural," odor-free preservative for personal care applications. NataPres was developed for parabens- and formaldehyde-free preservation with effectiveness in a broad pH range. The ingredient also is effective against gram-positive and gram-negative bacteria, the companies claim, as well as fungi and yeast.

In related news, Clayton, Dublier & Rice—a private equity firm—is acquiring a 42.5% stake in Univar. An additional 42.5% will remain in the ownership of private equity firm CVC Capital Partners and the remaining 15% will be held by Univar management and other existing investors.



The Grocery Manufacturers Association (GMA), a trade group based in Washington, DC, USA, presented its 2010 CPG Awards for Innovation and Creativity to Henkel and Diamond Foods at the association's Executive Conference in August 2010. The group also recognized former P&G Chief Executive Officer A.G. Lafley by presenting him its 2010 Hall of Achievement Award.

CONTINUED ON NEXT PAGE

Surfactants, Detergents, & Personal Care News



First Mideast oleochemicals plant planned

The first oleochemicals plant in the Mideast is scheduled to open in 2013.

SABIC announced at the end of August that it had signed a technology licensing and engineering agreement with Germany's Lurgi for an oleochemicals complex at the Jubail, Saudi Arabia, production site of Saudi Kayan Petrochemical, a SABIC affiliate.

The complex will include an upstream natural acid unit, a wax ester unit, a hydrogenation unit, and a downstream natural alcohol fractionation and distillation line, as well as a complete glycerine line. The complex will have capacity to produce 83,000 metric ton (MT)/year of distilled natural alcohols of various compositions for use in household and laundry products, plasticizers, lubricant additives, plastics, cosmetics, and personal care industries.

The feedstock will be based on natural raw materials from renewable oils

such as palm kernel oil and coconut oil, SABIC said.

EC investigates fatty alcohol dumping

A European Commission (EC) investigation of possible dumping of various grades of fatty alcohols into Europe was scheduled to conclude in November 2011, according to *ICIS Chemical News & Intelligence*. (Fatty alcohols are used in a number of industrial applications including detergents/surfactants and in the production of alcohol ethoxylates used in a variety of lubricating/cleaning industries.)

"I doubt there are any justifications to this investigation. Fatty alcohol producers in Asia are enjoying good margins now," a Singapore-based trader told ICIS.

Fatty alcohol demand within the region was stable so there was no reason for producers to "dump" it in Europe, a trader based in Asia added.

The complaints were filed in August 2010 by specialty chemical supplier Cognis (Monheim, Germany) and Sasol Olefins & Surfactants (Johannesburg, South Africa) against fatty alcohol suppliers in India, Indonesia, and Malaysia. In 2009, India exported more than 19,000 MT of fatty alcohols into the EU; Malaysia shipped 38,127 MT and Indonesia exported 93,092 MT to Europe, based on information from the EC accessed by ICIS. The three countries' combined exports in 2008 were about 6% more than in 2009.

Results of the probe are not expected until sometime in 2011.

California's green chemistry regulations for consumer products

The US state of California is only a few months away from a makeover of its toxic substances control regulation.

The state's Department of Toxic

Substances Control (DTSC) submitted its Green Chemistry Proposed Regulation for Safer Consumer Products to the state Office of Administrative Law on September 15, 2010, triggering a 45-day public comment and formal rulemaking process for the regulations. DTSC must adopt final regulations by January 1, 2011.

DTSC's regulations flesh out a process for identifying and setting priorities for dealing with chemicals in consumer products that may be subject to additional restrictions. The regulations also provide for conducting an "alternatives analysis" that will enable California regulators to determine the permissible use of those chemicals in products already in the market as well as in consumer products on the drawing board.

The process consists of three main parts: prioritization, alternatives assessments, and regulatory response. For products already on the market, this will require examining whether safer alternatives exist and, potentially, reformulating the product or banning it entirely. For new products, this will mean looking at potential impacts and addressing them before the product is manufactured.

Henkel won the Division B award for companies smaller than \$1 billion for the introduction of Purex Complete 3-in-1 Laundry Sheets. The project, which took more than five years to develop, "sought to bring innovation to a traditionally sedate category," GMA said. ■

For more information, see <http://tinyurl.com/DTSCgreen>.

Nalco acquires Fabrication Technologies

Nalco (Naperville, Illinois, USA) has acquired substantially all of the businesses and assets of Fabrication Technologies, Inc. (Casper, Wyoming, USA).

Renamed Nalco Fab-Tech LLC, the company employs 60 people and designs, fabricates, and installs complex injection and fluid treatment facilities. Nalco Fab-Tech supplies Enhanced Oil Recovery (EOR) mixing and injection equipment for

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alkali surfactant polymer, polymer, water, and CO₂ injection facilities throughout the United States and Canada.

"The acquisition of Nalco Fab-Tech allows Nalco to complete its integrated EOR solutions platform started in 2008 with the formation of TIORCO, a joint venture company between Nalco Company and Stepan Co.," Nalco said in a statement.

P&G to compact NA powders

Procter & Gamble (P&G; Cincinnati, Ohio, USA) announced in September 2010 that it will compact its entire US and Canadian powder laundry detergent offerings beginning in February 2011, which will help reduce waste and save energy and water.

Doris de Guzman, who writes the ICIS Green Chemicals blog (<http://networked-blogs.com/7GviM>) wondered how the reformulation will affect the amount of surfactant used and if new types of surfactants will be used. The answer, in brief: The new formulation probably involves a combination of new technology that improves surfactant efficiency as well as different surfactants. But until the product reaches the shelves and can be analyzed, nobody knows for sure.

De Guzman also mentions P&G's product introduction last year in Europe of Ariel ExcelGel, which contains 20% fewer chemicals per wash and whose pack uses 45% less plastic than "regular" liquid detergents. She points out that the European detergents association AISE instituted a laundry powder compaction initiative in 2009 under which, over a two-year period, "detergent manufacturers are committed to reducing [the] volume and weight of powder detergents by 10–15% without reducing the number of wash loads."

AISE estimates that the initiative will save 200,000 metric tons (MT) of powder and 5,000 MT of packaging, de Guzman says.

In other P&G news, the Gain scent and brand are moving beyond the laundry room with new products.

As reported by *Drug Store News*, P&G is expanding the Gain product line to reach Hispanic consumers.

One product introduction—Gain dish-washing liquid—is the first dish brand to be introduced by P&G in 37 years, the company said. The Gain scent also will be added to

the Febreze line of fabric refreshers, air fresheners, candles, and oil warmers.

This introduction, in conjunction with the expansion of the Febreze with Gain collection, was designed to help P&G's home care category increase awareness of Gain's scent among more consumers, including "scent-conscious Hispanic consumers," the company said in a statement.

In other company news, P&G has added a new franchise to its roster of offerings. Not content to call it quits with its Mr. Clean Car Wash (nine have been opened so far), the company is ready to introduce franchised Tide Dry Cleaners across the United States.

One person who is betting on their success is Andrew Cherng, founder of Panda Restaurant Group Inc., a franchise Chinese fast-food outfit.

"I wasn't around when McDonald's was taking franchisees," Cherng said in a telephone interview with Bloomberg news. "I'm not going to miss this one."

Triclosan points the way

Ironically, even as the US Food & Drug Administration reviews the health effects of the ubiquitous antibacterial agent triclosan, new drugs based on its chemical structure could help billions of people.

The antibacterial ingredient in some soaps, toothpastes, odor-fighting socks, and even computer keyboards is pointing scientists toward a long-sought new treatment for toxoplasmosis—a parasitic disease that affects almost two billion people worldwide, including 80% of the population of Brazil.

People can catch the infection, spread by the parasite *Toxoplasma gondii*, from contact with feces from infected cats, eating raw or undercooked meat, and in other ways. Many have no symptoms because their immune systems keep the infection under control and the parasite remains inactive. But it can cause eye damage and other problems, even becoming life threatening in individuals with immune systems weakened by certain medications and diseases such as HIV infection, which allow the parasite to become active again, and in some persons without immune compromise. Most current treatments for toxoplasmosis have some potentially harmful side effects, and none of them attacks the parasite in its inactive stage.

Scientists led by Rima McLeod of the University of Chicago knew from past research that triclosan has a powerful effect in blocking the action of one of *T. gondii*'s key enzymes. Triclosan, however, does not dissolve in the blood and so cannot be used outright as a medication. Instead, the scientists describe using triclosan's molecular structure as the model for developing other potential medications, including some that show promise as more effective treatments for the disease.

Their report appears in the *Journal of Medicinal Chemistry* (53:6287–6300, 2010).

HSHO sunflower oil in cosmetics

Cocoa butter equivalents (CBE) from high-oleic, high-stearic (HSHO) sunflower oil could be used in cosmetic applications as well as in food applications, according to new research led by Joaquín Salas of the Instituto de la Grasa (CSIC) in Seville, Spain.

The research team reported that solid fractions containing 65–80% saturated-unsaturated-saturated configurations displayed properties similar to cocoa butter and were consistent with the characteristics of CBE. Further, mixtures of sunflower CBE and cocoa butter were observed to be "fully compatible," indicating they could be used as CBE.

Although the study focuses on the use of HSHO sunflower oil in food applications, the scientists told *CosmeticsDesign-Europe.com* that "they have already been contacted by a leading ingredients player in the cosmetic and personal care segment and are now working toward creating samples for testing."

The study appeared in *Food Chemistry* (doi: 10.1016/j.foodchem.2010.06.053).

Organic hair care claims misleading

The UK's Advertising Standards Agency (ASA) has ruled that an advertisement for hair care products described as "naturally organic" was "likely to be misleading" to consumers.

The magazine ad for US-based natural and organic beauty brand Simply Organic

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People News/ Inside AOCS

Garti honored

In August, **Nissim Garti**, who is with the Casali Institute of Applied Chemistry at Hebrew University of Jerusalem (Israel), received the Rattner Chair of Honor. The award was given in recognition of "out-standing scientific achievement and other academic contributions to the university," one of only 11 such chairs granted to professors from all disciplines at the university.

Garti, who joined AOCS in 2003, has received a number of awards over the years for his presentations at AOCS annual meetings. At the 2009 annual meeting he was presented with the Stephen S. Chang Award for distinguished and significant accomplishments in basic research. Garti is currently serving as co-editor for two pending AOCS Press books: *Edible Oleogels: Structure and Health Implications* (with **Alejandro Marangoni**) and *Cocoa Butter and Related Compounds* (with **Neil Widlak**).



Declercq moves to Dalhousie University

AOCS student member **Vanessa C. DeClercq** successfully defended her Ph.D. thesis in August in the Department of Food and Nutritional Sciences at the University of Manitoba (Winnipeg, Canada). Her dissertation involved the role of adipose tissue on blood pressure regulation in obesity-related hypertension, with emphases on adipokine production and secretion, specifically adiponectin. Her research directors were **Peter Zahradka** and **Carla Taylor**.

