



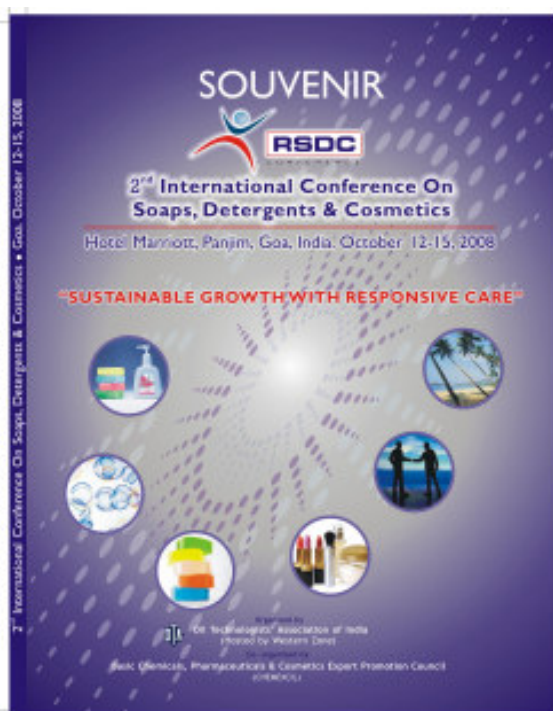
NEWS LETTER

OIL TECHNOLOGISTS' ASSOCIATION OF INDIA
WESTERN ZONE

Inside This Issue

- Responsible Care
- Biodiesel
- Sustainable Energy
- Purifine
- Biofuel Test Flight
- Biotechnology
- Nano Technology

Responsible Care has adapted over the past to suit environment health, Safety and Security Challenges a program Code in Canada could be a world-wide application. With Greater transparency and accountability.



**This news letter is for free circulation only to the members
of OTAI-WZ**

C/o. Department of Oils, Oleochemicals & Surfactants
Institute of Chemical Technology Tel.: 91-22-32972206/91-22-24146526
(Formerly UDCT) Fax: +91-22-24124017
Nathalal Parekh Marg Email: info@otai-westernzone.org
Matunga (East), Mumbai-400 019 Website: www.otai-westernzone.org
INDIA.



**OIL TECHNOLOGISTS'
ASSOCIATION OF INDIA
WESTERN ZONE**

EDITORIAL ADVISORY BOARD

T.K. VENKATESAN
V.V.S. MANI
S.N. TRIVEDI
B.R. GAIKWAD

EDITOR

V.V. RAO

EDITORIAL BOARD

A.D. SHITOLE
D.N. BHOWMICK
B.V. MEHTA

From the Editors's Desk

The Second International Conference on Soaps, Detergents and Cosmetics at GOA has been a resounding success. OTAI and the front-runners, the Western Zone had to strain every nerve to ensure world-wide participation. Experts in their field shared their thoughts and experience with delegates, who profited immensely. We believe they will strike a new path in all-round improvement of their technologies and markets. What is intriguing is the small participation of Oil Processing Organisations. Are they feeling their operations are different? But, diversifications could add to their strength. Perhaps, a special effort to brief them about the advantages of the new processes may be needed. What brings out in clear vision is the enormous and dedicated efforts by the leaders of the OTAI. The financial out-gos and higher receipts shows a healthy track. The top leader showed remarkable self-confidence in the performance of the task. We congratulate the leader who led a powerful team for a dazzling impact. And yet, his humility and simplicity was significant and relevant.



Trade & Commerce

BE THE OWNER

Indian patent law and the changing business landscape

By Varun Chhonkar

It has been four years since India reluctantly amended its patent law in 2005 to allow patent protection for pharmaceutical, chemical and food production to meet its obligation of extending patent protection in all fields of technology under the TRIPS agreement. However, contrary to what many expected these four years brought no visible changes significantly in the pharmaceutical and nutraceuticals industry. The real impact of patent protection is yet to be seen in domestic business landscape which is expected to bring both great challenges and opportunities for home-grown research and generic companies. Patents are eventually issued by the Indian patent Office (IPO) against the mail-box applications for various new drugs and food products which are launched or likely to be launched in the Indian market with patent protection. No doubt the road ahead is not as easy as what it was prior to 2005 and will bring new legal risks for businesses in India. The article will try to deal with possible challenges that the Indian patent law is likely to bring to the domestic industry.

Over the past couple of years, the exponentially growing Indian business landscape has got increasingly competitive and challenging mostly due to the mergence and vibrancy of patent protection as business and legal tool for market capture. Many companies are geared up for protecting their global products with patents and intellectual property rights in India and aggressively using them to keep competitors out of the market. Lately a couple of generic companies looking to launch generic version of patent drugs are sued for infringement of patents and are now involved in time-consuming and expensive patent litigations. These litigations are going to be a tough

challenge for Indian companies, probably requiring drastic changes in their business operations which will possibly be changing the facet of Indian business landscape be it from regulatory or pricing or alliances or competitiveness standpoint.

It is now imperative for domestic companies to understand acknowledge legal challenges related to patents and should include patent strategy into business strategic planning. In fact some of the Indian companies have already made a constructive move in such direction by establishing patent or IPR cells to support their R&D units in preparing and developing non-infringing products and platform technologies. Even such companies have also taken initiatives in protecting their innovative and incremental products/technologies by filling patent protection invarious countries, showing their commitment in protecting intellectual property. However, to better deal with challenges there are certain measures that need to be included in the business strategy for turning odds into evens.

Constant patent monitoring : It is utmost important for a company that it should keep account and a close eye on patent granted or patent issued and patent application filed in their areas businesses. Every week, the Indian Patent Office publishes a gazette covering new patents issued and patent applications filed in their areas of businesses. Every week, the Indian Patent Office publishes a gazette covering new patents issued and patent applications filed by companies in various field of technologies. Lack of constant monitoring of patents may bring unanticipated barriers later in the product development or commercialisation. Even such monitoring is useful in keeping track of competitors activities and business strategies. Possibly a company should assign dedicated people for monitoring and scouting of patent information.

Mitigation Legal Risk : Prevention is better than cure. The same is applicable for business decisions. It is recommended that a company looking to start new product development or launching new product should do a thorough

check/search for patents and published patent applications that may create legal risks in launching the products. Such practices always help in avoiding unexpected legal risks and assist company management to take right call at right time. Even it is recommended that the company before commercializing a product should obtain IP clearance opinion from a practicing patent attorney. Such opinion is always useful if there is a possibility of litigation in future.

Pre and Post Grant Oppositions : Indian patent law has a unique combination of pre and

post grant opposition which allows a company to oppose published patent application before the grant of a patent (known as pre-grant opposition) and even one year after the grant of the patent (post-grant opposition). Opposition should be used as a strategic business tool to challenge patents and/or published patent applications that may barrier your businesses. This is, infact, the cheapest way of knocking down or challenging patents/patent applications compared to fighting expensive litigations. However, to utilize pre and post-grant opposition as an effective business tool it is important that a company must constantly

WALMART sustainable product index : 15 questions for suppliers

Energy and climate : reducing energy costs and greenhouse gas (GHG) emissions

1. Have you measured your corporate GHG emissions?
2. Have you opted to report your greenhouse gas emissions to the carbon Disclosure Project?
3. What is your total annual GHG emissions reported in the most recent year measured?
4. Have you set publicly available GHG reduction targets? If yes, what are those targets?

Material efficiency : reducing waste and enhancing quality

1. If measured, please report the total amount of solid waste generated from the facilities that produce your product(s) for Walmart for the most recent year measured?
2. Have you set publicly available solid waste reduction targets? If yes, what are those targets?
3. If measured, please report total water use from facilities that produce your product(s) for Walmart for the most recent year measured.
4. Have you set publicly available water use reduction targets? If yes, what are those targets?

Natural resources : producing high-quality, responsibly sourced raw materials

1. Have you established publicly available sustainability purchasing guidelines for your direct suppliers that address issues such as environmental compliance, employment practices and product/ingredient safety?
2. Have you obtained third-party certifications for any of the products that you sell to Walmart?

People and community : ensuring responsible and ethical production

1. Do you know the location of 100% of the facilities that produce your product(s)?
2. Before beginning a business relationship with a manufacturing facility, do you evaluate the quality of, and capacity for, production?
3. Do you have a process for managing social compliance at the manufacturing level?
4. Do you work with your supply base to resolve issues found during social compliance evaluations and also document specific corrections and improvement?
5. Do you invest in community development activities in the markets you source from and/ or operate within?

Source : ICIS Chem Business, July-Aug. 2009, P.17

monitor patents granted and patent applications published every week.

Protecting IP: In a competitive market it is critical that a company must protect its own intellectual property by filling patent application, applying trademark and securing copy-right protection. Building intellectual property significantly help the company to leverage corporate value and also protect it market space from competitors. It is recommended that companies should closely work with patent counsel to strategic how patents can be used to support their business objectives. A strong IP portfolio may also help in raising investment or attract potential alliance with global companies.

The Indian patent law is definitely bringing challenges for Indian companies but a constructive approach to align patent with business strategy may work wonders for companies. Not only a patent is important for business survival but also as a runway for global expansion. Most of the foreign MNC's have already realized the portential of growing Indian market for global products and have already started working on model business strategies with patent as core tool. Now it is high time for Indian companies to realize the potential of patent and other intellectual property in business landscape and without losing any further time must start learning rules of the IP business landscape.

The author is CEO with IP Feathers an intellectual property consultancy firm.

Source : Ingredients, April 1-15, 2009, P.40

CUSTOMER SERVICE

**Responsible Care :
Meeting the Needs of a changing World**

Responsible Care has adapted over the past 22 years as environment, health, safety, and security challenges have evolved. New directions going forward include a global product stewardship push. A rewrite of the program's codes in Canada focuses on sustainability.

There is a growing consensus that Responsible Care will provide the foundation for industry's global advocacy efforts, giving the chemical sector a seat at the table when policy makers craft environment, health, safety, and security initiatives (p. 24). Public concerns about global warming, security, and chemicals management have made it more important for voluntary national and international initiatives to be expanded and revised. And executives say the program is already yielding tangible benefits in improved communications between industry, regulators, and nongovernmental organizations (NGO).

One notable success has been the 2002 site security code, which ACC and Socma members have used to demonstrate to U.S. lawmakers and the public that they acted well ahead of the 2006 federal site security regulations. Responsible Care has provided the U.S. industry with a solid underpinning for domestic advocacy efforts, says Nova Chemicals v.p./government affairs Greg Wilkinson. The challenge now will be to make that work in the international arena, which is inevitably more complex. "One of the challenges ahead of industry is management of the overall Responsible Care brand as we approach international organizations with our advocacy efforts," Wilkinson says.

Industry leaders say it is a priority to extend Responsible Care globally, particularly in emerging markets such as Russia, China, and the Mideast. "Even responsible companies can be tainted by the errors of other players in the global chemical industry," Eastman chairman and ACC vice chairman Brian Ferguson told attendees at ACC's annual meeting last month. "Chemical contamination in baby formula or pet food in China is not viewed as merely a 'Chinese problem.' It is viewed as evidence of the danger of chemicals anywhere in the world. We know these fears are overblown or misguided, but the industry suffers nonetheless. We need to reach out directly to our counterparts in emerging economies and help them build the systems, procedures, and expertise they need to operate at the same safe levels that we do," Ferguson says.

Industry executives have also responded to challenges by advocating greater transparency and accountability. The International Council of

CARE SNAPSHOTS

RESPONSIBLE CARE:

The chemical industry's global voluntary initiative under which companies, through their national associations, work to continuously improve their health, safety and environmental performance, and communicate with stakeholders about their products and processes.

RESPONSIBLE CARE GLOBAL CHARTER:

Provides the vision for future development of the initiative by establishing a broader and more vigorous agenda for the international chemical industry by focussing on new and important challenges facing the business of chemistry and society.

