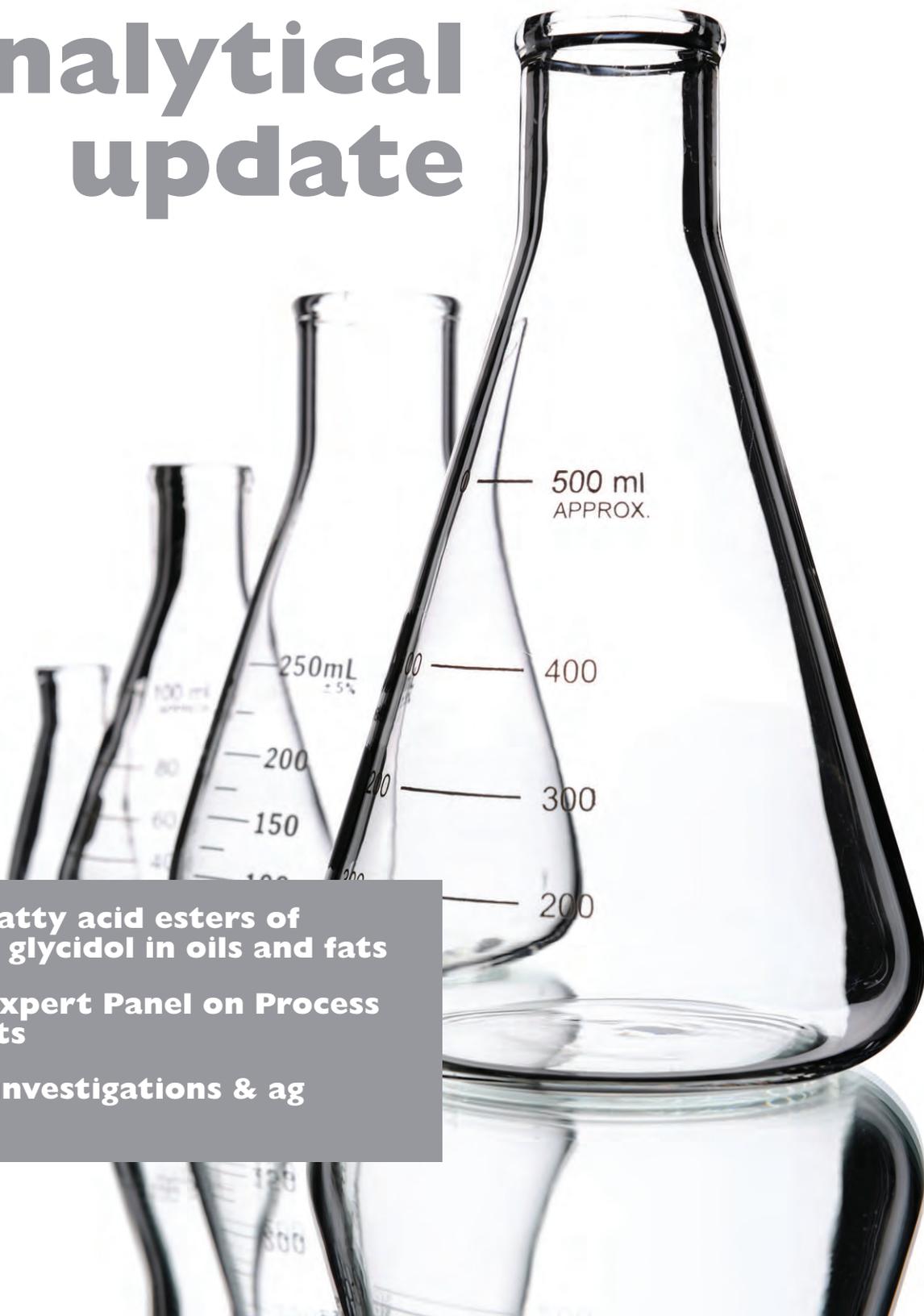


Analytical update



**Analysis of fatty acid esters of
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Calendar

February

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

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

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

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

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

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

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

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

February 21–26, 2010. Principles and Practice of Cosmetic Science: An Interactive Residential Course, Wessex Hotel, Bournemouth, United Kingdom. Information: e-mail: ifsc.scs@btconnect.com; www.scs.org.uk.

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

March

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

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

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

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

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

March 4–6, 2010. Commodity Classic (sponsored by the American Soybean Association, National Corn Growers Association, National Association of Wheat Growers, and National Sorghum

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July 11–16,
2010. 19th
International Sym-
posium on
Plant Lipids,
Cairns Convention Centre,
Cairns, Australia. Informa-
tion: www.ispl2010.org.



October 4–7,
2010. 7th
World
Conference
on Detergents:
New Strategies in

a Dynamic Global Economy,
Montreux Music & Con-
vention Centre, Montreux,
Switzerland. Information:
[www.aocs.org/meetings/
montreux](http://www.aocs.org/meetings/montreux).

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

Producers), Anaheim Convention Center,
Anaheim, California, USA. Information:
www.commodityclassic.com.

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

**March 10–11, 2010. Nutracon 2010,
Hilton Anaheim, Anaheim, California,
USA. Information: [www.nutra-
conference.com](http://www.nutra-conference.com).**

**March 10–11, 2010. Soyfoods 2010,
Anaheim Hilton, Anaheim, California,
USA. Information: +1 207 244
9544; [http://events.soyatech.com/
conference.php?cid=12](http://events.soyatech.com/conference.php?cid=12).**

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

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

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

**March 18–19, 2010. Canola Council of
Canada Conference, Fairmont San
Francisco, San Francisco, California,
USA. Information: [www.canolacoun-
cil.org/convention/default.aspx](http://www.canolacouncil.org/convention/default.aspx).**

March 21–25, 2010. 239th Amer-
ican Chemical Society National
Meeting and Exposition, San Fran-
cisco, California, USA. Information:
[http://portal.acs.org/portal/acs/corg/
content?_nfpb=true&_pageLabel=PP_
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id=2060&use_sec=false&sec_url_
var=region1&__uuid=b706dc39-e14f-
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March 23–26, 2010. 22nd International
Trade Fair and Analytica Conference
("Analytica"), New Munich Trade Fair
Centre, Munich, Germany. Information:
www.analytica.de.

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

March 24–25, 2010. Wellness 10, Inter-
Continental Chicago O'Hare, Rosemont,
Illinois, USA. Information: [www.ift.org/
cms/?pid=1001994](http://www.ift.org/cms/?pid=1001994).

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Analysis of fatty acid esters of 3-MCPD and glycidol in oils and fats

Katrin Hoenicke

In December 2007, the German official food control and animal health laboratory (Chemisches und Veterinäruntersuchungsamt; CVUA) in Stuttgart detected significant amounts of 3-monochloropropane-1,2-diol (3-MCPD) fatty acid esters in numerous refined edible oils and fats as well as in foods containing refined fat such as infant and toddler formula. The amounts of 3-MCPD found in edible oils and fats in the form of fatty acid esters ranged from around 500 to around 10,000 $\mu\text{g}/\text{kg}$. The principle of the analytical method used by CVUA Stuttgart is that 3-MCPD is released from its fatty acid ester by a transesterification with methanolic sodium methylate. The released 3-MCPD is derivatized by the addition of phenylboronic acid in a sodium chloride solution to form a cyclic boronic acid ester. The derivative is then analyzed by means of gas chromatography/mass spectrometry (GC/MS), as described in a February 2008 paper by Rüdiger Weisshaar.

However, Jan Kuhlmann of SGS Institut Fresenius GmbH (Berlin, Germany) later showed this method was nonspecific for the analysis of 3-MCPD (unpublished data). Rather, other substances, such as glycidol (2,3-epoxy-1-propanol), can be converted into 3-MCPD during the derivatization step when using sodium chloride. Thus, the presence of glycidol can result in an overestimation of the 3-MCPD content.

Glycidol can be present in oils and fats in the form of a fatty acid ester as a consequence of heat-induced cyclization of glycerides during the refining process. The CVUA Stuttgart reported glycidol palmitate and oleate at part-per-million (ppm) levels in refined palm oil. There are strong indications that in some oils and fats a significant amount of measured bound (i.e., esterified) 3-MCPD may result from fatty acid esters of glycidol. This seems to be the case in oils and fats with higher levels of 3-MCPD-esters, especially in palm fats.

The German Association of Fat Science (Deutsche Gesellschaft für Fettwissenschaft; DGF) reacted to the discovery of the artifact produced by the method and published a method for the “determination of 3-MCPD esters and 3-MCPD forming substances” (DGF Standard Method C-III 18 (09)) in early 2009 that is based on the CVUA method.

Glycidol is classified by the International Agency for Research on Cancer (IARC) as a genotoxic carcinogen (IARC

group 2A, "probably carcinogenic to humans"). However, the levels of glycidol released from its esters or the fate of glycidol esters in the human digestive tract is presently unknown. The German Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung; BfR) has therefore alluded to an urgent need for the development and validation of a suitable detection method for glycidol fatty acid esters. Currently there are no methods available for the quantitative determination of glycidol esters or the direct analysis of glycidol (see sidebar below). Because glycidol is chemically unstable, a direct analysis is very unlikely.

Beyond the need for a suitable detection method for glycidol or its esters, there is also still a need for a reliable and selective method for the quantitative determination of 3-MCPD released from its fatty acid esters. The German BfR has therefore developed three different methods for the analysis of 3-MCPD in oils and fats. (i) The first method is based on the CVUA, or rather, DGF Standard Method, but additionally uses sulfuric acid after the alkaline hydrolysis of the esters. The addition of sulfuric acid results in the destruction of glycidol: The epoxide ring is opened and glycidol is quantitatively removed through the formation of different reaction products. In addition, sodium chloride is replaced by ammonium sulfate. (ii) In the second method an acid hydrolysis is applied instead of the alkaline transesterification by use of sulfuric acid. In the course of this, glycidol is destroyed during the hydrolysis step. (iii) The third method again uses sulfuric acid after alkaline transesterification and ammonium sulfate but heptafluorobutyric anhydride is used for the derivatization of 3-MCPD instead of phenylboronic acid. This alternative derivatization reagent was suggested as some laboratories reported difficulties with the presence of residual phenylboronic acid during GC/MS analysis. To validate these three methods, the BfR has initiated a ring trial. The aim of this study is to obtain at least one reliable standard method for the selective quantification of 3-MCPD in fats and oils or, alternatively, to have different methods that lead to the same result. The outcome of this ring trial will probably be published in early 2010.

Besides these BfR methods, the Eurofins laboratory WEJ Contaminants (Hamburg, Germany) has also developed a method for the quantitative determination of (ester bound) 3-MCPD in fats and oils. In this method sodium chloride is replaced by sodium sulfate to avoid the formation of 3-MCPD from glycidol during sample preparation. In addition a deuterium-labeled 3-MCPD fatty acid ester is used as an internal standard (instead of deuterium-labeled 3-MCPD). First experiments have shown that the three different BfR methods and also the internal Eurofins method produce different results.

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New AOCS Expert Panel on Process Contaminants meets

Discussion of direct methods for the determination of two food contaminants (see cover feature starting on page 4) was the highlight of the first meeting of the newly formed AOCS Expert Panel on Process Contaminants.

Held Monday, December 7, 2009, at AOCS headquarters in Urbana, Illinois, USA, the meeting was attended by representatives of the US processing industry and the Malaysian Palm Oil Board. Founding members of the panel also include partners from Europe (EU Oil and Proteinmeal Industry, or FEDIOL) and Asia (the Japan Oilseed Processors Association and the Japan Oil Chemists' Society), who were unable to attend.

The panel will initially focus on two issues:

- The accurate measurement of fatty acyl esters of 3-MCPD (3-monochloropropane-1,2-diol) and glycidol, and
- The collection and dissemination of articles, news stories, and commentary on these two process contaminants.

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Short-term price forecasts for palm and lauric oils

Dorab E. Mistry

Editor's note: The following article presents excerpts from a talk entitled "Short-Term Forecasting Palm & Lauric Oil Price Outlook" presented by Dorab E. Mistry at the Indonesian Palm Oil Conference 2009 of GAPKI (Gabungan Pengusaha Kelapa Sawit Indonesia, the Association of Indonesian Palm Oil Producers) on December 4, 2009, at the Westin Resort (Nusa Dua, Bali, Indonesia).

Ladies and Gentlemen: At the outset may I say what a great pleasure it is to visit this beautiful island paradise of Bali and to participate in this Indonesian Palm Oil Conference, which is hosted with such warm hospitality by GAPKI. As a long-standing friend of Indonesia and the Indonesian palm oil industry, I am delighted to see Indonesia being mentioned repeatedly as one of the five fastest-growing economies in the world. The BRIC (Brazil, Russia, India, and China) nations may soon be called the BRICI nations, with Indonesia joining that select club. This country, rich in natural resources and blessed with a young population, will show great prosperity and progress in the next few years.

Today, I shall concentrate on recent developments on the price front and then discuss the outlook for the next six months. I shall reference my recent papers, presented at Globoil India in Mumbai on September 27, 2009, and at the CIOC (China International Oil and Oilseeds Conference) in Guangzhou on November 8, 2009.

INDIA

The fundamentals on supply and demand with regard to India have not changed since my presentation in Guangzhou at the CIOC, so I shall merely summarize the forecast composition of Indian imports for the oil year November 2009 to October 2010 in Table 1.

THE SCENARIO SO FAR

I am pleased to understand that the Indonesian government has now finalized a plan to make palm biodiesel workable for the domestic



market. On the other hand, it now appears fairly certain that the dreaded export tax will be triggered in Indonesia.

The paper that I presented at the CIOC forecast a quick move in crude palm oil (CPO) prices to a level of 2,400 ringgits. As of today, that forecast has already been exceeded. At the same time, we witnessed record CPO production in the month of October this year. Never before has so much palm oil been produced in one month in Malaysia. Never before have stocks jumped by such a high percentage as at the end of October. Yet this information was NOT construed bearishly. The market reacted with commendable maturity and left these statistics exactly where they belonged—in the archives.

During the past three weeks, palm oil prices have climbed more than 300 ringgits, signaling clearly that the period of maximum production and of burdensome stocks is now past. The price move has been helped by a weakening dollar and some excellent export demand.

Many market participants had come to believe and expect a huge upsurge in palm oil production in the September to November 2009 period. They were right. They are also expecting a massive rise in soybean plantings and production in South America in 2009/10. They are right in that, too. Yet the market of late has completely discounted both these bearish factors and concentrated on the developing demand and stocks scenario. Is the price action in the market of the past three weeks justified? My answer is a resounding YES, and I shall explain the major reasons.

TABLE 1. Actual and predicted annual Indian imports (000 metric tons) for 2007/09 and 2009/10, respectively

	2009/10	2008/09	2007/08
Soybean oil	900	1,000	750
Palm oil	6,900	6,650	5,270
Sunflowerseed oil	500	600	30
Lauric oils	250	250	200
Vanaspati	50	50	50
Others	—	50	—
Total	8,600	8,600	6,300

TABLE 2. Supply and demand (million metric tons) for 17 major oils and fats, 2004 and 2008*

	2004	2008	Net increase
Production, 17 oils and fats	132.40	159.74	27.34
Palm oil production	31.17	43.12	11.95
Demand	131.58	159.93	28.35

*Source: *Oil World*.

DOMINATION OF PALM IN WORLD VEGETABLE OIL GROWTH

According to statistics prepared by *Oil World*, world production of 17 major oils and fats increased in the past five years (Table 2). The contribution of palm oil to this increase was 11.95 million metric tons (MMT). If one sums the increases registered by palm oil and by palm kernel oil, they add up to more than 50% of the growth in supply.

The growth in demand over the past five years, as per *Oil World*, for the 17 major oils and fats, was 28.35 MMT. These figures tell us that, without the contribution from palm and palm kernel oils, the growth in world supply would have been less than half the growth in world demand. I do not have to tell you what effect that would have had on prices.

The world continues to rely on expansion of palm oil acreage to satisfy its hunger for vegetable oil and, more importantly, to keep prices at a reasonable level. Whenever there is a discussion on climate change, this important and undeniable fact tends to be ignored. Recent conferences on food security have missed the point completely. It is easy to blame someone else—usually the victim is biofuels. When will people realize that the developed countries

(with the exception of United States) have failed to raise their agricultural production despite recourse to subsidies and supports? Even with these props, the production of industrialized nations has failed to keep pace with world demand. Similarly, in the case of vegetable oil, we have had to rely on just two countries—Malaysia and Indonesia—to expand production and to keep availability at a high level.

The ability of Malaysia and Indonesia to increase acreage is not unlimited. In the case of Malaysia, the limits seem to have been approached already. Should Indonesia be subjected to similar limitation, the majority of the world's consumers will face much higher prices. I point this out because we are moving into a situation in 2010 where palm oil is likely to contribute very little to growth in the world supply of fats and oils.

In 2008, Malaysia produced a record 17.734 MMT of CPO. In 2009, the trees initially took a much-needed rest. The high cycle kicked in partially in June 2009 and fully in September. October saw record monthly production. Despite this, my prognosis is that for all of 2009, Malaysian CPO production will only reach 17.5 MMT. 2009 will be one of the few years on record when production actually falls below the previous year.

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Historically, over the past 30 years, we have seen that when CPO production has fallen from year to year, the next year has been blessed with strong growth once again. The trees, having rested in the previous year, begin to produce at full throttle. The converse of this is also true and proven. The biological high cycle that kicked in partially in June 2009 and fully in September will end sometime around April 2010 or, at latest, by July 2010. After that, the trees will require rest and recuperation.

That is not all. As I said in my Guangzhou paper, meteorologists have forecast the development of a new El Niño from now (December 2009) until the first quarter of 2010. The Southern Oscillation Index has been pointing in this direction for the past several weeks. Dry weather must be expected to commence in the next few weeks in parts of Indonesia and to travel westward to cover most of Malaysia. The effect of this developing El Niño is likely to be felt in lower CPO production in the second half of 2010. This will coincide with the biological low cycle.

Malaysia must also face the effects of the government's incentive-based replanting program.

FORECAST FOR MALAYSIAN CPO FOR 2010

As a result of the three critical factors—(i) the end of the high cycle and commencement of a new low cycle; (ii) the onset of a new El Niño; and (iii) the replanting program—we must fear for CPO production in 2010.

It is conceivable that 2010 CPO production will turn out to be less than 2009. If so, it will be the first time in history that Malaysian CPO production will have declined for two years in a row. I am probably the first analyst to go public with this prognosis. I realize there are few certainties in the field of agriculture, yet it would be wrong not to forewarn the industry about this pessimistic outlook for Malaysian CPO production for 2010.

FORECAST FOR INDONESIAN CPO FOR 2010

The developing El Niño also puts a question mark on the production prospects for Indonesia. So far, almost all analysts have predicted an increase of at least 2 MMT over 2009. In the light of what I have just

said, an increase of 1–1.5 MMT looks more realistic.

PROSPECTS FOR OTHER OILSEEDS FOR 2010

Good news comes from soybeans. Plantings and production in South America appear to be on course. El Niño is likely to lead to abundant rainfall; and if rust problems can be minimized, we are looking for record crops of soybeans in Argentina and in Brazil. However, soybeans are a meal seed and not an oilseed. The prospects for sunflowerseed production have somewhat deteriorated in recent weeks. Rapeseed production seems to be coming up to expectation, and the forecast for 2010 has not changed. Therefore, the biggest new development, I believe, is in palm and by extension in palm kernel oil.

DEMAND PROSPECTS FOR 2010

On the demand side, there does not appear to be any significant change except for biodiesel. Recently *Oil World* estimated that biodiesel demand in 2010 will increase by

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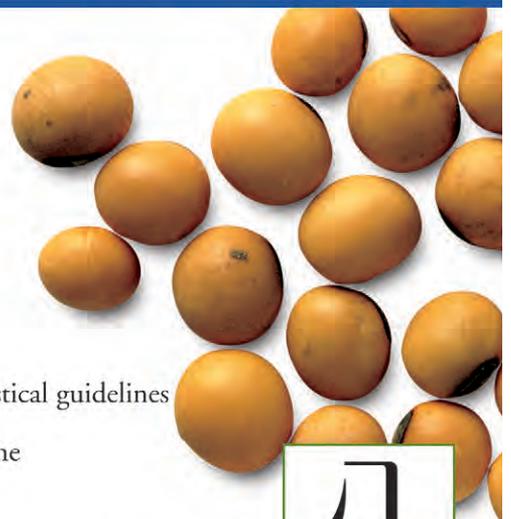


TABLE 3. Global incremental supply (000 metric tons)

	Oct '08–Sept '09	Oct '09–Sept '10
Soybean oil	-1,500	+1,500
Rapeseed oil	+1,600	+800
Sunflowerseed oil	+2,000	-500
Groundnut oil	-200	-200
Cottonseed oil	-200	-200
Palm oil	+1,500	+2,500
Lauric oils	+250	+500
Total increase	+3,450	+4,450

TABLE 4. Probable global increments (000 metric tons) in supply and demand of 17 major fats and oils

	Oct '08–Sept '09	Oct '09–Sept '10
Supply	+3,450	+3,250
Demand	+4,500	+5,500

more than 3 MMT. I had been much more conservative, saying it could go up by 1–2.5 MMT. Recent news, however, warrants an upward revision. On the other hand, higher prices (as a result of the factors mentioned earlier) will restrain the expansion of food demand to less than 4 MMT. Therefore, I am keeping constant my prediction of an overall expansion of demand to 5.5 MMT.

Next, I present the incremental supplies (Table 3) and demands that I had foreseen before I wrote this paper. At that time, it looked as if incremental demand of 5.5 MMT would marginally outstrip incremental supply of 4.5 MMT. And now, after what I have said about lower palm oil production in 2010, we can see a different picture altogether. If the increase in palm oil production in 2010 is a mere 1.5 MMT, and, correspondingly, lauric oil production is up only 300,000 MT, then the total increase in supply is just 3.25 MMT.

Thus, the new probable global incremental S&D can be seen in Table 4. Based on these figures, the incremental supply and demand figures for 2009/10 do not look comfortable. I must hasten to add that I am on my own in this prognosis, and none of the official agencies or governmental departments have spoken about a shortfall in CPO production in 2010. On the other hand, in recent years most official agencies have got CPO production completely wrong, and my production

forecasts have been, by and large, closer to the final outcome. The conclusion to be drawn from this incremental S&D projection is that prices must rise so as to curtail demand and encourage higher plantings.

RSPO

The Round Table on Sustainable Palm Oil (RSPO) continues to make sound and steady progress. What has been achieved so far is very commendable. There is recognition by all stakeholders that the RSPO is the best way forward. We must all continue to support the RSPO and increase its influence. As prices rise, plantations will find it easier to fund the expensive but necessary certification process. Sustainability comes at a cost, and everyone must recognize this.

PRICE OUTLOOK

I am assuming that the US dollar will remain around current levels of 1.50 to the euro. Dollar weakness will lead to higher prices and vice versa. I am also presuming that Nymex [New York Mercantile Exchange] crude oil will trade around the \$80-per-barrel mark and in a range from \$70 to \$90 over the next several months. I also do not expect the Indian government to impose any import taxes or increase existing ones on vegetable oil at least until April 2010.

CONTINUED ON PAGE 59



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Unique properties of carbon dioxide-expanded lipids

Bernhard Seifried and Feral Temelli

Stricter environmental laws related to the use of organic solvents in many areas of the fats and oils industry have stimulated the search for sustainable technologies for lipid processing. Furthermore, as consumers demand “natural” products, the use of potentially toxic solvents in various production processes is being scrutinized. The application of pressurized carbon dioxide (CO_2) in lipid processing may offer new opportunities to reduce the amount of organic solvents needed. Lipids saturated with CO_2 under moderate pressure expand in volume, and their physical properties change substantially (Seifried and Temelli, 2009). In this short review, the unique properties of CO_2 -expanded (CX) lipids are discussed, and their relevance for promising new applications is outlined.

PROPERTIES OF CX LIPIDS

Volumetric expansion. Lipids, such as triglycerides (TG) and fatty acid ethyl esters (FAEE), can dissolve large amounts of CO_2 when exposed to pressurized CO_2 . As a result, the lipids expand in volume, and concomitantly their physical properties also change with temperature and pressure. The volumetric expansion of fish oil TG and FAEE at a temperature of 40°C is illustrated in Figure 1. At 40°C , the volumetric expansion of FAEE and TG is very pronounced with an increase in pressure to about 10 MPa, reaching a fairly constant expanded volume at higher pressures ranging up to about 20 MPa. The volumetric expansion of CX TG and FAEE is nearly 40 and 70%, respectively. This increase is caused by the uptake of CO_2 , which amounts to about 30 and 55% by weight at 15 MPa for TG and FAEE, respectively.

Density, interfacial tension, and viscosity. The dissolution of large amounts of CO_2 in lipids at elevated pressures leads to both volumetric expansion and a pronounced change in physical properties, such as density, interfacial tension (IFT), and viscosity. The changes in these physical properties with pressure and temperature at CO_2 pressures of up to about 25 MPa for CX TG and FAEE of fish oil are illustrated in Figures 2 and 3, respectively. In contrast to the pronounced volumetric expansion with CO_2 pressure of up to 10 MPa, the density of CX lipids only increases moderately, by

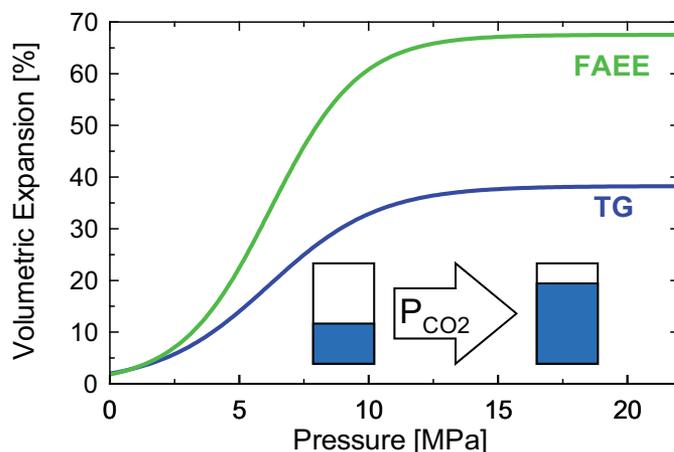


FIG. 1. Volumetric expansion of lipids with increasing CO_2 pressure at 40°C . TG, triglycerides; FAEE, fatty acid ethyl esters. The blue bars illustrate the volumetric expansion of the liquid phase for TG and FAEE with increasing CO_2 pressure.

about 5%. However, the increase in density following the dissolution of pressurized CO_2 seems surprising, since the density of pure CO_2 and that of pure lipids under all pressure and temperature conditions shown (Figs. 2, 3) are lower than that of the mixture.