DeClercq is now in Halifax, Nova Scotia, where she has a postdoctoral appointment with Dalhousie University.

She received top prize in the poster competition held by the Canadian Section of AOCS in June 2007.

Aker BioMarine adds staff

Aker BioMarine, headquartered in Oslo, Norway, has added two new staff members, concentrating on the North American market. **Eric Anderson** has been named vice president for sales and marketing and **Todd Norton** is now vice president of new business development. Both have extensive experience in the branded ingredients business. The new staff are tasked with educating the natural products industry and consumers on the unique health benefits of krill and Aker's unique Eco-Harvesting™ practices.

Krill oil is an excellent source of marine omega-3 fatty acids. The EPA and DHA [eicosapentaenoic acid and docosahexaenoic acid] from krill are present in the highly bioefficient phospholipid form, which provides unique benefits compared to triglyceride fatty acids.

Lipid researchers to be recognized

The American Society for Biochemistry and Molecular Biology will recognize several lipids researchers at their annual meeting April 9–13, 2011, in Washington, DC.

Michael Brown and **Joseph Goldstein**, two Nobel laureates from the University of Texas Southwestern Medical Center at Dallas, have been named the winners of the inaugural Earl and Thressa Stadtman Distinguished Scientist Award. Brown and Goldstein shared the 1985 Nobel Prize in Medicine or Physiology for their discovery of the LDL (low density lipoprotein) receptor and the process of receptor-mediated endocytosis, which controls the level of cholesterol in blood and cells. In recent years, they discovered sterol regulatory element binding proteins and the process of regulated intramembrane proteolysis, which maintains the lipid composition of cell membranes.

Charles E. Chalfant, an associate professor at Virginia Commonwealth University

School of Medicine and a research career scientist at the McGuire Veterans Administration Medical Center in Richmond, Virginia, won the Avanti Young Investigator Award in Lipid Research for his work on lipid signaling pathways regulating alternative pre-mRNA processing and eicosanoid biosynthesis.

Yusuf Hannun, professor and department chairman at the Medical University of South Carolina, in Charleston, South Carolina, won the Avanti Award in Lipids for his work on bioactive sphingolipids, a class of lipids that, when defective, can cause disorders with significant medical impacts.

IN MEMORIAM

GARY R. ABLETT

Gary R. Ablett, associate professor at the University of Guelph-Ridgetown Campus, Canada, died on April 4, 2010, at the age of 58.



A b l e t t

received a B.Sc. from the University of Waterloo (Canada) and his M.Sc. and Ph.D. from the University of Guelph. Ablett began his research and teaching career at Ridgetown in 1979, where he initiated a public soybean breeding program that would deliver more than 50 new soybean varieties for Ontario agriculture.

His research program focused on making advances in two major areas. (i) The first was to increase the intrinsic value of soybeans by modifying seed components. This ultimately resulted in a higher value for soybeans while increasing opportunities for identity-preserved production systems. More recently, his research thrusts had been in the area of modified oil components and enhanced isoflavone levels. (ii) The second major area of focus was the development of cultivars/germplasm with enhanced productivity and stability.

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Patents

Published Patents

Mixing and grinding edible fat-based slurries and emulsions using a vibratory drum

Peterson, R., *et al.*, General Kinematics Corp., US7681818, March 23, 2010.

A system which may be used to perform simultaneous grinding and intimate mixing of edible fat-based slurries or emulsions, may include a cylindrical drum having a central longitudinal axis and a curved inner surface and mounted on springs, and a motor and tuned mass coupled to the cylindrical drum to vibrate the cylindrical drum about a center of vibration that is offset from the central longitudinal axis of the cylindrical drum. The system includes at least one pair of partition plates disposed at an angle to the longitudinal axis of the cylindrical drum to divide the cylindrical drum into at least two process zones, the partition plates of the at least one pair having matching apertures and moveable relative to each other between alignment and misalignment. The system may be used for example in chocolate manufacture.

Product for use in papermaking and preparation thereof

Sundberg, K., *et al.*, Ciba Specialty Chemicals Corp., US7682487, March 23, 2010.

A paper sizing composition comprising at least one first sizing component dispersed in water, the sizing component being a reaction product of a maleic anhydride and a fatty acid component and an aluminum component. The fatty acid component comprises an alkyl ester of one or more fatty acids selected from a vegetable oil-based fatty acid mixture. The particle size of the particles in said first sizing component has been reduced so that in the dispersion at least 50% of the particles are less than 2.5 μm , at least 75% of the particles are less than 4 μm , and at least 90% of the particles are less than 5 μm ; preferably so that at least 50% of the particles are less than 2 μm , at least 75% of the particles are less than 3 μm , and at least 90% of the particles are less than 4 μm .

Fat and oil composition for spreads

Haruna, H., *et al.*, The Nisshin OilliO Group Ltd., US7682644, March 23, 2010.

An object of the present invention is to provide a fat and oil composition for spreads having good oral solubility and spreadability without greasiness. A fat and oil composition for spreads of the present invention is composed of a continuous fat and oil phase and a water phase characterized in that the fat and oil phase comprises (i) a liquid-state fat and oil containing as a main ingredient triglycerides having fatty acids with 8 to 10 carbon atoms in an amount of not less than 10% by mass of the total constitutional fatty acids;

(ii) a low-melting transesterified fat and oil obtained by subjecting 40 to 90 parts by mass of the palm-based fat and oil and 60 to 10 parts by mass of a liquid-state fat and oil to transesterification with a 1,3-position-specific lipase; and (iii) a solid-form fat and oil having an open-tube melting point under increasing temperature of 38°C or higher.

Method of manufacturing toner, toner, and image forming method

Koyama, M., and K. Hayashi, Konica Minolta Business Technologies Inc., US7682769, March 23, 2010.

Disclosed is a method of manufacturing toner possessing the steps of conducting a polymerization process for acquiring wax-containing polyester resin particles via condensation-polymerization of carboxylic acid and alcohol employing oil droplets after forming the oil droplets made of wax and a polymerizable monomer containing at least one kind of carboxylic acid with divalence or more and at least one kind of alcohol with divalence or more in an aqueous medium containing a surfactant including a compound having a long-chain hydrocarbon group and acidic group, and conducting a process of coagulating at least the wax-containing polyester particles in the aqueous medium.

Non-hydrogenated vegetable oil based margarine for puff pastry containing an elevated diglyceride emulsifier

Skogerson, L., *et al.*, Caravan Ingredients Inc., US7687096, March 30, 2010.

A mono-, di- and triglyceride emulsifier is provided that is obtained by the interesterification or glycerolysis of triglycerides with glycerol. The diglyceride portion w/w is at least about 65 to about 80% and most preferably from about 70 to about 80%. The high diglyceride emulsifier is useful in preparing a margarine from a selected quantity a non-hydrogenated vegetable oil and from an amount of saturated fat for use in puff pastry products. The puff pastry is *trans* fat free and a less than usual percentage of saturated fats. A preferred structured puff pastry margarine is prepared by mixing on a weight to weight basis about 14 parts of the high diglyceride emulsifier that is in predominantly stable β crystal form from about 14 to 27 parts of a non-hydrogenated vegetable oil, and from about 40 to about 52 parts of a saturated fat.

Production of olefins having a functional group

Schmidt, L.D., and R. Subramanian, Regents of the University of Minnesota, US7683232, March 23, 2010.

A process is disclosed for producing functionalized olefins from a fuel source including an organic compound including a functional group. Useful fuel sources include for example biofeedstocks (e.g., carbohydrates, triglycerides, polyols, and biodiesel). The process is preferably carried out by partial oxidation. The overall process can be carried out autothermally.

Use of milk serum apoproteins in the treatment of microbial or viral infection

Folan, M.A., and D. Brady, Westgate Biological Ltd., US7687074, March 30, 2010.

The present invention relates to use of a milk apoprotein or a mixture thereof to prevent or treat microbial or viral infection of the human or animal body. It is believed that this is achieved by inhibiting adhesion of potential pathogens. More preferably at least one milk apoprotein or a mixture thereof is administered simultaneously or sequentially with either or both of at least one free fatty acid or a mixture thereof or a monoglyceride thereof; and/or at least one organic acid or a salt or ester thereof or a mixture thereof. The active agent(s) may be delivered by means of a pharmaceutically acceptable delivery system which includes parenteral solutions, ointments, eye drops, nasal sprays, intravaginal devices, surgical dressings, medical foods or drinks, oral healthcare formulations, and medications for mucosal applications.

Anti-obestic composition

Nakagawa, K., *et al.*, Nagaoka Perfumery Co., US7687085, March 30, 2010.

The composition of the present invention comprises (i) a biologically effective amount of an extract of a plant of the genus *Eucalyptus* as an active ingredient and (ii) a biologically acceptable carrier or diluents, and is effective for inhibiting or preventing obesity (increase in weight), lipid storage disease, hyperlipemia, arteriosclerosis, or thrombosis and is also effective for inhibiting or reducing an amount of triglyceride or an amount of cholesterol in blood. Therefore, the composition of the present invention is used in the form of drugs, food products, food additives, animal feeds, and additives for animal feeds.

Non-hydrogenated vegetable oil based shortening containing an elevated diglyceride emulsifier composition

Skogerson, L., and T. Boutte, Caravan Ingredients Inc., US7691428, April 6, 2010

A mono-, di-, and triglyceride emulsifier composition is provided that is obtained by the interesterification or glycerolysis of triglycerides with glycerol. The diglyceride portion w/w is at least about 65% to about 80% and most preferably from about 70% to about 80% (HiDi [high diglyceride emulsifier]). The HiDi is useful in preparing a *trans*-free shortening from a non-hydrogenated vegetable oil for use in bakery goods, which then have a significantly lower saturated fat content and a substantially higher polyunsaturated level than heretofore available when a conventional mono- and diglyceride emulsifier is used in the goods. A preferred shortening that is predominantly in stable β' crystalline form is prepared by mixing on a weight to weight basis from about 10% to about 30% and preferably about 15% to 20% of the HiDi composition with the remainder being non-hydrogenated soybean oil.

Polyglycerol, polyglycerol/fatty acid ester, and processes for producing these

Endo, T., and H. Omori, Daicel Chemical Industries Ltd., US7687649, March 30, 2010.

The present invention relates to a polyglycerol significantly reduced in content of a polyglycerol having a cyclic structure formed by removal of a water molecule from a polyglycerol molecule, and to a fatty acid ester of a polyglycerol having excellent surface activity. 2 Moles or more of glycidol and a catalyst are successively added to 1 mole of glycerol for a reaction to obtain a polyglycerol in which a ratio of [total polyglycerol (1)] to [total polyglycerol (2) having a cyclic structure] is [70% or more]/[30% or less] (the total of both is 100% by weight) in terms of an intensity ratio determined by liquid chromatography/mass spectrometry; and an average polymerization degree "n" is 2 or more. A reaction of a polyglycerol with a fatty acid provides the corresponding a fatty acid ester of the polyglycerol.