GLOBAL PRODUCT STEWARDSHIP (GPS):

Supports the Product Stewardship Commitment of the Responsible Care Global Charter. It is an ICCA initiative to strengthen product stewardship within the chemical industry and with customers throughout the chain of commerce. Launched in 2006 as the industry's contribution to the United Nations Strategic Approach to International Chemicals Management (SAICM), GPS provides a framework to ensure a strong and consistent standard globally for product stewardship. In so doing, GPS also seeks to improve government and public confidence in the industry's management of chemicals.

Source: Dow Chemical, CW.

Chemical Association's (ICCA) Global Product Strategy (GPS), a global implementation of product stewardship guidelines that will include public release of product safety data, is one example. "The Global Product Strategy represents an acceleration of industry efforts to implement product stewardship globally, particularly for the developing world," says Greg Bond, corporate director/product responsibility at Dow Chemical and co-chair of ICCA's chemicals policy and health leadership group.

GPS provides a framework for strengthening product stewardship and helping shape or contribute to chemicals management work worldwide, Bond says. ICCA, through GPS, is also continuing its work to bring Responsible Care programs to emerging and developing countries. One of the key goals of GPS is to develop a base set of hazard and exposure information that is used worldwide in making product safety assessments, Bond says. "GPS commits all companies to complete safety assessments by the end of 2018 and make them publicly accessible," he says.

Public release of data will help mitigate unfounded concern about chemicals, Bond says.

"One of the reasons there is so much concern about chemicals in products is that for many years the chemical industry was doing these assessments in a black box," Bond says. "A lot of the effort now is about opening that box and kicking up the level of transparency around what we know about risk and how we manage chemicals."

Dow intends to lead by example. All of Dow's high-priority products will be assessed by 2010, and by the end of 2015 all of its products will be assessed, Bond says. GPS also strives "to provide communication to key audiences, and to proactively advocate on existing and evolving regulatory initiatives," he says.

GPS is central to industry's participation in the Strategic Approach of International Chemicals Management (SAICM). SAICM is an international program designed to ensure the sustainable management of chemicals with certain targets that the chemicals industry must meet by 2020.

A key test of the industry's ability to respond to the demands of a changing world will be seen in an experiment underway in Canada. The Canadian Chemicals Producers Association (CCPA;

Ottawa), which launched the first Responsible Care program in 1987, is redrafting its codes with sustainability as the program's core goal. The shift reflects a belief that Canada's Responsible Care program is not addressing growing concerns about issues such as climate change, inherently safer technologies, corporate social responsibility, and business ethics, says CCPA v.p./Responsible Care Brian Wastle. Rewriting the codes hardwires sustainability into the program, he says. CCPA board members had argued that Canada should take the lead on directing Responsible Care more toward sustainability, he adds. "We felt the need to establish Canada again as the leading edge," Wastle says.

The CCPA initiative will also be an example that other associations can emulate or avoid, depending on how it is received by stakeholders. CCPA discussed its revisions, with ICCA and other trade organizations that "probably see us as a nice test market" for a possible dramatic shift in Responsible Care, Wastle says.

CCPA's Responsible Care ethic and principles for sustainability holds that CCPA member companies "dedicate ourselves, our technology, and our business practices to sustainability—the betterment of society, the environment, and the economy." Members also commit "to do the right thing, and be seen to do the right thing."

Socma's ChemStewards program, meanwhile, also reflects the need to respond to changing times. Smaller U.S. companies find ChemStewards to be a better way of demonstrating that measures are in place to manage environment, health, safety, and security practices, says Socma president Joe Acker. Some companies recently joined Socma solely because of the ChemStewards program, he says. "I think the change in administration has made a lot of people recognize the value of being in a trade association, one that will represent their industry in Washington," Acker says.

ChemStewards appeals to smaller firms because it is more flexible than Responsible Care, Acker says. "Seventy percent of our members have sales of less than \$60 million/year," he says. However, firms still want a program that is third-party certified, to demonstrate to regu-

lators and others that management systems are in place. ChemStewards offers three levels of compliance, and companies can choose between basic, enhanced, and excellence tiers (chart), Acker says.

Socma offers its members one-on-one training, as well as the ChemAlliance compliance assistance Web site. Socma purchased the rights to the site from EPA last May, and is working to expand the site's focus beyond environmental compliance to include health and safety, as well as chemical security. Socma also has a network request system where members can request and trade information or advice.

Industry representatives say ChemStewards and Responsible Care will also help facilities that may be randomly targeted for review as part of OSHA's National Emphasis Program (NEP) for chemical facilities. OSHA recently completed an NEP for refineries, and plans to move on to chemical facilities this year, experts say.

OSHA launched NEP partly because of the 3005 explosion at HP's Texas City complex that killed 15, experts say. Congress held hearings on the accident, and OSHA officials were in an awkward position when asked about the frequency of OSHA inspections.

Companies that adopt ChemStewards will be better prepared for OSHA inspections, Acker says. "It's really going to save a lot of time," he says. Socma has been offering Web seminars and guidance documents on how to prepare for an OSHA inspection, Acker adds.

The OSHA chemical NEP program will likely target 8,000 chemical plants that are covered by process safety management (PSM) requirements, over a 6-8 year period, says Steve Arendt, v.p./process industries at ABS Consulting (Houston). The chemical NEP will also be an important test for Responsible Care management systems. "If a chemical plant is serious about Responsible Care, and serious about the audits and those audits were good, they should be in a better spot than other facilities," Arendt says. It will be interesting, once the program results are tallied, to see if Responsible Care member plants performed better than their peers in the chemical NEP, he

says. If so, it could be a big boost for membership recruitment efforts.

It is vital, given the eight-year timeframe slated for a chemical NEP, that chemical industry trade groups use the examples of the early OSHA audits to network with their members and learn what lessons they can from those inspections, Arendt says. "They will need to take the lead and tell everyone what has happened in the first NEP reviews," he says.

Evonik Industries says the Responsible Care program likely will help facilities targeted by OSHA, establishing a clear portion of a site's management system that addresses regulatory requirements and best practices being reviewed by NEP. "ACC has done a good job focusing on process safety in the last few years as part of Responsible Care, with tracking the annual metrics, working with the Center for Chemical Process Safety, and other activities," says John Wnek, Evonik v.p./environment, safety, and health. One of the main benefits of Responsible Care for Evonik is having an integrated environment, health, safety, and security program management system driving targets and goals across the organization, Wnek says. "Many of our operations followed the international environmental management system standard ISO 14001, so we had an established management system foundation in place that was used to integrate the other elements of Responsible Care," he says.

The primary challenge for Evonik "is that we operate under a decentralized business model," Wnek says. "A high level of cooperation was needed from ACC, the certification registrars, and accreditation bodies to allow flexibility in our approach to comply with Responsible Care while ensuring a cost-effective, value-added process for the business lines."

Enhanced cooperation with ACC is also on the agenda for chemical distributors, says Chris Jahn, president of the National Association of Chemical Distributors (NACD; Arlington, VA). NACD recently signed an agreement with ACC that will result in closer cooperation between the two organizations on Responsible Care and NACD's Responsible Distribution Process (RDP).

The groups will start off with a side-by-side com-

parison of the two programs, and draft recommendations on how they can be harmonized as much as possible, Jahn says. The results of the review, due out later this year, will dictate the details of how the agreement is implemented going forward. Executives will decide next year what changes to RDP are necessary, he says.

The number of customers that distributors deal with is much greater than the number dealt with by typical suppliers, Jahn says. "We have 245 members; 1,600 sites; and 750,000 customers," he says. That means the scope of RDP is broad, and the implications for national transportation safety and security are even broader. "An NACD distributor makes a delivery every four seconds," Jahn says. That also means NACD members are constantly on the road. One issue for distributors is conflicting mandates from government agencies, however. Transportation safety is overseen by the Department of Transportation (DOT) and transportation security is administered through the DHS.

A DOT official may demand information that DHS prohibits firms from releasing. "We can't have these situations where distributors are stuck in the middle," Jahn says. Now that DHS has been around for seven years, better cooperation is long overdue, he says.

- KARA SISSELL.

Source : chemical Weekly, July 2009, P21-23

MORE INFO

Biodiesel

USES

BIODIESEL is a clean-burning alternative fuel produced from renewable sources of vegetable or animal fats and oils. It contains no petroleum, but can be blended at any level with petroleum diesel.

Biodiesel can be used in compression-ignition (diesel) engines and most oil-fired boilers. It is suitable for most applications where regular diesel is currently used. It can also be used in most modern diesel engines without modification, including those in passenger cars, sport utility ve-

hicles, light trucks, buses, ships, trains, off-road heavy equipment and mining equipment, as well as for home heating fuel, power generation and in two-stroke engines (as a mixing agent).

SUPPLY/DEMAND

Many analysts consider the US market to be oversupplied, due to a relatively underdeveloped fuel infrastructure and the increasingly aggressive stance against US biodiesel imports that Europe has taken recently.

Demand for US biodiesel in the domestic and overseas markets is expected to be muted through the first quarter of 2009. The EU, traditionally the destination of about 70% of US biodiesel, is investigating allegations of dumping by subsidized US biodiesel sellers and has taken steps to reduce imports.

In the US market, the rapid decline in crude oil values has squeezed profit margins for biodiesel producers, who compete against mineral-based diesel. The global recession has also contributed to a considerable softening in demand.

TECHNOLOGY

Biodiesel is made by transesterification, a chemical process involving the methylation of the fatty acid from a triglyceride molecule of animal or vegetable fat or oil. The process is catalyzed by an alkaline catalyst. In addition to biodiesel, the process produces glycerin.

PRICES

US biodiesel prices rose on the back of increased feedstock costs, despite little actual market activity, sources said during the week ended May 14, 2009.

US fatty acid methyl ester (FAME) prices rose on stronger demand, while soy methyl ester (SME) values were little changed amid slow sales and low production during the week ended May 28, 2009.

SME transactions were heard at \$2.95-3.05/gal FOB Midwest, unchanged for the third consecutive week. FAME was heard sold

at \$2.65-2.80/gal FOB Midwest, as sales were relatively strong in warm weather markets, according to global market intelligence service ICIS pricing.

Sellers and distributors said the overall market was gloomy, with little or no demand from markets other than those with mandates to fill.

Biodiesel renewable identification numbers (RINs) for 2009 were trading at 23-27 cents during the week, as the market looked to off-load excess RINs for the year, said ICIS pricing.

OUTLOOK

The US biofuels industry is expected to undergo consolidation in 2009, with many ethanol and biodiesel plants either closing or being absorbed by a few larger players who will dominate the market.

The US has 171 biodiesel refineries, with estimated capacity at more than 2.4bn gal/year, well ahead of the 6m gal/year mandated by the US government for 2009, according to ICIS.

Lower investment, together with weaker utilization rates of existing plants would reduce the global incremental biofuels supply, according to the Paris, France-based International Energy Agency (IEA). Commercial biodiesel suppliers are

US BIODIESEL CAPACITY (BY LARGEST VOLUME), '000 TONNES/YEAR		
Company	Location	Capacity
Agri-Source Fuels	Dade City, Florida	400
GreenHunter Biofuels	Houston, Texas	350
Delta BioFuels	Natchez, Mississippi	335
Imperium Renewables	Seattle, Washington	330
ADM Processing	Velva, North Dakota	285
Louis Dreyfus Agriculture Industries	Claypool, Indiana	275
Safe Renewables	Cowoe, Texas	235
East Fork Biodiesel	Algona, Iowa	200
Nova Biosource Fuels	Seneca, Illinois	200
Twin Rivers Technologies	Cincinnati, Ohio	200
Natural Ingredients		
FuelBio Holdings	Elizabeth, New Jersey	155
Owensboro Grain	Owensboro, Kentucky	185
Blackhawk Biofuels	Danville, Illinois	150
Carolina Biofuels	Taylors, South Carolina	135

SOURCE: ICIS PLANTS & PROJECTS

increasingly looking toward "second-generation" feedstocks like algae and jatropha seed, but that technology is considered years away from commercialization.

EAT & DRINK

Indian food industry to grow to US\$ 100 billion to US\$ 300 billion by 2015

Indian food industry to grow to US\$ 100 billion to US\$ 300 billion by 2015, a study said. "The Indian food industry estimated at US\$ 200 billion (Rs.8,80,000 crore) in the year 2006-07 is slated to reach US\$ 300 billion (Rs. 13,20,000 crore) by 2015 with the share of processed food in value terms increasing from 43 per cent to 50 percent," a report by FICCI-technopak said.