It has been suggested that CO_2 dissolved in the lipid phase facilitates the compression of the bulky lipid molecules, acting like a lubricant between them. Furthermore, CO_2 , being a rather small molecule compared to the lipids, may be solubilized in the cavities of the bulky lipid molecules, thus existing in a more “condensed” form in the liquid phase. The density of CX lipids is lowered by increasing temperature, as illustrated in Figures 2 and 3.

The influence of CO_2 pressure on IFT of lipids in contact with CO_2 is notable for both TG and FAEE (Figs. 2, 3). IFT decreases sharply with an increase in CO_2 pressure, from ambient up to pressures of 10 and 15 MPa at 40 and 70°C , respectively. In the case of TG, this decrease amounts to about an order of magnitude at 40°C : IFT decreases from around 28 mN/m at ambient pressure to a fairly constant level close to 2.5 mN/m at 25 MPa. FAEE exhibit a higher mutual solubility with CO_2 ; therefore, the IFT reaches ultra-low levels and eventually vanishes at elevated pressures, where the phases become miscible. Furthermore, at pressures above approximately 2.5 MPa, the IFT for both CX TG and FAEE increases with temperature. The change in IFT for CX lipid systems is related to several mechanisms contributing to interactions between the lipid molecules and the surrounding dense CO_2 phase. The mechanisms taking place in the bulk CO_2 phase, the interphase, and the lipid phase are affected by pressure and temperature. In the low-pressure range of up to 2.5 MPa, the driving force is most likely

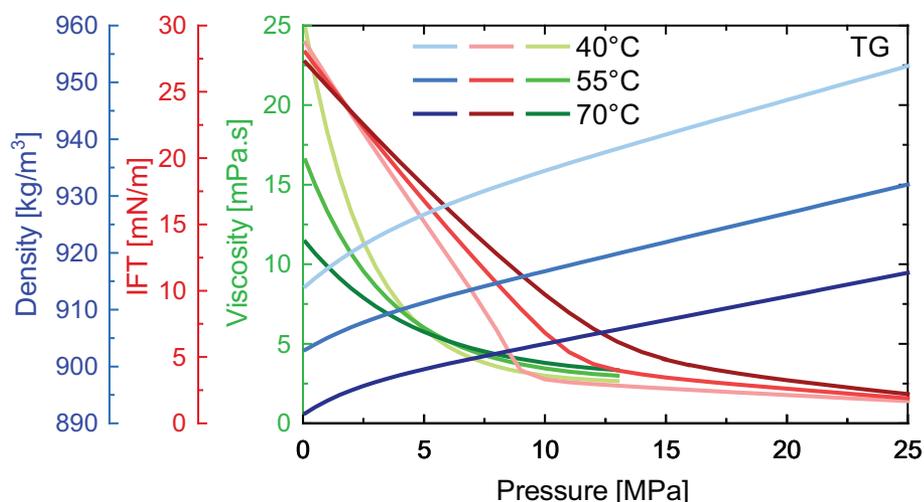


FIG. 2. Density, interfacial tension (IFT), and viscosity of CO_2 -expanded triglycerides (TG) at various temperatures.

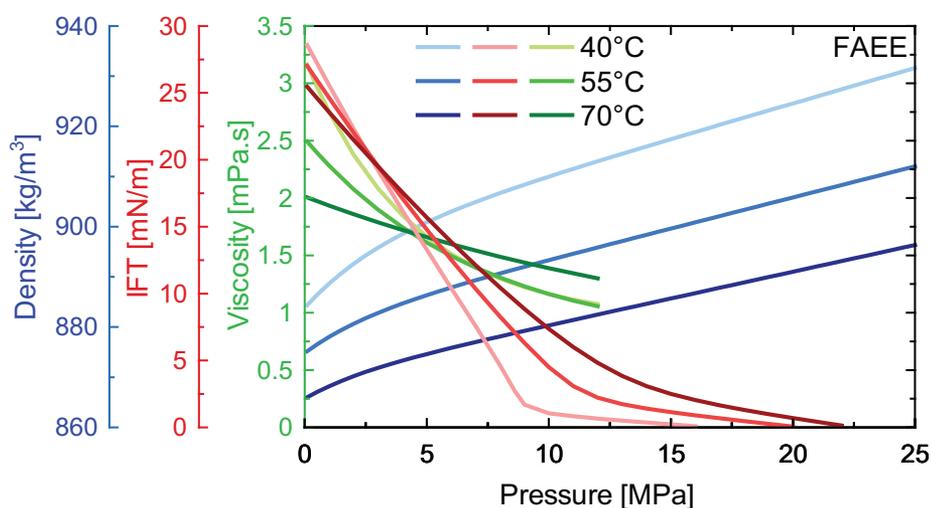
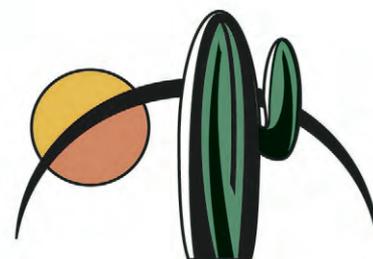


FIG. 3. Density, interfacial tension (IFT), and viscosity of CO_2 -expanded fatty acid ethyl esters (FAEE) at various temperatures.

the dissolution of CO_2 into the lipid phase, which increases with pressure and decreases with temperature. As pressure is further increased, adsorption of CO_2 at the interphase increases due to the higher CO_2 density, thereby leading to more interactions in the vicinity of the interphase. Additionally, with increasing pressure the solubility of lipids in CO_2 is enhanced, which is also linked to temperature and the density of the CO_2 phase.

The effect of temperature is twofold: First, an increase in temperature causes an increase in vapor pressure, thus enhancing solubility. Second, both temperature and pressure affect the density of CO_2 , especially close to the critical point ($P_c = 7.3 \text{ MPa}$, $T_c = 31^\circ\text{C}$). While an increase in temperature close to the critical point has a very strong lowering effect on CO_2 density, this effect is less pronounced at higher pressures. Furthermore, around the critical point, the density of CO_2 is extremely sensitive to pressure, where it increases substantially from gas-like to liquid-like densities. For example, the density of CO_2 increases from about 250 kg/m^3 at 7 MPa to 615 kg/m^3 at 7.5 MPa , which has a great impact on the solubility of lipids in CO_2 as well as the solubility of CO_2 in lipids. Therefore, both temperature and pressure effects impact the IFT of lipids in contact with pressurized CO_2 .

The trend for viscosity with increasing pressure is most striking for TG at 40°C , where the viscosity of CX TG decreases by about an order of magnitude from initially around



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25 mPa·s to 3 mPa·s, with an increase in pressure to about 12 MPa (Fig. 2). In the same pressure range at 40°C, the viscosity of CX FAEE decreases from about 3 to 1 mPa·s (Fig. 3). The CO₂ molecules reduce the interactions between large molecules inside the bulk lipid phase by expanding the lipids, thereby reducing viscosity and resistance to flow. The impact of temperature on the viscosity of CX lipids may seem surprising. At atmospheric conditions,

viscosity declines with increasing temperature, but the opposite change occurs at elevated CO₂ pressures for CX lipids. Since an increase in temperature lowers the amount of CO₂ dissolved in the lipids, an increase in viscosity at elevated pressures above 5 MPa can be observed.

POTENTIAL OF CX LIPIDS FOR FATS AND OILS PROCESSING

The properties of CX lipids can be easily tuned by adjusting the temperature and pressure of CO₂. Therefore, many potential applications for fats and oils processing could take advantage of the pronounced expansion of lipids saturated with CO₂. The pressure required to induce substantial changes in the physical properties of CX lipids, such as viscosity and interfacial tension, ranges from 10 to 15 MPa, which is a technically feasible range. In recent years, several novel processes have been investigated that profit from the properties of CX lipids. Gas-assisted mechanical expression (GAME) and gas-assisted oilseed pressing benefit from the volumetric expansion and reduced viscosity of CX lipids, thus leading to significantly higher yields in pressing experiments using rapeseed, soybean, sesame, linseed, palm kernel, and jatropha (Voges *et al.*, 2008; Willems *et al.*, 2008). The reduced viscosity of CX lipids could also be beneficial in processes involving reactions, such as transesterification. The reduced viscosity could accelerate the reaction rates in heterogeneously catalyzed reactions, especially in the case of highly viscous oils (Pomier *et al.*, 2007). Furthermore,

CONTINUED ON PAGE 59

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The European Food Safety Authority has released a guidance document for industry on the evaluation of Article 13.1 health label claims. The PDF document is available at www.efsa.europa.eu/cs/BlobServer/Report/1386.pdf?ssbinary=true.



India imported almost 8.7 million metric tons (MMT) of vegetable oil in the 2008–2009 oil year ending in October—a record—according to the Solvent Extractors Association of India (SEAI). The group attributed the rise to lower or zero import duties and a sliding US dollar as well as increasing demand. The country imported 6.3 MMT of vegetable oil, including vanaspati, in the corresponding period last year, SEAI said in a statement.



A new Frost & Sullivan report on the market for marine and algal omega-3 fatty acids puts the annual ingredients market value at \$1.2 billion. The estimated global consumption of marine and algal omega-3 ingredients last year reached almost 71,500 metric tons (MT), with North America the largest consumer at more than 26,900 MT, followed by Asia-Pacific at about 21,100 MT, the EU at around 13,500 MT, and the rest of the world at more than 5,700 MT.



Cargill announced in November 2009 that Cargill Alking Bioengineering (Hubei) Co., Ltd., a joint venture between Cargill and Alking Bioengineering, was nearing completion of a new facility for the production of arachidonic acid-rich oil, a product used primarily in infant formula. The facility will begin production in early 2010 in Wuhan, China.



French oil processor SOFIPROTEOL Group has set up a subsidiary in Malaysia under the name of Oleon Sdn Bhd, according to the Bernama news agency. Oleon's products are intended for specialized markets and for specific applications. The RM 75 million (more than \$22 million) plant has an annual production capacity of 17,000 MT of fatty esters, the report said. ■

News & Noteworthy



Richard Cantrill speaks about current fats and oils issues at the 1st Annual Meeting on Standards and Quality of Grain and Oil in China. Cantrill, who is director of AOCS Technical Services, represented AOCS at the November 11–13, 2009, conference in Beijing. The gathering was notable because it was the site of the first meeting of the Sub-Association of Grain and Oil Quality Inspection Research of the Chinese Cereals and Oils Association. The sub-association was formed as China moves from a focus on food sufficiency to work on food safety and quality issues.

Rabobank looks at 2010 soybean prospects

In December 2009, Rabobank's market research group produced a year-end report on the outlook for soybeans. Rabobank Group (Coöperatieve Centrale Raiffeisen-Boerenleenbank BA) is a global financial services provider with offices worldwide and headquarters in the Netherlands. Food and agribusiness are the Group's prime international focus.

Key highlights included the following:

- South American (Argentina/Brazil) soybean prospects appear set to reshape the world oilseed market in coming months with record production

forecast in 2010.

- Rabobank expects a bearish outlook for soybean prices in 2010, weather permitting.
- Favorable seasonal conditions with early rains in Brazil have facilitated earlier-than-normal plantings in October and November.
- The situation in Argentina remains a little more unclear with weather conditions raising questions about the feasibility of soybean planting and production expectations.
- Rabobank estimates that Argentinian soybean production will reach a record 51 million metric tons (MMT) in 2009–2010, or 60% higher year on year.
- Based on its current production forecasts, Rabobank believes that Argentina/Brazil will produce an additional

24 MMT of soybeans for export in 2009–2010 versus the previous season.

- Global stock levels are set for a recovery in the 2009–2010 season despite strong demand expectations continuing for China.
- “We expect world ending stocks to rebound by around 30% next season, with the global stocks-to-use ratio loosening from 19% to 24%,” the research group says.
- Rabobank’s expectations for soybean market fundamentals for next season suggest that “a supply-led bear market for soybean prices is likely throughout 2010.”
- The timing of an easing in prices is most likely to be evident after the South American harvest in the first quarter.
- Prospects of a burdensome balance sheet for the global soybean market are expected to result in a 12% fall in average price levels and the lowest average prices in three seasons.

EPA bans carbofuran residues

The US Environmental Protection Agency (EPA) has determined that current dietary exposures to the pesticide carbofuran are not safe. “The evidence is clear that carbofuran does not meet today’s rigorous food-safety standards,” Steve Owens, assistant administrator for EPA’s Office of Prevention, Pesticides & Toxic Substances, said in a news release.

Effective December 31, 2009, carbofuran residues were banned in all foods sold in the United States, including imports. The sole US manufacturer—FMC Corp.—and three grower associations (corn, sunflower, and potato) submitted objections to EPA’s tolerance revocations and requested an administrative hearing to prove the safety of the presumed neurotoxic pesticide. That request was denied in November 2009.

FMC voluntarily withdrew 22 uses of the pesticide in 2008 (including for cotton and soy), but six uses remained for four food crops and two nonfood crops. The agency is expected to eliminate all uses of the pesticide once the ban on food residues is final.

Camelina meal feed definition expanded

The US Food and Drug Administration (FDA) has concurred with the expansion of a feed ingredient definition for camelina meal, according to an FDA spokesperson. This means that camelina meal can be added to cattle feed at up to 10% by weight, said Scott Johnson, president of the North American Camelina Association and general manager of Sustainable Oils in Bozeman, Montana, USA.

“The best estimate that we have today for all camelina production in the United States [annually] is approximately 8,500 short tons (about 7,700 metric tons) of meal and 900,000 gallons (more than 3.4 million liters) of oil off of somewhat less than 35,000 acres (more than 14,000 hectares) in more than 10 states,” Johnson added.

The ingredient definition, which will be published in a future *Official Publication of the Association of American Feed Control Officials*, states that:

Camelina meal, extracted, is the product obtained from high-pressure crushing of seed, or from a pre-press solvent extraction process, which removes the oil from the whole seed of the species *Camelina sativa*. The meal may be heated. The meal is the material [that] remains after most of the oil has been removed. It must not contain less than 30% crude protein, a maximum of 12% crude fiber, and typically contains 15% residual oil. The meal contains less than 30 micromoles of any mixture of 9-Methylsulfinylnonyl glucosinolate, 10-Methylsulfinyldecyl glucosinolate, and 11-Methylsulfinylundecyl glucosinolate per gram of dry oil free solid. It is used in the diets of broiler chickens and feedlot beef cattle at an inclusion of no more than 10% of the diet.

ACH Food plant closes

The ACH Food Companies’ plant in Jacksonville, Illinois, USA, was scheduled to close on January 8, 2010, according to the *Jacksonville Journal-Courier* newspaper.

The closing was first announced in December 2008 after the creation in October 2008 of a joint venture between ACH (Memphis, Tennessee, USA) and Archer Daniels Midland Co. (Decatur, Illinois). That joint venture, Stratas Foods, bought product from both parent companies.

According to the newspaper account, “Stratas decided to terminate a supply agreement serviced by the two ACH plants and transfer production to other Stratas facilities, effectively leaving insufficient volume to continue the local operation.”

Food traceability report

A new report says that clear objectives should be set for all users of a simpler, globally accepted food supply chain that can benefit from existing commercial systems. The report, which was created by the Institute of Food Technologists (IFT), was released by the US Food and Drug Administration’s (FDA) Center for Food Safety and Applied Nutrition (CFSAN).

The IFT report is part of the public record that FDA will consider in determining ways to improve the ability of government and industry to trace food products throughout all stages of the supply chain.

The IFT recommendations are available at ift.org/traceability.

Novel lipid kills phytoplankton

A chemical culprit responsible for the rapid, mysterious death of phytoplankton in the North Atlantic Ocean has been found by collaborating scientists at Rutgers University (New Brunswick, New Jersey, USA) and the Woods Hole Oceanographic Institution (WHOI; Woods Hole, Massachusetts, USA).

The team discovered a previously unknown lipid in a virus that has been attacking and killing the coccolithophore *Emiliania huxleyi*, a phytoplankton that plays a major role in the global carbon cycle.

Kay Bidle, Rutgers assistant professor of marine science at the Institute of Marine and Coastal Sciences, said “*Emiliania huxleyi* . . . blooms all over the oceans, and we can easily see it by satellite. We know

that these blooms are frequently infected with viruses, and this virus is specific to this phytoplankton.”

“The lipids are the key ingredient in the virus that causes the phytoplankton to die,” says WHOI scientist Benjamin Van Mooy. “We have a completely different lipid molecule that, as far as we know, is unknown.”

The research appeared in the journal *Science* (326:861–865, 2009).

ACS/RSC and sustainability

Two of the world’s largest chemical societies have pledged to work cooperatively to contribute to global efforts aimed at developing sustainable energy, providing abundant food and clean water, and seeking to address other global challenges that threaten the sustainability of our planet.

The American Chemical Society (ACS) and the Royal Society of Chemistry (RSC) agreed to use their resources “to contribute to global efforts that seek out solutions for many of the emerging problems caused by unprecedented worldwide population growth and shrinking availability of the resources needed to sustain life as we know it,” the organizations said in a news release. ■



Acquisitions/mergers

Bunge Argentina, a division of **Bunge Ltd.** (White Plains, New York, USA), has purchased the fertilizer business of Argentina’s **Petrobras Energia** (Buenos Aires), which is a unit of Brazil’s federal oil and gas company, **Petroleo Brasileiro**. The products are distributed in Argentina, Uruguay, and Chile, according to the Dow Jones newswire.

■■■

Monsanto Co. (St. Louis, Missouri, USA) is acquiring **Pfizer Inc.**’s Chesterfield Village Research Center located in Chesterfield, Missouri. The research center comprises 1.3 million square feet (more than 121,000 square meters) and includes approximately 250 laboratories, 122 plant growth chambers, and two acres of greenhouse. Pfizer is based in New York City, New York, USA.

■■■

Pharmaceutical maker Bristol-Myers Squibb Co. (Lisle, Illinois, USA) announced in November that it would spin off its 83% holding in infant nutrition company Mead Johnson Nutrition Co. As *inform* went to press, potential buyers included France’s **Groupe Danone SA** and **Nestlé SA**.

Commodities

CACAO/CHOCOLATE

In November 2009, Zurich’s **Barry Callebaut** signed an agreement with the Nederland Group to acquire Spanish chocolate maker **Chocovic, SA**, which specializes in chocolate and specialty products for industrial and artisanal customers. Chocovic has a factory in Gurb, near Barcelona. The company produces about 30,000 metric tons (MT) of chocolate and specialty products per year, according to a statement from Barry Callebaut.

CANOLA/RAPESEED OIL

Statistics Canada reported in December 2009 that Manitoba has achieved a record canola harvest for the third straight year. Better yields and more acres helped

the canola harvest increase by 9.8% from 2008. Also in December, Prime Minister Stephen Harper said of China’s restrictions on Canadian canola imports: “We welcome China’s decision to lift restrictions on Canadian pork, but ill-considered protectionist measures—like restrictions on canola imports—can only lead to increased pressures for retaliation and protectionism,” he said. China imports canola primarily as a cooking oil.

PEANUT

Luhua Group Co., Ltd., an edible oil processor headquartered in central China’s Shandong Province, has opened a new facility in the city of Xinyi, Jiangsu Province, according to www.l63.com. The plant has an annual capacity of more than 100,000 MT of peanut oil, the report noted.

SESAME

SunOpta (Toronto, Ontario, Canada) has completed the construction of what it says is “the first natural and organic sesame hulling plant in Ethiopia.” **Selet Hulling** is a joint venture between the SunOpta International Sourcing and Trading Group and the Ethiopian company **Kaleb Service Farmers House**. Kaleb holds a majority stake with a 65% share; SunOpta has a 35% share.

SOY

Saudi Arabia plans to phase out production of all water-intensive crops, the Minister of Water and Electricity, Abdullah bin Abdul-Rahman Al-Husayen told the *Saudi Economic Survey* business magazine in November 2009. These crops include wheat, soybeans, and animal fodder, he said, declining to comment on when the crops will be phased out.

R&D

General Mills is strengthening its Worldwide Innovation Network (G-WIN) with an online collaboration tool to align “scientists, researchers, engineers, inventors and entrepreneurs” with technical challenges highlighted by the company. The company has about 50 of these challenges posted on the website (www.generalmills.com/win). ■

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Briefs

In Thomson Reuters' IP Market Report, prepared from the Derwent World Patents Index®, the number of patents issued worldwide for biofuels was shown to have grown dramatically since 2002. For the year 2003 a total of 341 biofuel patents were identified; of those, 3 involved algae. In 2008, there were 1,878 biofuel patents, and 63 of those related to algae. And in the first quarter of 2009, there were 2,466 patents for biofuels, and 92 of those involved algae.

Of the top 11 companies patenting processes related to algal-based biofuels in 2008–2009, eight were from the United States, one was from Brazil, one from the United Kingdom, and one from France.



PetroAlgae Inc. (Melbourne, Florida, USA) announced that PA LLC, a Delaware limited liability company that is PetroAlgae's operating subsidiary, signed a Memorandum of Understanding to enter into an agreement to license the company's proprietary micro-crop technology to Indian Oil Corporation Limited (IOCL) for its future large-scale production of renewable fuels. IOCL will build a pilot facility to demonstrate the commercial viability of producing renewable fuels from micro-crops. IOCL and PA LLC initially will collaborate on adapting the algal strains and technology developed by PA LLC to suit Indian conditions. Thereafter, a pilot facility is proposed to demonstrate the commercial viability of the technology. A commercial production facility with a capacity of 200,000 metric tons per annum of biodiesel is proposed in the near future.



In a master's degree research project, Bethany Fisher and her advisor Anthony Marchese (Colorado State University, Fort Collins, USA) found that combustion of biodiesel formed from algal fatty acid methyl esters produced decreased NO_x relative to canola and soy biodiesel, as well as

CONTINUED ON NEXT PAGE

Biofuels News



ALGAE

Not all algae are created equal

Lake Winnipeg, in the Canadian province of Manitoba, is the 10th-largest freshwater lake in the world (area: 24,000 km²). Recent algal blooms in the lake have led the government of Manitoba to look into harvesting the algae as a means of lowering phosphorus levels in the water as well as obtaining feedstocks for biofuels, bioplastics, food ingredients, nutritional supplements, and fertilizers. However, it has concluded that commercial harvesting is not feasible.

For instance, in a small pond, operators can control which algae are present; in a lake the size of Lake Winnipeg, the dominant species change with the season. The *Winnipeg Free Press* also notes that some species may contain toxins that would render nutritional supplements made from algae unusable. Additionally, blooms occur somewhat randomly in the lake, and some parts of the lake are difficult to access, especially during bad weather.

Harvesting algae for biofuel feedstocks also looks unpromising, since the oil content of the algal biomass in Lake Winnipeg, taken as a whole, is very low.

In other words, Manitoba will likely not be able to kill two environmental problems with one stone by collecting Lake Winnipeg algae for biodiesel production, according to Arne Elias, director of the University of Winnipeg's Centre for Sustainable Transportation. Instead, the Manitoba Water Stewardship Board plans to return to basics for now and reduce the amount of nutrients entering the Lake. For example, Manitoba is implementing new rules on livestock waste, including a ban on winter spreading of manure on Manitoba farms by 2013, to lessen nutrient runoff into the Lake and other bodies of water.

Record claimed for algal production

A joint project between Murdoch University (Perth, Western Australia) and the University of Adelaide (South Australia) claims to have achieved the world's best production rates of oil from algae grown in open saline ponds. In a press release, Project

ultra-low sulfur diesel. Amounts of total hydrocarbons, formaldehyde, and organic carbon particulate matter were slightly elevated with the two algal fuels evaluated in comparison with traditional feedstocks. Particle size distributions, total particulate matter masses, and carbon monoxide and acetaldehyde levels were similar for the different types of biodiesel evaluated.



The National Automobile Dealers Association (NADA) urged the US Environmental Protection Agency and the National Highway Traffic Safety Administration, which are working to finalize fuel economy and greenhouse gas rules for motor vehicles, to adopt a consistent, single national standard. Forrest McConnell, chairman of NADA's regulatory affairs committee, said, "Incorporation of [the California Air Resources Board's] greenhouse gas rules is neither practically necessary nor legally appropriate for a well-designed . . . national program." He added, "NADA's objections . . . focus on the unworkable impact on dealership new-vehicle commerce that would result from a 'patchwork' of state-based regulations."



In a third quarter (2009) presentation, Claudio Molina, chief executive officer of the Argentinean Biofuel and Hydrogen Association, said that the biofuel sector in Argentina will grow 90% in 2010. One factor contributing to this growth is the implementation of Law 26093, which establishes that diesel sold within the country must contain 5% biodiesel starting in January 2010. Petrol also must be mixed with up to 5% sugar-derived ethanol from January 1, 2010. ■

Leader Michael Borowitzka said, "It was previously believed impossible to grow large quantities of algae for biofuel in open ponds consistently and without contamination, but we've proven it can be done." He added, "This is the only biofuel project in Australia working simultaneously on all steps in the process of microalgal biofuels production, from microalgae culture, harvesting of the algae, and extraction of oil suitable for biofuels production."