Metal hydroxide desiccated emulsions used to prepare grease

Nolan, S.J., *et al.*, The Lubrizol Corp., US7691795, April 6, 2010

The invention provides a grease composition comprising a stable dispersion of a metal hydroxide with a number average particle size in the range 20 nanometers to 2 micrometers, a surfactant with a HLB [hydrophilic-lipophilic balance] of less than 10, a mono- or polycarboxylic acid, and an oil of lubricating viscosity. The method of preparing a grease composition is also disclosed with benefits including a reduction in reaction time, amount of foam produced, and environmental hazards.

Substance for lowering high cholesterol level in serum and methods for preparing and using the same

Miettenen, T., *et al.*, Raisio Nutrition Ltd., US7691834, April 6, 2010

The invention relates to a substance which lowers LDL cholesterol levels in serum and which is fat soluble β -sitostanol fatty acid ester and to a method for preparing and using the same. The substance can be taken orally as a food additive food substitute or supplement. A daily consumption of the β -sitostanol ester in an amount between about 0.2 and about 20 g/day has been shown to reduce the absorption of biliary and endogenic cholesterol.

High lipid diet

Turini, M., *et al.*, Nestec S.A., Institut de la Research Agronomique, US7691906, April 6, 2010

A composition for use as a medicament, functional food, or nutritional product is described that comprises at least one lipid wherein the lipid provides greater than 35% total energy of the composition. A preferred embodiment comprises an n-6/n-3 fatty acid ratio of about 2:1 to 7:1. In addition a method of preparing the

composition; use of the composition in the manufacture of a medication, functional food, or nutritional product; and a method of treatment or treatment or prevention of sepsis or inflammatory shock, which comprises administering an effective amount of the composition, are described.

Soy-based thermosensitive hydrogels for controlled release systems

Liu, Z., and S. Erhan, The United States of America as represented by the Secretary of Agriculture, US7691946, April 6, 2010

Biopolymeric hydrogel precursors are prepared by means of a ring-opening polymerization of epoxidized vegetable oils, followed by chemical hydrolysis. The recovered hydrogels having properties similar to Pluronic™-type surfactants would have a plurality of end-use applications including use as food additives and pharmaceutical ingredients. This invention provides the potential for an enhanced market for vegetable oils and particularly for soybean oil.

Chemical synthesis methods using electro-catalysis

Lawson, J.A., and A. Baosman, ECR Technologies Inc., US7695534, April 13, 2010

Synthesis methods are provided using electrochemical catalysis. In one method diesel fuel is made by (i) flowing a mixture of a triglyceride source and an alcohol through a high-voltage electrical field, effective to convert the triglyceride into saturated mono alkyl esters; and (ii) adding the saturated mono alkyl esters to a petroleum-derived diesel fuel to form a diesel fuel blend. In another method a high-temperature, oxidatively stable lubricant is made by (i) flowing a renewable oil including unsaturated fatty acids through a high-voltage electrical field effective to convert the unsaturated fatty acids into saturated fatty acids; and (ii) adding one or more functional additives to the saturated fatty acid-containing renewable oil to form a synthetic lubricant. In another method ethanol is made by flowing a liquid which comprises a simple sugar through a high-voltage electrical field effective to convert the sugar into ethanol without fermentation.

Extraction and winterization of lipids from oilseed and microbial sources

Dueppen, D.G., *et al.*, Martek Biosciences Corp., US7695626, April 13, 2010

A process for purifying a lipid composition having predominantly neutral lipid components having at least one long-chain polyunsaturated fatty acid is disclosed. The process employs contacting the lipid composition with a polar solvent, such as acetone, wherein the solvent is selected such that contaminants are less soluble in the solvent than is the long-chain polyunsaturated fatty acid. The process is typically conducted at cooler temperatures, including about 0°C. Upon precipitation of the contaminants from the lipid composition, a separation is conducted to remove the precipitated material from the lipid composition. The long-chain polyunsaturated fatty acids can include arachidonic acid (ARA), n-6 docosapentaenoic acid

(n-6 DPA), n-3 DPA, eicosapentaenoic acid (EPA), and/or docosahexaenoic acid (DHA). The process of the present invention effectively winterizes lipid compositions, thereby reducing the tendency of such compositions to become hazy.

Method for producing phospholipid

Sakai, M., *et al.*, Kabushiki Kaisha Yakult Honsha, US7695944, April 13, 2010

A method for producing a phospholipid using transphosphatidyl-ation, which comprises homogenizing a mixture of a raw material phospholipid, a hydroxyl-containing acceptor phospholipase D, and water in the absence of an organic solvent to obtain a homogenized mixture; and subjecting the homogenized mixture to a transphosphatidyl-ation reaction at 15–65°C. The homogenized mixture has a lamellar lyotropic liquid crystal structure. An objective phospholipid can be obtained from the homogenized mixture through transphosphatidyl-ation without using an organic solvent or calcium.

Use of non-absorbable fat in determining dietary fat absorption

Jandacek, R.J., *et al.*, Children's Hospital Medical Center–University Of Cincinnati, US7695971, April 13, 2010

The use of sucrose polyester containing behenate fatty acid chains as a non-absorbable fat marker to determine total dietary fat absorption by the digestive tract of a subject. A test food for use in measuring fat absorption contains a non-absorbable fat and a dietary fat. The method is useful for diagnostic testing for diagnosing mal-absorption of dietary fat by the digestive tract of the subject, and impairment of dietary fat digestion in the subject.

Geosynthetic composite for borehole strengthening

Cowan, K.M., Shell Oil Co., US7696133, April 13, 2010

Disclosed is a composition comprising a chemical formulation useful for creating geosynthetic composites *in-situ* which includes a reactive ester having at least one carbon-carbon double bond, preferably a vinyl ester of a C₉ to C₁₁ versatic acid or vinyl ester of a long-chain fatty acid, or a combination thereof; at least one unsaturated thermoplastic elastomer soluble in the reactive ester; at least one di- or trifunctional acrylate or methacrylate monomer. The formulation may further include a nonaqueous drilling fluid.

Oil-resistant sheet material

Akiyama, K., Tokushu Paper Mfg. Co., US7700197, April 20, 2010

An oil-resistant sheet material having low resistance to air permeability and being excellent oil resistance, and particularly, being able to be suitably used as a packaging material for food containing edible oil. The oil-resistant sheet material includes at least one coating layer that contains starch and/or polyvinyl alcohol and a fatty acid on at least one side of a substrate in a solid content of 0.5–20 g/cm². When the coating layer further contains a crosslinking agent, the oil resistance is improved. A coating layer that contains a fatty acid as a main component or a coating layer that contains polyvinyl

alcohol as a main component may be further applied to the above-mentioned coating layer to form at least two coating layers.

Oil recuperation process

Kellens, M., and W. De Greyt, De Smet Engineering N.V., US7696369, April 13, 2010

The invention provides a process for recuperating a triglyceride oil from wet gums from a vegetable oil, said process comprising the steps of: (i) providing wet gums by water degumming a crude vegetable oil, (ii) mixing said wet gums with water containing a phospholipidolytic agent, (iii) allowing the mixture to separate into two or more phases, said two or more phases including at least an oily phase and an aqueous phase, and (iv) recuperating said oily phase.

Preparations of phospholipids and pharmaceuticals containing 5-amino salicylic acid for the treatment of inflammatory bowel disease

Lichtenberger, L., The Board of Regents of the University of Texas System, US7700651, April 20, 2010

A unique composition of a 5-amino salicylic acid (5ASA) and a phospholipid is disclosed for treating inflammatory bowel disease (IBD), where the composition can be a mixture, a molecular association complex, or a covalent compound of 5ASA and a reactive phospholipid covalently bonded together via a diazo linkage and to methods for administering the compositions to treat symptoms of IBD.

Prime foam containing vegetable oil polyol

Griggs, W., Sleep Innovations Inc., US7700661, April 20, 2010

A polyurethane foam created from a formulation comprising from about 1% to about 70% of a vegetable oil polyol is disclosed. The polyurethane foam is made from a formulation comprising an isocyanate, a surfactant, and a polyol blend comprising a vegetable oil polyol. Also disclosed is a polyurethane foam made from a formulation comprising a polyol blend comprising a petrochemical polyol and a vegetable oil polyol, and an isocyanate blend comprising a 2,4-toluene diisocyanate (TDI) isomer and a 2,6-TDI isomer, wherein the ratio of petrochemical polyol to vegetable oil polyol in the polyol blend is about equal to the ratio of the 2,4-TDI isomer to the 2,6-TDI isomer in the isocyanate blend.

Plasticized poly vinyl chloride compositions

Bueno de Almeida, W., *et al.*, Cognis Brazil Ltda, US7700675, April 20, 2010

The invention relates to plasticizer compositions for polyvinyl chloride resins. A plasticized polyvinyl chloride resin contains (a) 100 parts by weight of at least one polyvinyl chloride resin and (b) 0.1–200 parts by weight of a plasticizer compounded with the polyvinyl chloride resin, wherein the plasticizer comprises (i) at least

one isobutanol ester of a fatty acid with 8–24 carbon atoms, wherein the fatty acid can be saturated or olefinically unsaturated, linear or branched and contain at least one epoxy group per molecule and (ii) at least one methyl ester of a fatty acid with 16–18 carbon atoms, wherein the fatty acid can be saturated or olefinically unsaturated, linear or branched.

Catalysts for producing carboxylic acid salts

Wessel, H., *et al.*, BASF Aktiengesellschaft, US7700803, April 20, 2010

Catalysts for preparing carboxylic acid salts from alcohols which (i) consist of copper or (ii) comprise from 99.9% to 10% by weight of copper and from 0.01% to 90% by weight of iron and from 0 to 50% by weight of one or more other metals, and may optionally be doped, the hydroxides being obtained by precipitation of copper salt solutions or by coprecipitation of copper and iron salt solutions optionally containing salts of other metals using a base, and being reduced by hydrogen.

Vitamin/mineral compositions with DHA

Bydlon, R.J., *et al.*, Xanodyne Pharmaceuticals Inc., US7704542, April 27, 2010

Compositions containing the fatty acid docosahexaenoic acid (DHA) in combination with at least one vitamin and mineral are provided to supplement nutrition in a mammalian diet. DHA is present in the composition in concentrated amounts, advantageously in a carrier such as marinol oil to allow for quantities of DHA sufficient to supply expectant and new mothers and their children as recommended on a daily basis. This DHA may also be used to treat a variety of disorders in children and adults. The compositions advantageously include vitamins, minerals, and optionally other nutrients to provide a nutritional supplement which may be convenient to swallow and taken once a day.