Food processing being the major sector in the Indian food industry stands at US \$ 85 billion (Rs. 3,74,000 crore) and gives direct employment to about two million workers, the report said.

The food processing industry is highly fragmented and dominated by the unorganized sector with 75 per cent units falling under it.

"The increasing contribution of food processing sector would largely come from the organized sector," the report said.

The key growth drivers for the Indian food industry would be higher disposable incomes, shifts in spending orientation, increasing organized food retailing, increasing export opportunities, favourable regulatory environment and Government support and investment inflows amongst others, the report said.

Although the industry is growing at a fast pace, the level of food processing is still lower as compared to other countries, FICCI-Technopak report said.

The major challenges faced by the sector are low level of research and development, industry academia gap, skill and technology gaps and meeting global quality and standards," the report said.

(Source : Economic Times, Mumbai)

THE SILVER LINING

Sustainable Energy – The emerging horizon

By Pradeep Chaturvedi

Introduction

Sustainable development holds humans responsible for the state of environment and challenges them to accept responsibility for initiating the changes necessary to attain sustainability. Sustainability of natural, economic and social systems is threatened by the global economic melt down and thereby making every country work for minimum standards of life support systems of its population even if that means neglect of sustainability principles. Irrespective of the phenomenon of 2008 which has emerged more due to greed of the people camouflaging it through corrupt practices, the natural capital of the planet earth has been threatened by common man's greed; and inappropriate wasteful practices of production and consumption.

In the intervening years since the Rio there have been several statements on sustainable development at various international fora. In October 1994 a group of 16 scientists, economists, policy makers and business leaders met at Cornelius, France and published a declaration, which is known as Cornelius Declaration. The declaration called for radical increase in resource productivity and expressed the hope that within our generation, nations can achieve a ten fold increase in the efficiency with which they use energy, natural resources and other materials (meaning 90% reduction in the use of) called itself the Factor ten Club had made only basic commonsensical recommendations for satisfying human needs without unduly damaging the environment, the implementation has faced monumental resistance. Some of the European countries like the Netherlands, Norway and Austria have adopted a watered down version of Factor Four improvements (75% reduction in the use of resources). Most of the countries are continuing to spend hundreds of billion of dollars of tax payers' money each year on subsidies for mining, oil, coal, fishing and forest industries that promote insufficient and unproductive use of resources.

The experts thought that at the onset of this millennium it was an irony that the gruelling and mind numbing poverty that we face in this world exists alongside extreme affluence and abundance. United States, is classic example of waste. It has been estimated that of the US \$ 9 trillion spent every year in the United States, in 2000, at least US \$ 2 trillion annually was wasted. What is meant by "waste" in this context? Simply stated, it represents money spent where the buyer gets no value. An example of waste, familiar to everyone, is sitting in a traffic jam on a congested freeway. Nearly US \$ 200 billion a year in energy costs was estimated as waste because efficiency norms similar to those in Japan were not applied in US in transportation, business and home. In health care, US \$ 65 billion was reportedly spent annually on nonessential or even fraudulent tests and procedures, US \$ 250 billion dollars of inflated and unnecessary medical overhead as generated by then current insurance system. Paul Hawken, author of 'National Capitalism the Next Industrial Revolution' also estimated, in 2001, that as much as one-half of the entire UD GDP may be attributable to some form of waste. And this waste is one major cause of unsustainability.

Mr. Ola Ullsten, Former Prime Minister of Sweden, and a well known environmentalist, said in 2007, "Ensuring that current generation capacity in India and China is up to average of OECD standard efficiency would have greater effect than the total impact of Kyoto on the whole developing world." Giving as an example he said, "If the 800 coal fired power plants that are planned for the two countries for 2012 are built it will result in a staggering 2.5 billion tonnes of carbon dioxide, from burning coal alone. This compares to the 500 million tonnes of reduction from all the Kyoto signatories for the same period of time. New technology gives us a change, if developed."

Much talked reasons for threat to sustainability are high use of fossil fuels and deforestation. Both these threats can be brought down to manageable proportions; but not much is seen on the ground.

The European Union has committed its members to a 20% reduction in the use of fossil fuels by year 2020. If all countries followed this example then that would reduce 1.6 billion tonnes of carbon

from the atmosphere every year. Among others the World Bank deems it possible to reverse deforestation. A trend in that direction is already under way thought at a very slow pace. Deforestation contributes to about 20% of the carbon that is being emitted to the atmosphere. That is equivalent of 1.5 billion tonnes of carbon.

Two measures together – less fossil fuels and more forests – would remove 3.1 billion tonnes of carbon. This amount of three fourths the quantity of what is needed to stabilize atmosphere to the point where there is no more increase of carbon. Which most likely is a pre-condition if we ever shall be able to start decreasing the green-house gases as was agreed at Kyoto.

There is one important stand-off between the developed and developing countries that is a potential obstacle. This is how it goes: Say the developed countries: "We do not want to give up our hard earned standard of living. We need growth". Say the developing countries "We want to go the same way as you did. No way will we accept any post 2012 Kyoto agreement that threatens our future economic development. We need growth.

If the global leaders cannot find a solution to this argument then how can sustainability be ensured. If the leaders do not manage to break those stand offs, the common man is doomed. The role of forest might be crucial in climate change, even politically. The world needs more forests, to build a bigger carbon sink and because forests are crucial for the functioning of most forest for the same reason but also because deforestation is one of the major causes of starvation and poverty. Everybody wins, nobody loses.

Elements of unsustainability

Although there seems to be no physical limits to the world's energy supply for atleast the next 50 years, today's energy system is sustainable because of the equity issues as well as environmental, economic and geopolitical concerns that have implications far into future. Aspects of unsustainability of energy system identified during 1997-99 included the following.

1. Modern fuels and electricity are not universally accessible, and leads to inequity ac-

cessible, and lead to inequity that has moral, political and preactical dimensions in a world that is becoming increasingly interconnected.

2. The current energy system is not sufficiently reliable or affordable to support widespread economic growth. The productivity of one-third of the world's people is compromised by lack of access to commercial energy and perhaps another one third suffers from economic hardship and insecurity due to unreliable energy supplies.

3. Negative local, regional and global environmental impacts of energy production and use threaten the health and well being of current and future generations.

Expert meeting of asian countries

Energy experts from a number of Asian countries met in Delhi in December 2008 to consider the environmentally sound energy pathway for development. Active role was played by the scientists and engineers belonging to IIT Delhi and Kyoto University under the banner of Sustainable Energy and Environment Forum based in Kyoto. Many of those who participated had contributed to drafting of the Kyoto Protocol and had followed up on its development. This group made specific recommendations as follows :

1. Evolve Energy Policy that will combine, as appropriate, the increased used of renewable sources, more efficient use of energy, greater reliance on advance energy technologies, including clean fossil fuel use technologies and the sustainable use of traditional energy resources, which could meet the growing needs for energy services in the longer terms to achieve sustainable development.

2. Promote Action Plans that will ensure accessibility to energy services using renewable sources to the optimum and finding ways and means by which energy services using renewable sources to the optimum and finding ways and means by which energy services can be delivered reliably, affordably, and in an economically viable, socially acceptable and environmentally sound manner.

3. Renewable energy is a main pillar of sus-

tainable energy supply that can effectively tackle rural poverty and energy deprivation through the installation of decentralized, locally appropriate and affordable energy services for the poor. Renewable energy supply should be an integral part of energy security, poverty alleviation and rural development, and therefore, should be strongly supported in policy and action plans of relevant ministries and agencies in all Asian countries.

4. Energy efficiency is the second pillar of sustainable energy supply and should be treated in an integral manner along with the renewable energy applications to ensure energy use and climate security.

5. Proactive role should be played by energy experts to evolve and implement renewable energy services to promote less consuming devices that may even call for change in consumption patterns.

6. Address urgently and vigorously the issues of local emissions from use of traditional biomass fuels for rural cooking energy and fossil fuels for transport. Action for accelerated development of technological and mass transport systems on cleaner fuels should be initiated.

7. Biogas is an important fuel for India and Asian countries. With the new development in utilization of biogas for power and automobile fuel, proper emphasis should be given to promote biogas enrichment and bottling for its large scale applications as an integral part of renewable energy.

8. Innovative financing schemes that may ultimately substitute subsidies for the poor should be evolved.

9. Intensive and accelerated research development and demonstration schemes for renewable energy devices should be involved and supported through public funding and international funding. The funding should support the activity till the market stage.

10. Package of innovative fiscal incentives be evolved that will effectively promote and work on the private investments and market forces.

11. International cooperation should be ensured in technology development; knowledge sharing, capacity building and trade.

Climate change and sustainable energy supply

Sustainability of energy system is linked to climate change and in this regard the 15th meeting of the committee of parties to the framework convention on climate change in Copenhagen in December 2009 will be extremely important. WFEO will certainly play a leading and proactive role to evolve logical solutions and approaches to ensure a smooth mitigation and adaptation strategy. The key to future lies in not only developing engineering and technology solutions but in providing engineering support for discussions at international conferences.

One needs to understand that UNFCCC and Kyoto Protocol related meetings are becoming increasingly unwieldy and now have a total of six separate processes including:

1. The bodies of the UNFCCC and Kyoto Protocol
2. Two subsidiary bodies focusing on implementation and science/technology; and
3. Two processes established to negotiate a new climate change agreement, one under the UNFCCC and the other under the Kyoto Protocol.

The negotiations are held under two processes

:

1. The Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) under the UNFCCC. The AWG-LCA negotiation has a broad mandate and includes all Parties under the UNFCCC, including the United States
2. The Ad Hoc Working Group on further Commitments for Annex Parties under the Kyoto Protocol (AWG-KP).

COP-14 at Poznan, Poland in December 2008 had slow progress and limited discussion on national targets. There was significant focus on what the global level of ambition for emission cuts should. In both the AWG-LCA and KP there were

repeated references to the IPCC 4th Assessment Reports' 450 ppm CO₂ stabilization scenario. This scenario requires a 25-40% cut in emissions for developed countries as well as substantial deviation from business as usual emissions from key developing regions 2020. The apparent coalescing of countries around this scenario implies that Parties will seek as de-facto target of limiting global temperature rising to no more than 2 degree centigrade.

The way the government have chosen to handle the financial crisis can be also followed to deal with the threat of global warming. Governments have highly identified the financial crises as something requiring quick, concerted and substantial action and responded immediately – not with rhetoric but with action. After billion dollars within the first weeks; trillions came by the end of 2008; and more are on the way.

The financial crises is far from over; but it has demonstrated how quickly governments can act when they believe in the seriousness of the crisis before them. Most governments have tagged climate change with the same rhetoric with the leadership and action required to effectively address it. Imagine where the global response to climate change would be if a fraction of the amount spent over the end of 2008 on the financial crisis had been spent at any time between 1990-2008 on global warming. Imagine a fraction of that money having been invested over that time, in any of the mitigation technologies, the world needs to tackle climate change; wind power, solar power, carbon capture and storage.

Experts wonder if the governments have instead demonstrated their commitment to tackling climate change not through substantive action but through participating in what can sometimes seen the travelling circus of climate change, the annual conference of the parties to the climate change treaties – Montreal 2005, Nairobi 2006, Bali 2006, Bali 2007, Poznan – 2008 and this year at Copenhagen.

PROACTIVE – The Way Forward

All above discussions points out that the PROACTIVE Model of Dr. madhav Mehra provides a realistic holistic solutions for future development.

(Source : Quality Times, Vol.XIV No. 4/2009).

THE AROMA

Sustainability, Economy drive discussion at SDA

The soap and Detergents Association annual meeting and industry convention in Boca Raton, FL convened this week amid a backdrop of uncertainty related to the global economic downturn that has the sector cautious about 2009. Demand in soap and detergent sector has held up well relative to other parts of industry but consumers and supplies are closely monitoring conditions, attendees say.