A multimillion dollar pilot plant to test the whole process on a larger scale will now begin construction in Karratha near the northwest coast of Australia; the pilot plant is expected to be operational by July 2010. The first stage is expected to cost \$1.5 million; additional funding of \$5–10 million is being sought for future stages.

Borowitzka said, "We have achieved production rates of 50 metric tons per hectare per year, over half of which is converted to oil. These high production rates are expected to increase at the new pilot plant due to the even better climatic conditions in Karratha."

In the past year, Borowitzka says, the cost of producing biofuel from algae has dropped from \$12 per kilogram to less than \$4 per kilogram. The goal is to produce algal biofuel for less than \$1 per kilogram.

Growing algae in the ocean

Two engineers from Kansas State University (Manhattan, USA) propose growing algae in the ocean on very large, supporting platforms. Wenqiao Yuan and Zhijian Pei have received a \$98,560 Small Grant for Exploratory Research from the National Science Foundation to explore the idea.

Yuan and Pei are working to identify oil-rich algal species that are inclined to settle down and grow en masse on a solid surface, rather than floating suspended in the water, a characteristic that will make algae production manageable and harvesting much simpler.

Questions the researchers are considering include: By what mechanisms do algae attach to various surfaces? What materials do algae prefer? What surface textures, if any, encourage the algae to bloom and grow?

Studies of two species of algae, including *Botryococcus*, that are characteristically high in oil content and fast-growing have found that algae attach well to a stainless-steel, thin-film surface that is slightly dimpled. Once attachment is established, the algae grow very well, producing a layer several millimeters thick.

Pei and Yuan envision growing algae on very large support surfaces in ocean water, perhaps a long, continuously rolling surface like a conveyer belt.

At some point, the growth surface/conveyer belt would emerge into the sunlight, where the algae would dry. A knife at the end of the conveyer system would scrape off dried algae for further processing, and the conveyer belt would submerge, to become home to the next growth of oil-rich algae.

Yuan said, "It will take [5–10] years to really understand the fundamentals of large-scale algae production and to establish pilot projects."

Recipe for algae

In a tongue-in-cheek article on November 16, *Biofuels Digest* published a recipe for making algal fuel in an open-pond environment:

- 320 mL of an aqueous solution of a superior strain of algae (that is, having a 33% oil content)
- 1,500 gallons (5,700 L) of water, which is recyclable
- 45 pounds (20 kg) of CO₂
- trace amounts of other nutrients such as iron and copper

Add algae, CO₂, and trace nutrients to the 1,500 gallons of water, place algal solution in sunlight in an open pond, and stir continuously until the algal content reaches 0.2%. Once that concentration has been reached, the algae are ready to be harvested.

To harvest, remove the water from the algae (or, alternatively, remove the algae from the water), extract oil from the algae and recycle the 99.8% water. Material remaining after oil extraction can be sold for its protein content, or burned.

Serves: one VW Jetta TDI for approximately 50 miles (80 km).

CONTINUED ON PAGE 21

Update on jatropha

Marguerite Torrey

Inedible oil from the seeds of *Jatropha curcas* is reputedly a wonder crop for biofuels in the middle latitudes of the globe (~30°N to ~30°S) because (i) it is not a source of food, (ii) it can be home-grown, reducing or eliminating the need to import petroleum-based fuels, and (iii) in sufficient quantity, it can be exported, thus providing an income stream for the producing country. Furthermore, the plant can grow on land unsuited for crops needed by humans and animals.

Jatropha in sub-Saharan Africa

One of the early ideas regarding jatropha as an energy source was to grow it in countries struggling to produce or purchase adequate supplies of petroleum-based fuels. In the past six years, jatropha has been planted in a number of sub-Saharan countries including South Africa, Ethiopia, Kenya, Tanzania, Mozambique, Ghana, and Swaziland. There are also plans to start production in Rwanda.

TANZANIA. Farmers and environmental groups, citing concerns over food shortages, have moved the Tanzanian government to suspended investments in jatropha worth millions of dollars after farmers were evicted from their fields in favor of biofuels. The government also halted allocation of large parcels of land to biofuel investors—5,000 rice farmers were evicted to make way for biofuels growth. The Kenyan newspaper *The EastAfrican* said Esther Mfugale, coordinator of biofuel production in the Ministry of Agriculture, Food Security, and Co-operatives for Tanzania, indicated the federal government has ordered local governments to stop selling

land to biofuel investors until nationwide policies can be established regarding biofuel investments.

KENYA. *Time* magazine featured the effects of jatropha farming on Kenyan food security in an October 2009 issue. In 2000, the Kenyan government started encouraging farmers to plant jatropha. The plant was promoted as growing with little water and as providing large profits in the global search for alternative energy sources. Hundreds of farmers converted parts of their small farms from food to jatropha. However, the drought that started in 2005 in Kenya clearly showed that jatropha cannot grow without water. A controversial study in the June 23 issue of *Proceedings of the National Academy of Sciences USA* (www.pnas.org/content/106/25/10219.full) suggests jatropha requires more water per liter of biofuel produced than most other biofuel plants. In a country facing a food crisis due to drought, growing jatropha for use in making fuel may not be the best use of the water resource.

Data from the World Food Programme (www.wfp.org/countries/kenya) indicate 3.8 million Kenyans need food aid; 31% of the population is undernourished.

RWANDA. The government of Rwanda announced in November that two foreign companies—Eco Positive (London, United Kingdom) and Eco-fuel Global LLC (Walnut Creek, California, USA)—had agreed to invest \$250 million in growing jatropha on 10,000 hectares provided by the government. The yield is expected to be 20 million liters of biodiesel annually, which may replace up to 20% of the country's fossil fuel requirement.

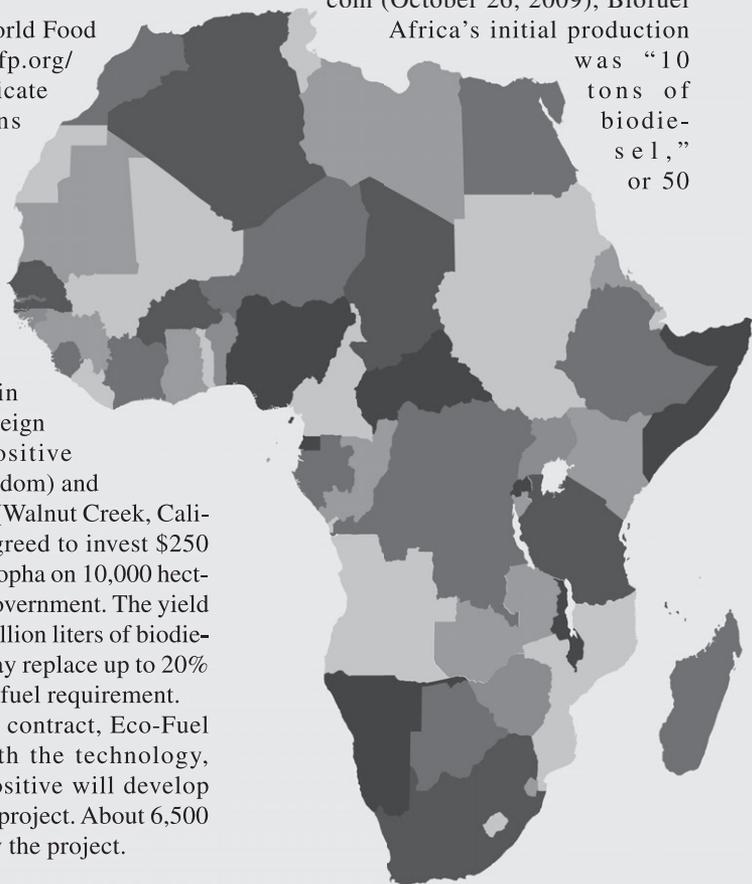
According to the contract, Eco-Fuel Global will deal with the technology, whereas Eco-Fuel Positive will develop the finances to run the project. About 6,500 jobs will be created by the project.

At present, Rwanda imports 160 million liters of fuel through Kenyan or Tanzanian ports, and it often faces shortages. The 13% of total fuel consumed that will be provided through local production of jatropha will “have no direct impact on agriculture production,” according to Energy Minister Albert Butare, since the crop will be grown on “marginal land which is less or not productive at all for agriculture.”

The project is expected to start production in 3–4 years. Groundwork should begin during the second quarter of 2010.

GHANA. Biofuel Africa Ltd., a subsidiary of Solar Harvest AS (Stavanger, Norway), started its first working farm operation in Ghana in 2007. It announced in October it has begun commercial production of jatropha oil, the first company in West Africa to move from growing and selling jatropha fruits and seeds to production and sale of jatropha oil on a commercial scale.

According to Ghana Business News.com (October 26, 2009), Biofuel Africa's initial production was “10 tons of biodiesel,” or 50



barrels, from 660 hectares of one-year-old trees.

The company has created considerable consternation, however, among small-holders who contend BioFuelAfrica took their farmland fraudulently, stripped it bare, and planted jatropha as a monoculture (www.africanbiodiversity.org).

Perspectives on jatropha as a biofuel

There is no doubt that the global financial downturn has contributed to disappointment in jatropha as a biofuel, but there are other considerations. Rob Bailis, an environmental scientist with Yale University, was quoted in *Nature* (461:328-329, 2009) as saying, "Over the past three years, the investment [in jatropha] got way ahead of the plant science."

Yields for crops such as maize have been optimized over the past several thousand years, whereas jatropha is still a newcomer in the field of agriculture. D1 Oils (see *inform* 20:421, 2009), which initially started as a business to plant jatropha and harvest oil, is now conducting a breeding program to develop seeds with high oil

yields. SG Biofuels (Encinitas, California, USA) is also collecting samples from jatropha plants growing in the wild and developing a library of genetic material to use in developing enhanced seed strains (*inform* 20:320, 514, 2009).

At a discussion organized by the Second Jatropha World Africa meeting (held in Brussels on October 14–15, 2009), Chris Unter and James Scruby, directors of Viridesco (London, UK; Mozambique; Zambia), pointed out that, in theory, there is no problem with jatropha as a large-scale plantation plant. It is necessary, though, that the crop be studied and cultivation techniques perfected.

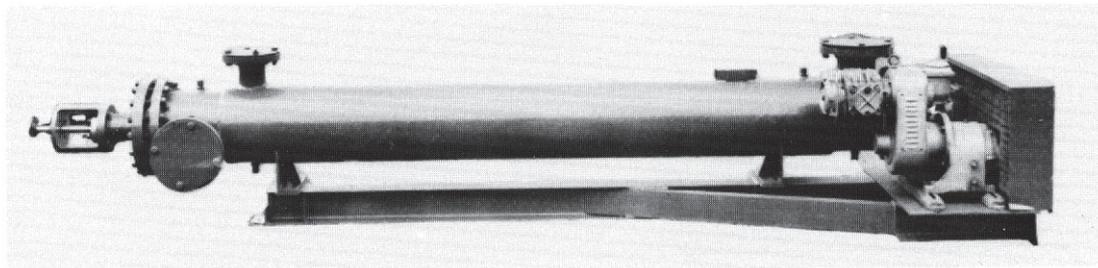
In an article written for *Cleantech.com* (<http://cleantech.com/news/5177/sg-biofuels-potential-jatropha>), Kirk Haney, chief executive officer of SG Biofuels, pointed out, "The genetic improvement of jatropha through traditional plant breeding could increase yields 50% to 100%, and quite possibly much higher." Further, "By way of comparison, yield of the rubber tree was increased by 400% through similar breeding efforts." If biotechnology is brought to bear on the question, the yield may be increased even more.

From another perspective, *CommodityOnline* reported that Scruby suggested that converting jatropha oil to biodiesel may be misguided. Putting jatropha oil through a chemical processing plant creates added costs. This may not be important in a large-scale plantation, where product is being exported to colder climates. In climates where temperatures do not fall far enough to congeal jatropha oil, though, pure oil (straight vegetable oil) can be pressed in local pressing equipment and the filtered oil used virtually as-is. Scruby said, "Within this model, I see a commercial approach, which has better margins and benefits local communities."

Thus, jatropha may have a future in sub-Saharan Africa once crop improvements have been devised and management practices are established. And an answer must be reached, perhaps uniquely for each country, whether the goal is to produce oil for local consumption—straight vegetable oil and/or biodiesel—or for export.

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

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BIODIESEL

Catilin technology lowers biodiesel cost

In November 2009, SRI Consulting of Menlo Park, California, USA, completed a technical and economic analysis of the process invented by Catilin, Inc. (Ames, Iowa, USA) for producing biodiesel. SRI concluded that Catilin's solid catalyst process has a value advantage over the traditional catalytic process of \$0.13 per gallon of biodiesel. When the capital expense savings are included, the advantage increases to \$0.19 per gallon of biodiesel.

The heart of the Catilin process is the T300 heterogeneous catalyst, which is a non-toxic direct replacement for the commonly used toxic sodium methylate. Unlike other solid catalysts trying to enter the market, Catilin's T300 catalyst is able to operate at industry standard pressures and temperatures. As a result, current producers can retrofit their plants in a matter of days at very low cost. Another advantage is that the glycerin co-product has a purity greater than 98% and qualifies as technical grade, which significantly enhances its overall value.

The abstract of the SRI Consulting report is available at www.sriconsulting.com/PEP/Public/Reports/Phase_2009/RW2009-5/.

Glycerol as chickenfeed

Research out of the Agri-Food Biosciences Institute (AFBI; Belfast, Northern Ireland) has found that glycerol from biodiesel production may be used as a dietary component for broilers.

Researchers Elizabeth McCann (AFBI) and Linda Griffiths (Queen's University Belfast) formulated diets to contain 0, 3.3, 6.7, and 10% glycerol as a partial replacement for wheat. These were offered to broilers from 7 to 28 days of age. Birds were weighed weekly, and excreta were collected to determine apparent metabolizable energy (AME). Breast tissue was collected from each bird at the end of the experiments to determine meat quality.

AME increased linearly with increasing inclusion of glycerol. Glycerol inclusion did not affect body weight, live weight gain, and feed intake. Nor did glycerol inclusion affect growth parameters or meat quality. Feed conversion ratio (FCR) was improved with increasing glycerol inclusion, and 6.7% glycerol inclusion resulted in the most efficient feed conversion.

Biodiesel and feedstock characteristics

In November 2009 the Renewable Energy Group (REG; Ames, Iowa, USA) announced the availability of "Biodiesel and Feedstock Characteristics Report." The 136-page publication, which can be downloaded at www.regfuel.com, compares data on ASTM D6751 results for biodiesel made from 34 commercially available and unique feedstocks. Samples were subjected to laboratory-scale pretreatment and production processes so as to mimic current commercial biodiesel procedures.

According to *BIOFuels Business* (www.biofuelsbusiness.com/news/news-archive.asp, November 25, 2009), Glen Meier, REG's director, technology and feedstock development, said, "For the first time, side-by-side comparisons of the feedstocks' fatty acid profiles and resulting biodiesel characteristics are now available. This opens the door to discussions about market viability and commercialization of new or unique feedstocks."

The data are intended to serve as an industry-wide resource regarding feedstock characteristics for biodiesel developers, suppliers, and researchers.

RENEWABLE DIESEL

Renewable jet fuel recognized

The Best of What's New Award from *Popular Science* magazine went to the Energy & Environmental Research Center (EERC) at the University of North Dakota (Fargo, USA) and the US Department of Defense's Defense Advanced Research Projects Agency (DARPA) for its 100%

renewable jet fuel. The award recognizes outstanding innovation, vision, and execution of revolutionary products and technologies from companies, universities, laboratories, and government agencies.

The fuel was created from renewable crop oils, such as canola and soybeans. The fuel was tested at the Wright-Patterson Air Force Base Air Force Research Laboratory (Dayton, Ohio) and met all of the screening criteria for jet propellant-8 (JP-8) aviation fuel, a petroleum-based fuel widely used by the US military. This renewable fuel can be tailored to meet a wide variety of mission-specific requirements.

KLM flies with camelina

The first passenger flight powered by sustainable biofuel took place on November 23, 2009. A KLM Royal Dutch Airlines flight took off from Amsterdam's Schiphol Airport for a flight lasting about an hour. Passengers included a number of Dutch government officials and industry partners.

A 50:50 mixture of standard jet fuel and of fuel derived from camelina oil was used in one engine of a Boeing 747. The camelina oil came from Great Plains-The Camelina Company (Cincinnati, Ohio, USA).

KLM also announced on November 23 the formation of the SkyEnergy consortium, along with North Sea Petroleum and Spring Associates. The World Wide Fund for Nature will advise the consortium in relation to ecological issues, particularly in relation to sustainable air transport.

ETHANOL

Costs for cellulosic ethanol fall

Cost reductions achieved over the first year of POET's operation of a cellulosic ethanol pilot plant at Scotland, South Dakota, USA, saw the company's cost per gallon fall from \$4.13 in November 2008 to \$2.35 per gallon in November 2009. Reductions were accomplished in energy usage, enzyme costs, raw material requirements, and capital expenses.

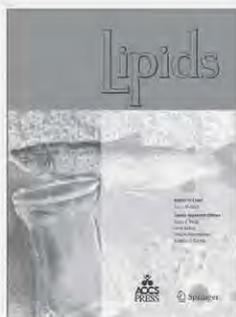
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Briefs

AOCS member Bill Christie notes in his Lipid Library blog that the *Journal of AOAC International* published a section containing review papers dealing with the nutritional properties and analysis of *trans* fatty acids (92:1249–1326, 2009). Christie also mentions that the entire archive of the *Journal of Oleo Science* (and its previous incarnations as the *Journal of the Japanese Oil Chemists' Society* and *Yukagaku*) is now available online with open access at www.jstage.jst.go.jp/browse/jos/-char/en. Christie's blog is available at www.lipidlibrary.co.uk/news/blog.htm.

A formal announcement will be made elsewhere, but this news item provides an opportunity for AOCS to thank Christie for his generous donation of the Lipid Library to us. He will continue to write his blog and will serve for several years as editor-in-chief of a newly formed editorial board, which will function under the umbrella of the AOCS Publications Steering Committee. Those interested in serving on the editorial board should email Christie at William.Christie@scri.ac.uk.



Results from the EPIC (European Prospective Investigation into Cancer and Nutrition) study of dietary fat intake appeared in a supplement to the *European Journal of Clinical Nutrition* (63:S61–S80, 2009; doi:10.1038/ejcn.2009.75). A stratified random sample of 36,034 participants completed a standardized 24-hour dietary recall. On average, the contribution of fat to total energy intake was greater than or equal to 34% of energy intake (%en) in women and greater than or equal to 36%en in men for most EPIC centers; British, Dutch, and Italian cohorts were exceptions. Also surveyed were total fat, monounsaturated fatty acid, saturated fatty acid, and polyunsaturated fatty acid intakes. Average daily cholesterol intake across EPIC was 140–384 mg in women and 215–583 milligrams/day in men.



Health & Nutrition

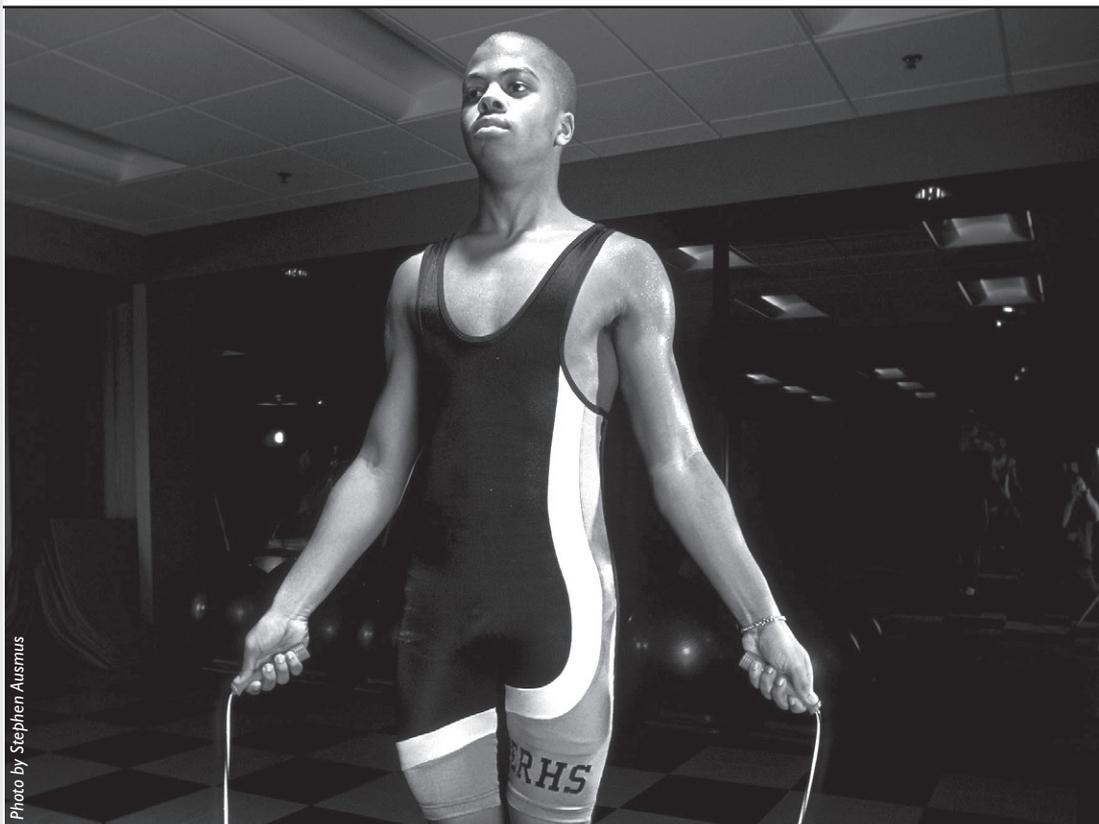


Photo by Stephen Ausmus

Dehydration affects mood, not just motor skills

Rosalie Marion Bliss

Dehydration has long been known to compromise physical performance. Now, a new study provides insight into the effects of mild dehydration on young athletes, and possibly into the lives of people too busy to consume enough water daily. The study was supported in part by the [US] Agricultural Research Service (ARS) and a US Army grant.

Biological psychologist Kristen D'Ancl led the study while with the Jean Mayer US Department of Agriculture (USDA) Human Nutrition Research Center on Aging at

Tufts University in Boston. Other coauthors were Holly Taylor with Boston-based Tufts University, and Caroline Mahoney with the US Army Natick Soldier Systems Center in Natick, Massachusetts.

The study adds to a relatively new area of research and was published recently in *Perceptual and Motor Skills* (109:251–269, 2009).

Athletes commonly lose between 2% and 4% of their body weight during athletic practice. The researchers wanted to explore the effects of dehydration on cognition—the ability to use information to function—and mood.

About 30 male and female Tufts University students, with an average age of 20, participated in the study. When students were assigned to the “dehydration group,” they were not given fluids during athletics. When in the control condition, they were given water throughout athletics.

The participants weighed in before and after athletics to assess body water loss. After athletic activity, participants underwent cognitive tests, which included short-term memory and mood scales among others. The researchers found that

As any chocoholic will tell you, the following study comes under the heading of “so what else is new?” Nonetheless, the “chocolate cure” for emotional stress is getting new support from a clinical trial conducted by researchers at the Nestlé Research Center in Lausanne, Switzerland, and published online in the *Journal of Proteome Research* (doi: 10.1021/pr900607v). The trial found that eating 40 grams of dark chocolate per day for two weeks reduced levels of stress hormones in the bodies of people feeling highly stressed. The daily treat also partially corrected other stress-related biochemical imbalances. Presumably, had the subjects been told they were consuming roughly 200 extra calories per day, their stress levels might have returned to the original levels.



Two recent studies in mice on coffee consumption bring mixed news.

On the one hand, the consumption of the equivalent of 2.5 cups of coffee daily (whether decaffeinated or caffeinated) suppressed weight gain in adipose tissue seen in control mice on a high-fat diet. The animals ingesting coffee also saw a reduction in biomarkers associated with the metabolic syndrome, or the combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes. The study was published online in the *Journal of Agricultural and Food Chemistry* (57: doi: 10.1021/jf901278u).

On the other hand, coffee consumption may increase the level of low-density lipoprotein cholesterol (the so-called bad cholesterol) because of its effect on a liver protein—pregnane receptor X. This is according to a study that appeared online in the *Journal of Lipid Research* (50: doi: 10.1194/jlr.M800608-JLR200). ■

dehydration was associated with negative mood, including fatigue and confusion, compared to the hydrated group.

The level of mild dehydration (losses of between 1% and 2%) experienced among participants in the study could be compared to the mild dehydration some people experience in their daily lives from drinking insufficient amounts of water, according to the authors.

Rosalie Marion Bliss is a public affairs specialist with the ARS in Beltsville, Maryland.

Flaxseed oil may reduce osteoporosis risk

Animal studies suggest that adding flaxseed oil to the diet could reduce the risk of osteoporosis in postmenopausal women and women with diabetes, according to a report published in the *International Journal of Food Safety, Nutrition and Public Health* (2:189–201, 2009).

Mer Harvi and colleagues at the National Research Center in Cairo, Egypt, have studied the effect of diabetes on bone health and evaluated how flaxseed oil in the diet might delay the onset of osteoporosis. The researchers studied 70 female albino rats of which 30 had their ovaries removed (ovx) to simulate the postmenopausal state and experimental diabetes was present in one group of rodents.

After two months, the team collected urine and blood samples from the rats and measured serum insulin-like growth factor 1 (IGF-1) and the bone-creating protein osteocalcin. They found that these two compounds were present at higher levels in the ovx and the diabetic ovx groups, but much lower in the non-ovx diabetic group. The concentrations of IGF-1 and osteocalcin could be raised to normal levels by adding flaxseed oil to the diet.