Selective oxidative conversion of methane to methanol dimethyl ether and derived products

Olah, G.A., and G.K.S. Prakash, University of Southern California, US7705059, April 27, 2010

The present invention relates to a method of producing methanol from a methane source by oxidizing methane under conditions sufficient to a mixture of methanol and formaldehyde while minimizing the formation of formic acid and carbon dioxide. The oxidation step is followed by treatment step in which formaldehyde is converted into methanol and formic acid, which itself can further be converted into methanol via catalytic hydrogenation of intermediately formed methyl formate. ■

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

Cholesterol, the central lipid of mammalian cells

Maxfield, F.R., and G. van Meer, *Curr. Opin. Cell Biol.* 22:422–429, 2010.

Despite its importance for mammalian cell biology and human health, there are many basic aspects of cholesterol homeostasis that are not well understood. Even for the well-characterized delivery of cholesterol to cells via lipoproteins, a novel regulatory mechanism has been discovered recently, involving a serum protein called PCSK9, that profoundly affects lipoproteins and their receptors. Cells can export cholesterol by processes that require the activity of ABC transporters, but the molecular mechanisms for cholesterol transport remain unclear. Cholesterol levels in different organelles vary by 5–10-fold, and the mechanisms for maintaining these differences are now partially understood. Several proteins have been proposed to play a role in the inter-organelle movement of cholesterol, but many aspects of the mechanisms for regulating intracellular transport and distribution of cholesterol remain to be worked out. The endoplasmic reticulum is the main organelle responsible for regulation of cholesterol synthesis, and careful measurements have shown that the proteins responsible for sterol sensing respond over a very narrow range of cholesterol concentrations to provide very precise, switch-like control over cholesterol synthesis.

Characterization of bacterial lipid profiles by using rapid sample preparation and fast comprehensive two-dimensional gas chromatography in combination with mass spectrometry

Purcaro, G., *et al.*, *J. Sep. Sci.* 33:2334–2340, 2010.

The fatty acid profile of bacteria has been extensively studied for taxonomic classification purposes, since bacteria, in general,

contain particular and rare fatty acids, compared with animal and plant tissues. As for any real-world sample type, the development of rapid and reliable methods for (i) sample identification (in this case, bacterium type), and (ii) constituent identification (in this instance, the fatty acid profile) is desirable. In this research, a half-hour procedure—to analyze bacteria—was developed: A 2-min, one-step sample preparation step was followed by a relatively fast comprehensive 2D GC-MS (two-dimensional gas chromatography-mass spectrometry) separation (25 min). Furthermore, dedicated MS libraries were constructed for the identification of bacteria and fatty acids. Finally, data processing, only qualitative at this stage, was carried out with the support of novel comprehensive 2D GC software.

An update on the therapeutic role of alkylglycerols

Iannitti, T., and B. Palmieri, *Marine Drugs* 8:2267–2300, 2010.

Scandinavian folk medicine used shark liver oil for the treatment of cancers and other ailments based on the rarity of tumors in sharks and their ability to resist infections. Shark liver oil is a source of alkylglycerols, which have been studied as anti-cancer agents in several clinical trials. Moreover, alkylglycerols have been investigated for the treatment of radiation-induced side effects and for their ability to boost the immune system. Several experimental studies have shown the ability of alkylglycerols to open the blood-brain barrier to facilitate the access of therapeutic drugs to the central nervous system. This review covers the most important studies of alkylglycerols in both animals and humans.

Therapeutic applications of bioactive sphingolipids in hematological malignancies

Ekiz, H.A., and Y. Baran, *Int. J. Cancer* 127:1497–1506, 2010.

Sphingolipids are sphingosine-based lipid molecules that have important functions in cellular signal transduction and in a variety of cellular processes including proliferation, differentiation, programmed cell death (apoptosis), and responses to stressful conditions. Ceramides, dihydroceramide, sphingosine, and sphingosine-1-phosphate are examples of those bioactive sphingolipids. They have a major impact

on determination of the cell fate by contributing to cell survival or cell death through apoptosis. Despite the number of carbon atoms in the fatty acid chain changes the physiological role; ceramides generally exert suppressive roles on cell proliferation. There have been several enzymes identified in this pathway that are responsible for the conversion of ceramide into other sphingolipid derivatives. Those derivatives also have differential roles on those cellular process. Sphingosine-1-phosphate is an example of such sphingolipid derivatives that have antiapoptotic effects. As they have significant impacts, particularly on the cell death and survival, bioactive sphingolipids have a great potential to be targets in cancer therapy. An increasing number of studies indicate that sphingolipid derivatives are important in the progression of hematological malignancies, and they are also involved in the resistance to current chemotherapeutic options. This review compiles the current knowledge in this area for enlightening the therapeutic potentials of bioactive sphingolipids in various leukemias.

Multidimensional approaches in LC and MS for phospholipid bioanalysis

Guo, X.H., and E. Lankmayr, *Bioanalysis* 2:1109–1123, 2010.

The advancement of both LC (liquid chromatography) and MS (mass spectrometry) has contributed significantly to phospholipid analysis. Two major trends of developments have emerged in the past decade: application of dedicated online (or offline) LC-MS techniques including two-dimensional and sophisticated chromatographic separations, and the development of so-called shotgun lipidomics represented by multidimensional MS-based techniques. However, neither of these techniques has been shown to be a universal solution for the increasing demand on the comprehensive information of lipid metabolomics in lipidomics studies. This is partially due to the intrinsic complexity of naturally occurring phospholipids in practice. It is evident that either chromatography or MS has to go multidimensional in order to fulfill this goal. This review focuses on recent developments of multidimensional MS, LC-MS, and chromatographic approaches for lipidomics analysis. The perspectives and retrospectives of chromatography and MS in these aspects will be reviewed and discussed.

Phosphatidylserine targeting for diagnosis and treatment of human diseases

Schutters, K., and C. Reutelingsperger, *Apoptosis* 15:1072–1082, 2010.

Cells are able to execute apoptosis by activating series of specific biochemical reactions. One of the most prominent characteristics of cell death is the externalization of phosphatidylserine (PS), which in healthy cells resides predominantly in the inner leaflet of the plasma membrane. These features have made PS-externalization a well-explored phenomenon to image cell death for diagnostic purposes. In addition, it was demonstrated that under certain conditions viable cells express PS at their surface such as endothelial cells of tumor blood vessels, stressed tumor cells, and hypoxic cardiomyocytes. Hence, PS has become a potential target for therapeutic strategies aiming at Targeted Drug Delivery. In this review we highlight the biomarker PS and various PS-binding compounds that have been employed to target PS for diagnostic purposes. We emphasize the 35 kD human protein annexin A5, which has been developed as a molecular imaging agent to measure cell death *in vitro*, and noninvasively *in vivo* in animal models and in patients with cardiovascular diseases and cancer. Recently focus has shifted from diagnostic toward therapeutic applications employing annexin A5 in strategies to deliver drugs to cells that express PS at their surface.

An update on vitamin E, tocopherol, and tocotrienol—perspectives

Colombo, M.L., *Molecules* 15:2103–2113, 2010.

Vitamin E, like tocotrienols and tocopherols, is constituted of compounds essential for animal cells. Vitamin E is exclusively synthesized by photosynthetic eukaryotes and other oxygenic photosynthetic organisms such as cyanobacteria. To prevent lipid oxidation, plants accumulate mainly tocochromanols in oily seeds and fruits or in young tissues undergoing active cell divisions. From a health point of view, at the moment there is a great interest in the natural forms of tocochromanols, because they are considered promising compounds able to maintain a healthy cardiovascular system and satisfactory blood cholesterol levels. Some evidence suggests that

the potency of the antioxidant effects may differ between natural or synthetic source of tocochromanols (vitamin E).

Sterols and sphingolipids: Dynamic duo or partners in crime?

Gulati, S., *et al.*, *Prog. Lipid Res.* 49:353–365, 2010.

One manner in which eukaryotic cells respond to their environments is by optimizing the composition and proportions of sterols and sphingolipids in membranes. The physical association of the planar ring of sterols with the acyl chains of sphingolipids, particularly sphingolipids, produces membrane microheterogeneity that is exploited to coordinate several crucial pathways. We hypothesize that these lipid molecules play an integrated role in human disease; when one of the partners is mis-regulated, pathology frequently ensues. Sterols and sphingolipid levels are not coordinated by the action of a single master regulator, however the cross-talk between their metabolic pathways is considerable. We describe our perspectives on the key components of synthesis, catabolism, and transport of these lipid partners with an emphasis on evolutionarily conserved reactions that produce disease states when defective.

An update of MALDI-TOF mass spectrometry in lipid research

Fuchs, B., *et al.*, *Prog. Lipid Res* 49:450–475, 2010.

Although matrix-assisted laser desorption and ionization (MALDI) mass spectrometry (MS)—often but not exclusively coupled with a time-of-flight (TOF) mass analyzer—is primarily established in the protein field, there is increasing evidence that MALDI MS is also very useful in lipid research: MALDI MS is fast, sensitive, tolerates sample impurities to a relatively high extent, and provides very simple mass spectra without major fragmentation of the analyte. Additionally, MALDI MS devices originally purchased for “proteomics” can be used also for lipids without the need of major system alterations. After a short introduction into the method and the related ion-forming process, the MALDI mass spectrometric characteristics of the individual lipid (ranging from completely apolar hydrocarbons to complex glycolipids with the focus on glycerophospholipids) classes

will be discussed and the progress achieved in the last years emphasized. Special attention will be paid to quantitative aspects of MALDI MS because this is normally considered to be the “weak” point of the method, particularly if complex lipid mixtures are to be analyzed. Although the detailed role of the matrix is not yet completely clear, it will be also explicitly shown that the careful choice of the matrix is crucial in order to be able to detect all compounds of interest. Two rather recent developments will be highlighted: “Imaging” MS is nowadays widely established and significant interest is paid in this context to the analysis of lipids because lipids ionize particularly well and are thus more sensitively detectable in tissue slices than other biomolecules such as proteins. It will also be shown that MALDI MS can be very easily combined with thin-layer chromatography (TLC) allowing the spatially resolved screening of the entire TLC plate and the detection of lipids with a higher sensitivity than common staining protocols.

Biodiesel production from *Jatropha curcas*: A review

Parawira, W., *Sci. Res. Essays* 5:1796–1808, 2010.