“There is some somberness in the overall market,” says Frank Sherman, SDA board president and general manager of AkzoNobel Surface Chemistry, addressing the mood of the show. “I think the consumer business is a little less affected than most other markets. Consumer applications are less affected than industrial applications, but the whole market has suffered from the run up of high raw material and energy prior to the fourth quarter of last year,” he says.

Trends that drive demand development have not changed, he adds. “Sustainability is still a big push, and there will be a trend of more value products because of the recession. “I think there’s still an interest in greater convenience in home applications” that will drive demand, Sherman adds.

Sustainability is being rewarded, he adds. “It is becoming more valued so consumers pay for that,” Sherman adds. “Formulators will try very hard to try to hit the right value for performance products, but the trend is so strong that people will pay for sustainable products.”

Demand and volumes have weakened but are holding up better than the overall economy, says David Del Guercio, senior v.p. and general manager/consumer specialties and household care at Evonik Goldschmidt. “2007 was an extraordinary year for the business, I’d say current conditions are more like 2006,” which was still a strong period, Del Guercio says. “The household sector is doing very well compared to how other sectors of industry are doing now,” says Reinhold Brand,

president of Evonik Goldschmidt.

Supply chains are being run extremely lean, which is having an effect on volumes, Brand says, “Big companies and retailers have drawn down inventories and this has had an effect on demand,” Brand says. “This has a positive effect on cash flow, which is why it is being done.” Suppliers are also doing this keeping a close eye on inventories, raw material levels and costs, and utilization, “We are finding out how to operate at these lower inventory levels without running out product,” Brand says. “We have seen some term-term spikes” as demand returns, which has caused some volatility in prices. “This should calm down as the market moderates,” he adds.

Trends are continuing on the compaction side : customers want innovation that allows cold-water formulations and effectiveness in lower temperatures. “A primary concern from customers is that suppliers keep up with the level of innovation,” Brand says.

Consumers are driving the push for more sustainable products, says Sharon J. Mitchell, senior v.p./research & development, global fabric care at Procter & Gamble (P&G).

P & G’s innovation process incorporate the company’s life cycle assessment tool, which assess overall use of energy and materials by products from creation of raw materials, through consumer use, and to final disposal. One key factor in successful applications is that performance is not diminished, P & G says, “Early attempts sometimes asked consumers to trade off performance for other attributes,” she says. “Those were not successful products.”

P & G’s innovation and sustainability efforts focus four board themes: more efficient use of energy, water and materials and increased use of renewable raw materials. Reducing energy usage is a key sustainability driver. “The single biggest level we have [in sustainability and energy efficiency] is to get consumers to use cold water,” Mitchell says. Cold water use would reduce energy costs per load by 70% and a saving of all household electricity, she adds.

Henkel's strategy for managing the uncertainty of 2009 includes maintaining close communication with a value chain. "There is a greater focus on supply chain management and selection of partners says Bertrand Conqueret, corporate senior v.p. purchasing at Henkel. "Discussions [at SDA] were very constructive, and concrete targets were set. "Henkel rates its suppliers bases three criteria" cost out, risk management and value in. "There are a lot of "different scenarios but no real answers" on the economic outlook for 2009, says Thomas Muller-Kirschbaum, Henkel corporate senior v.p. launcry and home care. "The only thing we can do is keep a clear vision of what we would like to achieve in the next few years. We are looking ahead to the next peak, but will manage what comes this year."

Demand for enzyme-based products is increasing, says Per Falholt, executive v.p. of research and development at Novozymes. "Sustainability is driving demand. The idea that you can do more with less," Falholt adds. Novozymes continues to grow, Farholt says, and continues to use enzyme technology to enhance performance in its products.

Consumers are also willing to pay extra for more sustainable products. "I think we see people are willing to pay more for sustainability," Falholt says, citing the efficiency and lack of carbon dioxide waste produced when sustainable products are used.

Novozymes still expects to grow in 2009, "Though it may now be as much as 2008, which was about 13%," Falholt says.

Sustainability continues to be key theme across

the markets Rhodia serves, says Pascal Juery, president of Rhodia Novecare. "A vast amount of product development is toward more ecofriendly solutions" such as including less material, reducing impact from VOCs, and using nontoxic materials, he says. The reaction of Rhodia's customer base to the company's recent McIntyre Group acquisition has been positive, Juery says. Close of the \$100 million deal is expected by the end of the first quarter. Despite excitement over the deal, the mood of the show cannot ignore the state of the economy, Juery says, "Doing more with less" is becoming increasingly important, he says.

Richard Carter, director of global key accounts and regional sales/detergents and cleaners at BASF says the mood of the show is cautious. "We're taking a cautionary stance because of the extreme unpredictability of the economic environment we're in. We're also looking at the difficulties of forecasting because of the volatility," Carter says. "When we look at the detergents and cleaning business is relatively stable. There has been some destocking across the whole chain, and people are talking about a crisis in the economy. But for us the crisis is for opportunities," Carter says, citing one of BASF's objectives as getting closer with its customers to enhance products as well as optimize its supply chain.

Carter notes that although customers want sustainability cleaning products, they are not willing to sacrifice the performance. "The end consumer and our customers who are part of the chain have stated they are not prepared to trade performance for sustainability. They want performance and sustainability," carter says.

(Source: Convention News Daily, Friday, January 30, 2009)

Technology

BLEAK

Are jatropha advantages overstated?

Indian experience with jatropha has found that the plants do indeed grow in wastelands, but if high yields is to be achieved the plants must be cared for, according to Suman Jha, researcher with R.R. Shah at Navsari Agricultural University (Gujarat, India).

A jatropha farm was established in 2005 on parched, desolated land in the Vyasa district of the state Gujarat. The project ended in May 2009, and *The National*, a newspaper out of Abu Dhabi, quoted R.R. Shah, the dean of agribusiness at Navsari: "There is no yield... The literature said that with dry land, after four year's growth, you can get a yield of 1 kg per plant. For us, it is hardly 200 g per plant". Findings from 22 agricultural colleges across India were similarly discouraging.

Jha has tried growing the plants with fertilizer, intermingled with other crops and trees. In those plantings, yield has been as much as 4 kg per plant. *The National* quoted Jha as saying, "This is not a wasteland crop. It needs fertilizer, water and good management. Yes it grows on wasteland, but it doesn't give you any yield."

London-based DI oils reportedly has planted about 257,000 hectares of jatropha, mainly in India (see *Inform* 19:739, 2009). DI has also had



trouble harvesting anything near 500 g of seed per plant. Early mortality of young plants has destroyed many plants per hectare, but the company anticipates the surviving plants will continue to grow and produce. DI hopes to achieve 1000 kg/hectare by the fourth year after planting, max. yield is not expected before the eighth year.

DI has also contracted for planting jatropha in Africa. In water-scarce Swaziland, some jatropha farmers have found that the plants need regular watering, in contradiction to widely disseminated claims that jatropha does well under water-limited conditions. To enhance opportunities for profits some farmers have turned food-growing land over to jatropha production, limiting their ability to produce food.

Questions are arising in Swaziland regarding the appropriateness of jatropha as a cash crop for its farmers. Siculo Simelane from Yonge nawe, a public interest nongovernmental organization in Swaziland working on issues of environment and sustainable development to prevent and reduce the impact of inappropriate development on the environment and people was quoted by Friends of the Earth as saying, "[T]he reality is that biofuel developments are firmly controlled by northern companies which are taking over our land at an incredible pace, and are bringing about serious socioeconomic and environmental impacts on our communities, food security, forests and water resources" ([www.foe.co.uk / resource / press_releases / jatropha_27052009.html](http://www.foe.co.uk/resource/press_releases/jatropha_27052009.html)).

DI company spokesman Graham Prince stated that DI decided that its jatropha plantings in Swaziland had produced "disappointing results" and that DI's planting joint venture with BP, DI-BP Fuel Crops Ltd., has withdrawn from Swaziland (www.biofuelreview.com/content/view/1916/1). Prince also said, "We have made very clear in our recent materials that marginal land is likely to deliver only marginal yields. We have never claimed that jatropha is a plant-and-forget crop."

Source : Inform, July 2009, P 421-422

GORILLA IN THE PLAY PEN

The rise and fall of surfactants lore

by Michael F. Cox

Significant changes have occurred in the surfactants industry in the past 30 years, both in terms of what we consider to be important and in the paradigms that we operate under. The following discussion highlights my view of the significant changes that have occurred and is based entirely on my experience, recollection, and opinion.

Since I do not have a lot of space, I am going to focus on two key topics: surfactants as a business and paradigms in the surfactants industry.

Surfactants as a business

You might ask yourself why an old research and development guy would delve into the business side of surfactants. The answer is that technical development and business development are (or should be) symbiotic; both aim to achieve the vision for the business. To a young scientist, it may seem more like the meeting of the Titanic (his or her technical project) and an iceberg (the business), but this should not often be the case when business and technical efforts area aligned. During the past 30 years, the surfactants business and therefore the technical focus, has changed significantly. The two most significant changes that have occurred deal with who the key players are and who has had the greatest influence over the industry (in other words, who has been “800-pound gorilla” in the surfactants playpen).

In the 1980s, surfactants were considered a great way to extend the oil business “downstream” to capture the rich returns that downstream derivatives could provide. This more or less began to reverse itself in the late 1980s as oil vs derivative margins changed and oil companies concluded that they needed to focus on their core business of producing crude oil derivatives. This resulted in surfactants-based assets being sold off and in a reduction of new assets being built.

Although I worked for the company for 26+ years, my resume looks as if I jumped ship on a regular basis. I started with Conoco in its chemicals divisions in 1981. Conoco was then purchased by DuPont, which sold the Conoco Chemicals division to form Vista Chemical Co., which later went public and was then purchased by RWE, who combined it with other purchased assests to form CONDEA, which was later sold to Sasol. This is reason the governing board of the surfactants & Detergents Division of AOCS has put considerable effort into developing a company name/ asset roadmap, so that our younger scientists can better understand the history of our industry.

As those with experience will tell you, there is usually some entity in the industry that has significant influence over the industry at any given time. I refer to this entity as the “800-pound gorilla in the surfactants playpen.” In the early 1980s, the well-integrated large-volume surfactants producers had significant power (they were well positioned in that supply was tight and margins were good).

A good illustration of this is the 1985 AOCS meeting in Philadelphia. A surfactants manufacturers had organized a session focusing on a new surfactants it was promoting and had invited a number of companies evaluating the new surfactants to give presentations at the AOCS meeting on their experience with it. One of these companies informed the session chair (an employee of the surfactant manufacturer) that the data were not positive but they felt obligated to share the data



and experience with the industry rather than cancel their presentation. My collection is that just prior to the session, the session chair reorganized the session so that the offending paper was given last (at the end of the day). Furthermore, the session chair gave both an introduction and rebuttal to the offending paper, something I have never seen occur since. My point is not to point fingers here (both companies involved felt they were doing the right thing) but to illustrate that during this period of time, the large surfactants manufacturers had clout, and clearly were 800-pound gorillas.

In the 1990s, the big gorilla was Wal-Mart, because of the sheer volume of product it moved through its plethora of stores, Wal-Mart's buying power had significant influence on pricing (as well as packaging, etc.), which initiated and/or exacerbated the pressure that the industry faced in the late 1990s and early 2000s to reduce costs and improve production efficiency.

In the 2000s, we saw a change in terms of what gave the gorilla its power. In the 1980s and 1990s, I think the ability to impact supply and demand (margin and sales) gave the gorilla its power, but in the 2000s, knowledge took over. Detergent manufacturers learned how to manage the gorillas of the 1980s and 1990s, and those that understood and planned for unexpected variations in supply became the 800-pound gorilla in 2000s. If we have learned anything in the last decade, our ability to predict feedstock costs (and resultant surfactants costs) is comparable to our ability to predict the stock market. Detergent manufacturers that understood what could happen, and prepared for it, were logically better positioned to thrive in the market. As a technical person, I am gratified that power in our industry now comes from knowledge.