The team also found that levels of deoxypyridinoline in the urine were raised in the diabetic group. Deoxypyridinoline is normally present in healthy bone, and its presence in urine is a specific marker for bone resorption associated with osteoporosis. Levels of this marker compound fell when the rats were given flaxseed oil.

The team concludes that diabetes has a more pronounced effect on bone health than ovariectomy and that diabetes in postmenopausal women may also be a greater

risk factor for osteoporosis than the decline in sex hormones associated with menopause. However, their results suggest that flaxseed oil has a beneficial effect on bone mineral density and reduces markers associated with osteoporosis, suggesting that this dietary supplement could be beneficial to women with diabetes in reducing their risk of osteoporosis.

The team explains that the presence of α -linolenic acid in flaxseed oil may play a role in protecting the processes of matrix formation and bone mineralization, which are apparently compromised by diabetes and menopause. “We recommend further investigations using animals and humans to confirm the effect of using dietary flaxseed oil to improve bone health and to prevent osteoporosis,” Harvi and colleagues conclude.

Omega-3s and bone health

Previous studies on omega-3 fatty acids and bone health have looked at older adults and young men. A new study led by Susanne Eriksson of the University of Gothenburg, however, looked specifically at 8-year-old boys in an urban Swedish community.

The scientists found that children with higher long-chain omega-3 intakes had significantly better bone mineral density, which is a sign of strong and healthy bones. Further, those boys with a lower omega-3 intake and a higher omega-6 intake had the lowest bone density. The researchers also found that children who seldom or never drank milk had stronger bones than those who drank milk. A possible explanation is that most dairy cows are fed grains and, therefore, their milk is high in omega-6 fatty acids, the researchers said.

The study appeared in the *British Journal of Nutrition* (102:407–412, 2009). ■

information

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Briefs

In a research report published in the journal *Genetics* (183:979–1003, 2009) scientists show how a family of genes (1-aminocyclopropane-1-carboxylate synthase, or ACS genes) are responsible for production of ethylene. This gas affects many aspects of plant development, and they believe that this information lays the foundation for future genetic manipulation that could make plants disease-resistant, able to survive and thrive in difficult terrain, increase yields, and other useful agronomical outcomes. This discovery was made with *Arabidopsis thaliana*, but it should be applicable to plants used in agriculture.

“I hope that this work will provide insights into how a set of genes work together like a finely tuned symphony to regulate plant growth because we may be able to use such knowledge to engineer plants more suited to our changing world,” said Athanasios Theologis, a senior scientist at the Plant Gene Expression Center of the US Department of Agriculture and the senior researcher involved in the work.

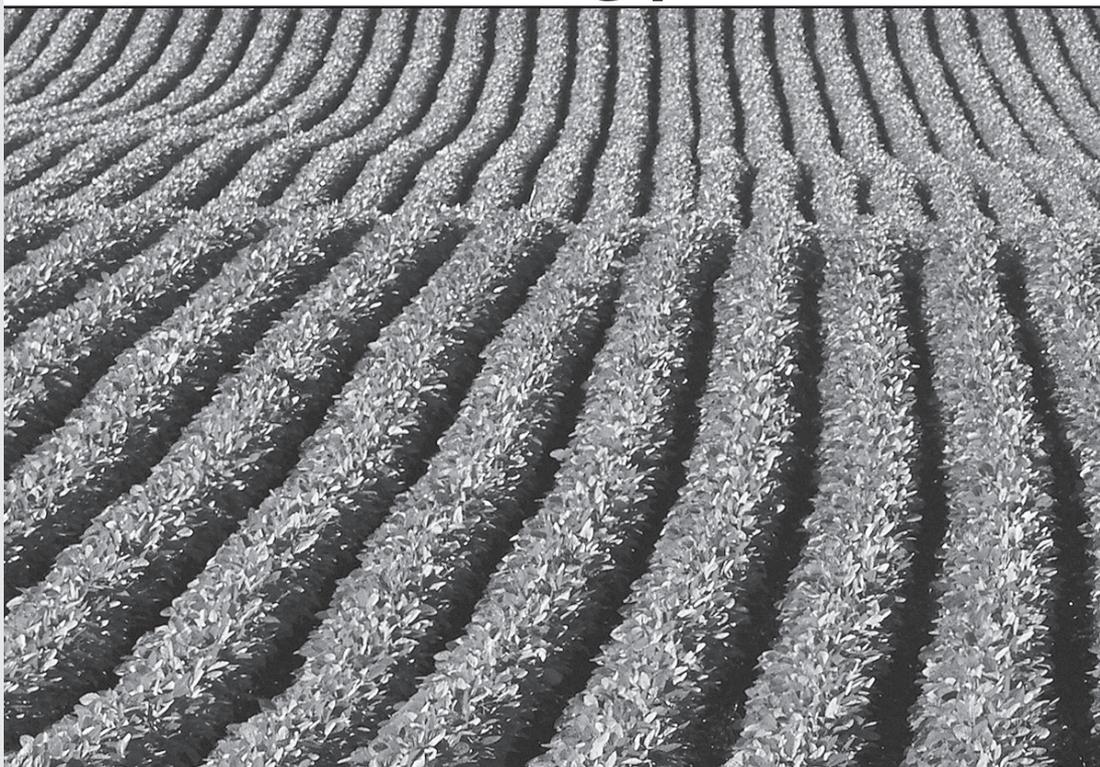
“Ethylene gas is best known for causing fruit to ripen,” said Mark Johnston, editor-in-chief of the journal *Genetics*, “but the molecule is critical to development and growth of plants. By revealing how plants regulate the amount of ethylene they produce, this study gives scientists an entirely new genetic approach for developing heartier, more productive crops.”



A lengthy Associated Press article published in many US newspapers on December 13 examined Monsanto Co.’s business practices and spoke of the St. Louis, Missouri-based company as “squeezing competitors.” In response, Monsanto released a statement that said the article “missed the mark on the real facts behind our business and our licensing approach.” The US Departments of Agriculture and Justice have announced a general

CONTINUED ON NEXT PAGE

Biotechnology News



Predicting the environmental effects of Bt crops

Alfredo Flores

Potential risks from new transgenic Bt crop lines can be assessed using carefully controlled laboratory tests, according to findings of a study by US Department of Agriculture Agricultural Research Service (USDA ARS) scientists and cooperators. This finding, reported in November, will help streamline the assessment process for introducing new insect control technology to the marketplace, while ensuring environmental safety.

Bt (*Bacillus thuringiensis*) is a biological control bacterium that is effective against a number of key insect crop pests. Crops that contain Bt genes have a built-in defense against these insects, but such crops need to be studied to make sure they don’t pose a risk to nontarget organisms.

To test whether the impact of these transgenic crops in the field was predictable from laboratory experiments, scientists

from ARS collaborated with researchers at Santa Clara University (California, USA) to compare all current laboratory and field studies on nontarget effects using meta-analyses. Findings of the ARS study suggest that researchers should be able to more accurately predict from laboratory studies the impact that new experimental lines may have in the field.

Entomologists Jian Duan, Jonathan Lundgren, and Steven Naranjo led the study. The study was initiated to test the underlying assumption of biotechnology risk assessment—that laboratory tests can accurately identify potential risks of transgenic insecticidal Bt crops in the field. The new ARS study demonstrated that carefully controlled laboratory tests can accurately detect toxicological risks that might emerge in the field, thereby reducing the need for more expensive and time-consuming tests.

The study, completed earlier this year, was published in the journal *Biology Letters* (doi: 10.1098/rsbl.2009.0612).

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investigation of competition in agriculture. A government-conducted workshop focused on the seed industry is planned for March 12 in Ankeny, Iowa, USA.



Dow AgroSciences Canada announced in late November that it would acquire the assets of Hyland Seeds, a division of Thompsons Limited. The addition of Hyland Seeds will further expand Dow AgroSciences' current seeds business as the company anticipates the introduction of SmartStax™ in 2010 and Dow AgroSciences Herbicide Tolerant Trait Technology in corn in 2012. Under the terms of the agreement, Dow AgroSciences will acquire the Hyland brand and the sales, marketing, and administrative areas. The acquisition also includes germplasm; the research and development (R&D) program, with three R&D sites; and the corn production facility. Dow AgroSciences will continue to market seeds independently under the Hyland Seeds brand, and Hyland will continue to be headquartered at its existing location in Blenheim, Ontario. John Cowan, general manager for Hyland Seeds, will continue in the same position.



In December Reuters reported that a genetically modified (GM) soybean seed, developed by BASF (Ludwigshafen, Germany) and Brazilian agricultural researchers, had been approved for use in Brazil. According to Reuters: "The soy is tolerant of imidazoline-based herbicides and it is the first genetically modified seed ever to be approved by Brazil's CTNBio biosecurity commission that was developed with the participation of a government entity." BASF has plans to make the seed available for sowing in the 2011/12 season.



Syngenta (Wilmington, Delaware, USA) announced December 8 that it had received cultivation approval for its corn trait GA21 in the Philippines, following biosafety and other required assessments by the Depart-

Key to drought-resistant crops?

Has the key to creating drought-resistant crops been found? Scientists at the Van Andel Research Institute (VARI; Grand Rapids, Michigan, USA) have determined how the plant hormone abscisic acid (ABA) works at the molecular level to help plants respond to environmental stresses such as drought and cold. Their findings, published in the journal *Nature* (462:602–608, 2009), could help engineer crops that thrive in harsh environments around the world and combat global food shortages.

VARI scientists have determined the structure of the receptors that plants use to sense ABA, a hormone that keeps seeds dormant and keeps buds from sprouting until the climate is right. Locating these receptors and understanding how they work is a key finding. This discovery is crucial to understanding how plants respond when they are under stress from extreme temperatures or lack of water.

"It [this discovery] could have major effects on nutrition and crop yields, especially as fresh water sources become scarcer," said VARI Research Scientist Karsten Melcher, one of the lead authors of the study.

Melcher works in the VARI Laboratory of Structural Biology led by Distinguished Scientific Investigator H. Eric Xu. The lab began studying ABA signaling in March this year because a proposed ABA receptor was reported to be a member of G-protein coupled receptors, a group of proteins that the lab studies. More than 50% of all drugs on the market target these proteins, but it has been extremely difficult to determine their atomic structure.

Although it later resulted that the ABA receptors were found to be members of another protein family, Xu's lab continued their studies on the newly identified ABA receptors. The lab worked with specialists in plant biology at other institutions to validate the data, including the National Center for Plant Gene Research in Beijing, China; the Department of Botany and Plant Sciences at the University of California at Riverside; the Center for Plant Stress Genomics and Technology at the King Abdullah University of Science and Technology in Thuwal, Saudi Arabia; and the Department of Biochemistry at the Medical College of Wisconsin.

Corn genome sequenced

In the November 20, 2009, issue of *Science*, scientists revealed the genetic instructions inside corn (maize), one of the big three cereal crops. More than 100 scientists contributed to the papers making up the package of articles on this topic. The team, which included Doreen Ware, a computational biologist at the USDA-ARS Robert W. Holley Center for Agriculture and Health (Ithaca, New York), has released the most comprehensive draft sequence to date, providing the most detailed look thus far at the functional portions of the corn genome.

Ware led the computational effort and is a lead author of the report, along with Richard Wilson of Washington University School of Medicine (St. Louis, Missouri), and Patrick S. Schnable of Iowa State University (Ames). Other key participants in the project included the University of Arizona (Tucson) and Cold Spring Harbor Laboratory (New York). USDA's National Institute of Food and Agriculture, along with the National Science Foundation and the US Department of Energy, jointly funded the \$29.5 million effort.

Edward Buckler, an ARS geneticist, and Ware also have used next-generation sequencing data to assemble a haplotype genetic map of the corn genome that lays out portions of the genome shared by 27 diverse inbred lines of corn. A haplotype is a combination of alleles—alternative forms of genes—that are located closely together on the same chromosome and tend to be inherited together. The corn lines in the haplotype genetic map were selected specifically because they represent the vast majority of the genetic diversity in corn. Buckler's "HapMap" shows a 30-fold variation in recombination rates, which are the rates that genetic materials from parents mix to show up in the progeny. The researchers already are linking the HapMap to the basis of hybrid vigor.

A set of companion papers also appears in the journal *PLoS Genetics* (visit <http://collections.plos.org/plosgenetics/maize.php> to read more).



Research on plant genes, disease

A researcher at Iowa State University (Ames, USA) has discovered how a group of proteins from plant pathogenic bacteria interact with DNA in the plant cell, opening up the possibility for what the scientist calls a “cascade of advances.”

Adam Bogdanove, associate professor in plant pathology, was researching the molecular basis of bacterial diseases of rice when he and Matthew Moscou, a student in the bioinformatics and computation biology graduate program, discovered that the so-called TAL effector proteins injected into plant cells by strains of the bacterium *Xanthomonas* attach at specific locations to host DNA molecules. They found that different proteins of this class bind to different DNA locations, and particular amino acids in each protein determine those locations, called binding sites, in a very straightforward way.

Bogdanove’s research was highlighted in Science Express, ahead of its publication in the journal *Science* (326:1501, 2009).

In his research, Bogdanove was examining how *Xanthomonas* uses TAL effectors to manipulate gene function in plants in ways that benefit the pathogen. Bogdanove was specifically interested in how different TAL effector proteins are able to activate different corresponding plant genes. Researchers in Germany, at Kansas State University (Manhattan), and at Iowa State had previously shown that these proteins bind host DNA and activate genes important for disease, or in some cases defense against the bacteria. But no one yet understood how different TAL effectors recognized different parts of the DNA in order to attach and turn on the different genes at those locations.

Through computer analyses, Bogdanove and Moscou discovered that pairs of amino acids distributed throughout a TAL effector protein each specify a particular nucleotide, one of the bases in DNA abbreviated as the letters G, A, T, or C. The complete set of these pairs directs the protein to a matching string of Gs, As, Ts, and Cs in the DNA.

“This simple relationship allows us to predict where a TAL effector will bind, and what genes it will activate. It also makes it likely that we can custom engineer TAL

effectors to bind to virtually any DNA sequence,” says Bogdanove.

According to Bogdanove, being able to predict TAL effector binding sites will lead quickly to the identification of plant genes that are important in disease.

More data on SDA to EPA conversion

Ingestion of oil from soybeans modified through biotechnology to contain higher levels of stearidonic acid (SDA; 18:4n-3) increased levels of eicosapentaenoic acid (EPA; 20:5n-3) in red blood cells, according to the results of a small study.

The study, which was funded by Monsanto Co. and The Solae Co., both based in St. Louis, Missouri, USA, was presented in November 2009 at the American Heart Association’s (AHA) Scientific Sessions 2009 (*Circulation* 120:S456, 2009). The AHA presentation followed on the heels of an announcement by the two companies that oil from Monsanto’s bioengineered soybean, which expresses between 15 and 30% SDA, had been given GRAS (Generally Recognized as Safe) status by the US Food and Drug Administration.

Conversion of α -linolenic acid (ALA; 18:3n-3) to SDA in the human body is inefficient. However, conversion in the body of SDA to EPA is roughly 30% more effective than that of ALA to SDA. Therefore, Monsanto sought to bypass the ALA-to-SDA conversion step in the body by doing so in the soybean plant.

To do so, Monsanto researchers introduced two desaturase genes that encode for the proteins *Primula juliae* $\Delta 6$ desaturase and *Neurospora crassa* $\Delta 15$ desaturase. Soybeans lack $\Delta 6$ desaturase, and the minimal requirement for production of SDA in soybeans would be the introduction of a gene encoding $\Delta 6$ desaturase. However, $\Delta 6$ desaturase may also convert linoleic acid (LA) to γ -linolenic acid (GLA). “The addition of a $\Delta 15$ desaturase with temporal expression similar to the $\Delta 6$ desaturase increases ALA levels, allowing greater flux to SDA,” Monsanto said in its GRAS submission. “The $\Delta 15$ desaturase also lowers LA levels, thus lowering the substrate pool for GLA production. Compositional data on several lots of SDA soybean oil support the opinion that the phenotype is stable over several generations.”

CONTINUED ON PAGE 41

ment of Agriculture. The GA21 trait genetically enhances corn seeds with a built-in resistance to herbicides. The company said that the cultivation of GA21 corn will enable it to accelerate the development and introduction of better hybrid varieties and new traits, responding to the growing demand across the Asia Pacific region.

■■■

Origin Agritech Limited (Beijing, China) received final commercial approval in China for their GM phytase corn. Phytase is currently used as an additive in animal feed to breakdown phytic acid in corn, which holds 60% of the phosphorus in corn. Phytase increases phosphorus absorption in animals by 60%. Phosphorus is an essential element for the growth and development of animals and plays key roles in skeletal structure and in vital metabolic pathways. Phytase, as an additive for animal feed, is mandatory in Europe, Southeast Asia, South Korea, Japan, and other regions for environmental purposes.

According to Origin, phytase transgenic corn will allow animal feed producers the ability to eliminate purchasing phytase and corn separately, as well as the need to mix the two ingredients together.

■■■

Bayer CropScience (Monheim am Rhein, Germany) and FuturaGene PLC (London, United Kingdom) have entered into a license agreement for a drought-tolerance technology. The agreement grants Bayer CropScience exclusive worldwide rights to utilize a FuturaGene drought-tolerance technology in cotton. FuturaGene will receive an upfront license fee, followed by development milestone payments and trait royalties on sales of cotton seeds incorporating this technology. Further financial details were not disclosed.

The technology licensed to Bayer is intended to protect the yield of cotton plants when they are subjected to drought. Drought hampers the cultivation of crops on more than 40% of the earth’s land surface. ■

Briefs

US detergent brand Wisk is cleaning up in many ways. The brand's owner, Sun Products, has developed a Facebook application named "Wisk-It" that allows users to target questionable photos of themselves housed on friends' Facebook pages. The application then sends an email to the friends that, when opened, shows the questionable photos and asks for their removal.



In a transaction that was expected to close by December 31, 2009, BASF Corp. signed an agreement in late November 2009 to sell its Clear Lake, Texas, USA, manufacturing facility. The new owner is Clear Lake Chemicals LLC, a Gulf Baysport subsidiary based in Pasadena, Texas. Clear Lake will toll-manufacture specialty surfactants for BASF under the agreement.



German specialty chemicals supplier Cognis has opened a new SO₃ sulfation plant at its site in Ecatepec, Mexico. The facility produces ingredients such as fatty alcohol sulfates, fatty alcohol ether sulfates, and other surface-active agents for use in products such as shampoos, shower gels, paints, paper coatings, and agrochemical applications. The new reactor uses crystalline sulfur instead of chlorosulfonic acid as the basis for the sulfation process. As a result, the products do not contain any chlorine by-products, according to Cognis.



More than a quarter (29%) of small businesses in the United States have cut back on workplace cleaning—citing the economic downturn—according to a survey conducted by The Procter & Gamble Co. (P&G) and the National Federation of Independent Business.

Although roughly one in three business owners (31%) recognized "cleanliness and appearance" as having the greatest impact on customers' first impressions, a significant number have curtailed their cleaning processes. Eliminating professional cleaning services and buying less expensive or generic

Surfactants, Detergents, & Personal Care News

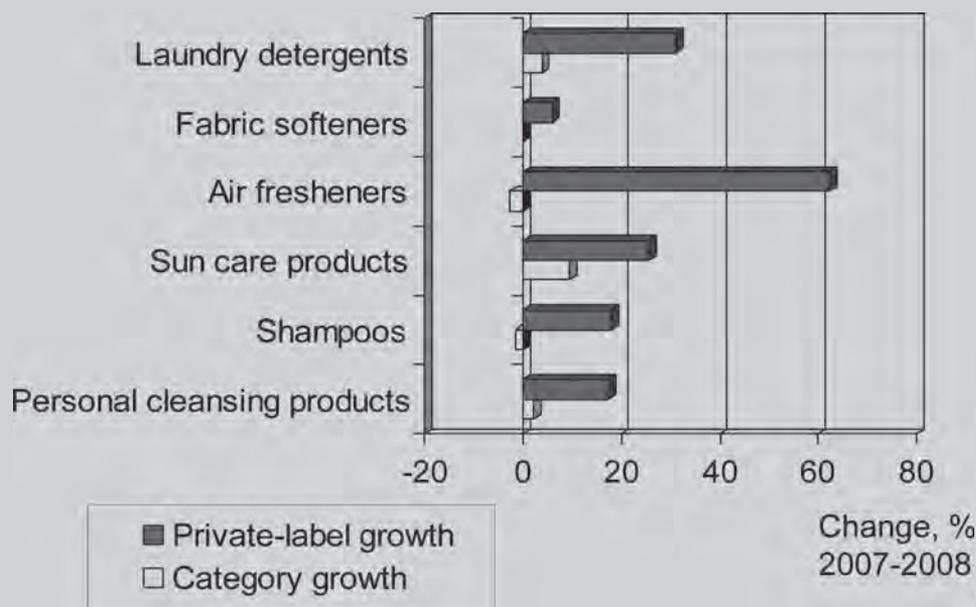


FIG. 1. US growth of private-label vs. total category, 2008. © 2009 Kline & Company.

Beginning with this issue, what previously was known as the "S&D News" becomes the "Surfactants, Detergents, and Personal Care News." We hope the change better reflects the diverse interests and job responsibilities of our members.

Consumer products poised for a rebound in 2010

Carrie Mellage

No doubt 2009 will go on record as one of the toughest years in the world's economic history, leveling a serious blow to the consumer products industry. Struggling with declining sales and profits, many retailers have shuttered doors or closed down completely. However, if history teaches us

anything, it is that "This too shall pass." New US GDP (gross domestic product) figures already show a promising 3.5% growth rate for the third quarter, and we're seeing signs of a slow (and hopefully steady) recovery. As we look ahead to 2010, we'll examine the question: What can consumer product companies do to get a jump on the recovery and get ahead in the coming year?

In nearly every sector, 2009 was unquestionably a rough year for the consumer markets. The news was dismal from both manufacturers and retailers:

- Store closings (C.O. Bigelow, Crabtree & Evelyn, and Ann Taylor, to name a few)
- Complete shutdowns (Linens 'N Things, Fortunoff, and Illuminations bid a final farewell)
- Discontinued brands (the legendary Max Factor has been pulled in the United States, and Prescriptives is no more)

Stymied by a steep increase in cost of goods sold for most of 2008 and followed by sharp sales declines in 2009, many

marketers were forced to cut ad spending considerably. This leveled a serious blow to a number of magazines; some of which—including Conde Nast's *Modern Bride*, *Elegant Bride*, and *Gourmet*, as well as *Domino* and *Vibe*—were forced out of print due to low ad spending. The news, however, has been relatively good for the consumer, as many of the major manufacturers turned to offering hefty promotions to retain and attract new customers.

THE BRIGHT SIDE

Fortunately, the news for marketers hasn't been all bad, so long as one knows where to look. The naturals segment remains a relatively high-growth proposition from both a product and packaging standpoint in personal care and in home care. Sales of natural personal-care products in the United States grew by about 8% in 2009—down from 15.3% in 2008, but still well ahead of the overall market. Meanwhile, US sales of Seventh Generation natural household cleaning products more than doubled in 2008.

Around the world, consumers seem to have fallen in love with the idea of preserving the environment through the use of natural (or naturally inspired) products or concentrated formulations that reduce wasteful packaging—and marketers and retailers have responded. In the BRIC countries (Brazil, Russia, India, and China), the growth in naturals has been spectacular, with each market adopting its own unique perspective on this trend. In Brazil, the naturals movement is about biodiversity and the rainforest connection; in Russia, the emphasis is on Siberian earth minerals; India's surge is based on traditional Ayurvedic principles; and China's long heritage of herbal medicine serves as a foundation in this high-growth market.

Value brands and value channels have weathered the storm quite well, albeit at the expense of luxury brands and retailers, as consumers look to cut costs at every opportunity. Perhaps the biggest indicator of this trend in the United States has been the incredible surge in sales of private-label products (see Fig. 1). In many product categories, private-label products registered double-digit gains—as much as 30% in laundry detergents and liquid soaps—while the product categories as a whole barely stayed even or even lost momentum.

Already a number of earnings reports

have indicated that 2010 will be the Year of Recovery—Procter & Gamble and Estée Lauder have both posted better-than-expected quarterly results. By far, the key to success in the coming year will be to take action—serious action—to turn these tip-of-the-iceberg glimmers into sustainable growth.

INNOVATION: THE KEY TO RECOVERY

Innovation in both product development and marketing strategy will be a key component in getting ahead of the curve as consumers begin to feel more comfortable. It took the industry about five years to recover from the last major recession (1990–1991), and even then it was innovation, particularly in the mass skin-care category, that lit the path to recovery.

Although the new GDP recovery numbers are promising, there is some evidence that the recovery may be coming at the expense of “intangible investments” such as research and development and new product design. In other words, in an effort to cut costs and quickly restore profitability, some companies have slashed investment in areas that drive innovation, which could come back to haunt them in the very near future.

To prevent this innovation backslide, new product activity must be dusted off and pushed forward to renew consumer excitement in shopping, spending, and trying new products. By invigorating the market with new formulations, novel delivery systems, and updated packaging, branded companies can differentiate themselves against the private-label surge. It may seem tempting to pull back brand support to trim costs, but marketers must continually re-invest to maintain a competitive edge and stave off pressure from private-label competitors.

SOCIAL MEDIA: OPENING NEW DOORS

Beyond product innovation, marketers must leverage the power of the Internet and social media to connect with consumers. As a sales channel, the Internet is no longer insignificant in the personal-care market with online sales tripling over the last five years. Consumers love the wider selection, competitive pricing, and the convenience of shopping online, especially for replenishment of higher-priced items.

products are the most common ways owners have cut back, while others now clean less often or buy fewer products. Of those who have altered their cleaning practices, almost half (44%) report negative repercussions, such as rising customer and employee complaints and longer cleaning time when using cheaper products.