Biodiesel has attracted considerable attention during the past decade as a renewable, biodegradable, and nontoxic fuel alternative to fossil fuels. Biodiesel can be obtained from vegetable oils (both edible and nonedible) and from animal fat. *Jatropha curcas* Linnaeus, a multipurpose plant, contains high amounts of oil in its seeds that can be converted to biodiesel. *Jatropha curcas* is probably the most highly promoted oilseed crop at present in the world. The availability and sustainability of sufficient supplies of less expensive feedstock in the form of vegetable oils, particularly *J. curcas*, and efficient processing technology to biodiesel will be crucial determinants of delivering a competitive biodiesel. Oil contents, physicochemical properties, and the fatty acid composition of *J. curcas* reported in the literature are provided in this review. The fuel properties of *Jatropha* biodiesel are comparable to those of fossil diesel and conform to the American and European standards. The objective of this review is to give an update on the *J. curcas* L. plant, the production of biodiesel from the seed oil and research attempts to improve the technology of converting vegetable oil to biodiesel, and the fuel properties of the *Jatropha* biodiesel.

The technological methods that can be used to produce biodiesel are presented together with their advantages and disadvantages. The use of lipase as biotechnological solution to alkali and acid catalysis of transesterification and its advantages are discussed. There is need to carry out research on the detoxification of the seed cake to increase the benefits from *J. curcas*. There is also need to carry out life-cycle assessment and the environmental impacts of introducing large-scale plantations. There is also still a dearth of research about the influence of various cultivation-related factors and their interactions and influence on seed yield. Many other areas that need to be researched on *Jatropha curcas* L. are pointed out in this review.

Viscosity modification of different vegetable oils with EVA copolymer for lubricant applications

Quinchia, L.A., *et al.*, *Ind. Crops Prod.* 32:607–612, 2010.

During these last years, special attention has been paid to the protection of the environment against pollution exerted by lubricants and hydraulic fluids based on mineral oils. Thus, vegetable oil-based lubricants are being actively demanded for many green industrial activities. Although vegetable oils have some excellent properties for their potential use as lubricants, some inconveniences should be technologically improved, for example, the limited range of viscosities available. Consequently, environmentally friendly viscosity modifiers should be included in the lubricant formulation. In this paper, ethylene–vinyl acetate copolymer (EVA) has been successfully tested as viscosity modifier for several common vegetable oils, yielding potentially environmentally friendly lubricants for some applications. EVA addition always yields an important increase in vegetable oil viscosity. The most important viscosity increments have been found for low-viscosity vegetable oils, such as sunflower oil (SO), high-oleic sunflower oil (HOSO), and soybean oil (SYO), at moderate temperatures. Viscosity increments up to 330–420% with respect to the original oil have been obtained for these vegetable oil/EVA blends at 40°C. On the contrary, the lowest increments correspond

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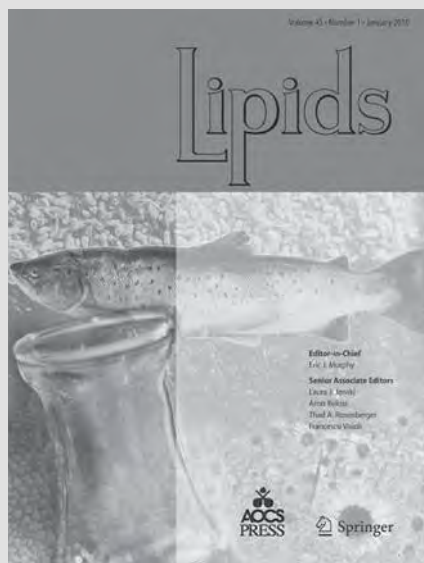
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This award was established to honor long-time AOCS member Thomas H. Smouse.

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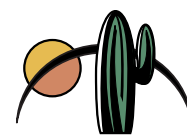
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Completed applications must be returned to AOCS by February 1, 2011.



Problem solving through lipid chemistry



Andrew Proctor

Andrew Proctor, professor of food science at the University of Arkansas (Fayetteville, USA), received the Herbert J. Dutton Award at the 2010 AOCS Annual Meeting & Expo, held May 16–19, 2010, in Phoenix, Arizona, USA. In his address, Proctor mentioned that although the recipient of the award has traditionally been an analytical method development chemist, his research career has focused on the applied lipid chemistry of processing and has involved applying or adapting existing analytical techniques and sometimes developing new ones to address research problems.

Proctor's lipids career began in 1984 under Dr. Harry Snyder at the University of Arkansas Graduate School, where he studied the Freundlich isotherm behavior of soy oil lutein pigment adsorption from soy oil and demonstrated the competitive adsorption of minor oil components onto common adsorbents. He was then hired as assistant professor in food science at The Ohio State University (Columbus, USA) where he developed biosilicates material from rice hull waste as a "green adsorbent" for use in oil processing. Later, he returned to the University of Arkansas as an associate professor to work more closely with the rice industry on rice-related issues, such as the nature of lipid adsorption to synthetic and rice biosilicate adsorbents. In these studies he used FTIR (Fourier-transform infrared) spectroscopy to describe the nature of lipid binding involved in competitive adsorption of minor soy oil components during oil bleaching. Later studies involved milled rice surface lipid chemistry studies, utilization of rice hull silica, and CLA (conjugated linoleic acid) production from soy oil linoleic acid.

The presentation highlighted three areas of Proctor's research: lipid adsorption by rice biosilicate, the surface lipid chemistry of



Andrew Proctor, right, receives the 2010 Herbert J. Dutton Award from Analytical Division Chairperson Rick Della Porta at the 101st AOCS Annual Meeting & Expo, held in Phoenix, Arizona, USA.

milled rice, and production and quality of CLA-rich soy oil. These projects resulted from industry interactions and involved undergraduate and graduate students, as well as postdoctoral research activities with funding from the US Department of Agriculture National Research Initiative, Arkansas Soybean Promotion Board, Arkansas Rice Promotion Board, Arkansas Bioscience Institute, University of Arkansas Institute of Food Science and Engineering, and industry.

RICE HULL RESEARCH

Rice hull ash is a product of rice hulls that is obtained by gasification and combustion to produce "green" energy. At The Ohio State University, Proctor and a Ph.D. agricultural engineering student, Sevugan Palaniappan, used X-ray diffraction to demonstrate the amorphous nature of rice hull ash and conducted isotherm studies to demonstrate its capacity for minor soy oil components. At the University of Arkansas, AOCS Honored Student Chatali Adhikari and Proctor used FTIR to show the nature of the surface interaction between silicate and lipids and demonstrated the importance of hydrogen bonding, polar interactions, and van der Waals forces. Another graduate student and AOCS Honored Student, Michael Sostrin, developed computer models to visually simulate the adsorption phenomena based on the chemistry of the system. These studies showed the potential of rice hull silicate as an inexpensive substitute

for silica gel in oil processing. Proctor and his postdoctoral scientist Uruthira Kalapathy then developed a “green” technology to produce silica gel from rice hull silica by simply dissolving rice hull ash in sodium hydroxide to form sodium silicate. Silica gel was then precipitated with acid. Production of sodium silicate was commercialized in 2004 by using a high-carbon ash to produce both silicate and activated carbon.

MILLED RICE SURFACE LIPIDS

Proctor also discussed his work on milled rice surface lipid quality and flavor issues as they relate to rice brewing quality. A brewing company that uses rice as an adjunct allows a limit of 0.1% of fatty acids, as greater levels result in lipid oxidation and consequent off-flavors in the beer. There was a need for rapid, reliable methods for fatty acid determination on the surface of milled rice. Proctor’s research group developed both rapid wet chemistry and DRIFTS (diffuse reflectance Fourier-transform infrared spectroscopy) methods to measure milled rice surface free fatty acids to allow brewers to determine the lipid quality of rice as it arrives for processing. The wet chemistry method requires only a 2-minute vortexing with isopropanol followed by colorimetric determination of fatty acids while the DRIFTS method uses a chemometric approach based on fatty acid spectroscopy characteristics. Both methods require only 10–15 minutes to complete the analysis and were developed by AOCS Honored Student Henry Lam, who is now working in the Canadian food industry. Former Ph.D. student Mamun Monsoor, now with Nestlé, explored the effects of rice storage on lipid oxidation and volatile off-flavor production.

CLA

Currently, Proctor is involved in research producing CLA-rich oil by isomerization of soy oil linoleic acid to produce soy oil containing up to 20% CLA. The CLA content of the resultant oil is considerably more than is available from dairy and other bovine ruminant food sources, without cholesterol and the high levels of saturated fat often associated with animal CLA sources. This project is based on a concept developed by graduate student and AOCS Honored Student Rahul Gangidi. The isomerization is achieved by simple irradiation with ultraviolet (UV) light in the presence of an iodine catalyst. Another AOCS Honored Student, Vishal Jain, who is now with Oil-Dri Corporation, designed and built a pilot plant-scale unit to optimize the CLA yields and processing conditions. It consists of a customized illuminated laminar flow unit (ILFU) comprising three borosilicate glass plates, forming two chambers, and three 450 W UV/visible lamps for maximum exposure of oil to the UV light. Oil is fed into one chamber and water is circulated as a means of controlling temperature. An optimal yield of ~20% CLA was obtained by photoirradiation of soy oil with 0.35% iodine at 48°C in 12 h.

The benefit of small amounts of added soy tocopherols in promoting CLA yields was demonstrated by recent master’s degree student Tanushri Tokle. Postdoctoral scientist Reddy Yettella Ramesh, assisted by technician Brooke Henbest, is investigating various antioxidants and antioxidant systems to promote CLA yields, during linoleic acid photoisomerization, while inhibiting autoxidation. This is a difficult task as both reactions proceed by a lipid free radical step.

At the time of Proctor’s AOCS presentation, catalytic iodine was being removed from CLA-rich oil by adsorption, but since then engineering exchange graduate student Guillaume Galy from

National Polytechnic Institute of Toulouse, France, has been working with Proctor and Professor Robert Beitle of the University of Arkansas Department of Chemical Engineering to remove iodine from the oil by membrane separation and is having significant success.

Vishal Jain developed a CLA-rich oil for use in preparing potato chips and MS graduate student Chelsey Castrodale developed an Italian salad dressing. She is now conducting lipid oxidation studies on CLA-rich oil and CLA-rich potato chips.

Current master’s degree student Jeta Kadamne has developed a rapid FTIR chemometric model to monitor the CLA content in oil, as a quicker and alternative method to conventional GC-FID (gas chromatography-flame ionization detection) analysis of fatty acid methyl esters.

We have also completed the triacylglyceride (TAG) analysis of the CLA-rich oil, identified those TAG species carrying linoleic acid that are converted to CLA, and identified LLL (trilinolein) as a major contributor. A unique feature of the oil is that 70–80% of the CLA is present as *t,t*-CLA isomers.