Although I think the gorilla of the 2000s (knowledge) will thrive in the next decade, I think we will also see the emergence of another gorilla from the surfactants manufacturers' side. Enhanced oil recovery (EOR) is becoming a reality, and the volume of surfactants that will be consumed in this market is significant (comparable, potentially, to the detergents market). You can argue that EOR has been talked about for decades and that oil prices have come back down, but the bottom line is that nobody thinks that, in the long-term, the price of oil is going anywhere but up. In addition,

EOR technology has become more effective and technically driven, making EOR less speculative in nature. It is my opinion that surfactants manufacturers that align themselves to service this emerging market, while a force in the detergents market will take on "gorilla" stature.

Paradigms that have been shattered

Paradigms shape our industry, and an examination of how paradigms have changed over time gives us an idea of where we are and where we are headed. When I started in the surfactants industry in 1981. I was taught that linearity and acceptability went hand-in-hand, and that surfactants with nonlinear hydrocarbon backbones were inferior. Shell put the first serious crack in this paradigm by successfully teaching the industry that alcohol and alcohol derivatives with some methyl-branching (and with both even and odd carbon-number chain lengths) were not only acceptable but performed more or less identically to their oleochemical or Ziegler-based counterparts. This paradigm was more completely shattered by Procter & Gamble's research and development of selectively branched surfactants, which provide enhanced surfactants properties without negatively impacting environmental acceptability.

When I started as surfactants chemist, the fundamental understanding of surfactants was left to the academicians. Industry scientist focused on the application of surfactants and not on basic surfactants properties. AOCS meetings had "academic" sessions and they had "industrial" sessions. I am glad to say that I think this segregation has largely been eliminated. Although academia still orients towards fundamentals and the commercial industry towards applications, they share a common appreciation that both orientations require an understanding of the other. I think we have academia to thank for this. Professor Milton Rosen, John Scamehorn, and others have worked hard to make sure their research had practical utility to the industry, and they have effectively educated the industry on the importance of understanding the fundamental chemistry of surfactants. This is why we now have technical sessions where both academicians and industrial chemists participate, both in the seats and the podium. Another good example of this blending of academia and industry is illustrated by Professor

Milton Rosen of the University of New York (USA), an academician, for significant accomplishments in the application of the principles of surfactant chemistry in industry. Thank You Dr. Rosen.

The last paradigm that I think has been firmly shattered is this; feedstock consumption, availability and costs (and the stock market) can be reliably predicted.

The paradigm that just will not go away

One way of thinking that I wish would just go away is the “my product is greener than yours” mentality. If we have larned any-mental claims so as to market products only results in the industry having to put tons of money into unneeded product defence instead of into research that move the industry forward. For example, the word “green” is often inappropriately used and is seldom adequately defined in our industry, which unfortunately means that it will eventually be discarded (except by fashion designers and landscrappers) and replaced by a new word that some in the industry can then spin-doctor into oblivion. Meeeting acceptable human health and environmental standards is the responsibility of the industry as a whole. The giants in our industry understand this. I think it is the smaller “want-to-be-giants” that sometimes use their limited understanding of an issue(for example, 1,4-dioxane in ethoxylates) an an opportunity to market their products; this only causes confusion and hinders efforts being made in the industry through organizations such as Soap and Detergents Associations to apply good science and reason to real issues. The bottom line is this : Knowledge, good science and common sense are critical when dealing with these issues. If you do have these tools, please do not pick a fight in order to advance your agenda.

Paradigm of the future?

I believe that success in the surfactants industry in the next decade will require two things; knowledge and flexibility. Feedstock availability and costs will continue to vary (perhaps unpredictably) and the influence of EOR will begin to impact surfactant availability. Although the parent hydrocarbons used to make surfactants for EOR are largely different from those used to make surfac-

tants for the detergents industry, harvesting new hydrocarbon feedstocks from exisiting sources and the need to convert these new feedstocks to surfactants using conventional derivatization technologies (sulfonation, ethoxylation, etc.), will certainly impact surfactants' supply and demand to the detergents industry. Surfactants manufacturers that understand this and align themselves to take advantage of this, will be more successful than those that do not. Detergent producers that understand this, and prepare for this, will be more successful than those that do not.

I want to thank Milton Rosen for sponsoring the Samuel Rosen Memorial Award, the selection committee, and AOC for the honor of receiving this year's Rosen Award, and for the opportunity to present my thoughts on “ Rise and Fall of surfactants Lore”

Michael F. Cox retired after 26+ years in the surfactants industry and is now a consultant based in Georgetown, Texas, USA. He can be reached at MichaelFCox@suddenlink.net.

Source : Inform July 2009, P 453-488

PURE REFINE?

Purifine PLC : Industrial application in oil degumming and refining

by Tim Hitchman

Plant oils, such as soybean rapeseed, sunflower and corn oils are an important global source of nutrition. They are also widely used as feedstocks for diodiesel production. Crude oil extracted from oilseeds is refined to remove impurities that adversely impact oil stability, color and flavor. However, each refining step to separate neutral oil triacylglycerols (TAG) and diacylglycerols (DAG) from impurities results in a loss of oil yield proporational to the amount of impurities present. Phospholipids are a major class of impurities removed in conventional processes by oil degumming, at significant cost to yield. Phospholipids must be removed because they

cause oil darkening (or browning) during the subsequent bleaching, hydrogenating, and deodorizing steps of refining. IN addition, phospholipids reduce oxidative stability of the refined oil and inhibit the performance of chemical catalysts used in oil hydrogenation and biodiesel production. Phospholipid quantities and type are determined by oilseed growth, s torgae and handling conditions, as well as oil extraction method, but they may represent up to 3% by weight of crude oil.

In traditional oil refining, phospholipid removal is accomplished by the addition of water to crude oil. The phospholipids comprise DAG coupled to a polar phosphate ester (Fig.1). Addition of water to the oil causes hydration of the phosphate esters, bringing the phospholipids to the oil-water interface (Fig 2A). The hydrated phospholipids drag neutral oil with them, resulting in formation of an emulsion or gum, containing water, phospholipids and entrained neutral oil. This viscous gum is separated from bulk oil by centrifugation and the process is termed water degumming. Ease of phospholipid removal by hydration (i.e. emulsifying potency) is determined by the type of

phosphate ester present. Phosphatidylcholine (PC) is by far the most hydratable phospholipid, and therefore the strongest emulsifier. This very property makes lecithin, the PC-rich by-product of water degumming, a useful emulsifier in numerous food applications. In water degumming, however, the strong emulsifying of PC cause the greatest oil-yield loss owing to entrainment oil. Further yield losses arise during centrifugation because clean separation of oil (light phase) from gum (heavy phase) necessitates the sacrifice of oil close to the phase boundary. Residual phospholipids in the water-degummed oil cause additional yield losses in later refining steps, such as removal of free fatty acids, again owing to formation of emulsion owing to the presence of intact phospholipids, and the extent of yield loss is proportional to the amount of phospholipids present.

Enzymatic degumming, already available on an industrial scale, is an alternative water degumming that addresses the yield-losses issue. Unlike chemical catalysts, enzymes are highly specific and act only on target molecules, leaving similar molecules untouched. For instance, phospholipase enzymes, such as Purifine@ PLC (phospholipase C), specifically react with the phospholipid impurities in oil, leaving the bulk oil untouched.

Photo from
page 469 from inform July 2009

Fig 1. Structure of phospholipids and reaction catalyzed by phospholipase enzymes. Phospholipids comprise diacylglycerol coupled to a phosphate ester. All phospholipase enzymes act to break phospholipids into water-soluble and oil-soluble fragments. In the case of phospholipase A (PLA) enzymes, these are a lysophospholipid and a fatty acid, respectively. PLA1 and PLA2 enzymes differ by the position of the fatty acid removed from the phospholipid. A phospholipase C (PLC), such as Purifine@ enzyme, has a different mode of action in that it removes the water-soluble phosphate ester from the phospholipid, leaving intact diacylglycerol oil.

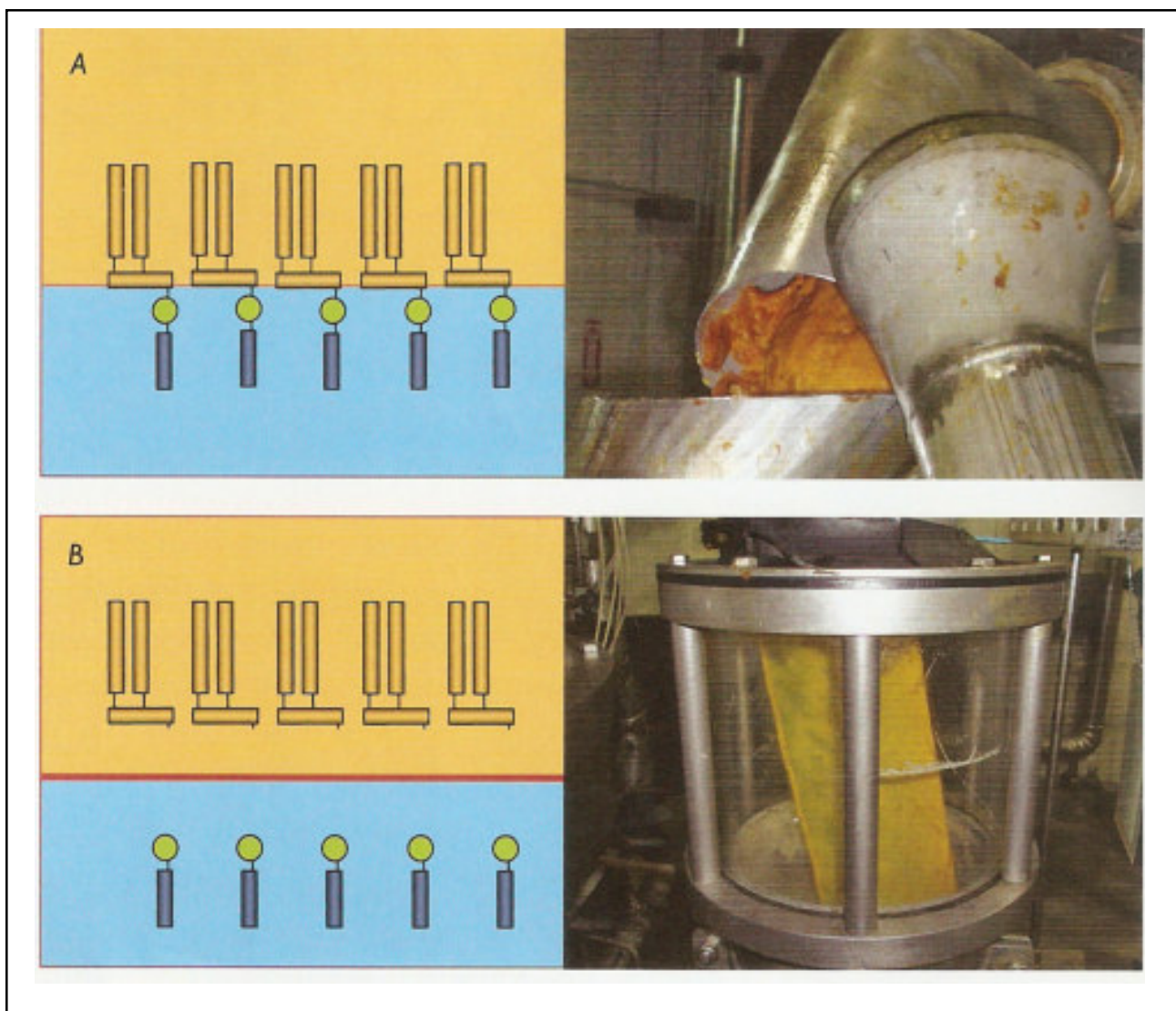


Fig 2. Comparison of heavy phases from water-degumming and enzymatic degumming and monitoring the reaction. (A) Phospholipids are emulsifiers and in the presence of water will sit at the oil water interface, trapping oil in the process (left panel). The gum of water, phospholipid, and oil is removed in a centrifuge and is viscous and difficult to handle as it exits the separator (right panel). (B) The action of a degumming enzyme like Purfine PLC on phospholipids breaks the emulsion (left panel), reducing the amount of entrained oil; the resultant heavy phase is free-flowing as it exits the centrifuge (right panel). The change in gum viscosity with addition of enzyme to a water-degumming process allows easy visualization of a successful enzyme reaction by plant operators. (C) Accurate confirmation of enzyme performance can be attained using analytical techniques. NMR (nuclear magnetic resonance; left panel) enables the phospholipids in the oil to be quantified in crude oil before (-E) and after (+E) enzyme action. HPLC (high-performance liquid chromatography; right panel) can be used to measure the increase in DAG levels in crude oil (-E) after enzyme action (+E). Abbreviations: PL, phospholipid; PLC, phospholipase C; DAG, diacylglycerol; PC, phosphatidylcholine; PI, phosphoinositol; PE, phosphatidylethanolamine; PA, phosphatidic acid. Photographs provided by Bunge North America and used with their permission.