The Beauty Care Research Laboratories of Kao Corp. and the Technology Center of Kanebo Cosmetics Inc.—a Kao subsidiary—have announced the development of a new material: surface-treated flake zinc oxide. The companies say that the material provides “effective daily protection against UV-A rays (longer-wavelength ultraviolet rays), which can damage the deeper layer of skin and cause skin changes such as flecks.” The technology will be used in sunscreens and daytime-use aging skin care products.



EUCODIS Bioscience, an Austrian company that develops and markets industrial enzymes, has entered into a research agreement with Bio Sidus, a Latin American biopharmaceutical company. Under the agreement, EUCODIS has exclusive access to search for enzymes of interest in Bio Sidus' proprietary collection of psychrophilic bacteria strains and other organisms isolated from the Antarctic and the surrounding oceans. Psychrophiles are organisms that thrive at low temperatures. EUCODIS Bioscience will use its experience in enzyme development to screen the strains for enzymatic activities that can be used in industrial and other commercial applications.



The merger of the Professional Beauty Association (PBA; Scottsdale, Arizona, USA) and the National Cosmetology Association (NCA; Chicago, Illinois, USA) became official on January 1, 2010. NCA will join PBA's three existing company-based membership sections at PBA headquarters in Scottsdale as a fourth NCA membership section. ■

The explosion in social media has made the prospect of entering 2010 without a social media strategy in place akin to entering a dark cave with a candle—sure, there will be lots of opportunity out there, but you’ll be missing out on it. A number of savvy brand marketers have already begun to tap into these ubiquitous—and entirely affordable—new media and have discovered the awesome power of engaging consumers on a more personal level. From fan sites on Facebook to tweeting on Twitter, social media are all about creating connection in an atmosphere of mutual benefit for both buyer and seller.

Cosmetic brands have used the YouTube platform as a how-to channel for demonstrating proper makeup application techniques—Lancôme’s demonstration of how to apply its new vibrating brush mascara and Maybelline’s mineral makeup foundation video are two examples that drive consumer interest and investment in the products. Meanwhile, Gillette’s provocative “How to Shave Your ...” YouTube video series takes a somewhat tongue-in-cheek look at personal grooming. Frankly, from a cost vs. benefits perspective, it is impossible to ignore the potential return on investment from a single YouTube clip gone viral.

GLOBAL MARKET PERSPECTIVE: A MUST FOR SUCCESS

From a manufacturing and distribution standpoint, marketers must become well attuned to the competitive landscape—on a global scale—and keep a watchful eye on changing cost structures, competitors’ activities, product development, and consumer trends. With the worst of the recession behind us, access to accurate and timely data about the markets and consumer behavior will be critical in remaining one step ahead of evolving opportunities. With retailer inventories tighter than ever, marketers must be able to anticipate changes in demand and up-and-coming trends to maintain a proactive—rather than reactive—posture.

Ironically, even though the economy seems weak, now is the perfect time to explore a global strategy. The market has suffered the most in mature countries, but growth in nearly all product categories in developing countries such as Brazil, India, and China remains quite robust. Tempting as it may be, now is not the time to restrain

international expansion; instead, embrace it as an opportunity to gain an early foothold as these economies take off. With a strong presence on the ground in these regions, Kline’s international experts know the culture, understand the competitive landscape, and can provide invaluable insight that can maximize the opportunities and minimize the risk.

Certainly, 2009 may go down in history as one of the worst times in our modern economic history. However, in retrospect, it may also be celebrated as a turning point, one in which the troubled economy forced marketers, retailers—and consumers—to rethink and retool their operational strategies. As we kick off 2010 with a much more optimistic outlook, it is a safe bet that we’ll soon view 2009 as a period of necessary “growing pains” that ultimately propel the industry forward.

Carrie Mellage is director, Consumer Products at Kline & Company’s office in Little Falls, New Jersey, USA. She can be reached at Carrie.Mellage@klinegroup.com.

Knocking nanoparticles off the socks

In a finding with important environmental implications, researchers are reporting how silver nanoparticles used in anti-odor socks come off during laundering.

Scientists in Switzerland have reported results of one of the first studies on the release of silver nanoparticles from laundering anti-odor, anti-bacterial socks now on the market. Their findings, which appeared in *Environmental Science & Technology* (43:8113–8118, 2009), may suggest ways that manufacturers and consumers can minimize the release of these particles to the environment, where they could harm fish and other wildlife.

In the study, Bernd Nowack and colleagues note that widespread use of silver nanoparticles in consumer products, especially textiles, likely results in the distribution of nanoparticles in lakes and streams. Manufacturers favor silver nanoparticles because their antibacterial action slows the growth of odor-causing bacteria. The scientists studied release of nanoparticles in laundry water from nine different textiles,



Courtesy of Wikimedia Commons

including different brands of commercially available anti-odor socks. In previous studies, socks were laundered in pure, distilled water.

They found that most of the released particles were relatively large and that most came out of the fabrics during the first wash. The total released varied from 1.3% to 35% of the total nanosilver in the fabric. Bleach generally did not affect the amount released.

“These results have important implications for the risk assessment of silver textiles and also for environmental fate studies of nanosilver, because they show that under certain conditions relevant to washing, primarily coarse silver-containing particles are released,” the paper says.

Organic personal care standards no closer

Prospects for globally harmonized “natural” and organic cosmetic standards are not getting any closer, according to a study by the London-based Organic Monitor research and consulting firm.

Although certification programs do have regional and in some cases global recognition, the research company claims that even on a regional basis, certification is limited. In Europe, the Ecocert (France) and BDIH (Germany) certification programs are the most successful, the study says.

“Ecocert’s popularity has been driven by the fact that it runs two certification programs: one for natural products and one for organic products,” Organic Monitor notes.

In North America, less than 5% of “natural” and organic products are certified. The new NSF ANSI 305 “made with organic” standard is expected to gain momentum once certification begins, the report states. However, Organic Monitor says that “as in Europe, there is a significant hole in the North American certification landscape as there is no categorical organic certification standard, which is pushing manufacturers to adopt the US Department of Agriculture (USDA) NOP (National Organic Program) standard.”

In other regions such as Asia and Latin America, the certification of “natural” and organic personal care products is still very much in its infancy, the firm says.

For more information about the report, see www.organicmonitor.com/804111.htm.

Unilever and P&G change R&D

Consumer products giants Unilever and P&G are realigning several research and development units.

Unilever is combining its Chicago-based antiperspirants, deodorants, and hair care group with its skin care business, to create a Personal Care (PC) business unit based at the company’s North America headquarters in Englewood Cliffs, New Jersey. Because of the integration, Unilever will close the Chicago offices by July 2010. The move will affect approximately 200 employees, the company said in a news release.

Meanwhile, P&G told the *Boston Globe* newspaper that it is centralizing some of its R&D facilities, “and one result is that a Needham [Massachusetts] facility will be closed in 2012,” the report said. The company did not reply to requests for confirmation.

The Needham facility’s 105 employees will be transferred to other P&G facilities in locations such as South Boston; Bethel, Connecticut; Ohio; and Germany, P&G told the newspaper, adding that the transitions will begin in 2010 and will be completed by June 2012. ■

Meet Bernhard Seifried

Mountain climber, globetrotter, toymaker, inventor, 2009 AOCS Honored Student, soon-to-be post-doc: These are only a few of the important details about Bernhard Seifried, who currently is working on his Ph.D. at the University of Alberta (UofA) in Canada. He plans to complete his work in June 2010 and then work as a post-doc in Chile on a multidisciplinary project related to biodiesel production from microalgae.

Seifried was born in Haag, Austria, and received his M.Sc. in chemical engineering from Graz University of Technology. That is where he first encountered supercritical fluid (SCF) processing of lipids as he studied the extraction of rapeseed oil using supercritical carbon dioxide (SC-CO₂).

“I was fascinated by the many possibilities of SCF, especially for sustainable process developments due to the versatile and environmentally friendly properties of CO₂ as a solvent,” he remembers.

Before finishing his master’s, Seifried worked on a project at the UofA Department of Civil and Environmental Engineering, where he designed a high-pressure cell equipped with a quartz crystal microbalance (QCM) to measure solubilities of metal chelates in SC-CO₂.

“The QCM is able to detect mass changes in the range of nanograms. The aim was to find out if SCF technology may be used to clean up contaminated soil,” he says.

“While working on that project at the UofA,” he continues, “I met two important women in my life, who were about to have a significant impact on my life. The first one was Susan, my girlfriend, and the second was my current supervisor, [AOCS member] Feral Temelli from the Department of Agriculture, Food and Nutritional Science at the University of Alberta.”

After finishing his master’s in Austria, he returned to the UofA to start his Ph.D. program in bioresearch and food engineering, “where I now explore the potential of SCF for lipid processing, focusing on particle formation and microencapsulation of marine lipids.”

CONTINUED ON PAGE 43



Honored Student Bernhard Seifried and his girlfriend, Susan Armijo-Olivo, climbing a mountain near Maligne Lake in Canada’s Jasper National Park. Seifried equates mountain climbing to research, noting that “to reach the top of a mountain requires endurance, strength, many hours of effort, and the will to keep going. So it is very much like research, except that with research, we don’t always see the summit because of the clouds.”

People News/ Inside AOCS

No shooting on the Expo floor

Catherine Watkins

Urban myth and a multitude of websites suggest it is illegal to shoot camels in Arizona. This may actually have been the case at one time, because the US Army established a Camel Corps in the mid-1800s to create an alternative means of transportation in the dry and dusty southwestern United States. The Civil War in the 1860s put an end to the Camel Corps experiment, although reports of camel sightings continue to this day.

What does any of this have to do with the 101st AOCS Annual Meeting & Expo, you ask? First, because it will be held in Phoenix, Arizona, USA, on May 16–19, 2010. Second, because we would like to declare—tongue firmly in cheek—a ban on shooting (with anything other than a camera) the CAML on the Expo floor.

In this case, CAML stands for “Crop Analytics Mobile Laboratory,” the versatile on-the-go laboratories developed and used by Monsanto Co. at grain elevators to ensure that its low-linolenic Vistive soybeans have not been contaminated with commodity soybeans. The unit consists of a small semi-trailer that travels by standard over-the-road trucking equipment and will fit nicely on the Expo floor.



Monsanto Co.'s CAML, or Crop Analytics Mobile Laboratory, which will be a part of the 2010 AOCS Annual Meeting & Expo.

At a glance

- 101st AOCS Annual Meeting & Expo
- May 16–19, 2010
- Phoenix Convention Center, Phoenix, Arizona, USA
- The last day for online registration discounts is March 1, 2010. Visit <http://AnnualMeeting.aocs.org> to register or to find the latest information on the technical program.



The CAML is equipped with a fast gas chromatography system and a near-infrared (NIR) spectrometer. The lab also is stocked with an NIR and spare parts so the technicians can make minor repairs.

Meeting attendees will be able to tour the CAML during Expo hours. In addition, AOCS Technical Services plans special demonstrations of AOCS Methods during lunch breaks. More details will follow in next month's *inform*.

OPTIONAL TOURS

The aim of this year's tour offerings for guests is to present the best of the US Southwest, from red rocks to Arabian horses.

The traditional opening day city tour

on Sunday, May 16, will feature sightseeing in both Phoenix and Scottsdale. Each city offers a blend of Native American, Hispanic, and Old West ambience, complete with modern architecture against a dramatic red rock desert backdrop. Sights on tap include historic buildings and beautiful residential neighborhoods. The tour guide will also introduce area museums, art galleries, points of interest, and shopping centers.

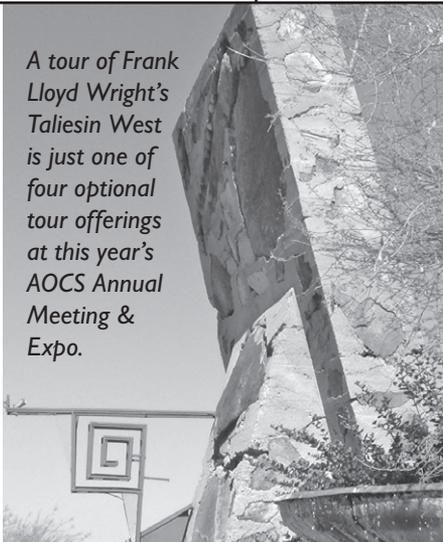
Monday, May 17, is reserved for a full-day exploration of nearby red rock mountains, with artisan shops and galleries thrown in for good measure. On this Red Rocks of Sedona Tour, participants will learn about the many red rock formations for which Sedona is famous and travel through the diverse terrain of the Sonoran Desert, home of Phoenix; Verde Valley; and Camp Verde. Sedona itself is about 100 miles (160 km) from Phoenix.

Tuesday afternoon, May 18, is reserved for the Taliesin West Insight Tour. This Frank Lloyd Wright masterpiece demonstrates how the architect related his designs to the desert. Participants will see the Taliesin theater, music pavilion, cabaret cinema, and Frank Lloyd Wright's private office. The world-famous complex sits in the middle of 600 acres of Sonoran desert in North Scottsdale and served as Wright's winter residence and studio.

The optional tour program will end on Wednesday, May 19, with a morning tour of the Los Cedros Arabian Horse Ranch. There, participants will see an equine swimming pool as well as a presentation of many National Champion horses. Throughout the tour, the guide will provide stories about the horses, their history, and their accolades. The tour, which is also serving as a special interest opportunity for the AOCS Agricultural Microscopy Division, will present some of the science behind feed evaluation and equine nutrition.

Tour tickets may be purchased at the

A tour of Frank Lloyd Wright's Taliesin West is just one of four optional tour offerings at this year's AOCS Annual Meeting & Expo.



time of registration, and tours are booked on a first-come, first-served basis until the tour is sold out. If a tour or event must be cancelled because of insufficient registrations, persons who purchased tickets will be notified and given refunds. For complete tour descriptions, visit <http://AnnualMeeting.aocs.org> and click on "Tours."

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

Mailer receives Farrer Memorial Medal

Winners of the Farrer Memorial Medal are selected by trustees of the Farrer Memorial Research Scholarship Fund to recognize persons who have rendered distinguished service in agricultural science in Australia in the fields of research, education, or administration. AOCS member **Rodney Mailer** was presented this medal in Sydney on September 28, 2009, in conjunction with the joint meeting of the World Congress on Oils and Fats and the 28th International Society for Fat Research (ISF) Congress, which he chaired. Mailer is also currently president of ISF.

The award was presented for his contribution to edible oils research in Australia, in particular his work on canola and olive oil. Among other things, Mailer was cited for his involvement "with the release of 22 canola cultivars, which have at times made up 50% of Australia's \$600 million canola crop," according to **Richard Sheldrake**,

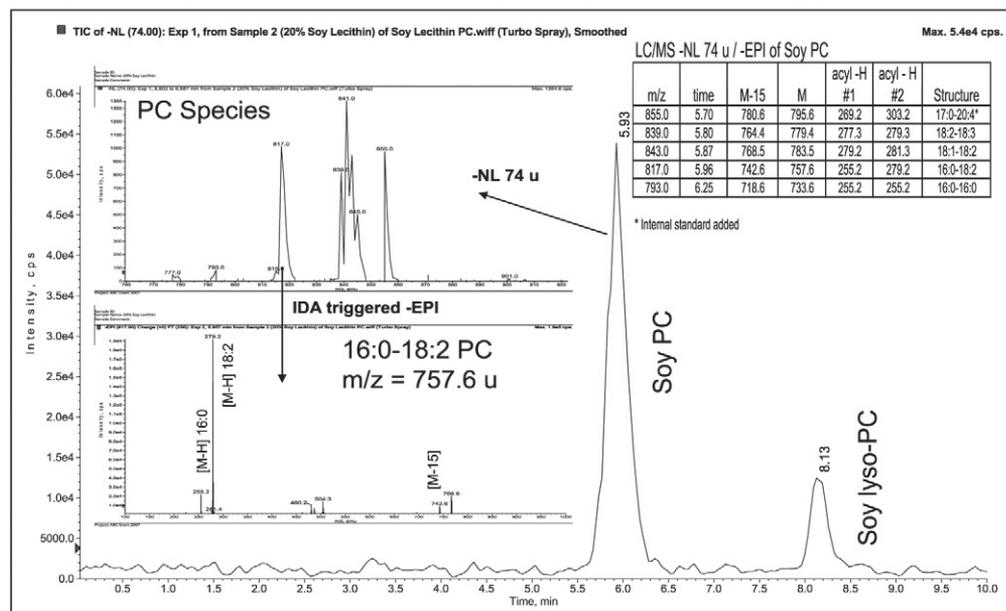


Rodney Mailer receiving the Farrer Medal from Richard Sheldrake, Industry & Investment NSW Director-General.

chairman of the Trust. He added, "His studies on olive oil quality, harvest timing, irrigation, and storage have earned Dr. Mailer international recognition for his major contribution to the development of the Australian olive industry."

Mailer is principal research scientist with the New South Wales Department of Primary Industries and the EH Graham Centre for Agricultural Innovation at the Wagga Wagga Agricultural Institute. He is also the Australian representative for

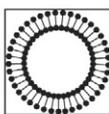
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fats and oils on the Technical Committee 34/Subcommittee 11 of the International Standards Organisation. After he was presented with the Farrer Memorial Medal at the World Congress, he delivered a talk on "The Good Oil."

Management changes at ADM

Archer Daniel Midland Co. (ADM; Decatur, Illinois, USA) has appointed **Brent Fenton** as the new managing director of European Oilseeds, replacing **Joe Taets**. Taets was recently named as the new vice president of the ADM Grain Group, and is moving to ADM headquarters.

Fenton, who formerly was vice-president of ADM's North American Oilseeds Processing, will move to Rolle in Switzerland and report to Oilseeds president **Mark Zenuk**. Fenton is on the board of directors of the Canadian Oilseed Processors Association, the Canola Council of Canada, the National Cottonseed Products Association, and the Golden Peanut Company.

Kullman becomes DuPont chairperson



As of December 31, DuPont's chief executive officer, **Ellen Kullman**, took office as chair of the company's Board of Directors. Kullman replaces **Charles O. Holliday, Jr.**, who retired from the Board on that date after 11 years as chairman.



Valle as research fellow for Codexis

Codexis, Inc. (Redwood City, California, USA) announced in November that **Fernando Valle** had joined the company as its first research fellow. Valle has had a 30-year

career in industrial biotechnology as a researcher in metabolic and genetic engineering. He formerly held positions with LS9 and Genencor.

In his new position he will focus on Codexis' advanced biofuels programs.

Calton joins Lipid Nutrition

Gita Calton was hired in mid-November 2009 by Lipid Nutrition (Wormerveer, the Netherlands) as a technical key account manager of the eastern section of the United States. Her primary responsibility will be the continual development of this market for Clarinol™ CLA, PinnThin™, and Marinol™ Omega-3 fish oils.



Clarinol CLA (conjugated linoleic acid) received GRAS approval in July 2008, and Calton will concentrate on increasing

its incorporation into more daily food items. Calton came to Lipid Nutrition with experience as a sales manager with Fuji Oils.

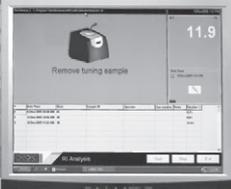
Bunge announces two appointments

On January 1, 2010, **Carl Hausmann**, chief executive officer (CEO) of Bunge North America (White Plains, New York), assumed the role of managing director of global government and corporate affairs for the company. He will coordinate Bunge's government affairs, corporate sustainability, and community relations on a global level. Hausmann had served as CEO of Bunge North America since 2004. Before that he was CEO of Bunge Europe and of Cereol S.A. prior to its acquisition by Bunge in 2002. He started his agribusiness career with Continental Grain.

Soren Schroder, who has been with Bunge since 2000, replaced Hausmann as CEO of Bunge North America. Schroder had been serving as vice president, agribusiness for Bunge Europe. He has also worked for Continental Grain and Cargill. ■

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Book Review

Advances in Deep-Fat Frying of Foods

Serpil Sahin and Servet Gülüm Sumnu (eds.)

CRC Press/Taylor and Francis Group, 2008

321 pages, \$169.95

ISBN: 978-1-4200-5558-0

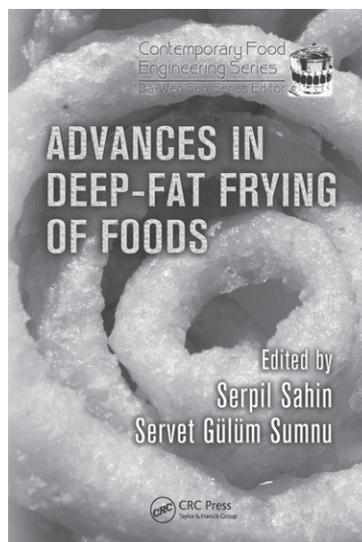
Robert A. Yates

Deep-fat frying is one of the oldest known ways to prepare a wide variety of foods for both immediate and delayed consumption. It is used in the home to prepare single servings, in the restaurant to prepare multiple servings, and in the factory to prepare bulk quantities. Worldwide, it is a billion-dollar industry owing to its versatility, flexibility, and economics. Understanding deep-fat frying requires knowledge of both chemistry and engineering principles, and it is only recently that new methods of analysis have made investigating some of the finer details possible. Over 20 scientists from North America, Europe, and South America contributed to *Advances in Deep-Fat Frying of Foods* on various aspects of this complex process.

The chemistry of what happens when triacylglycerols are heated to the temperatures necessary for frying in the presence of water and oxygen is well known. The chapter devoted to changes in oil owing to the chemistry of frying explains oxidation, hydrolysis, and thermal degradation in good detail. The migration of food components into the oil and chemical interactions between food and oil are also described. A separate chapter describes how chemical changes affect the quality of the frying oil. The latest methods for measuring oil degradation are discussed and well referenced.

The chapter on heat and mass transfer between the food and the frying medium is very detailed. Convective heat transfer from the oil to the product, convective heat transfer coefficient during frying, coupled heat and mass transfer inside the product, and the mechanism of oil uptake are all explained using a well-balanced combination of text, equations, and illustrations. Other details include the numerous kinetic and physical changes that take place and descriptions of how they determine the overall quality of the fried food.

Batters and breading contribute greatly to the appearance, texture, and flavor of the many fried products. In fact, a full chapter is devoted to batter rheology because it is so important to the manufacturing process and final food quality. The chapter provides substantial information on how different flours, starches, and proteins affect batter rheology. Methods of measuring batter rheology are explained and well referenced.



Acrylamide is a potential carcinogen that is formed in some foods during frying at high temperatures. The mechanism of acrylamide formation is shown and the process parameters that affect its concentration are reviewed. Several viable strategies to reduce acrylamide concentration in deep-fried foods are provided.

Large-scale deep-fat frying operations are a major segment of the food industry. The chapter on industrial frying describes the variety of equipment

available for both batch and continuous frying processes. Examples of typical frying processes for thin potato chips, extruded products, and coated products are used to explain the unique requirements for frying these foods in large quantities.

The book concludes with a brief chapter on recent developments in alternative frying technologies. Vacuum frying, pressure frying, and even application of microwave heating are now being used to enhance the quality of fried foods. Lower oil uptake and lower acrylamide concentrations are the two greatest advantages of these alternative technologies.

Advances in Deep-Fat Frying of Foods is part of the Contemporary Food Engineering Series by Da-Wen Sun, the series editor. Researchers and food processors working in the field of frying should find this volume very useful. The greatest shortcoming of the book is that all of the illustrations and photographs are in grayscale. Although grayscale is fine for many of the figures, it would have been more beneficial if items such as photographs used to illustrate the color classification of deep-fried foods had been printed in color.

Robert A. Yates is manager, analytical services and regulatory affairs for The Dallas Group of America, Inc. He has a B.S. in chemistry and over 30 years experience with a company that supplies active filter aids and oil filtration equipment to the foodservice industry, plus additional experience in the retail frying industry. He can be reached at 110124.2220@compuserve.com.

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Patents

Published Patents

Method for manufacturing ethyl esters from fatty substances of natural origin

Hillion, G., and B. Delfort, Institut Français du Pétrole, US7566794B2, July 28, 2009

A method allowing, from natural fat or oils, or from other glyceride mixtures, to obtain fatty acid ethyl esters that can be used as gas oil substitutes, comprises: stage (i) oil, fat, or a glyceride mixture is transesterified by ethanol using a soluble catalyst or a catalyst that becomes soluble during the reaction; stage (ii) resultant glycerin is decanted and removed, without requiring an excess ethanol evaporation operation; stage (iii) a second transesterification is conducted to obtain a product whose ester content is at least 97% by mass; stage (iv) evaporation of excess ethanol is carried out in the presence of the catalyst under suitable conditions preventing a reverse transesterification reaction, the resultant ethanol being practically anhydrous; stage (v) the ester undergoes purification by water wash sequences; and stage (vi) the ester is dried under reduced pressure.

Lube base oil and lubricating oil composition

Egawa, T., *et al.*, Idemitsu Kosan Co., May 19, 2009, US7534749B2

The invention provides a lube base oil other than silicone oil having a kinematic viscosity of 12 mm²/s or below at 40°C, exhibiting, in Noack test (250°C, 1 hr), an evaporation loss of 30 mass % or below and/or a flash point of 200°C or higher, and exhibiting an aniline point of 60°C or higher. It also provides a lubricating oil composition comprising the lube base oil mixed with at least one additive selected from the group consisting of an antioxidant, a viscosity index improver, a detergent dispersant, a friction-reducing agent, a metal inactivator, a pour point depressant, an abrasion-resisting agent, a defoamer, and an extreme-pressure additive. The lube base oil and the lubricating oil composition realize reduction of evaporation loss despite being of low viscosity and excellent compatibility with organic materials.

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.



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Extracts & Distillates

Effects of lutein and zeaxanthin on aspects of eye health

Ma, L., and X.-M. Lin, *J. Sci. Food Agric.* 90:2–12, 2010.