Recent nutritional studies conducted by Latha Devareddy (Department of Food Science, University of Arkansas) and her Ph.D. student Will Gilbert showed that including 0.5% *t,t*-CLA-rich oil in the diet of Zucker (obese) rats resulted in a 41% reduction in total serum cholesterol and 50% reduction in serum LDL (low density lipoprotein), relative to control obese rats fed 0.5% conventional soy oil. Furthermore, there was a 39% reduction in liver lipids and 35% reduction in liver weight relative to the controls. In addition, there was a significantly reduced level of hemoglobin glycosylation in the blood indicating an intermediary effect on fasting insulin and thus a positive effect on diabetes.

Utkarsh Shah, one of Proctor’s current graduate students, conducted silver ion analytical and preparative HPLC (high-performance liquid chromatography) studies to separate the *t,t*-CLA isomers and identify them by mass spectroscopy (MS), in collaboration with Jack Lay, director of the University of Arkansas Mass Spectrometry Center. The objective is to obtain pure *t,t*-CLA isomer samples for cell culture and possibly further animal studies with a view to developing pure biologically active compounds. Shah, Lay, and Proctor are currently conducting studies to confirm the positional isomer structure of the biologically active *t,t*-CLA species for Devareddy and Gilbert, who will conduct further cell culture and animal studies.

Andrew Proctor has teaching assignments in food law and lipid chemistry. He is US lead for a European Union (EU)–US consortium entitled Integral Valorization of Bioproduction working with former AOCS president Lawrence Johnson of Iowa State University (Ames) and Ronald Madl of Kansas State University (Manhattan) to facilitate transatlantic student educational exchanges in bioresource utilization and green technology with the University of Gent (Belgium), Karl Franzens University (Graz, Austria), and the National Polytechnic Institute of Toulouse (France). AOCS member Koen Dewettinck is the EU lead at Gent. Proctor recently pioneered the AOCS Lipid Educators Common Interest Group, whose role is to facilitate communication on lipid education issues within the society. He is a longtime AOCS member and is currently serving a second consecutive term on the Governing Board. He has served as senior associate editor of JAOCS (Journal of the American Oil Chemists’ Society) since 2001 and as an associate editor from 1992 to 2001. Contact him at aproctor@uark.edu.

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trans Fat update from Argentina

Food industry and health officers reach consensus to limit *trans* fat content in food.

Eduardo Dubinsky

NEW LEGISLATION ON *trans* FATS ACCEPTED IN ARGENTINA

Under the umbrella of the Panamerican Health Organization (PAHO) Program entitled Trans Fat Free Americas (see *inform* 19:711–712, 2008), the Health Ministry of Argentina joined a task force in 2008 composed of representatives from the Argentinean food industry, health ministry officers, agriculture ministry officers, and experts from academia and consultancies.

The first meeting of The Trans Fat Free Americas National Group took place in the Health Ministry in the City of Buenos Aires in November 2008. Representatives to this meeting gathered with the goal of putting in practice the recommendations of the Declaration of Rio of the PAHO in connection with *trans* fats elimination. (Fig. 1). Three working subgroups were formed: scientific, legislation, and communication.

The “Legislation/Regulation Group” held several meetings during 2008 and 2009 and adopted a final consensus document, including a proposed amendment to the Argentinean Food Code to limit the *trans* fat content in foods. The first portion of this 15-page Background Technical Report describes the issue of mortality throughout the world attributable to cardiovascular disease (CVD) and considers its importance in Latin America in general and Argentina in particular: “In Argentina, CVD has the highest incidence of cause of death, corresponding to 34% of total deaths. In 2006 the gross mortality rate for CVD was 230 per 100,000 inhabitants and the lost-potential years of life because of CVD were of 82 per 10,000 inhabitants.”

The document includes other sections mentioning previous activities concerning the *trans* fats issue such as (i) the PAHO Group (Trans Free America’s); (ii) Argentina and Mercosur actions,

including the labeling rules that have been mandatory since 2006; and (iii) the agreements between the Argentinean Health Ministry and trade organizations such as COPAL (Coordinator of Food and Beverage Industries of Argentina) and others in order to improve the nutritional profile of foods in Argentina by replacing *trans* fats. There are also references to policies in other countries such as Denmark, Canada, and the United States concerning the different legislations and actions taken to overcome this problem.

The proposal takes into consideration all the reasons that support the resolution, which consists in limiting industrially produced *trans* fatty acid content in vegetable oils and margarines to a maximum of 2% and to a maximum of 5% (grams of *trans* fat/100 grams of total fat) in the other foods. (These limits were adopted by Denmark in 2003.) The former limit does not include naturally occurring *trans* fatty acids, which may be present in animal and dairy fat. Almost all the recommendations of the Rio Declaration signed by health ministries, food industry representatives, and experts from the Americas were taken into account by the text that accompanied the proposal.

This proposal was accepted, nearly unchanged, by the CONAL (National Commission of Foods), which is the government institution in charge of the Argentinean Food Code, in a meeting in March 2010. Once the final document is written and signed by the Health Ministry (expected in the second quarter of 2011), manufacturers of vegetable oils and margarines will have two years to make formulations changes; other food manufacturers will have four years.

In connection with education and communication, a poster on *trans* fats was prepared to show the deleterious effect of *trans* fatty acids (see Fig. 2).

With enactment of this proposal, Argentina will be the first country in Latin America to accept and put in practice the Recommendations of the 2008 Rio Declaration by limiting the use of *trans* in the same way previously by Denmark in 2003 and recommended



FIG. 1: Picture taken in one of the meetings between health officers, food industry representatives, scientists, and experts that led to the approval of the consensus document and project of legislation for limiting *trans* fats.

TABLE 1. Comparison of *trans* fat/serving between labeling by US Food and Drug Administration rules and 5% regulatory limit on foods (Denmark, Panamerican Health Organization recommendations, proposed rule in Argentina)

	Serving size (g)	Typical % fat	Fat (g)/serving	Partially hydrogenated SBO ^a			<i>trans</i> /serving with 5% <i>trans</i> in foods other than oils and margarines
				<i>trans</i> (g/serving)	Saturates (g/serving)	<i>trans</i> + saturates (g/serving)	
Nondairy creamer	2	25	0.5	0.15 ^c	0.09	0.24	0.025
Sliced, wrapped bread ^b	50	3	1.5	0.45 ^c	0.27	0.72	0.075
Soda cracker	30	10	3	0.9	0.54	1.44	0.15
Potato chips	28	30	8.4	2.52	1.512	4.03	0.42

^aPartially hydrogenated soybean oil containing 30% *trans* fatty acids and 18% saturated fatty acids.

^bApproximately two slices

^cLess than 0.5 g *trans*/serving

by a task force organized by Health Canada in June 2006 (www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/tf-gt_rep-rap-eng.pdf).

DIFFERENT APPROACHES FOR LIMITING *trans* FATS IN THE DIET

In this document “TRANSforming the Food Supply” of the Health Canada task force, two different approaches were compared and analyzed: regulatory and voluntary guidelines

Voluntary guidelines combined with mandatory labeling have prevailed in the United States and other countries. The big issue of this approach is the rule for labeling zero *trans* content. According to US Food and Drug Administration labeling rules, this is possible for foods with less than 0.5 grams of *trans* fatty acids per serving. This seems to be a very low content, but in products with a very small serving size, such as nondairy creamers, or with very low fat content (less than 3%) in the recipe, such as some types of sliced, wrapped bread, this rule may allow the use of a traditional partially hydrogenated oil (soybean or rapeseed) with a very high content of *trans* fatty acids.

Table 1 shows the current serving sizes used in different products, their typical fat content, and the resultant grams of fat per serving. Using a partially hydrogenated soybean oil with a *trans* level of 30% and a saturated fatty acid level of 18%, we can find in the table the *trans* fats per serving. We can see in the table that soda crackers and potato chips with medium and high fat content per serving fall far above the limit to declare zero *trans*.

But when the serving size is small (e.g., nondairy creamer), the *trans* fats/serving is as low as 0.15 grams, less than a third of the level in which zero *trans* may be included in the labeling panel. Considering that a customary portion could be at least double the “legal” serving size (a teaspoon may be up to 5 grams) or even more, the amount of *trans* per serving increases to dangerous levels (for a detailed analysis on coffee creamers see: www.cspinet.org/nah/04_08/creamed.pdf). Even consumers who are conscious of the *trans* fats issue may not realize that they are including *trans* in their diets when the label declares “Trans: 0 g,” thereby worsening the situation.

Considering that the current recommendations state that *trans*

fats should be as low as possible (the Institute of Medicine in the United States says that the upper limit should be zero [“Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty acids, Cholesterol, Proteins and Aminoacids,” Institute of Medicine of the National Academies, The National Academies Press, Washington, DC, September 2002]), this becomes a big issue especially for people who suffer from some type of CVD and want to

follow the recommendations. With the most common recommendation for *trans* fats to constitute a maximum of 1% of the calories consumed, the maximum daily amount of *trans* should be 2.2 grams. By drinking three or more coffees “whitened” with nondairy creamers and eating four slices of bread (manufactured with conventional partially hydrogenated oils) a day, one could very easily exceed the limit—while still following the labeling rules—without knowing it. The nutritional panel would show “0” grams of *trans*.

In the last column of Table 1 we can see as a comparison that the limits in the regulatory approach are a lot more demanding, being as low as 10% of the “zero” *trans* labeling rule.

**FIG. 2.** Informational poster explaining the need of reducing *trans* fats in the diet.

inform Contributing Editor Eduardo Dubinsky is a consultant on fats and oils for food applications with Eduardo Dubinsky & Associates (www.dubyasoc.com.ar). Contact him at edubinsky@dubyasoc.com.ar.

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**TECHNICAL
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Using nuclear magnetic resonance to test fat content in foods

Contract laboratory improves sample throughput with NMR

John Paul Cerroti

The quickening pace of business caused one of Europe's leading independent testing laboratories to seek an alternative to the standard solvent extraction/acid hydrolysis (Soxhlet) method for testing the amount of fat in a variety of foods. This contract laboratory, with numerous sites throughout the UK and Ireland, provides quality control analytical services to the food industry. By converting from the wet chemistry method to a benchtop nuclear magnetic resonance (NMR) analyzer for measuring fat content of foods, the lab reaped significant economic and environmental benefits.

Advantages of NMR over other secondary methods include the following:

- Calibration possible over a concentration range from 0.5% to 100% fat
- Single fat sample needed for primary calibration
- Infrequent recalibration needed
- Short sample measurement time
- Minimal sample preparation necessary
- No requirement for solvents
- Suitable for bulk measurements
- Insensitive to sample granularity and product additives
- Nondestructive, facilitating repeat measurements

BOTTLENECKS FROM STANDARD WET CHEMISTRY METHODS

Customers send foodstuff samples to this contract quality control laboratory, which specializes in fast turnaround service. A typical

request includes five or six measurements, including fat (oil) content. The Soxhlet method used for the oil measurement takes as long as 6 hours. This situation led to serious bottlenecks that were reducing throughput and affecting the lab's ability to deliver its promised rapid analysis service. The process is also rather cumbersome, can be inaccurate, and requires highly skilled personnel. In addition, many of the hazardous chemicals used are becoming increasingly unacceptable according to international environmental standards.