Phospholipases break phospholipids into water-soluble and oil-soluble fragments, thereby reducing their ability to form an emulsion. Less emulsion formation means less yield loss due to entrained oil, and lower gum content enables cleaner separation of oil and heavy phases, with

further reduction in yield loss. Several commercially available degumming enzymes are available, most of which have a common mode of action. Phospholipase A (PLA) enzymes remove fatty acids from the phospholipid, forming lysophospholipids that are poor emulsifiers in the low-water environment of oil processing. Degum-

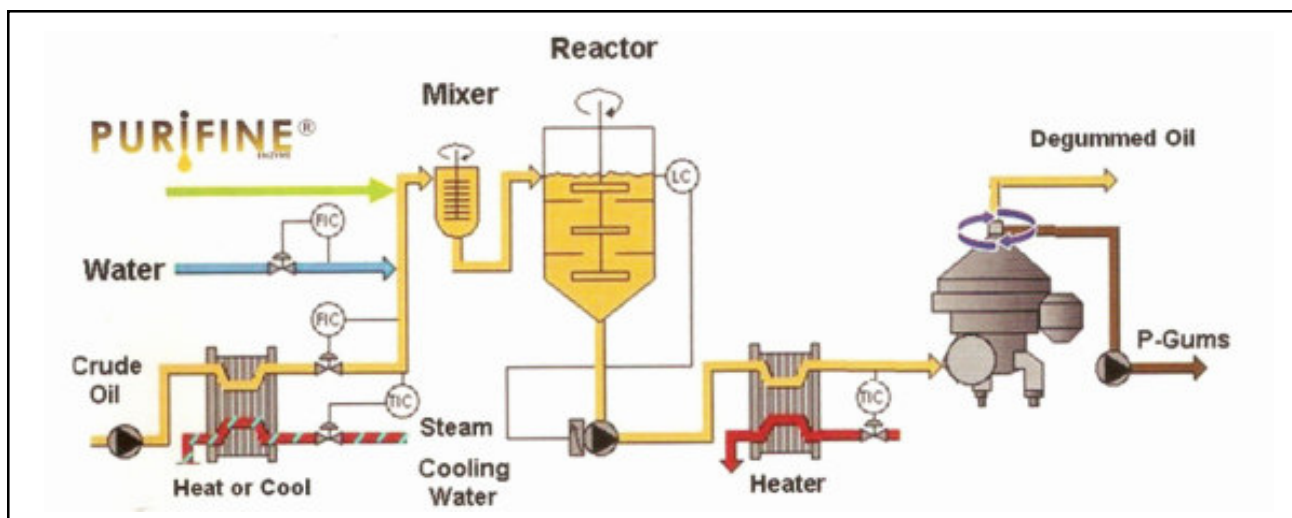


Fig 3. Process schematic for implementation of Purifine enzymatic degumming. Schematic by ALfa Laval; used with permission

ming with PLA enzymes results in significant reduction in yield loss due to the reduction in entrained oil. However, the fatty acids produced remain in the degummed oil and, for both edible oil and biodiesel production, have to be removed in later refining steps (usually) by conversion to soapstock, resulting in formation of an emulsion and loss of yield.

Purifine enzyme is a novel product from Verenium Corp., (San Diego, California, USA) that was developed specifically for oil degumming and validated at industrial scale. This PLC is differentiated from other degumming enzymes because it converts phospholipids into DAG and a water-soluble phosphate-bearing ester fragment. Unlike PLA, PLC does not produce any additional free fatty acids (Fig. 1). Purifine PLC acts on the two major phospholipids in oils, phosphatidylcholine (PC) and phosphatidylethanolamine (PE). Due to conversion of PC, the strongest emulsifier of the four phospholipids found in crude oil, reduction in entrained oil yield loss by degumming with Purifine PLC is close to equivalent to the yield loss reduction obtained with PLA enzymes. The DAG produced by Purifine degumming, however, is a bonus oil yield that is retained throughout the refining process. The increase in DAG content caused by degumming with Purifine enzyme lies within the natural variation of DAG levels in oils (which may reach 10% Yasukawa and katsuragi, 2004) and has no impact on oil performance indicators, such as smoke point. In fact, an oil product containing greater than 80% DAG is sold in the United States for general use. Together, the DAG bonus

yield and reduction in oil loss obtained during Purifine PLC degumming result in approximately twice the yield gain achieved with PLA degumming enzymes, without increasing the fatty acids content of the oil.

Enzymatic degumming using Purifine PLC can easily be integrated into most existing plant designs. The basic equipment required to carry out the process is an ultra-high shear mixer and a reaction tank (Fig.3). The mixer is required to create sufficient area of interface between the oil and water to enable complete reaction of phospholipids with minimal enzyme dosage and minimum reaction time. In fact, creation of a fine emulsion allows the Purifine enzyme to react rapidly with the emulsifiers and break down the emulsion in less than 2 hours. This technology is a paradigm shift from traditional oil refining, which is designed to minimize the occurrence of emulsions and the associated yield losses. The enzyme process can be optimized by controlled oil temperature, water dose, and enzyme dose. The result is a robust and uniform process where the enzyme is simply allowed to do its work, without adjusting process parameters according to the quality of the incoming oil.

Verenium has developed sophisticated analytical techniques that accurately measure conversion of phospholipids into DAG and that can be applied to optimize the process. In a plant, easy visualization of success boosts operator confidence. As the enzyme is dosed in, the heavy phase exiting the separator is seen to change visibly

from gelatinous water gums that are difficult to pump to free-flowing "phosphoro gums." Despite the change in heavy-phase properties, the phosphoro can still be added to the oilseed-derived meal, with possible advantages such as reduced dilution of meal protein content, or reduced energy input to dry the meal. Degummed oil that results from use of Purifine PLC typically contains less phosphorus than the same oil degummed using just water, which can result in savings in usage of water, chemicals and processing aids as it is refined to edible oils or biodiesel. The increased oil yield and reduced overall refining costs resulting from Purifine PLC degumming can translate into significantly improved operating margins for the oilseed processor.

To date, there are relatively few plants operating enzymatic degumming despite the availability of PLA enzyme for nearly 20 years (De Maria et al. 2007). Recent economic conditions have made squeezing additional value from existing investments a high priority to the oil processing industry, particularly biodiesel producers. To facilitate adoption of Purifine PLC degumming, Verenium has qualified Alfa laval, an engineering services company, to provide comprehensive engineering packages for existing and Greenfield plants. Alfa Laval has proven technology and know-how in the oil refining industry and can offer customers the security of performance guarantees.

Oilseed processors also make the decision to proceed with a new economic benefits to make the decision to proceed with a new technology such as enzymatic degumming with Purifine PLC. The first step is accurately estimating yield gain benefits compared with the current process based on phosphorus levels in the crude oil. For instance, in crude soybean oil containing 800 ppm elemental phosphorus, the intact phospholipids typically account for 1.76 wt%. Purifine PLC reacts with the two most prevalent phospholipids, PC and PE, generally 70% of the total (i.e. 1.23 wt% of oil). The mass of DAG produced is about 80% of the mass of phospholipids converted due to removal of the phosphate ester portion, and so the attainable DAG yield is (0.8×1.23) equal to 0.99 wt% of oil processed. Efficient water degumming of this oil may result in neutral oil losses of approximately 0.88 wt% of oil processed. Purifine enzyme action on PC, the strongest emulsifier, leads to an overall reduction in mass of gums and recovery of most of this yield loss. Thus, for a

typical soybean oil of this type, a total yield increase of 1.87% may be attained using Purifine degumming to replace water degumming. Actual gains will vary depending on the efficiency of the pre-existing process, quality of the crude oil and whether other equipment is configured to allow full capture of the additional yield. For instance, in an industrial implementation of Purifine PLC degumming of soybean oil containing 720 ppm elemental phosphorus, a net DAG yield of 0.8% by weight was measured in the degummed oil, representing 90% combined reaction and yield recovery efficiency (data obtained at Bunge facility; used with permission).

In an evermore difficult global economic climate, it is increasingly important that essential commodities are produced in a highly efficient manner. Purifine PLC offers a way to improve yields and overall economics of edible oil and biodiesel production that is likely to play an important role in the future of oil refining.

Tim Hitchman, Purifine product manager for Vernium Corp. (San Diego, California, USA), can be reached via email at Tim.Hitchman@verenium.com.

Source : Inform, July 2009, P 469-472.

ANY TAKERS?

Sustainable use of glycerine honoured

Three researchers from Pittsburg State University in Kansas, USA, are the recipients of the 2009 Glycerine Innovation Award, which is given annually by the Industrial Oil Products Division of the American Oil Chemists' Society.

AOCS members Zoran Petrovic, Ivan Javni and Mihail Ionescu were honoured at the 100th AOCS Annual Meeting & Expo for their research, which developed a new family of glycerine-based polyols suitable for use in rigid polyurethane foams. The meeting was held May 3-6 in Orlando, Florida, USA.

Polyols foams are used in thermal insulation for the refrigeration and construction industries,



The National Biodiesel Board's Steve Howell (left) and The Soap and Detergent Association's Kathleen Stanton present the 2009 Glycerine Innovation Award to Ivan Javni, Zoran Petrovic, and Mihail Ionescu of Pittsburg State University (Kansas USA). Courtesy of Brian Sanosil/SDA

packaging, transportation, adhesives, sealants and coatings. The total volume of polyols used annually for these applications is measured in the millions of metric tons.

“We are urethane specialists,” Petrovic explained, “and our soy-based polyols are being commercialized by Cargill as BioH polyols.” The patent application on glycerine-based polyols has filed, he noted, which is the first step leading to commercialization. Several companies are interested in the glycerine-based polyols, which are in most cases 100% bio-based and are always more than 80% biobased, according to Petrovic.

Pricing has to be determined by taking into account both raw material and processing costs, he noted. “The price will be determined primarily by the price of crude glycerin. We hope to be competitive with petro-polyols,” Petrovic said.

The market for rigid foams manufactured from all feedstocks was 3.4 million tons (MMT) in 2005, according to IAL Consultants of London. Polyols comprise approximately 40-50% of the market for rigid foams, PETrovic said, or about 1.5 MMT per year. IAL projected the global market for rigid foams at approximately 4.4 MMT in 2010, which is unlikely to be reached, given the recession.

The award is sponsored by the Soap and De-

tergent Association (SDA; Washington, DC, USA) and the National Biodiesel Board (NBB; Jefferson City, Missouri, USA). It recognizes outstanding achievement for research into new applications for glycerine, with particular emphasis on commercial viability.

The deadline for nomination for the 2010 award is November 1, 2009. For details, visit AOCS' website at www.aocs.org/members/awards/award.cfm?awd=glycerine.

Source : Inform July 2009, p 483

HOWZZAT?

‘Good fat’ helps burn calories : Study

Calorie-burning fat may seem like science, fiction, but a study released in Wednesday (April 8) found that adults have small blobs of metabolism-regulating brown fat previously believed to exist only in babies and children. This “good fat”, researchers said, unlike white fat that makes up most body fat, is active in burning calories and using energy.

The study published in Thursday (April 9) issue of the New England Journal of Medicine, showed that brown fat subsisted in adult humans and demonstrated, for the first time, that it is metabolically active.