Lutein and zeaxanthin are members of the oxygenated carotenoids found particularly in egg yolks and dark-green leafy vegetables. A great deal of research has focused on their beneficial roles in eye health. The present article summarizes the current literature related to the bioactivity of these carotenoids, emphasizing their effects and possible mechanisms of action in relation to human eye health. Available evidence demonstrates that lutein and zeaxanthin are widely distributed in a number of body tissues and are uniquely concentrated in the retina and lens, indicating that each has a possible specific function in these two vital ocular tissues. Most epidemiological studies and clinical trials support the notion that lutein and zeaxanthin have a potential role in the prevention and treatment of certain eye diseases such as age-related macular degeneration, cataracts, and retinitis pigmentosa. The biological mechanisms for the protective effects of these carotenoids may include powerful blue-light filtering activities and antioxidant properties. Although most studies point toward significant health benefits from lutein and zeaxanthin, further large-scale randomized supplementation trials are needed to define their effects on ocular function in health and disease.

Bile salt deconjugation and cholesterol removal from media by *Lactobacillus* strains used as probiotics in chickens

Ramasamy, K., *et al.*, *J. Sci. Food Agric.* 90:65–69, 2010.

Bile salt deconjugation by *Lactobacillus* strains is often closely linked to bile tolerance and survival of the strains in the gut and lowering of cholesterol in the host. The present study investigated the

deconjugation of bile salts and removal of cholesterol by 12 *Lactobacillus* strains *in vitro*. The 12 strains were previously isolated from the gastrointestinal tract of chickens. The 12 *Lactobacillus* strains could deconjugate sodium glycocholate (GCA, 16.87–100%) and sodium taurocholate (TCA, 1.69–57.43%) bile salts to varying degrees, with all strains except *L. salivarius* I 24 having a higher affinity for GCA. The 12 *Lactobacillus* strains also showed significant ($P < 0.05$) differences in their ability to remove cholesterol from the growth medium (26.74–85.41%). Significant ($P < 0.05$) correlations were observed between cholesterol removal and deconjugation of TCA ($r = 0.83$) among the *L. reuteri* strains (C_1 , C_{10} and C_{16}) and between cholesterol removal and deconjugation of TCA ($r = 0.38$) and GCA ($r = 0.70$) among the *L. brevis* strains (I 12, I 23, I 25, I 211, and I 218). In contrast, although *L. gallinarum* I 16 and I 26 and *L. panis* C 17 showed high deconjugating activity, there was no correlation between cholesterol removal and deconjugation of bile salts in these strains. The results showed that the 12 *Lactobacillus* strains were able to deconjugate bile salts and remove cholesterol *in vitro*, but not all strains with high deconjugating activity removed cholesterol effectively.

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

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

Conjugated linoleic acid (CLA) isomers in oils are currently measured as fatty acid methyl esters by a gas chromatography–flame ionization detector (GC–FID) technique, which requires approximately 2 h to complete the analysis. Hence, we aim to develop a method to determine CLA isomers in CLA-rich soy oil rapidly. Soy oil with 0.38–25.11% total CLA was obtained by photo-isomerization of 96 soy oil samples for 24 h. A sample was withdrawn at 30 min intervals with repeated processing using a second batch of oil. Six replicates of GC–FID fatty acid analysis were conducted for each oil

sample. Oil samples were scanned using attenuated total reflectance–Fourier transform infrared (ATR–FTIR) spectroscopy, and the spectra were collected. Calibration models were developed using partial least-squares (PLS-1) regression using Unscrambler software. Models were validated using a full cross-validation technique and tested using samples that were not included in the calibration sample set. Measured and predicted total CLA, *trans,trans* CLA isomers, total mono *trans* CLA isomers, *trans*-10,*cis*-12 CLA, *trans*-9,*cis*-11 CLA and *cis*-10,*trans*-12 CLA, and *cis*-9,*trans*-11 CLA had cross-validated coefficients of determinations (R^2_v) of 0.97, 0.98, 0.97, 0.98, 0.97, and 0.99 and corresponding root-mean-square errors of validation (RMSEV) of 1.14, 0.69, 0.27, 0.07, 0.14, and 0.07% CLA, respectively. The ATR–FTIR technique is a rapid and less expensive method for determining CLA isomers in linoleic acid photo-isomerized soy oil than GC–FID.

Evaluation of virgin olive oil thermal deterioration by fluorescence spectroscopy

Tena, N., *et al.*, *J. Agric. Food Chem.* 57:10505–10511, 2009.

The evolution of fluorescent compounds during the thermal deterioration of virgin olive oil is not yet well known. Samples of heated virgin olive oils collected from a fryer every 2 h up to 94 h were analyzed to study their fluorescence spectra, as well as the evolution of the concentrations of α -tocopherol and individual phenols, by high-performance liquid chromatography (HPLC). The regions of the fluorescence spectra of the heated oils, diluted in hexane at 1%, were explained by the content of these compounds with regression coefficients higher than 0.90 (R^2 adjusted). The fluorescence intensity recorded at 350 nm and the wavelength of the spectrum maximum in the range of 390–630 nm also allowed for the explanation of the increase of the percentage of polar compounds during the experiment. On the other hand, the spectra of the undiluted heated oils indicated that the maximum of the spectrum of any undiluted oil at 490 nm or beyond is related to a percentage of the polar compounds higher than 25%, which is the maximum percentage accepted for edible oils used in frying processes.

Mechanisms of aqueous extraction of soybean oil

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

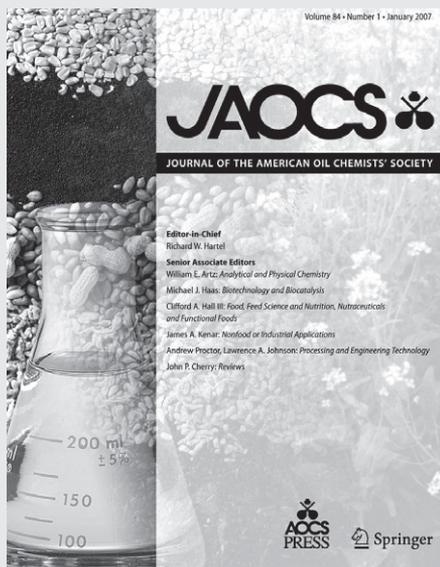
Aqueous extraction processing (AEP) of soy is a promising green alternative to hexane extraction processing. To improve AEP oil yields, experiments were conducted to probe the mechanisms of oil release. Microscopy of extruded soy before and after extraction with and without protease indicated that unextracted oil is sequestered in an insoluble matrix of denatured protein and is released by proteolytic digestion of this matrix. In flour from flake, unextracted oil is contained as intact oil bodies in undisrupted cells, or as coalesced oil droplets too large to pass out of the disrupted cellular matrix. Our results suggest that emulsification is an important extraction mechanism that reduces the size of these droplets and increases yield. Protease and sodium dodecyl sulfate were both successful in increasing extraction yields. We propose that this is because they disrupt a viscoelastic protein film at the droplet interface, facilitating droplet disruption. An extraction model based on oil droplet coalescence and the formation of a viscoelastic film was able to fit kinetic extraction data well.

Effect of the solvent type and temperature on phytosterol contents and compositions of wheat straw, bran, and germ extracts

Dunford, N.T., *et al.*, *J. Agric. Food Chem.* 57:10608–10611, 2009.

Wheat fractions, such as bran, germ, and straw, are rich in a number of health-beneficial bioactive compounds. However, they have not been exploited to their full capacity for value-added product development. This study examines the potential of recovering phytosterol (PS)-enriched extracts from wheat germ, bran, and straw. The main objective of the study was to evaluate the effect of solvent type and temperature on PS content and composition in straw, bran, and germ extracts. Petroleum ether, chloroform, *n*-hexane, and ethanol were used as solvents. A pressurized solvent extraction system was used for extraction of wheat fractions. Germ extracts had the highest total PS content followed by straw

AOCS Journals



Journal of the American Oil Chemists' Society (December)

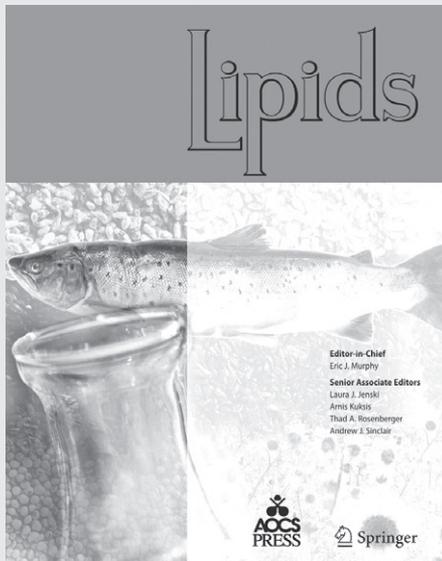
- Catalytic activity of ruthenium nanoparticles supported on carbon nanotubes for hydrogenation of soybean oil, Guo, S., K.Y. Liew, and J. Li
- Analysis of cod-liver oil adulteration using Fourier transform infrared (FTIR) spectroscopy, Rohman, A., and Y.B. Che Man
- Cholesterol, lipid content, and fatty acid composition of different tissues of farmed cobia (*Rachycentron canadum*) from China, Liu, S.C., D.T. Li, P.Z. Hong, C.H. Zhang, H.W. Ji, J.L. Gao, and L. Zhang
- Physical properties of rice bran wax in bulk and organogels, Dassanayake, L.S.K., D.R. Kodali, S. Ueno, and K. Sato
- Characteristics of oil from hullless barley (*Hordeum vulgare* L.) bran from Tibet, Qian, J., S. Jiang, W. Su, and P. Gao
- A comparative study of the properties of six Sudanese cucurbit seeds and seed oils, Mariod, A.A., Y.M. Ahmed, B. Matthäus, G. Khaleel, A. Siddig, A.M. Gabra, and S.I. Abdelwahab
- Microbial conversion of vegetable oil to rare unsaturated fatty acids and fatty alcohols by an *Aeromonas hydrophila* isolate, Nagao, T., Y. Watanabe,

K. Hiraoka, N. Kishimoto, T. Fujita, and Y. Shimada

- Frying stability of purified mid-oleic sunflower oil triacylglycerols with added pure tocopherols and tocopherol mixtures, Warner, K., and J. Moser
- Fatty acid, phytosterol, and polyamine conjugate profiles of edible oils extracted from corn germ, corn fiber, and corn kernels, Moreau, R.A., A.-M. Lampi, and K.B. Hicks
- Characterization of olive-leaf phenolics by ESI-MS and evaluation of their antioxidant capacities by the CAT assay, Laguerre, M., L.J. Ló Giraldo, G. Piombo, M.C. Figueroa-Espinoza, M. Pina, M. Benaissa, A. Combe, A. Rossignol Castera, J. Lecomte, and P. Villeneuve
- The influence of reaction parameters on the epoxidation of rapeseed oil with peracetic acid, Milchert, E., and A. Sma-gowicz
- Enzyme-assisted aqueous extraction of Kalahari melon seed oil: Optimization using response surface methodology, Nyam, K.L., C.P. Tan, O.M. Lai, K. Long, and Y.B. Che Man
- A laboratory decanting procedure to simulate whole stillage separation in dry-grind corn ethanol process, Wang, H., T. Wang, A.L. Pometto III, and L.A. Johnson

Lipids (December)

- n-3 PUFA as regulators of cardiac gene transcription: A new link between PPAR activation and fatty acid composition, Di Nunzio, M., F. Danesi, and A. Bordoni
- Impact of saturated, polyunsaturated and monounsaturated fatty acid-rich micelles on lipoprotein synthesis and secretion in Caco-2 cells, Jackson, K.G., P.A. Bateman, P. Yaqoob, and C.M. Williams
- Different ratios of docosahexaenoic and eicosapentaenoic acids do not alter growth, nucleic acid and fatty acids of juvenile cobia (*Rachycentron canadum*), Xu, Y., Z. Ding, H. Zhang, L. Liu, S. Wang, and J. Gorge
- Thermally induced isomerization of trilinolein and trilinoelaidin at 250°C: Analysis of products by gas chroma-



tography and infrared spectroscopy, Christy, A.A.

- Determination of lipid degradation by marine lipase-producing bacteria: Critical evaluation of lipase activity assays, Duflos, M., M. Goutx, and F. Van Wambeke
- Effects of weight loss on lipid transfer proteins in morbidly obese women, Laimer, M.W., J. Engl, A. Tschoner, S. Kaser, A. Ritsch, T. Tatarczyk, M. Rauchenzauner, H. Weiss, F. Aigner, J.R. Patsch, and C.F. Ebenbichler
- Plant stanol supplementation decreases serum triacylglycerols in subjects with overt hypertriglyceridemia, Theuwissen, E., J. Plat, C.J. van der Kallen, M.M. van Greevenbroek, and R.P. Mensink
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- Plant stanol esters lower serum triacylglycerol concentrations via a reduced hepatic VLDL-I production, Plat, J., and R.P. Mensink
- Isorhizochalin: A minor unprecedented bipolar sphingolipid of stereodivergent biogenesis from the *Rhizochalina incrustata*, Makarieva, T.N., A.M. Zakharenko, P.S. Dmitrenok, A.G. Guzii, V.A. Denisenko, A.S. Savina, D.S. Dalisay, T.F. Molinski, and V.A. Stonik

and bran extracts. β -Sitosterol, campesterol, and stigmasterol were the main PS in all of the extracts. Ethanol extraction resulted in the lowest total PS recovery from germ. Solvent type had a significant effect on PS composition in straw extracts. β -Sitosterol was the most abundant PS in straw hexane extracts (74% of total PS). Petroleum ether, chloroform, and ethanol extracted more stigmasterol than β -sitosterol from straw. This study demonstrated that the solvent type and temperature had significant effects on both PS content and composition of extracts collected from wheat fractions. Because of the complex nature of the agricultural materials, solvent selection and process optimization need to be based on experimental data. Pressurized solvent extraction is a useful technique to screen complex biological materials for their composition and to determine processing conditions to be optimized.

Effect of a purification step and the type of internal standard used on fatty acid determination of grass and maize silages

Alves, S.P., *et al.*, *J. Agric. Food Chem.* 57:10793–10797, 2009.

The fatty acid (FA) analysis of grass and maize silages was studied by application of a direct transesterification method (DT) followed by purification by solid-phase extraction (SPE). The choice of the internal standard (IS) for quantification of FA by gas-liquid chromatography (GLC) was also studied. The acidic DT method applied to grass silage samples produced a high amount of non-fatty acid methyl ester compounds (non-FAME) compared with those formed in maize silages. The application of the SPE cleanup step reduced significantly the amount of non-FAME compounds in both samples. Five FA were tested as IS; among them, 3 were naturally present in all silages; however, their use as IS did not affect quantification of total FA composition. Nevertheless, some minor FA present in silages were significantly affected by the IS used. Additionally, application of corrections to the GLC peak areas did not significantly influence quantification of total FA composition of silages.

ω -3 Long-chain polyunsaturated fatty acid intake and 12-yr incidence of neovascular age-related macular degeneration and central geographic atrophy: AREDS report 30, a prospective cohort study from the Age-Related Eye Disease Study

SanGiovanni, J.P., *et al.*, *Am. J. Clin. Nutr.* 90:1601–1607, 2009.

ω -3 (n-3) Long-chain polyunsaturated fatty acids (LCPUFA) affect processes implicated in vascular and neural retinal pathogenesis and thus may influence the risk of developing age-related macular degeneration (AMD). We investigated whether ω -3 LCPUFA intake was associated with a reduced likelihood of developing central geographic atrophy (CGA) and neovascular (NV) AMD. We undertook a nested cohort study within a multicenter phase 3 clinical trial, the Age-Related Eye Disease Study (AREDS), to study progression to advanced AMD in 1,837 persons at moderate to high risk of this condition. The AREDS was designed to assess the clinical course, prognosis, risk factors, and nutrient-based treatments of AMD and ran from November 1992 to December 2005. We obtained baseline data on ω -3 LCPUFA intake with a validated food-frequency questionnaire. Trained fundus graders ascertained AMD status from annual stereoscopic color photographs by using standardized methods at a single reading center across a 12-yr period. We applied multivariable repeated-measures logistic regression with the incorporation of generalized estimating equation methods, because this permitted determination of progression to outcome at each visit. Participants who reported the highest ω -3 LCPUFA intake (median: 0.11% of total energy intake) were 30% less likely than their peers to develop CGA and NV AMD. The respective odds ratios were 0.65 (95% CI: 0.45, 0.92; $P \leq 0.02$) and 0.68 (95% CI: 0.49, 0.94; $P \leq 0.02$). The 12-yr incidence of CGA and NV AMD in participants at moderate to high risk of these outcomes was lowest for those reporting the highest consumption of ω -3 LCPUFA. If these results are generalizable, they may guide the development of low-cost and easily implemented

preventive interventions for progression to advanced AMD.

Propagation techniques, evaluation, and improvement of the biodiesel plant, *Pongamia pinnata* (L.) Pierre—A review

Mukta, N., and Y. Sreevalli, *Ind. Crops Prod.* 31:1–12, 2010.

The leguminous tree *Pongamia pinnata* (L.) Pierre has been receiving considerable attention since its role as a feedstock for biodiesel production was defined and confirmed. Policy makers and scientists as well as farmers have turned their attention to this species since the benefits to be derived affect all the stakeholders. Tremendous interest has been generated for raising organized plantations of this untapped species. This has created the need for technology for its propagation and management. Though studies have been conducted on many aspects, the information is scattered. With this in view, the literature on important aspects of propagation, evaluation of genetic resources, and improvement has been reviewed to glean the available information that can form the guidelines for raising of plantations to meet the current need. This review also aims to assist in the identification of gaps in information while preventing duplication of research efforts and unnecessary outflow of valuable resources.

Potential antioxidant activity of γ -oryzanol in rice bran as determined using an *in vitro* mouse lymph axillary endothelial cell model

Huang, C.-c.J., *et al.*, *Cereal Chem.* 86:679–684, 2009.

A mouse lymphatic endothelial cell (SVEC4-10) *in vitro* model was developed and found to be effective in the study of antioxidant activity of γ -oryzanol in rice bran. The critical and vital parameters in developing these cell models included the emulsion preparation of hydrophobic compounds, the consistent management of cell culture, and the selection of cell viability detection methods compatible with the cell lines and the test substances. The SVEC4-10 cell line had a fast metabolism and consequently could be used to

determine antioxidant activity of a test substance in a relatively rapid manner. Results showed that γ -oryzanol, ferulic acid, and α -tocopherol could interact with cells such that oxidative damage induced by *tert*-butyl hydroperoxide on cellular mitochondrial activity lessened; and in some situations, γ -oryzanol was a more effective antioxidant than α -tocopherol. The results also suggested different antioxidant mechanisms among γ -oryzanol, ferulic acid, and α -tocopherol. The three major components of γ -oryzanol generally had higher antioxidant activity than γ -oryzanol, with 24-methylene cycloartanyl ferulate relatively more effective. Synergistic antioxidant activity among γ -oryzanol, ferulic acid, and α -tocopherol was also found.

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

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

Commercial rice bran contains 15–20% of oil and also an endogenous lipase that degrades the oil and produces free fatty acids (FFA). This study was undertaken to examine the quality of refined oil prepared from crude oil after the action of endogenous lipase in bran. The oil which was degraded by lipase to low, medium and high FFA, upon extraction in the rice bran oil industry were obtained and were refined in the laboratory, and quality of the oils was studied. The crude oils had FFA of 6.5, 36.0, and 87.0%; oryzanol content of 1.52, 1.55, and 1.65%; color of 32.0, 65.0, and 65.0 Lovibond units; unsaponifiable matter of 3.2, 4.2, and 4.9%; phytosterol content of 4,600, 4,000, and 1,900 ppm; and sum of tocopherols and tocotrienols of 962, 56, and 96 ppm, respectively. After refining these three crude oils (6.5, 36.0, and 87.0% FFA) were refined; the resultant oils had an FFA content of 0.4, 2.4, and 4.8%; oryzanol content of 1.13, 2.5, and 6.35%; color of 20.0, 55.0, and 50.0 Lovibond units; unsaponifiable matter of 3.5, 6.5, and 33.4%, phytosterol content of 4,900, 6,100, and 13,800 ppm, and the sum of tocopherols and tocotrienols of 1,050, 880, and 740 ppm, respectively. The refined oils produced from high-FFA crude oil had high amounts of unsaponifiable matter, oryzanol, phytosterols and sum of tocopherols and tocotrienols than the permitted level for refined rice bran oil. The

refined rice bran oil obtained from fresh rice bran (without lipase action) contained about 90% of triacylglycerols, whereas the refined oil from that of high FFA bran oil showed about 10% triacylglycerols. Hence, the latter cannot be used as an edible oil, but instead can be used at low levels as a nutraceutical in foods.

Comparative effects of tuna oil and salmon oil on liver lipid metabolism and fatty acid concentrations in rats

Huang, T., *et al.*, *J. Food Lipids* 16:436–451, 2009.

The comparative effect of tuna oil (TO) and salmon oil (SO) on the plasma and liver lipid and fatty acid compositions in Sprague-Dawley rats was investigated. The total triacylglycerol (TG) and total cholesterol (TC) concentrations in liver were significantly decreased in the TO group; TG level in liver was also significantly decreased in the SO group. The mRNA expression of HMG-CoA reductase in liver was significantly down-regulated in the TO and SO groups relative to the control group. The plasma TG and TC were decreased in TO, but not in SO; plasma low-density lipoprotein and very low-density lipoprotein levels in TO and SO were decreased compared with the control group. The content of total n-3 polyunsaturated fatty acids (PUFA) in plasma and liver phospholipids was significantly elevated in the TO and SO. Docosahexaenoic acid (22:6n-3) and eicosapentaenoic acid (20:5n-3) in tissues were significantly increased in the TO and SO, respectively. In this study, TO had a more beneficial effect on liver TC and plasma TG, TC, and high-density lipoprotein in rats than SO. The likely mechanism for lowering liver and plasma cholesterol by n-3 PUFA is to suppress the mRNA expression of gene encoding HMG-CoA reductase responsible for cholesterol biosynthesis.

trans-Fatty acids and cancer: A mini-review

Smith, B.K., *et al.*, *Brit. J. Nutr.* 102:1254–1266, 2009.

The association between *trans*-fatty acids (TFA) and cancer risk is poorly understood and remains controversial. It is recognized that unique biological effects are associated with specific isoforms within families of fatty acids such

as those belonging to the n-3 fatty acids. Furthermore, the interactions between diet and genetic polymorphisms are increasingly recognized for their potential risk-modifying effects on human health and disease. Therefore, the aim of the present review is to evaluate whether specific TFA isomers and genetic polymorphisms differentially modify cancer risk in prostate, colon, and breast cancers in animal and human models. Potential mechanisms of action by which TFA may affect cancer development are also reviewed. Overall, across a number of experimental models and human studies, there is insufficient and inconsistent evidence linking specific TFA isomers to cancers of the prostate, colon, and breast. A number of methodological limitations and experimental considerations were identified which may explain the inconsistencies observed across these studies. Therefore, further research is warranted to accurately assess the relationship between TFA and cancer risk.

Cholesterol oxidase: Physiological functions

Kreit, J., and N.S. Sampson, *FEBS J.* 276:6844–6856, 2009.

An important aspect of catalysis performed by cholesterol oxidase (3- β -hydroxysteroid oxidase) concerns the nature of its association with the lipid bilayer that contains the sterol substrate. Efficient catalytic turnover is affected by the association of the protein with the membrane as well as the solubility of the substrate in the lipid bilayer. In this review, the binding of cholesterol oxidase to the lipid bilayer, its turnover of substrates presented in different physical environments, and how these conditions affect substrate specificity are discussed. The physiological functions of the enzyme in bacterial metabolism, pathogenesis, and macrolide biosynthesis are reviewed in this context. ■

BIOTECHNOLOGY NEWS (CONTINUED FROM PAGE 27)

The research presented at the AHA meeting was led by William Harris, chief of cardiovascular health research at Sanford Research/University of South Dakota and professor of medicine at Sanford School of Medicine, University of South Dakota, in Sioux Falls, USA. In the double-blind feeding study, Harris and his colleagues randomized participants into three groups. Each group received two packets of oil (7.5 grams each) to put on food and two gel caps (500 milligrams each) to swallow daily: One group received 15 grams of the SDA-enriched soybean oil (SDA) in packets and gel caps totaling one gram of regular (i.e., commodity) soybean oil per day. A second group consumed one gram of EPA in gel caps and 15 grams of commodity soybean oil. The control group got only commodity soybean oil—15 grams from packets and one gram from the gel caps.

At the end of the 12-week study, data from 157 volunteers (of the 252 in the initial group) who completed the study per protocol showed:

- EPA levels rose 17.7% in the SDA group and 19.7% in the EPA group.
- Compared to ALA, which did not raise cellular EPA levels at all, SDA raised blood cell EPA levels, with about 18% of the efficiency of pure EPA.
- In volunteers with high triglycerides, consuming SDA or EPA reduced fasting triglycerides by 26 to 30%, compared with the control group.

Most volunteers who completed the study (70%) were Caucasian. Harris said that, based on what is known about EPA in the body, the team expected that its findings would apply to all races. Other study limitations included the number of dropouts, which reduced its statistical power, and the lack of long-term data on the soybean oil's preventive effects on heart disease.

Among other companies and research institutions that are working on similar projects aimed at developing a land-based source of omega-3 fatty acids is BASF, which is developing a genetically modified canola variety that expresses higher levels of EPA. Dow AgroSciences and Martek Biosciences are inserting genes from algae into oilseeds for the synthesis of docosahexaenoic acid (DHA; 22:5n-3).

Australia's Commonwealth Scientific and Industrial Research Organisation is also developing oilseeds that express DHA. ■

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CALENDAR (CONTINUED FROM PAGE 3)

March 25–26, 2010. Sustainable Cosmetics Summit, New York City, New York, USA. Information: www.sustainablecosmeticssummit.com.