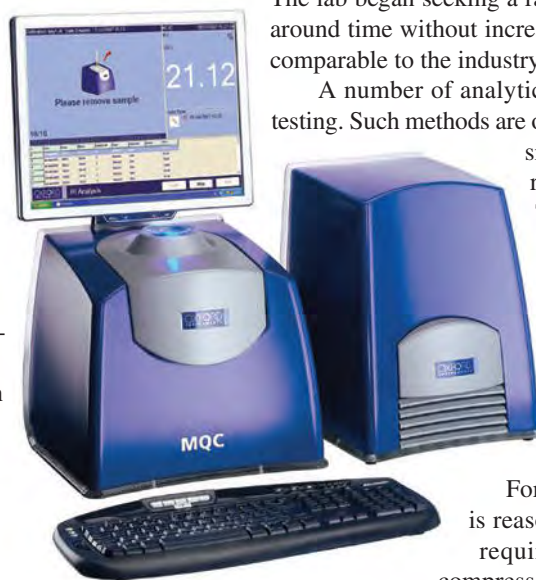
ALTERNATIVES INVESTIGATED TO SPEED TESTING THROUGHPUT

The lab began seeking a rapid technique that would improve turnaround time without increasing operating costs, but would also be comparable to the industry standard Soxhlet technique.

A number of analytical methods can be used to conduct the testing. Such methods are often referred to as *secondary* techniques, since they are usually set up to match the results produced by solvent extraction. To provide a result equivalent to the traditional extraction techniques, secondary techniques must be correlated to the reference technique used. Although they may be fast in use, many secondary techniques need to be calibrated and maintained regularly. Maintenance and consumables add significantly to the cost of ownership.

For example, supercritical fluid extraction is reasonably fast, but the equipment involved requires high maintenance, and the cost of compressed CO₂ that is used to extract oil is also significant. Near-infrared spectroscopy (NIR) is sometimes used, but it is generally sensitive to the surface rather than the bulk of the sample and has substantial calibration and calibration maintenance

issues. NIR calibration is complex because measurements are sensitive to product granularity and other physical characteristics and can be affected by additives such as seasoning, making it difficult to maintain accurate calibrations on a large variety of product types. This gives NIR limited applicability for the quality control of fat content in foodstuffs.



The Oxford Instruments MQC benchtop nuclear magnetic resonance (NMR) analyzer.

In contrast to the standard wet chemistry methods and various secondary techniques, low field NMR provides a fast, direct, and user-friendly method for determination of the fat and oil content in foodstuffs. The technique is based on measurement of the NMR response obtained from fat in the product, and quantification of the fat content by simple and direct calibration without the use of chemometrics. One such easy-to-operate instrument is the Oxford Instruments MQC, which can be reliably operated without the need for skilled chemists or NMR specialists.

The Oxford Instruments MQC can be calibrated to cover a concentration range from 0.5% to 100% fat. The user can produce a primary calibration using a single sample of fat. The NMR technique yields calibrations that are very stable over the long term; recalibration is only required infrequently. Sample measurement time is short, typically about 20 seconds, allowing a high throughput of samples and efficient laboratory operation. Minimal sample preparation is required because the entire sample is normally loaded into a tube and measured directly, and several different-sized tubes are available.

With NMR, no solvents are required since the sample is analyzed in its natural state. The instrument facilitates bulk measurement; the signal is generated from the whole sample, ensuring that the result embodies everything inside the sample, not just on the surface. NMR is virtually insensitive to sample granularity and such additives as spices, flavors, colors, and salt. Finally, unlike Soxhlet, the NMR technique is nondestructive, so any required repeatability measurements can be made easily.

NMR SELECTED TO SOLVE THROUGHPUT CHALLENGES

After reviewing the potential alternative solutions to bottlenecks associated with fat measurements, the laboratory contacted Oxford Instruments. Oxford offers a benchtop NMR instrument that is widely used to measure the oil content in foodstuffs and seeds. The Oxford Instruments MQC NMR analyzer offers the analyst the benefits of accurate, quantitative results; sampling ease; and convenience.

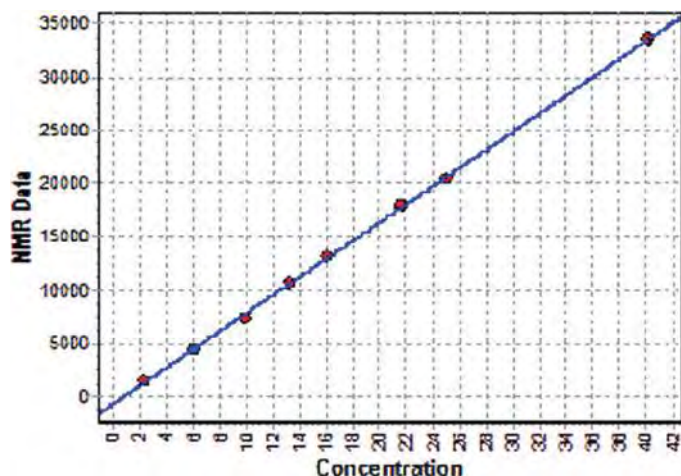


FIG. 1. Fat (oil) content in foodstuffs. Calibration obtained for fat content in foodstuffs; standard deviation of the linear fit is 0.20% by mass, correlation coefficient $R^2 = 1.00$. Measurements were made using an Oxford Instruments MQC-23 benchtop NMR analyzer equipped with a 26 mm diameter probe.

Table 1. Comparison of wet chemistry and MQC nuclear magnetic resonance (NMR) instrument

Sample	Given fat content % (wet chemistry)	Measured fat content % (NMR method; MQC instrument)
Baked cheese	6.1	5.8
Muesli	2.3	2.2
Milk powder	25	24.2
Chicken powder	40.2	40.1
Garlic bread	16.1	16.0
Macaroni cheese	2.8–3.4	3.4
Meat	9.9	9.2
Sandwich filler	21.7	21.6

To verify that the MQC NMR instrument would meet the laboratory's needs, applications specialists from Oxford Instruments measured the fat content of samples of some of the foods the lab typically analyzes by NMR and by Soxhlet extraction. The goals of the testing process were to analyze 80% of samples using the MQC NMR instrument, achieve correlation to within 5% of the wet chemistry method, and achieve a repeatability of within $\pm 5\%$.

Applications specialists sampled a range of foods, with fat contents ranging from 2.1% to 40.2% by mass, including baked cheese, muesli, milk powder, chicken powder, trifle, garlic bread, macaroni and cheese, meat, and chicken sandwich filler. Sampling was conducted using an Oxford Instruments MQC-23 benchtop NMR analyzer equipped with a 26 millimeter diameter probe.

As shown in Table 1, the NMR results compared well with those obtained with the wet chemistry Soxhlet extraction method.

A calibration for the samples, indicating an excellent linear correlation between the NMR response and the concentration of fats in the products, is shown in Figure 1. Instrument repeatability was tested by measuring one sample 10 times. Prior to each measurement the sample was placed in a heating block for 20 minutes. Since the magnet is temperature stabilized at 40°C, precision is enhanced by conditioning the sample at 40°C prior to inserting it into the NMR magnet. Conditioning samples prior to measurement aids repeatability, since the NMR signal is temperature sensitive. In addition, pre-heating the samples to 40°C ensures that any solid fat in the samples is liquified so it becomes visible to NMR. The sample only needs to be returned to the block for a further 20 minutes if the measurement is going to be repeated on that sample.

For a given fat content of 16.1%, the results of 10 repeat NMR measurements showed a mean value of 15.81% (range 15.79–15.83%), with a standard deviation of 0.01%, well within the desired range.

Laboratory managers reported that the testing results exceeded their expectations, and the group purchased an MQC low-field, benchtop NMR analyzer. Currently, about 90–95% of the laboratory's samples are run on the MQC instrument, and the lab has increased its efficiency because of the rapid measurement capability. In brief, a highly skilled operator (usually a chemist) can complete

CONTINUED ON PAGE 716



Top 10 of 2009

Bestsellers



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ONE PERSON'S RESPONSE TO A HIGH OMEGA-6 DIET (CONTINUED FROM PAGE 667)

TYPICAL MENU BEFORE AND DURING EXPERIMENT

Breakfast • Instead of my usual cereal—whole grain flakes with flax seed—I had either oatmeal or a whole grain cereal without flax seed. Instead of the 1% milk I usually bought, from grass-fed cows, I now bought 1% milk from grain-fed cows. On those days when I didn't eat cereal, I had either eggs (commercial ones, of course) with whole grain toast or toast with peanut butter. My omega-3 self would always have spread a peanut butter made with flax oil and peanuts on this toast. For this diet, though, I bought freshly ground peanut butter, which is high in omega-6s, from the health food store. The other foods I always had at breakfast—bananas, grapefruit juice, and tea—remained the same.

Lunch • I often had a sandwich and a bowl of soup—or a salad of arugula from my garden. When it was a peanut butter and banana sandwich, I made it with the whole peanut butter. When it was tuna fish, I made it with a mayonnaise made with soybean oil, instead of my usual canola-oil based mayonnaise. Canola, flax and walnuts are three seeds that happen to be rich in α -linolenic acid, the omega-3 fatty acid found in plants, and all play a big part in my normal diet. My usual salad dressing is made of lemon juice, mustard, and a

mixture of canola and extra virgin olive oils. For this diet, though, I dressed my salads with a mixture of safflower, sunflower, corn, and soybean oils.

Dinner • Dinner was usually lots of vegetables or salad, accompanied by chicken, fish, pasta, or a baked potato. When I ate at home, I always used my mixture of high omega-6 oils as the cooking fat. When I ate out, I made the assumption that the restaurant also used one or more of these oils—because they tend to be less expensive and more shelf-stable than oils that are high in omega-3s. I also assumed that the meats and fish they served were from grain-fed rather than wild- or grass-fed animals. These assumptions probably overestimated the amount of omega-6s in my experimental diet because many restaurants do, in fact, use canola oil for cooking, but it allowed me to eat out during this month. Fish was on my menu, at least twice a week, as recommended by the American Heart Association, and I usually had wine or beer with dinner. Dessert was often fruit, though sometimes ice cream or a piece of chocolate. I snacked throughout most days on fruit, raisins, and almonds instead of my usual omega-3-rich walnuts.

The direction of this change was also predicted by what is known about omega-6s, but the amplitude surprised everyone involved in this project.

In the coming weeks, these findings from Volek's lab were backed up by the results of the blood tests, analyzed by Bibus in Minnesota. At the same time that my metabolic rate was decreasing and my arteries were becoming stiffer, the omega-6s in my red blood cells (and therefore the rest of my body) were increasing and the amount of omega-3s was falling—dramatically and precipitously.