The fact that there is active brown fat in adult humans means this is now a new and important targets for the treatment of obesity and type 2 diabetes,” says the study’s senior author C Ronald Kahn, who heads an obesity and hormone action section of the Joslin Diabetes Center in Boston,



Massachusetts.

The researchers said that obesity and other metabolic disorder could be treated by stimulating brown fat growth to control weight and improve glucose metabolism. Significant amounts of brown fat may be present in a much larger portion of the population, but may be spread out and thus not as easily seen on imaging, Kahn said.

Source : Ingredients,, April, Pp 16-30.

THE HUMBLE FRUIT

Popularising value added products from Bael

Vegetables and fruits contain health and nutrition promoting compounds in human diet. Their constituents prevent diseases through several mechanisms and thus increase one's life span and the quality of life. Among the under-utilised fruits, Bael fruit (*Aegle Marmelos*) occupies an important place. It is a fruit-bearing tree found in dry forests, hills and plains of Myanmar, Pakistan, Bangladesh, Nepal, Vietnam, Laos, Cambodia, Sri Lanka, Northern Malaya, Java and in the Philippines. In India, it is found in Uttar Pradesh, Madhya Pradesh, Orissa, Bihar and West Bengal (Gehlot et al. 2007). In Tamil Nadu it is found in Madurai, Sivagangai, Salem and Dindugal districts. The tree, which is only species in the genus *Aegle*, grows up to 18 metres tall with thorns and fragrant flowers. The plant easily withstands long periods of drought, which is needed for better fruit yields. It grows in all types of soil, climate and requires little care when established (Top Tropicals.com).

The tree is deciduous, with trifoliate aromatic leaves. The spines are straight, strong, auxiliary and about 2.5 cm in length. The leaflets are 3 to 5 and ovate-lanceolate, the laterals one being sessile and the terminal ones are long petioled. The flowers are 3 cm across, greenish-white and sweet scented. The fruit is nearly spherical and 5 to 15 cm in diameter. The rind of the fruit is grey or yellow and the pulp is sweet, thick, aromatic, gelatinous and orange colour. The pulp has numerous seeds which are densely covered with fibrous hairs, oblong and flat. The skin of some forms of

the fruit is so hard it must be cracked with a hammer (Agele marmelos.com).

Processing of Bael

Shelf life study of bael fruit pulp can be stored up to four months in PET jars and bottles at room temperature. The bael leaf powder can be stored in both Low Density Polyethylene (LDPE) and Metallised Polyester Polypropylene (MPP) packages for six months.

Bael fruit incorporated products Cereal bar

- Cereal bar was developed using puffed cereals and millets in two combinations as (corn and sorghum) with the incorporation of bael fruit pulp at 25%, 30% and 35%.
- In both the combinations 35% incorporation was highly accepted by the judges.

Nutrition Composition

Corn incorporated cereal contains 13.1 g protein, 964.50 µg B-carotene, 5.34 mg vitamin-C and 2.5 kg crude fibre and sorghum incorporated contains 17.3 protein, 964.50 µg B-carotene, 3.34 mg vitamin-C and 3.0 g crude fibre.

Bael toffee

- The toffee was developed with the incorporation of bael fruit pulp at 50%, 75% and 100%.
- Among the different incorporation tried 50% was highly acceptable.

Nutrition Composition

The 50% incorporated product contains 74.9 g protein and 2.1 mg of vitamin-C.

Bael Squash

- Bael squash was developed with the incorporation of (1) papaya fruit pulp and (2) sweet lime at different levels (3) and bael squash was developed without incorporation of other fruits.

- The organoleptic evaluation showed that 20% incorporation was highly acceptable.

Nutrition Composition

Sweet lime incorporated squash has 1% acidity and 1.33mg vitamin-C and papaya incorporated squash has 2.1 mg vitamin-C and 1% acidity. Bael squash contains 1% acidity and 2.5 mg vitamins-C.

USES AND BENEFIT OF DEVELOPED PRODUCTS

- Bael leaf incorporated roti mix has lot medicinal values for diabetic, heart disease. Suffocation and asthma etc. This roti mix can be used by all age groups including old age and obese person.
- Bael squash is good for all age groups and it helps to keep the body cool and relief from thirst.
- Cereal bar and toffee can be given to the children as a substitute for traditional toffee, with high nutritive value.

The author is consultant Business Development Division, National Research Development Corporation, regional Office. Bangalore.

Source : Ingredients, April 1-15, 2009, P 66.

A NEW FIND

Phytosomes show better bio-availability

Phytosomes increases the bio-availability of phyto-medicines. These are incorporated into standardized plant extracts or water soluble phytoconstituents into phospholipids to produce lipid compatible molecular complexes, according to Sajib Bhattacharya, from the Bengal School of Technology.

In a paper patented published in Pharma Times, Bhattacharya stated that Phytosomes improved that absorption and bioavailability.

Phytosome is a patented technology. The flavonoid and terpenoid constituents of plant extracts lend themselves well for the direct binding to phosphatidylcholine. Phytosomes results from the reaction of a stoichiometric amount of the phospholipids with the standardized extract in a non-polar solvent.

Phosphatidylcholine is a bi-functional compound. Specifically this binds to the compound while the lipid soluble phosphatidyl portion comprising the body and tail which then envelops the choline bound material.

Hence Phyto-constituents produce a lipid compatible molecular complex with phospholipids also called a phyto-phospholipid complex. Molecules are anchored through chemical bonds to the polar choline head of the phospholipids as can be demonstrated by specific spectroscopic techniques. Precise chemical analysis indicates the unit Phytosome is usually a flavonoid molecule linked with atleast one phosphatidylcholine molecule. The result is a little more micro sphere or cell is produced. The term phyto means plant extract or its active constituent is protected from destruction by gastric secretions and gut bacteria owing to the gastro-protective property of phosphatidylcholine.

Likewise Phytosomes, a liposome is formed by mixing a water soluble substance with phosphatidylcholine in definite ratio under specific conditions. Here no chemical bond is formed and the phosphatidylcholine molecules surrounding the water soluble substance.

There may be hundreds or thousands of Phosphatidylcholine molecules surrounding the water soluble compound. The difference results in Phytosomes being much better absorbed than liposomes showing better bio availability. Phytosomes have also been found superior to liposomes in topical and skin care products.

Phytosomes are prepared by complexing polyphenolic phyto-constituents.

Phytosomes enhance the absorption of lipid insoluble polar phyto-constituents through oral as well as topical route showing better bio-availability, hence significantly greater therapeutic benefits.

As the absorption of active constituents are improved its dose requirement is also reduced.

Phosphatidylcholine used in the preparation of Phytosomes, besides acting as a carrier also acts as a hepato-protective hence giving the synergistic effect when hepato-protective substances are employed.

Chemical bonds are formed between Phosphatidylcholine molecules and phyto-constituents so the phytosomes show better stability profile.

Recent research shows improved absorption and bio-availability with phytosomes as compared to the conventional means. Most of the phytosomal studies are focused to milk thistle or *Silybum marianum* which contains premier liver protectant flavonoids. The fruit of the milk thistle plant contains flavonoids known for hepato protective effects. Silybin is the chief and the most potent constituents of silymarin, the flavonoid complex from milk thistle. A standard extract from *Silybum marianum* is an excellent liver protectant but poorly absorbed orally, stated Bhattacharya.

Grape seed and phytosome are composed of oligomeric polyphenols which is a grape seed extract. The main properties of procyanidin flavonoids of grape seed are an increase in total antioxidants capacity and stimulation of physiological antioxidants defences against ischemia/reperfusion induced damages in the heart, protective effects against atherosclerosis thereby offering marked protection for the cardiovascular system and other organs through a network of mechanisms that extend beyond their great antioxidant potency.

In recent times the emerging technology of drug delivery is also being applied to phyto-pharmaceuticals. Standardised plant extracts or mainly polar phyto-constituents like flavonoids, terpenoids, tannins, xanthenes, when complexed with phospholipids like phosphatidylcholine give rise to a new drug delivery system called phytosome showing much better absorption profile following oral administration owing to improved lipid solubility which enables them to cross the biological membrane, resulting better bio-availability that is more amount of active principle in the systemic

circulation. This means more amount of active constituents becomes present at the site of the action which is liver, heart, brain and kidney at similar or less dose as compared to the conventional plants extracts. Hence the therapeutic action becomes enhanced more detectable and prolonged. Several excellent phyto-constituents have been successfully delivered in this way exhibiting remarkable therapeutic efficacy in animals as well as in human models.

Study of literature reveals that several plant extracts which are crude or partially purified or fractionated are reported to possess different significant pharmacological or health promoting properties. These extracts can be standardized accordingly and may be formulated as phytosomes for systematic investigation for any improved potential to be used rationally. In this way after screening and selection of potential extracts or constituents from plants, phytosomes can be developed for different therapeutic purposes like cardiovascular, anti-inflammatory immunomodulator, anti-cancer, anti-diabetic or for prophylactic purposes as nutraceuticals in due course.

Phytosomes enhance the absorption of lipid insoluble polar phyto-constituents through oral as well as topical route showing better bio-availability, hence significantly greater therapeutic benefits.

Kuvempu University's Department of Biochemistry & Food Technology proves control of cholesterol with flaxseed chutney

In a major research effort, the Kuvempu University's Nutraceuticals Research Group has identified the hypocholesterolemic and hepatoprotective effects of Flaxseed.

The Davangere based Kuvempu University's researchers from the department of Studies and Research in Biochemistry & Food technology have worked on the flaxseed chutney to ascertain its cholesterol reducing properties. The evidence from animals studies show that administration of 15 percent flaxseed chutney to hypercholesterolemic and produced significant reductions in serum total-cholesterol (13.76%), LDL-

cholesterol (44.0%) and liver homogenate total-cholesterol (18.02%) without changing HDL-cholesterol levels. Flaxseed or *Linum usitatissimum*, brown variety, were purchased from the local market of Davangere, a district in Karnataka and the traditional method was followed to prepare Flaxseed chutney.

The major nutritional components of Flaxseed include oil, viscous lignin rich fibres (mucilage), protein and minerals, which are analyzed by American Oil Chemists Society (AOCS). Flaxseed is the richest source of a linoleic acid, soluble and insoluble fibre and mammalian lignin precursor called secoisolariciresinol diglucoside.

Flaxseed or linseed (*Linum usitatissimum* L.) is a common name for Linaceae family of plants and for plants of a genus *Linum* within that family. One species: *Linum usitatissimum* is a shrub grown extensively for its fibre and seeds. Flaxseed has long history of use in India. Most of us do not know that Flaxseed was of native of India and once a staple food crop. Even now, in southern India, Flaxseed is partly being consumed at lower levels as Flaxseed chutney and as a raw material for medicines. Flaxseed chutney could be stored for months as food reserve and valued as a source of nutritional compounds, energy and food ingredients on long journeys stated Dr. Basavarak madhusudhan, Professor and Coordinator, Nutraceuticals Research Group, Dept of Studies and Research in Biochemistry and Food Technology, Kuvempu University.

In North America and Europe Flaxseed has been accepted at low levels as a component in some brands of cereals in speciality breads, as a seed dressing on buns and various other bakery products. An expert panel of food safety and nutrition recently highlighted Flaxseed as one of the ten promising plant sources of functional food. There are a number of studies indicating the hypolipidemic, hypoglycemic and hypocholesterolemic effect of raw Flaxseed and its baked products. Current research in nutritional biochemistry continues to identify various therapeutic substances in Flaxseed.

Flaxseed chutney supplemented diet 15% was found to be more effective in restoring lipid profile changes in rats fed with cholesterol. The activi-

ties of serum marker enzymes glutamateroxaloacetate transaminase (GOT) glutamate pyruvate transaminase (GPT) and alkaline phosphatase (ALP) were elevated significantly in carbon tetrachloride induced rats. Administration of Flaxseed chutney resulted in depletion of serum marker enzymes and exhibited recouplement thus showing significant hepatoprotective effect. It was observed that Flaxseed chutney supplemented diet could lower the serum cholesterol and as a potential source of antioxidants if could exert protection against hepatotoxic damage induced by carbon tetrachloride in rats. However, studies on either clinical or nutritional properties of Flaxseed chutney have not been undertaken which deserves special attention. The present study was aimed to examine the possible hypocholesterolemic and hepatoprotective effects of Flaxseed chutney supplemented diet in rats," stated Dr. Madhusudhan.