April

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

April 20–21, 2010. **Oils & Fats International Turkey 2010, Hilton Hotel and Convention Centre, Istanbul, Turkey. Information: www.oilsandfatsinternational.com/publication.asp?pubid=28&nav=3&exid=165&subnav=0.**

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

May

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

May 3–7, 2010. **18th European Biomass Conference and Exhibition, Cité Internationale—Centre de Congrès, Lyon, France. Information: www.conference-biomass.com.**

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

May 16–19, 2010. 101st AOCs Annual Meeting and Expo, Phoenix Convention Center, Phoenix, Arizona, USA. Information: phone: +1-217-



359-2344; fax: +1-217-351-8091; e-mail: meetings@aocs.org; http://Annual_Mtg.aocs.org.

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

May 23–27, 2010. **Practical-Short Course: Trends in Margarine and Shortening Manufacture. Non-Trans Products, Food Protein Research & Development Center, Texas A&M University, College Station, Texas, USA. Information: <http://foodprotein.tamu.edu/fatsoils/scmargarine.php>.**

May 26–29, 2010. **OLIVEX 2010: The 8th International Exhibition for Olive Oil, Edible Oil & Oil Processing Technology, Damascus Fairground, Syria. Information: www.olivex-sy.com.**

May 29–June 2, 2010. 9th ISSFAL Congress, Maastricht, Netherlands. Information: www.unimaas.nl/congresbureau/issfal2010.

June

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

June 2–5, 2010. **European Fat Processors and Renderers Association, Kempinski Hotel Corvinus Budapest, Hungary. Information: www.efpra2010.org.**

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

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

June 15–17, 2009. International Probiotic Conference 2010, Kosice, Slovakia. Information: www.probiotic-conference.net.

June 17–18, 2010. **Cosmetic Business 2010, M.O.C. (Münchener Order Center), Munich, Germany. Information: www.cosmetic-business.com/en/tradefair.**

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

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

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

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

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

BIOFUELS NEWS (CONTINUED FROM PAGE 21)

Jeff Broin, chief executive officer of POET, said, "While we still have some challenges ahead . . . Project LIBERTY will be commercially viable by the time we start up the plant." Project LIBERTY is POET's planned 25 million-gallon-per-year cellulosic ethanol plant that is under construction in Emmetsburg, Iowa, USA.

In the coming months further cost reductions are anticipated in the fermentation process.

Improved bioethanol production

Sugars released from agricultural residues such as wheat straw and corn stover are formed in conjunction with significant quantities of acetate. Acetate can slow or even halt bioethanol production by the yeast *Saccharomyces cerevisiae*. Another problem is that about 4% of the sugar is lost to the formation of the by-product glycerol.

By introducing into the yeast a single gene from the bacterium *Escherichia coli*, researchers of the Netherlands-based Delft University of Technology and the Kluyver Centre for Genomics of Industrial Fermentation enabled the conversion of acetate to ethanol, thus increasing the yield of ethanol. This substitution also replaced the normal role of glycerol so efficiently that key genes in glycerol production could be removed, thus completely abolishing glycerol production.

Follow-up research on the transfer of this concept to industrial yeast strains and real-life process conditions is continuing. The Delft yeast researchers—V. Guadalupe Medina, M.J.H. Almering, A.J.A. van Maris, and J.T. Pronk—who applied for a patent on their invention, hope to intensively collaborate with industrial partners to accelerate its implementation and commercialization. ■

SEIFRIED (CONTINUED FROM PAGE 31)

Seifried has designed instrumentation that ranges from a piezoelectric bite-force device and biofeedback system for the Department of Physical Therapy at UofA to a new high-pressure experimental system that can measure both density and interfacial tension under supercritical conditions.

"When I was a child I always looked inside my toys to understand how they worked. Later I started to build my own toys. Since then, not much has changed; the difference is that I now design more complex scientific instruments to measure fundamental data," he says.

"I like to find creative solutions to a given problem. The various devices and instruments I made for my Ph.D. work to measure fundamental properties of lipids under high-pressure conditions were just parts of the puzzle. The bigger picture is to design a process based on those findings. That is the challenging part, and I am in the middle of it right now—I love it, because even though it is hard and tiring sometimes, it is exciting and gratifying to develop something new."

When asked if there is any information about his family he wishes to share, he becomes serious. "I am grateful to my parents, especially my father (sadly, he passed away last year), who supported my curiosity from childhood. First, by allowing me to demolish my toys in order to see inside them and then by giving me the opportunity to build my own toys in [his] machine-shop, followed by a profound academic education in engineering and science. Even though the knowledge I gained at the university level is highly valuable, I learned many of the hands-on skills required to build novel equipment in the lab from my father."

Seifried is also grateful to AOCS: "I greatly enjoyed the 100th AOCS meeting in Orlando. I highly recommend [the annual meeting] to any student involved in the broad field of lipid science and engineering. And thanks for the great support from AOCS," he concludes. ■

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The application of feed microscopy in stock theft investigations

Christian W. Cruywagen

Feed microscopy can be used in stock theft investigations in various ways. Dietary samples, taken on the site from which animals have been removed, can be examined microscopically to identify the ingredients. The following types of samples can subsequently be examined and compared with dietary samples in an attempt to establish a positive resemblance: rumen content, fecal excretions, and material recovered from clothing and shoes. The success rate is higher when samples of rumen content are compared with dietary samples than when fecal samples are compared. Furthermore, the success rate to establish positive resemblances depends on the types of diets fed, type of samples taken (rumen vs. fecal), condition of samples, and ability and experience of the microscopist. It should be taken into account that microscopy is not as individual-specific as tests such as blood-typing and DNA fingerprinting.

BACKGROUND

Feed microscopy involves the identification, and often quantification, of feed ingredients in any kind of sample that contains feedstuffs. Unique characteristics of feed components are used by feed microscopists to identify components in mixed feeds. Identification is usually done under low magnification with a stereo (dissection) microscope, although compound light microscopes are sometimes used to identify certain fractions or ingredients under higher magnification.

Flotation techniques are often used to separate various fractions to facilitate ingredient identification. By weighing the various fractions and estimating the magnitude of ingredient occurrence in each fraction, experienced microscopists can quantify ingredients in mixed feeds fairly accurately.

A wide variety of feedstuffs of plant, animal, or synthetic origin are used in the livestock feed industry. For monogastric

animals, mixed feeds mainly consist of concentrate fractions, such as grains, grain by-products, protein and oilseeds, oil cakes, protein sources from animal or marine origin, and mineral and vitamin premixes. Total mixed rations for ruminants contain, in addition to concentrate fractions, varying levels of preserved forage material, such as silage or hay, while rations of grazing ruminants obviously consist of significant amounts of fresh forage.

It is sometimes necessary to identify the forage component of ruminant diets, especially grass material, from feed, rumen (forestomach), or fecal samples. For example, the author has been requested to compare rumen or fecal samples from cattle and sheep with material obtained from pastures or rangelands for forensic purposes. Identification of grass species on such occasions can be very helpful.

Although it is possible to identify grass or other forage material in the rumen contents and fecal excretions of animals with a microscope, the technique is rather difficult and requires a certain level of experience and expertise (Cruywagen and Kellerman, 2002). Grass identification from fecal samples is not done only for forensic purposes, and the initial application was probably to obtain information on grazing habits and forage intake of wild herbivores. This has been done successfully for many years, and results are well documented (e.g., Sparks and Malachek, 1968; Scotcher, 1979; Barker, 1986; De Munk, 1999).

In stock theft investigations, samples that are typically sent for analysis include those obtained from rumen content or feces. Sample material may be collected from a slaughter place, paddock, or vehicle, or may even be scraped off clothing or shoes. Although it is usually not necessary to identify the exact type of grass or other forage material in these samples for comparative analysis, the microscopist should at least be able to distinguish between legumes and grasses. However, feed ingredients such as grains, oil cakes, and by-products must be accurately identified. The microscopist should also be able to identify certain weed seeds, as these often provide the only clue in fecal examinations.

METHODS

Samples for microscopic examination should be taken from the diet of animals under investigation. In the case of feedlot and dairy animals, diets are often provided in the form of a TMR (total mixed ration). Where forage and concentrates are provided separately, samples of each should be sent for examination. Where animals are kept on pastures, samples should be taken from the paddock where they have been immediately before the theft occurred. In all cases, it is important that samples be as representative as possible.

Stock theft investigators should take a variety of samples, including samples from neighboring farms where applicable, as in the following examples:

- Rumen content of feedlot animals found at slaughtering site: Take samples of rumen content and the diet that the animals received, as well as diets from neighboring feedlots if applicable.
- Rumen content of pasture animals found at slaughtering site: Take samples of rumen content and samples from the paddock where the animals had been before the theft occurred, as well as from at least five other paddocks, including those of surrounding farms.
- Fecal samples of animals found to have been removed from feedlots or pastures: Take samples of diets/pastures, as well as feces from neighboring farms if applicable.

As much information as possible should be provided, such as time of theft, time of sampling of rumen content, feeding schedule of animals, type of pastures, and supplements provided. Samples of rumen content and feces should be dried to prevent mold formation and deterioration and also to facilitate shipment. Samples should at least be sun dried, but preferably be dried in an oven at a temperature not exceeding 50°C.

In the case of clothing and shoes, the relevant piece of clothing should be sent to the laboratory. Even very small blotches of rumen content spilled on clothing or shoes could be of significance to the microscopist.

Samples of feed, rumen content, and feces are all prepared in the same way for microscopic examination. Preparation steps include flotation with organic solvents to separate ingredient particles into fractions ranging from light to heavy, according to the American Association of Feed Microscopists' *Manual of Microscopic Analysis of Feedstuffs*, 3rd edition (1992). At the same time, samples are defatted to facilitate observation.

Apart from the preceding, samples of rumen content usually do not require any further treatment or preparation. However, in the case of fecal samples, it is sometimes necessary to subject fibrous material to additional treatment for microscopic examination, especially when specific grass species must be identified. Ruminant feces are washed through a 1-mm screen to remove unwanted material before recovering grass material. Fecal pellets (e.g., from sheep) must be crushed before washing. Recovered grass material is then prepared for microscopic examination as described by Cruywagen and Kellerman (2002). The various techniques that are used for grass identification involve the examination of epidermal cells or cuticle imprints to observe the unique characteristics of these cells. The techniques are based on the fact that the leaf epidermis is covered with cutin, a fat-like substance, which impregnates the epidermal cells and protects them to some extent against digestion. Microhistological examination of fecal epidermal material can therefore provide a reliable taxonomic basis for species identification, provided it can be adequately prepared for analysis.

MICROSCOPIC OBSERVATIONS

First, the microscopist would examine feed samples to identify and list ingredients in each fraction. Knowing what the animal has eaten, the microscopist would then analyze samples of rumen content or feces to search for recognizable dietary ingredients that have not yet been degraded or digested.

Soluble material, as well as rapidly degradable and readily digestible components or ingredients, will not be present in many

rumen content samples and will be virtually absent in fecal samples. The amount of degradable material present in samples of rumen content will depend on the time that has passed since the animal had last eaten and when it was slaughtered. An experienced microscopist can make a reasonable estimation of the time that has elapsed between the last meal and slaughtering based on the type of material that remains in the rumen and the fineness of the fibrous material following rumination.

Both rumen content and fecal samples will contain forage material and almost always some animal hair. (Hair finds its way into the rumen because animals lick themselves.) Since unprocessed hair is indigestible, hair is often also observed in fecal samples. Depending on the time between feeding and slaughtering, samples of rumen content could contain material such as maize bran, sunflower hulls, cottonseed hulls, wheaten bran, weed seeds, limestone, and sometimes maize endosperm particles. The occurrence of certain feed particles in rumen content, such as the horny starch part of maize, will depend on how finely the grain has been milled and the time since feeding and sampling of the rumen content. Urea, salt, molasses, and most starch particles will have disappeared.

Recognizable feed ingredients in rumen and fecal content will always occur in different ratios than in the original feed sample. The retention time of fibrous material (forage) in the rumen is much longer than that of grains, protein and oilseeds, or their by-products. Samples of rumen content therefore always contain high levels of forage, even in animals that received high-concentrate diets. Fecal samples contain even higher levels of forage, although other indigestible particles may be observed.

Fecal samples of animals on pasture will virtually always contain weed seeds owing to voluntary weed intake. Weed seeds are often also observed in fecal samples of animals on zero-grazing due to contamination of hay or silage with weeds. *Amaranthus* (pigweed) and *Brassica* (wild mustard) are probably the most common weed seeds found in animal feeds, rumen content, and feces. In South Africa, *Tagetes* (katiebos) is also sometimes observed. When weed control is neglected in crop production, grains and oil and protein seeds may be contaminated during harvesting. Weed seeds are usually removed in various ways, including sieving. The process typically is not 100% effective, though, and the following weed seeds have been observed by the author in contaminated crops: *Amaranthus*, *Ambrosia*, *Bidens*, *Brassica*, *Cassia*, *Cleome*, *Camelina*, *Crotalaria*, *Datura*, *Ipomoea*, *Polygonum*, *Sesbania*, *Setaria*, *Sida spinosa*, *Tagetes*, and *Vigna*.

MICROSCOPY IN STOCK THEFT INVESTIGATIONS

Feed microscopy is of great value in stock theft investigations; and in a number of cases the author has been able to present evidence that resulted in the conviction of alleged thieves. The majority of cases involved examination of rumen content and fecal samples.

The success rate of comparisons between diet and rumen content is much higher than where fecal samples are compared. In more than 70% of the cases that involved rumen content, definite conclusions could be drawn, whereas the success rate of fecal comparisons was in the order of 50%. The reason for the lower success rate in the case of fecal examinations is readily apparent: Fecal samples are usually from sheep in extensive farming areas

4th Annual Soya & Oilseed Summit

Amy Johnson

Soyatech hosted the 4th Annual Soya & Oilseed Summit at The Roosevelt New Orleans in New Orleans, Louisiana (USA), November 3–5, 2009. The meeting was once again co-located with the Global Soybean & Grain Transport conference, which took place November 2–4, 2009. About 300 attendees from industry, government, and academia gathered for presentations on topics such as international trade of oilseeds; the future of modified traits for food, feed, and industrial products; vegetable oils as biodiesel feedstocks; aquaculture feed; and sustainability.

In addition to the 20+ presentations during the conference, over 50 exhibitors were present. From state soybean associations and international laboratories to instrument and natural and organic food product companies, there was much to learn about and many contacts to be made.

A recurring theme of the meeting was population growth, with world population predicted to grow from the 6.8 billion people of today to 9.3 billion people by 2050. Thus, agriculture output must double by 2050 in order to feed this population.

Susan Knowlton of DuPont (Wilmington, DE, USA) focused on how both input and output traits can play a role in increasing agricultural output. Input traits can improve yield and production, whereas output traits can create high-acreage, which create value streams from seed sales, or high-value products, which create value by creating a processed product of significant value, such as low-linolenic acid soybeans. Since the commercialization of biotech crops in 1996, input traits have led the way, but owing in part to their potential health benefits, output traits are now receiving more attention. One new entry is a high-oleic soybean variety, that is being marketed by DuPont under the name Plenish™. High-oleic soybeans, which have about 80% oleic acid, will produce soybean oil that can replace hydrogenated fats. “Plenish high-oleic soybean oil provides the stability and performance of partially hydrogenated oil without the *trans* fat and with lower saturated fat [content],” Knowlton said.

Peter Golbitz of SunOpta (Minnetonka, Minnesota, USA) said that whereas a large portion of the world’s needs are being met by commodity oilseeds, a growing number of processors are requesting identity-preserved and specialty products such as non-genetically modified and organic agricultural products. Golbitz also said that the world population increase and the resulting agricultural need is going to change agriculture, reducing commodity crop production and increasing specialty crop production owing to the added value these crops provide.

Another theme of the meeting was the effect of the current economic situation on agriculture. Richard Galloway, co-author of the AOCS Press book entitled *Soybeans: Chemistry, Production, Processing, and Utilization*, discussed how the worldwide recession has negatively affected the soybean and oilseed industries. He noted that a decrease in domestic meat and poultry demand has reduced the amount of soybeans needed for feed. International demand for meat and poultry is also down, along with demand for edible oil.

KEYNOTE SPEAKER

Blairo Maggi, governor of the state of Mato Grosso, Brazil, gave the keynote address: *The Role of Brazilian Agriculture in Promoting Sustainability*. Mato Grosso is the major soybean producing state in Brazil, and sustainability has been a focus of Maggi’s time in office. His presentation focused on the system he has implemented in Mato Grosso to reduce deforestation while at the same time promoting agriculture. One aspect of the system is the conversion of 25% of the land currently being used to raise cattle into land for row crops, thereby doubling soybean production without destroying the forests.



Blairo Maggi, governor of Mato Grosso, Brazil, delivered the keynote address at the 4th Annual Soya & Oilseed Summit, held in New Orleans, Louisiana (USA), November 3–5, 2009.

TOUR

Eurofins and the Russell Marine Group sponsored a Grain Testing and Inspection Tour on Thursday, November 5. The tour included presentations by AOCS members Frank Spiegelhalter, executive vice president, Eurofins GeneScan, who gave an “Overview of GMO [genetically modified organism] Testing Strategies and Updates on Biotech Events”; and John Reuther, president, Eurofins Central Analytical Laboratories, who spoke about “Analytical Tools for Detecting Contaminants and Ensuring Food Quality.” The final presentation was given by Patrick Russell, president, Russell Marine Group, on the “Logistics of Moving Soybeans and Soybean Meal to Export Markets.” The tour provided participants with a view of the day-to-day operations of both Eurofins GeneScan and Eurofins Central Analytical Services, allowing participants to see the science at work.

The 5th Annual Soya & Oilseed Summit will be held in October 2010 in Minneapolis, Minnesota.

Amy Johnson is the Soybean Quality Traits program manager and can be reached at amyj@aoacs.org.

CAOCS, Lipid Crystallization attendees converge on Canada

Tania Dey

In October 2009 delegates gathered at Le Méridien King Edward Hotel (Toronto, Ontario, Canada) to attend two AOCs conferences: Crystallization of Lipids, Nucleation to Application (CLNA; Oct. 3–4) and the 23rd Meeting of the Canadian Section of AOCs (CAOCS; Oct. 5–6). Attendees of the CLNA included speakers from around the world; attendees for CAOCS were mainly from major Canadian institutions.

CLNA SESSIONS

The first day of the CLNA conference (Sessions 1 and 2) was devoted to presentations and discussions. There was also an evening reception, where attendees shared their research work, scientific views, and ideas. The second day of the conference was a half-day event (Session 3), which left ample time for sightseeing in the afternoon.

CLNA co-chair Dérick Rousseau (Ryerson University, Toronto) opened day one of the conference. In his talk he elucidated three models of liquid-state ordering in triglycerides (TG): namely, Larsson's smectic model, Cebula's nematic model, and Corkery *et al.*'s Y-shaped discotic model. With the help of Raman spectroscopy and computer simulation, Rousseau showed how aliphatic chain length, TG conformation, packing, and microenvironment can affect this ordering phenomenon.

Richard Hartel (University of Wisconsin, Madison, USA) discussed how the physical principles behind "partial coalescence" can be applied to thickening of whipping cream and fat (de)stabilization in ice cream. Silvana Martini at Utah State University (Logan, USA) reported on how high-intensity ultrasound (HIU) of frequency range 20–100 kHz can be used to modify lipid microstructures through bubble formation, which in turn affects the texture of a lipid network.

Kiyotaka Sato led off the afternoon

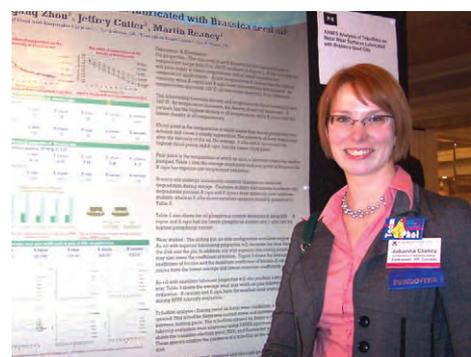
presentations by talking about the use of synchrotron radiation microbeam small-angle X-ray diffraction techniques to reveal the polymorphism and crystal orientations of fat crystals in systems such as: oil-in-water emulsion droplets containing solid fats in the oil phase, which were crystallized through interfacial heterogeneous nucleation at the oil-water membrane; granular crystals occurring in palm-oil-based margarine after a long thermal thawing procedure; and fat crystals placed around air bubbles in whipped oil. According to Sato, in these three fat

systems the microstructures containing different types of high-melting fat fractions were inhomogeneous, but some ordering did exist at the interface. In a coffee break between sessions, Sato announced his retirement from Hiroshima University (Japan) and cordially invited meeting delegates to join him during the upcoming Hiroshima Forum on Functionality of Lipids to be held on March 24–27, 2010, to commemorate this occasion.

Suresh Narine, University of Alberta (Edmonton, Canada), described in his presentation the method of formulating and processing vegetable shortenings with improved properties such as increased hardness, no *trans* fat content, and reduced saturated fat content by using structural enhancers comprising various combinations of palmitic-stearic triglycerides. Narine was followed by Nissim Garti, who examined how phytosterol intake can reduce cholesterol levels in blood through mixed micelle formation and how the cholesterol-to-phytosterol ratio, extent of dilution, and presence of a lecithin-based microemulsion can influence this process. It was interesting to hear from Anders Jensen how his research at Palsgaard USA (Morristown, New Jersey) is being directed toward studying the



Crystallization of Lipids, Nucleation to Application speakers, from right, Alejandro Marangoni, Silvana Martini, and Tania Dey. The Lipid Crystallization conference was held October 3–4, 2009, in Toronto, Canada. All photos courtesy of Tania Dey.



CAOCS poster presenter Johanna Clancy.



Baked desserts served during a lunch break of the Lipid Crystallization conference.

effect of different fat crystallizers in margarines, spreads, and shortenings and subsequent emulsion stability. I myself had the opportunity to present my research work in this session, in the area of structuring edible oils through polymer gelation. The day ended with a student presentation on polymorphism and phase behavior of model diacid 1,3-diacylglycerol.

The second day was solely dedicated to Alejandro Marangoni (University of Guelph, Canada) and his collaborators. In his talk, he reviewed various unique strategies of structuring liquid oils, including “use of small-molecule organogelators, crystal hydrates of monostearin, and novel polymer gels in oil.” His research group covered a wide range of topics, such as calculation of van der Waals’ forces between fat crystals, imaging of nanoplatelets in fat crystals, pre-nucleation structuring of triacylglycerol melts, influence of oscillatory shear in hydroxystearic acid-based self-assembled fibrillar network formation, and fat crystallization under laminar shear and its effect on oil migration kinetics. Jorge Toro-Vazquez (Universidad Autonoma de San Luis Potosi, Facultad de Ciencias Quimicas-CIEP, San Luis Potosi, SLP, Mexico) focused on the self-assembly capability of an *n*-alkane found in candelilla wax, its application in oil gelation, and subsequent characterization.

CAOCS CONFERENCE

The CAOCS conference was divided into four different sessions: (i) health issues related to fats and oils; (ii) genetically modified oilseeds and alternative feedstocks; (iii) physical properties of fats and oils in processed



Kiyotaka Sato addressing attendees of the 23rd Meeting of the Canadian Section of AOCS (CAOCS), held October 5–6, 2009.

foods; and (iv) nonfood applications of fats and oils. This meeting’s diversity in topics and student-centric presentations and awards had broad appeal to those at the earlier stages of their careers. A poster session was sandwiched in between two full-day events. The keynote presentations from this meeting also had a high impact on the audience.

In Session 1, Bruce Holub (University of Guelph) presented some interesting facts about fatty acid composition related to health and disease, based on population studies and clinical trials. He emphasized consuming fish for their content of omega-3 fatty acids, the active ingredients being DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid), and other possible future sources of DHA (such as bioengineered flax and canola). He also mentioned the importance of proper labeling and a less confusing marketing strategy. Brent Flickinger from Archer Daniels Midland Co. (ADM; Decatur, Illinois, USA) discussed the factors that are influencing the marketplace for edible fats and oils.

In Session 2, Randall Weselake (University of Alberta, Edmonton, Canada) pointed out the anticipated increase in demand for seed oil production in the next few decades, some viable sources of biodiesel, and trait-influencing factors in seed oils. Kiyotaka

Sato, in Session 3, nicely elucidated the effect of food emulsifiers on nucleation kinetics and morphology of semisolid fats in bulk systems, as well as in emulsions. In Session 4, Stewart Campbell talked about the challenges and opportunities of biodiesel (produced by transesterification of triglyceride oils) and renewable diesel (obtained from

hydrotreating and isomerizing these oils) in Canada, with special emphasis on winter operability and canola-centric production. His affiliation is with the Canadian Bioenergy Corp. (North Vancouver, British Columbia), Canada’s first BQ-9000-certified marketer. Canadian Bioenergy Corp. has taken part in various pilot programs with fleets throughout British Columbia and Alberta. Apart from the above-mentioned keynote presentations, lectures by Arnis Kuksis from the University of Toronto, David Dzisiak from Dow Agro-Sciences (Indianapolis, Indiana, USA), and Edgar Acosta from the University of Toronto were equally interesting.

At the very end of the CAOCS meeting, student awards were delivered. Travel awards went to Crystal Snyder from the University of Alberta and Felix Aladedunye from the University of Lethbridge (Alberta, Canada). In the student poster category, the runner-up was Tu Tran from Ryerson University; and the top award went to Julie Mason from the University of Toronto. Among student talks, Tyler Irving was chosen as runner-up and the award for best talk went to Jennifer Truan, both from the University of Toronto. Major judging points for these awards were scientific quality and presentation ability.