In the first 10 days, the total amount of omega-3s in my red blood cells dropped from 10% to 6%. The amount of omega-6s rose from 21% to 29%. The substitutions continued during the last 20 days of my diet, but the biggest change was almost immediate, as I thought it might be. The omega-3s in my cells were quickly being

replaced by seed fats, as I find it helpful to think of them, fats that change with the seasons for most animals, but that Americans eat, and overeat, all year long.

It would be easy to poke holes in this experiment, I realize. I am only one subject and anything but random. It would be easy to wait until this experiment was repeated on a larger scale. Nevertheless, I'm glad to be back on my normal diet and hope that my month-long experiment in high-omega-6 living helps others to better understand these fats.

Susan Allport is a science writer and author of The Queen of Fats: Why Omega-3s were removed from the Western diet and what we can do to replace them (University of California Press, 1996). Contact her at susan.allport@gmail.com.

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CROP RESIDUES

(CONTINUED FROM PAGE 680)

To determine economic feasibility, Tyner and Erickson examined a wide range of assumptions for cob collection, including the cost of cob-harvest equipment, the amount of time harvest is slowed by adding a cob-collection operation, the volume of cobs that could be collected per acre, and other factors.

In addition to the \$100 per ton price, Tyner and Erickson discovered that farmers would be most likely to collect cobs if they made up at least 20% of the corn stover and if rental charges for cob-collection wagons were half the standard \$28,000 seasonal rate.

Cobs are collected in a motorized wagon hitched to the back of a combine. At the time corn grain is separated from plant stover by the combine, stover is blown into the wagon instead of onto the ground. The wagon then separates cobs from other stover, which is blown onto the field. Once the wagon is filled with cobs, it is emptied into a truck or a designated dumping area.

The researchers used Purdue's B-21 PC-LP Farm Plan Model, a computer program that determines the return on a specific farm operation from production and other entered data, to develop their results. Anonymous data from 55 farms that supplied cobs to a Minnesota ethanol company in 2008 were plugged into the model, representing 100,264 acres (40,575 hectares). The model projected that none of the 55 farms would begin collecting cobs if wagon rental was \$28,000 and cobs brought \$40 a ton. If farm operators received \$100 a ton from biofuels producers, B-21 projected 22 of the 55 farms would collect cobs.

This study can be downloaded from www.purdue.edu/newsroom/general/2010/100831TynerCobs.html.

POET Biorefining, which is headquartered in Sioux Falls, South Dakota, USA, is presently scaling up operations at its Project Liberty plant in Emmetsburg, Iowa, USA (*inform* 19:740, 2008; 20:254–155, 2009; 21:618, 2010). There, POET is scheduled to begin construction of a 25 million gallons (95 million liters) per year cellulosic ethanol plant that will process baled corn cobs and light stover.

inform Technical Projects Editor Marguerite Torrey can be reached at mtorrey@aocs.org.

SD&PC NEWS

(CONTINUED FROM PAGE 692)

contained the claims "Simply Organic" and "Naturally Organic." These claims were challenged by Herb UK, which argued that they were misleading because "they implied the products met an independent organic standard."

After studying a response from Simply Organic, including the submission of documentation and certification from some US-based certifiers, the ASA upheld the complaint.

While noting that the US organic certification provided by the advertisers covered a list of ingredients, the ASA said it had not seen any documentation that set out which ingredients were used in the Simply Organic product range, or that showed whether those ingredients were covered by the certified list. The Agency also noted that a certificate of analysis provided by the advertiser was out of date, concluding that "the status of the advertised product range was unclear."

The ASA has instructed the company not to use the ad again in its current form.

Wilmar/PGEO buy rest of Natoleo

Wilmar International (Singapore) says that its wholly owned subsidiary in Malaysia, PGEO Group, has entered into an agreement with the National Land Finance Cooperative Society (Kuala Lumpur) to acquire the remaining 8.62% of Natural Oleochemicals (Natoleo; Pasir Gudang, Malaysia) for a cash consideration of RM42.5 million (\$14 million).

PGEO had entered into an agreement in July to acquire 91.38% of Natoleo from Kulim (Johor Bahru, Malaysia) for RM450 million. The acquisition of 91.38% interest in Natoleo from Kulim has been completed. The remaining 8.62% stake in Natoleo was owned by the National Land Finance Cooperative Society.

Natoleo's main feedstocks are crude palm kernel oil and palm stearin, and its products such as glycerine, soap noodles, fatty acids, and esters are used in industries such as detergents, home care, cosmetics and toiletries, plastics, pulp and paper, pharmaceuticals, food additives, grease and lubricants, paints and coatings, rubber and latex, and polyolefins. ■

BIOFUELS NEWS

(CONTINUED FROM PAGE 681)

obesity and its impact on vehicle demand, long-term government interventions are likely to miss the intended policy goals in reducing gasoline consumption and CO₂ emissions" (<http://tinyurl.com/RFF2009>).

Europe, UK reconsider biofuels targets

Government climate advisors in London said on September 10 that Britain should cut its target for biofuels use by 2020 to ensure that tropical forests are not felled to make way for biofuel crops. The Committee on Climate Change said a goal of obtaining 10% of transport fuel from renewable sources, mostly as biofuels, was too high in light of sustainability concerns. Instead, the Committee supported a target of 8%, as recommended in 2008 by a government-commissioned review. To lower costs, the Committee also recommended lowering the target for use of renewable sources for heating in the country from the original goal of 12% to 11%.

The European Union (EU) is also mulling the question. The charity group Friends of the Earth (FOE), among others, is accusing European companies of investing in African land to use for growing biofuels instead of food crops. According to the FOE report entitled "Africa: Up for Grabs" (available for download at <http://tinyurl.com/2f8sy29>), publication of which was funded in part by the European Commission, some 5 million hectares of land sold or acquired in Africa—about the size of Denmark—are intended for fuel crops. ■

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).

NUCLEAR MAGNETIC RESONANCE (CONTINUED FROM PAGE 712)

one fat analysis by Soxhlet extraction per hour at room temperature. In contrast, a nonskilled operator using the Oxford Instruments MQC instrument can produce 60 analyses per hour (1/minute). The purchase of the Oxford Instruments MQC instrument allowed the laboratory to replace four of its Soxhlet units. This significantly reduced the costs of purchase and disposal of solvents, increased available laboratory space, reduced running costs, achieved environmental benefits associated with reduced solvent usage, and facilitated better deployment of laboratory staff.

Since there is a slight calibration drift over about six months to a year, the laboratory will still need to recalibrate periodically against the primary technique or with set-up samples supplied by Oxford Instruments. During installation, set-up samples can be made to physically capture and maintain the original calibration, saving time during instrument recalibration. They also save time by allowing calibrations to be transferred to other similarly configured Oxford Instruments MQC NMR instruments.

While most potential users of NMR instruments do not do so, this particular contract lab chose to get its new fat measurement method accredited by the United Kingdom Accreditation Service (UKAS), the national accreditation body that uses a set of internationally agreed standards to assess organizations that provide certification, testing, inspection, and calibration services.

The lab developed a universal method using a sample blending process, sample conditioning to ensure the optimal temperature for reading by the temperature-sensitive NMR signal, followed by analysis using the MQC instrument. They used hundreds of data samples from Soxhlet and MQC NMR to prove they were getting similar results. This method has been UKAS-validated and fully accredited since 2009.

John Paul Cerroti is with Oxford Instruments. He may be contacted at magres@oxinst.com.

NEWS & NOTEWORTHY (CONTINUED FROM PAGE 676)

to Dennis Seisun of the IMR International consultancy based in San Diego, California, USA. "Most of the turbulence now and [that which is] expected in the future will be raw material-driven," he notes.

Among his observations:

- The poor lemon crop in Tucumán Province in Argentina and other factors have affected pectin availability and price.
- Agar markets are also affected by changes in raw material availability from areas as far apart as Morocco and Indonesia.
- Locust bean gum prices are low, but raw material supply may be impacted at such low prices.
- Alginate prices remain at high levels, especially for gelling grades, owing to raw material constraints.
- Carrageenan seaweed supply in Indonesia and the Philippines is constrained for different reasons, particularly for kappa carrageenan.

Some of the raw material issues are unavoidable and both suppliers and buyers simply have to learn to live with uncertainties of natural resources, Seisun says. Other issues, however, suffer from lack of long-term investment and short-term policies.

Rice bran oil mayo developed

Sensory tests of a mayonnaise-like product made from rice bran oil and soy protein got high marks from a consumer study in which people were asked to taste and evaluate the product developed by researchers at the Louisiana State University (LSU AgCenter; Baton Rouge, USA).

Sensory testing conducted by Karen Garcia, a graduate student, began with 10 formulations of a spread made with rice bran oil and soy protein. The oil content ranged from 30% to nearly 60%, and the soy protein ranged from 1% to 11%. The study was conducted with 360 consumers on the LSU campus in Baton Rouge.

In a follow-up study, 100 tasters were presented with the most popular formulation from the first test but with a twist. The product was offered with three flavorings—sour cream and onion, cheddar cheese and sour cream, and Monterey jack cheese. The preferred formulation included 37% rice bran oil and 6% soy protein.

With the addition of the flavorings, tasters' willingness to purchase the product jumped to 65%, Garcia said. And after hearing about the possible health benefits, the number rose to 77%. On top of that, 97% responded "yes" when asked if they deemed the product "acceptable." ■

IN MEMORIAM (CONTINUED FROM PAGE 693)

This included combining sources of pest resistance, yield potential, genetically modified traits as available, and agronomic characteristics to produce cultivars and germplasm of direct value to producers and to the industry.

He was director at the Ridgetown Campus for over 10 years, and was instrumental in working through the amalgamation of Ridgetown College with the University of Guelph. He also spent two years at the University of Guelph main campus as chair of the University's plant agriculture department, the second largest department of the Ontario Agriculture College.

Ablett joined AOCS in 1994 and was a member of the Canadian Section of AOCS. He was a member of the Advisory Committee for the World Soybean Research Conference VIII held in Beijing in August 2009, and served as a co-chair and speaker at the meetings.

He is survived by his wife Jane and two sons, Jeff and Greg. ■



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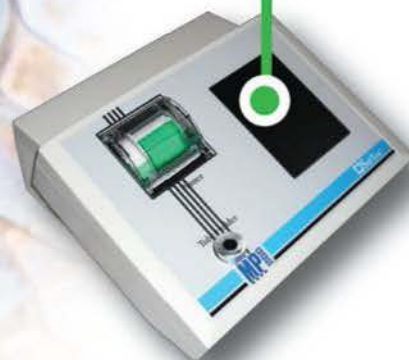
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