Tania Dey earned her Ph.D. in 2002 and worked as a postdoctoral researcher in the United States for five years. Her research interests include surface science, polymer chemistry, and nanotechnology. Currently she is a research associate at the University of Guelph. She also serves as an associate editor for the Central European Journal of Chemistry. The author can be reached at taniadey@hotmail.com



Neil Widlak, chairperson of the Lipid Crystallization conference, addresses attendees.



NuSun exhibit at the CAOCS meeting. From left to right, Chris Gould and Renuka Gupta (front row), Kiyotaka Sato, Dérick Rouseau, and Léa Arnaud (back row).

7th Euro Fed Lipid Congress

Jean Wills Hinton

More than 600 delegates from 54 countries gathered in Graz, Austria, to share their research related to lipidology and to network with colleagues during the conference entitled *Lipids, Fats and Oils: From Knowledge to Application*, held October 18–21, 2009. In addition to the five plenary lectures given by awardees, more than 200 presenters delivered information in either lecture or poster format.

Various satellite events were held in association with the meeting, including a short course on omega-3 fatty acids, which addressed market trends, regulations, stability, and specialty applications. The course, co-sponsored by Euro Fed Lipid (EFL), the



AOCS members attending the 7th Euro Fed Lipid Congress gathered for a breakfast while in Graz, Austria.

Your opinion, please

Strategic discussions between AOCS representatives and key representatives from various other scientific groups are an integral component of any scientific meeting. Specifically, while papers were being presented in Graz, we who work for Euro Fed Lipid, AOCS, the Australian Olive Association, and the European Section of AOCS were talking together about how to serve the professional needs of our members for information through the programs and products we host.

One recurrent theme in our discussions this past year, and in Graz, concerned the number of conferences and exhibits around the world; in particular, the feeling that there are too many meetings. Some of the issues raised have been: (i) an inability on the part of professionals to take advantage of so many meetings, (ii) difficulty in securing speakers, who are having to choose at which meetings to present, and who are having difficulty finding anything new to say, (iii) too many exhibitions for companies with budget constraints to support, and (iv) the reluctance of sponsoring societies to share meeting “turf” because of their dependence on revenues from meetings to support their operations.

As a practitioner in the field, you are a “user” of the products the professional societies offer, your perceptions about these issues are of great value. Please share your thoughts by e-mailing Jean Wills Hinton at jwh@aoacs.org. Thank you!

European Section of AOCS, and AOCS/EFL members Sefa Koseoglu and Ignace DeBruyn, addressed nutrition, application in food products, as well as supplements and production issues related to the topic. More than 70 attendees from 24 countries participated in the short course.

AOCS hosted a breakfast for members attending the meeting. Gary List, retired from the US Department of Agriculture (Peoria, Illinois, USA) and a former member of the AOCS Governing Board, attended the breakfast, after which he delivered his award lecture entitled, “Impact of *trans* Fat Nutrition Labeling on the US Edible Oil Industry” and received the European Lipid Technology Award.

Additional awardees presented lectures throughout the meeting, including:

- AOCS member Jürgen O. Metzger, Oldenburg, Germany, received the DGF (Deutsche Gesellschaft für Fettwissenschaft) Normann Medal and lectured on fats and oils as renewable feedstock for chemistry;
- Rudolph Zechner, Graz, Austria, received the European Lipid Science Award and delivered a presentation entitled “Pathway Under Construction: The Catabolism of Fat in Adipose and Non-adipose Tissues”;
- AOCS member Albert Dijkstra, St. Eutrope-de-Born, France, received the AFECG (Association Française pour l’Etude des Corps Gras) Chevreul Medal and spoke about “Questions No One Is Asking.”

The session on Lipid Technology: Developments in Processing

CONTINUED ON NEXT PAGE

Technology was dedicated to Dr. Katalin Kövári, formerly of Bunge Europe, who had served on the Euro Fed Lipid Board and scientific committee. Kövári was also an AOCS member and one of the key organizers of the AOCS World Conference & Exhibition on Oilseed Technology and Utilization held in Budapest, Hungary, in 1992. She served as the representative from Hungary to the ISF (The International Society for Fat Research) Member Council for many years as well. Kövári passed away in March of 2009 (see *inform* 20:379, 2009). She was a familiar and friendly face in the international fats and oils community.

Representatives from AOCS (Jean Wills Hinton and Jeff Newman), along with the AOCS European Section officers, met with Euro Fed Lipid leaders to discuss ways in which the two groups can have greater collaboration on future programs and how they can have more effective communications to better serve their collective memberships (see sidebar, page 49).

The Euro Fed Lipid members met for their annual business meeting during which they reported on 2009 activities and planned for 2010. The organization appointed a new president, Marc Kellens, of Desmet Ballestra Group (Belgium), who will take over from outgoing president Frédéric Staat, ITERG (Institut des Corps Gras) France. The next annual meeting of Euro Fed Lipid is scheduled for November 21–24, 2010, in Munich, Germany (visit www.eurofedlipid.org/meetings/munich for more information).

Jean Wills Hinton is AOCS executive vice president. Contact her at jwh@aocs.org.

STOCK THEFT INVESTIGATIONS

(CONTINUED FROM PAGE 45)

where the pasture is quite comparable from farm to farm. Because the feces contain mostly forage material, chances are that feces of sheep from one farm would very much resemble those of feces from another farm in the area. Thus, it is often not possible to prove that feces found at a remote site or in a vehicle came from a specific farm. In most of the successful fecal examination cases, the weed seed or sand profile proved to be extremely helpful.

In some successful cases, rumen content recovered from clothing or removed from the grooves in shoes were enough to make positive conclusions.

In one case, the author was requested to prove that hair found in a vehicle was from an Alpine goat. The alleged thief maintained that the hair was from his dog. In this case, atomic force microscopy (AFM) was used to examine the scale pattern of the hair. Samples were obtained from Alpine goats, cattle, dogs, horses, and other animals to compare with the sample hair. The AFM scan indicated beyond doubt that the sample hair was indeed that of an Alpine goat.

Christian W. Cruywagen is in the Department of Animal Sciences, Stellenbosch University (Private Bag XI, Matieland, Stellenbosch 7602, South Africa). Email him at cwc@sun.ac.za.

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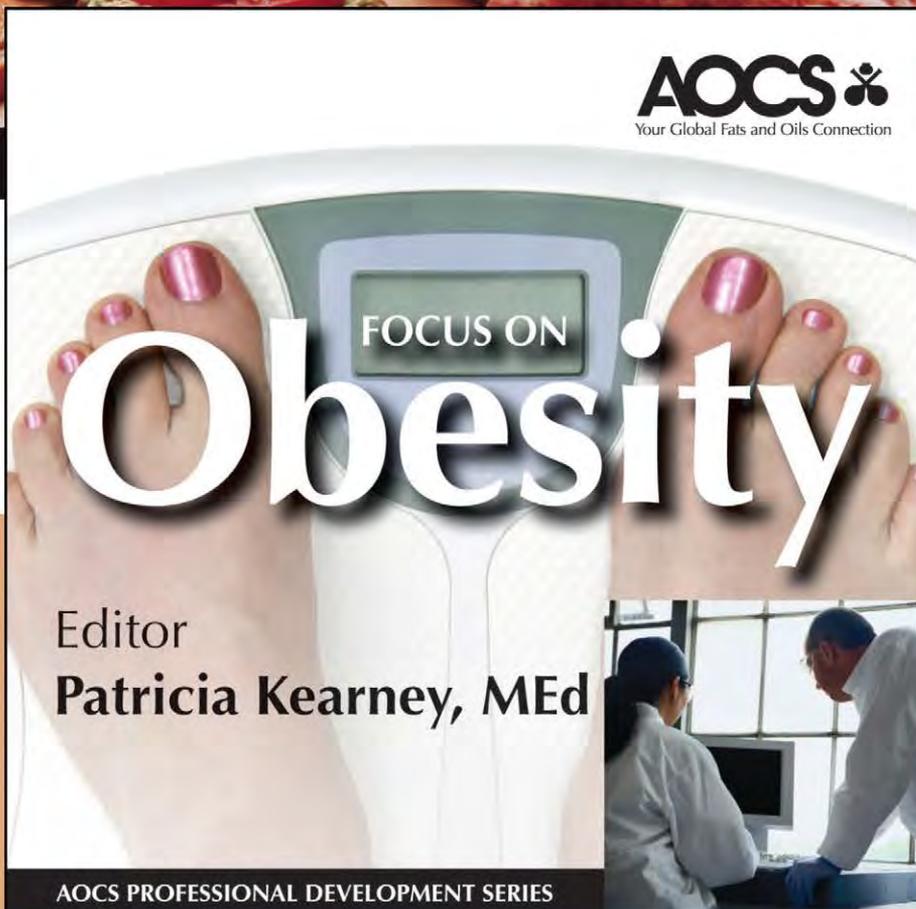
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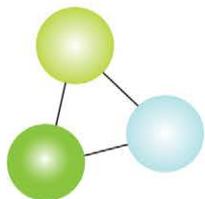
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Closing the gap

Barbara Jewett

Research into how anesthesia works may eventually unlock not only that mystery but dozens of others as well.

“Anesthetics have improved significantly over the last hundred years, but the mechanism of anesthesia is not understood at all,” says Grace Brannigan, a researcher at Temple University in Philadelphia.

To gain insight into how anesthetics work, a team consisting of Brannigan and fellow researchers Jérôme Hénin, Michael Klein, Roderic Eckenhoff, and Richard Law (Lawrence Livermore National Laboratory) is focusing on the nicotinic acetylcholine receptor (nAChR).

This receptor, found in both brain and muscle cells, is a ligand-gated ion channel. The channel opens or closes in response to binding with a chemical messenger (ligand) such as a neurotransmitter, like acetylcholine. When the channel is open, ions can cross the membrane. Anesthetics are believed to close the channel, thus reducing sensations and possibly causing the memory loss associated with being under general anesthetic.

STRUCTURAL GAPS

The basic nAChR structure consists of five protein subunits symmetrically arranged. Cryo-electron microscopy examination of the structure by British and Japanese researchers revealed more particulars about the receptor’s structure than previously known, including holes (gaps) in the protein’s density that were thought to hold water.

The team looked at those holes, however, and realized they were the perfect size and shape for cholesterol. Knowing that cholesterol is essential for brain function, and that nAChR can only do

its job properly if cholesterol is nearby, the team decided to explore the relationship between the gaps and cholesterol.

As nAChR is also involved in inflammation, Alzheimer’s disease, Parkinson’s disease, schizophrenia, and epilepsy, the team’s findings could lead to increased understanding of these health issues as well. In addition, the team’s results likely apply to closely related receptors, such as the GABA (γ -aminobutyric acid) receptor. These related neurotransmitter receptors are involved in regulating mood and sleep.

MODELING THE HYPOTHESIS

Since modeling and simulation are the team’s domain, they directed their expertise to their hypothesis that the nAChR protein density gaps were occupied by cholesterol rather than by water.

The team used the basic shape of the nAChR transmembrane domain as revealed by electron microscopy (EM) structure 2BG9. Improvements in EM allow researchers to observe specimens in their native environment, affording more accurate observations and better data to use in computer modeling and simulations. The team then calculated potential binding sites (colored yellow, orange, and red in Fig. 2) within the protein’s transmembrane domain. This was done by carefully examining the receptor using advanced visualization software, identifying holes, and then relying on their chemical intuition as to where to place cholesterol, as well as using an automated docking program that found holes and inserted cholesterol.

The researchers say their proposed sites for cholesterol that are colored orange and red contradict the 1993 publication of hypothetical binding sites for cholesterol for nAChR. The earlier research primarily considered cholesterol in the interface with the surrounding membrane only (Fig. 1). This new research shows that cholesterol can be deep within nAChR.

Using the prior data, the researchers used the Nanoscale Molecular Dynamics (NAMD) code on the Abe supercomputer

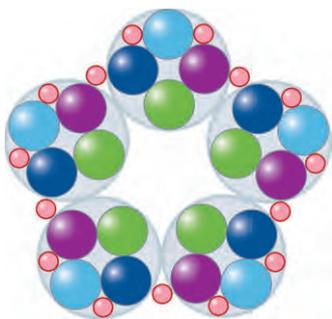


FIG. 1. 1993 proposed binding sites for cholesterol (shown in red) on the surrounding membrane only. All figures courtesy of Grace Brannigan, Temple University.

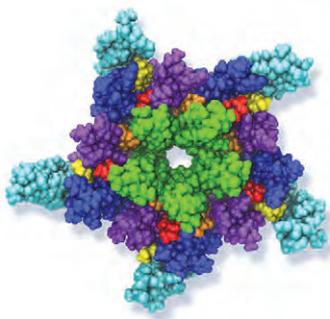


FIG. 2. Currently proposed cholesterol binding sites (colored yellow, orange, and red) within the protein’s transmembrane domain.

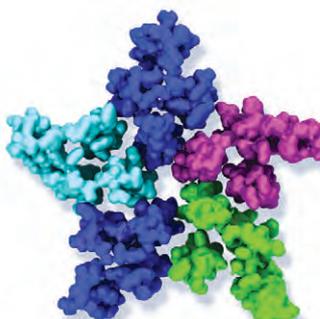


FIG. 3. Beginning of the protein simulation showing the open gaps.



FIG. 4. Twenty-five nanoseconds into the simulation showing the collapse of the protein’s subunits due to lack of cholesterol at the binding sites.

cluster at the National Center for Supercomputing Applications at the University of Illinois in Urbana-Champaign (USA) to test their theory. Running four simultaneous jobs requiring 800 processors each, the team simulated more than 230,000 atoms for 100 nanoseconds (Figs. 3 and 4).

They observed that after 25 nanoseconds in the control simulation, the protein significantly redistributed its density, with gaps closing because of the collapse of individual subunits (Fig. 4). Placing cholesterol in the gaps reduced the number of subunits collapsing.

NEXT STEPS

The molecular dynamics simulations supported the team's hypothesis that the published experimental structure is consistent with cholesterol molecules buried within the receptor. Their findings were published in September 2008 in the *Proceedings of the National Academy of Sciences*. Although the findings need to be confirmed by experimental researchers to become accepted scientific fact, the simulations will aid the team in the next phase of their anesthetics research.

"There are several next steps, but the most important in the framework of this project is to now actually start looking at how

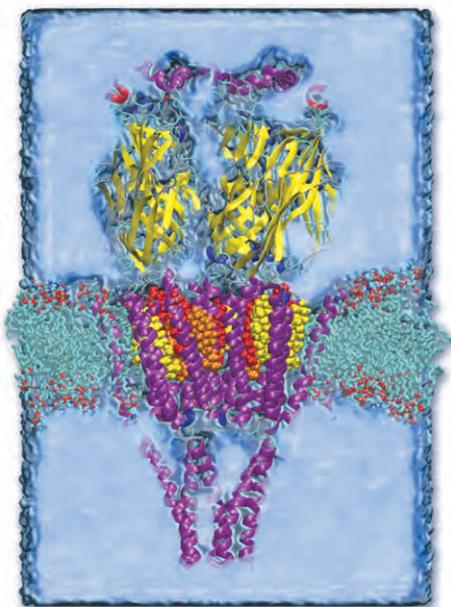


FIG. 5. Complete simulation.

small anesthetic molecules are going to interact with the protein," says Hénin. "And now we know that when we do these simulations, we'll need to include cholesterol molecules at the places where we think they are interacting (Fig. 5). We think that is going to be more of a multiple interaction. Not just a protein-anesthetic interaction, but also a protein-cholesterol-anesthetic interaction."

The researchers hope their work leads to improved drug design.

"You could fine-tune the properties of the drug if you could understand how the mechanism works," says Brannigan. "For instance, by understanding how anesthetics work, you could design new anesthetics that could be more powerful yet maybe wouldn't have some of the side effects that current ones do."

This project was funded by the National Institutes of Health.

This article first appeared in the National Center for Supercomputing Applications' Access magazine, <http://www.ncsa.illinois.edu>. Copyright 2009 Board of Trustees University of Illinois. Barbara Jewett is the managing editor of Access magazine. She may be contacted by email, barbaraj@ncsa.uiuc.edu.

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SHORT-TERM PRICE FORECASTS (CONTINUED FROM PAGE 9)

Based on these three presumptions and the incremental S&D I have projected, I believe CPO prices must rise very soon. Between now and the end of the first quarter of 2010, I expect CPO futures on the Bursa Malaysia to rise to a level between 2,800 and 3,000 ringgits. That would put RBD (refined, bleached, deodorized) olein at about \$900 FOB by the end of January 2010.

RBD olein will still be the cheapest edible oil in the world. In relation to other food and fuel products, it will be cheaper than most. When I entered this industry in 1977, RBD olein was \$500 FOB, while crude mineral oil was \$13 a barrel. RBD olein has neither kept pace with inflation nor has it kept pace with other natural resources.

I expect palm oil prices to rise at the fastest pace in relation to all other vegetable oils. The rise in the price of soybean oil will be moderated by the prospect of higher supply coming in from South America after April. However, that higher supply will be met by higher domestic biodiesel demand, and hence soybean oil prices will also have to rise to about \$950 FOB Argentina.

The spread between soybean oil and palm oil will undoubtedly narrow. I expect sunflowerseed oil prices to command a considerable premium and to go as high as \$1,200 in Europe. Rapeseed oil prices will be higher than for soybean oil but perhaps not as high as for sunflowerseed oil.

Finally, I expect palm kernel oil and coconut oil to trade in rough parity with palm oil in the first half of 2010. This is because both are industrial raw materials and growth in these industries is likely to be modest.

WHAT CAN HAPPEN TO NEGATE THESE PRICE FORECASTS?

The most important factor would be contagion. If stock markets were to fall for any reason, they will exert a bearish influence on

our markets also.

At some stage, the present liquidity and cheap money phenomenon must be curtailed. People talk of the dreaded “E word,” meaning an “exit” from cheap money and printing press policies. Such an exit is unlikely to happen before Christmas. There is no historical precedent for it to happen in this time period. However, February or March could be a different story. It is more than likely that we shall see a big correction in markets at some stage in Q1 of 2010. As traders we must be prepared for it. Therefore, one-sided long positions can be dangerous.

For 2010, the fundamentals are more bullish than in a long time. However, these days fundamentals count only about 33% toward price making. Other factors, usually called outside markets, have a preponderant influence on price behavior. Therefore, the risk of contagion cannot be overstated.

CONCLUSION

The GAPKI conference is very well positioned, towards the end of each calendar year, to explore the price outlook for the next year. I am grateful to Derom Bangun and his colleagues at GAPKI for inviting me to share my thoughts once again this year. I have stuck my neck out on CPO production prospects. Yet as you can see from the incremental S&D for 2010, the outlook is bullish regardless of whether we get half a million metric tons of extra CPO or not. With the world economy on the mend and expanding once again, this industry is going to forge ahead into good times. However, let us also not forget that the world needs more vegetable oil and we are not doing enough to raise productivity.

Dorab E. Mistry is director of Godrej International Ltd., Mumbai, India. He may be contacted at dorab.mistry@godrejinternational.com.

UNIQUE PROPERTIES OF CARBON DIOXIDE-EXPANDED LIPIDS (CONTINUED FROM PAGE 12)

enhanced flowability of highly viscous liquids by injecting CO₂ due to viscosity reduction has been applied to improve filtration of used motor oils and might be an option for filtration of used frying oils as well. Finally, reduced interfacial tension and reduced viscosity may be advantageous for applications involving formation of droplets in spray processes aiming at increasing the interphase, which may be desirable in lipid extraction and purification using pressurized CO₂.

CONCLUSIONS

The application of pressurized CO₂ in fats and oils processing may be beneficial for the development of novel processes ranging from oil expression and extraction of oilseeds to reactions and separation of lipid components. Jessop and Subramaniam (2007) have reviewed the potential of gas-expanded lipids and liquids, and the latest developments point in the right direction, such as using gas-expanded liquids in the production of biodiesel (Wyatt and Haas, 2009).

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ANALYTICAL (CONTINUED FROM PAGE 5)

Just recently, DGF replaced its Standard Method C-III 18 (09) by a new method for the estimation of 3-MCPD esters and glycidol (glycidyl esters). The new method describes a procedure for the sequential estimation of 3-MCPD and glycidol esters in fats and

PANEL ON PROCESS CONTAMINANTS (CONTINUED FROM PAGE 5)

The first direct method presented at the December meeting is a TOF LC–MS (time-of-flight liquid chromatography–mass spectrometry) method for determining esters of both 3-MCPD and glycidol. The method is based on a technique previously employed for determination of diglycerides. The use of high-resolution TOF-MS permits the elimination of interfering compounds in the determination of 3-MCPD esters.

The second direct method presented involves a combination of two solid-phase extraction steps and LC–MS measurements for the determination of glycidol (glycidyl) esters. Both methods are in the process of being submitted to peer-reviewed journals.

NEXT STEPS

The first method, which determines esters of both 3-MCPD and glycidol, will undergo a preliminary collaborative study organized by AOCS once it has been formally submitted for publication. AOCS will continue to update and augment its web-based resource page (www.aocs.org/tech/3-mcpd.cfm) with scientific articles and news stories, as they become available.

The next meetings of the Expert Panel will be held in Japan in February 2010 and at the AOCS Annual Meeting & Expo in May 2010. The date and location of the meeting in Japan had not been determined as *inform* went to press.

“The issue of fatty acid esters of 3-MCPD and glycidol has emerged as a global challenge for the fats and oils industries,” said Richard Cantrill, director of AOCS Technical Services. “Development of reliable validated methods for determining these compounds is the first requirement when answering concerns about potential contaminants in fats and oils.”

information

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- Erste Einschätzung zur Bewertung der in raffinierten pflanzlichen Fetten nachgewiesenen Gehalte von Glycidol-Fettsäureestern, Stellungnahme Nr. 007/2009 des BfR vom 10. März 2009
- AOCS maintains a web-based resource on 3-MCPD and glycidol esters at www.aocs.org/tech/3-mcpd.cfm.

oils by GC/MS after alkaline hydrolysis. So long as no other compounds are present in the fat sample that can form 3-MCPD under the conditions of the analysis except glycidol, the method also enables the estimation of the glycidol content. The method consists of two trials. In the first trial the sum of 3-MCPD and 3-MCPD-forming substances is analyzed according to the former DGF Standard Method. In a second trial the sample is first treated with sulfuric acid (before hydrolysis). As a consequence the epoxide ring of the glycidyl ester is opened and glycidol is quantitatively removed. After this treatment the analysis of 3-MCPD is performed again. The amount of 3-MCPD quantified in the second trial corresponds to the initial amount of 3-MCPD bound to fatty acid esters. Provided that the difference in the results of the two trials is exclusively due to the presence of glycidol, the difference can be used to estimate the content of ester-bound glycidol. However, it has to be pointed out that there might also be other substances in oils and fats that can be transformed to 3-MCPD during analysis. It is not yet proven that the difference corresponds directly to the glycidol content of the sample.

In summary, to compare results from different laboratories, the method used and the target substances have to be clearly defined.

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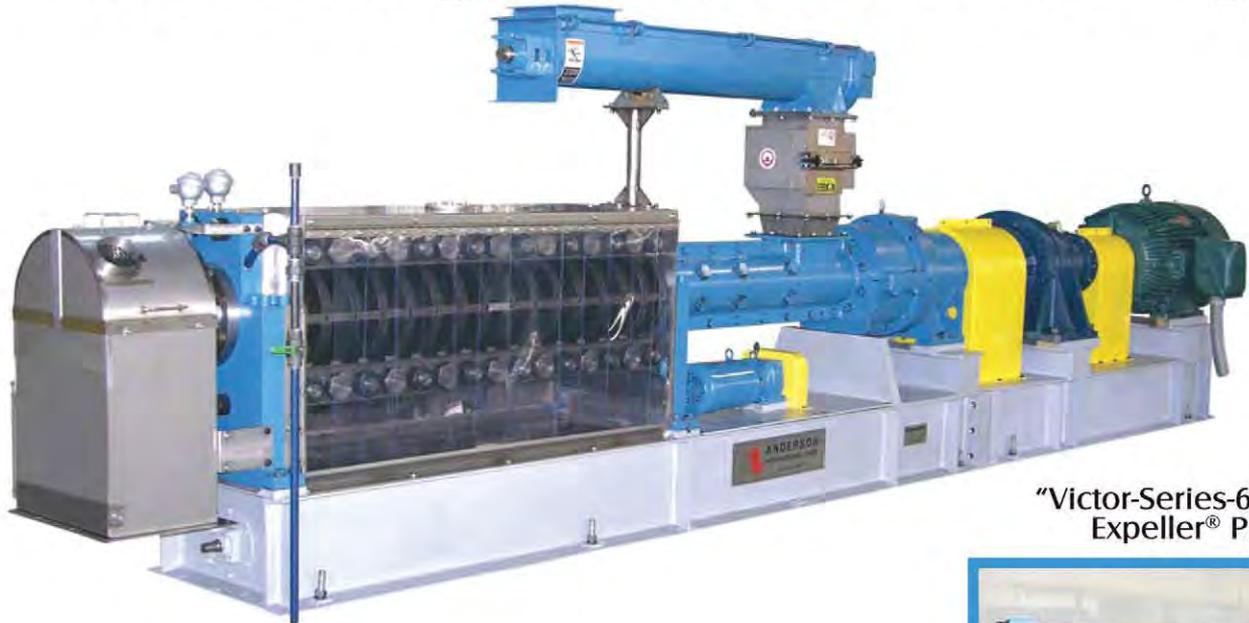
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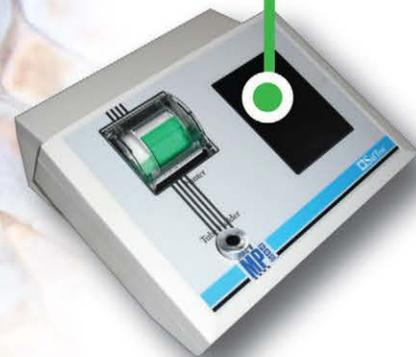
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