Source : Ingredients, April 1-15, 2009, P 86-87

THE QUANTUM LEAP?

Dow, Algenol Planning Carbon Dioxide-to-Ethanol pilot Plant

Dow chemicals says it will participate in a pilot-scale project with Algenol Biofuels (Naples, FL) to produce ethanol carbon dioxide (CO₂) using Algenol's algae-based technology. The \$50 million bio refinery will be built at Dow's Freeport, TX site, with Dow providing CO₂ streams from manufacturing units at the site as well as materials development, land and services.

The project will consist of 3,100 bioreactors with the collective capacity to produce 100,000 gals/year of ethanol. Dow has technology to produce ethylene from ethanol, but the company's primary purpose is to engineer films for the bioreactors in which the conversion takes place, says Steve Tuttle, bioscience business at Dow. "We're trying to provide an environment in which these algae can be most protective," he says. The next goal will be to lower the cost of the bioreactors to an economically viable levels, he adds.

"We are trying to make ethanol for about \$1/gal," says Algenol CEO Paul Woods. Dow did extensive due diligence with Algenol for several months and is comfortable that the technology is capable of hitting that mark, he adds. Algenol is seeking a \$25 million grant from the Department of Energy (DOE) for the project and Algenol will cover the remaining cost. Woods says. This site will consume 2 m.t./day of CO₂, exceeding the DOE's minimum consumption requirement of 1 m.t./day to qualify for funding, he adds. The DOE is expected make a decision on the grant between September and December if this year Wood says.

About \$3 million of the \$50 million price tag is earmarked for research, but the real aim of the project is to get the process optimized, Wood says. Multiple sources of CO₂ streams will be tested to determine the threshold of tolerance for the cultures. The project will also explore methods for purification and downstream processing of the ethanol, he says. The reactors are already at commercial-scale, and bringing capacities in the billion gallons/year range online is only a matter of adding additional units modularly, he adds.

Algenol's technology can produce 6,000 gals of ethanol per acre annually, compared with 400 gals/acre for corn. Woods says. The process requires CO₂ algae saltwater and sunlight.

-REBECCA COONS.

Source : *Chemical Weekly*, July 2009, P 14.

IN THE AIR !

Results from biofuel test flight

In late December 2008 Air New Zealand (ANZ) performed a biofuel test flight using Boeing 747-400 plane (seeinform20:88, 2009). At the time, ANZ announced that there had been no operational problems during the 2-hour test flight from Auckland, which was powered by a 50/50 blend of jatropha-based fuel and standard jet fuel.

ANZ released the analysis of scientific data gathered during the flight at the end of May. Extrapolation from the results showed that fuel burn

could be reduced by 1.2% and carbon dioxide emissions by 60-75% on an average 12 hour 747 flight compared with a flight powered by 100% standard jet fuel.

ANZ wants to use 10% alternative fuels (for flights and ground operations) by 2013, but ANZ General manager-Operations and Chief Pilot Dave Morgan told ATW Online (atwonline.com/news/story.html?storyID=16733) that jatropha may not be most nearly ideal feedstock for ANZ because it cannot be grown in New Zealand.

The New York Times (www.nytimes.com/gwire/2009/05/29/29_greenwire-plant-derived-fuels-could-be-certified-for-fli-24118.html) quoted Bill Glover, managing director of environmental strategy for Boeing Commercial Airlines, as saying that jet fuels derived from algae, camelina and jatropha could be approved and be replacing petroleum fuels as early as 2010. The technology is ready, he indicated – now enough nonfood feedstock plants need to be grown so that economic quantities of oil can be obtained from them.

Source : *Inform July*, 2009, P 420-421

BIO TO THE GRIND

Industrial Biotechnology: Heading Toward a Wealth of New Opportunities

The development of novel bioprocesses for producing chemicals is accelerating at a pace never seen before, thanks to the convergence of sophisticated information technology (IT) systems, genomics, and chemical processing in the field of industrial biotechnology. The pressure that chemical producers are under to develop and manufacture products more cheaply, sustainably, and quickly is increasingly driving them to industrial biotechnology, also known as white biotechnology. Many chemical firms say they are starting to gain a competitive edge through their investments in white biotechnologies. Firms failing to adopt white biotechnology processes are increasingly at risk of being overtaken by their competitors and undercut on price, market sources say.

The anticipated emergence in the next few years of second-generation, feedstocks derived

from non-food biomass will provide a major boost for industrial biotech producers, says Jens Riese, head of McKinsey & Co.'s Global Biosystems Practice. Certain white biotech hotspots are emerging, Riese says. "There is a lot happening in the field of chemicals by fermentation" including the conversion of polymers, polyols, organic acids, amino acids, vitamins, enzymes, and biologies, he says. Biomaterials feature properties with potential to displace many petrochemicals, but fewer biomaterials firms appear to be developing products that would displace inorganic chemicals.

Riese predicts that combined sales of chemicals derived from plant-based feedstocks, fermentation, and enzymatic conversion processes will rise from about •100 billion (\$133 billion) in 2007, accounting for about 6% of all chemical sales, to about •153 billion, or about 10% of total chemical sales, in 3012. Sales will be boosted by emerging low-cost biotechnologies, he says.

Biofuels generated •35 billion of the •100-billion white biotech sales in 2007, and traditional bio-based chemicals such as oleochemicals and natural rubber contributed •46 billion of sales. About •14 billion of sales were generated by fermentation processes and •5 billion from enzymatic conversion, Riese says in a recent report. Biofuels will account for •65 billion of white biotech sales in 3012, and traditional bio-based chemicals will generate about •60 billion of sales, followed by •31 billion of sales from chemicals by fermentation and •7 billion from chemicals via enzymatic processes. Riese's predictions are based on assumptions, including that there will be price pressure on biofuels in the medium term due to the current relatively low price of oil.

Genomatica (San Diego), a privately owned biotech startup, is one of the companies determined to muscle in on conventional chemical markets. Genomatica develops chemical processing routes, using a combination of propriety IT systems including bioinformatics, and genomics to develop and test economically viable bioprocesses at laboratory scale. The procedures typically take months rather than the years normally needed to develop chemical processes.

Genomatica's approach is based on the use of Simpheny, an IT platform that maps the metabolic

pathways of a given micro-organism in genomic scale models, to determine how to optimize the bioprocess for a selected chemical. Readily available genomic data is plugged into the program, and algorithms are used to select the most effective process from a selection of tens of thousands of potential routes. The company transfers the chosen process into its laboratory where it selects a suitable micro-organism, such as E.coli, which it engineers to replicate the metabolic system identified by Simpheny.

Under the guidance of CEO Chris Gann, a chemical industry veteran formerly with Dow Chemical, Genomatica is able to pick out processes that it deems of significant interest to the chemicals sector. The company announced earlier this year that it had in just six months developed a novel bioprocessing route for methyl ethyl ketone (MEK), which is in short supply. However, the product can be manufactured at standard biofuel plants using Genomatica's process. Genomatica was able to develop the MEK process as many biofuel plants are being mothballed due to under-utilization.

The MEK breakthrough followed Genomatica's announcement in September 2008 that it had developed the world's first bioprocess for manufacturing 1,4-butanediol (BDO), based on the use of E.Coli bacteria. "We have a dozen products in the pipeline," Gann says.

Genomatica's business model is based on licensing its process technologies, which the company says can make products 20%-30% more cheaply than making them via the latest petchem-based routes. The company is currently scaling up its production technologies to demonstrate that they are commercially robust.

Historically, biological R&D has been based on trial and error because relatively little was known about how biological systems functioned, but today "the game has changed," says Christophe Schilling, president and co-founder of Genomatica. The wealth of information available today on DNA, genes, proteins, and enzymes, and even on biochemistry or biological systems provides an opportunity for a more efficient and cost-effective approach by leveraging modelling and simulation, he says.

Genomatica's model enables the company to avoid the relatively high cost of high-throughput experimentation in the lab and its associated handling of volumes of data, Genomatica says.

The rapid development of white biotech, including capability from bioinformatics through to gene expression technologies, also presents market opportunities for more established players. Danisco's Genencor designs enzymes and enzymatic processes for manufacturing a broad range of materials (CW, Feb. S3, p. 20). The company says its industrial biotech capability is growing so quickly that even it failed to predict current capabilities. Genencor recently disclosed that it is honing a bioprocess in conjunction with Goodyear to manufacture isoprene for tires and other applications, but "three year's ago, we would have said that manufacturing bio-isoprene was impossible," Genencor CEO Tjerk de Ruiter told CW recently.

Other established biotech firms, including privately owned Codexis (Redwood City, CA), are developing bioprocesses for applications including pharmaceuticals. "The rapid pace of technology advancement in the past five years has greatly reduced both the time investment and cost required to develop efficient, clean new processes for human therapeutics," says Peter Seuffer-Wasserthal, senior v.p. at Codexis Pharmaceuticals.

Advances in Codexis's proprietary evolution technology, a combination of bioinformatics, molecular biology, and analytical biochemistry applied to chemical processes "have been key drivers in increased adoption of clean, cost-effective custom biocatalytic solutions for pharmaceutical processes that previously relied on conventional chemocatalysis," Seuffer-Wasserthal says.

Codexis has been working with Shell on the development of one, second-generation process for manufacturing biofuels. Shell announced recently that it has expanded the deal with Codexis and that, under terms of the revised agreement, Shell and Codexis will work with biofuels firm logen (Ottawa) to enhance the performance of enzymes used in logen's cellulosic ethanol process. Shell has an equity stake in Codexis, which

Shell says it has increased "considerably" in recent months.

Shell announced at the end of 2008 that it had signed biofuel research agreements with six renowned international academic institutes including Massachusetts Institute of Technology (MIT; Cambridge MA), to accelerate Shell's biofuel program. "Partnerships with top experts worldwide will be critical to speed and success in the fast-moving area of biofuels," says Shell executive v.p. Graeme Sweeney.

Elevance (Bolingbrook, IL), a chemical firm with biomaterials activities, predicts an "evolution" as genomics, bioinformatics, and classical chemistry converge. The company expects that chemical catalysis will continue to play a key role in materials processing. "We believe the development of chemical catalysis, using novel catalyst systems like the Nobel prize winning metathesis catalysts that are at the heart of Elevance's technology, is likely to be more straightforward and faster than the development of many of the fermentation technologies enabled by genomics," the company says. Elevance says the scale up of chemical catalysis is easier, because it has been carried out more times than the scale up of fermentation systems to the sizes that the petchem industry needs to be economically viable.

Innovative companies leading the industry transformation will recognize that a number of key technologies, assets, and skills are necessary to meet the demands of the 21st century, Elevance says. "Tools such as genomics, bioinformatics, and high-throughput research methods offer an opportunity for accelerating development," the company says. "However, no one company is going to hold all the tools or be able to provide all the solutions cost-effectively. This is why our business model is focused on creating partnerships with other companies, government, and academia. Collaboration will be the most effective tool in accelerating developments," Elevance says.

Elevance has a partnership with Cargill for feedstocks, with Materia and Tetramer Technologies for technology, and with Dow Corning for market development. "These collaborations have led to

commercial development and sales of product into the personal care market, a consumer paint application, and novel wax materials for a variety of applications, with more to come," Elevance says.

BASF says is introducing a broad range of groundbreaking biotech products. The company disclosed recently that it is in the process of commercializing a bacterial mouthwash that protects teeth against decay. The product features an engineered strain of *Lactobacillus*, a probiotic microorganism. BASF says it has been collaborating with biotech firm OrganoBalance (Berlin) to commercialize the technology, dubbed pro-t-action. The strain of *Lactobacillus* developed by BASF and OrganoBalance binds to cavity-forming *Streptococcus mutans* bacteria found in the mouth, so that they can be flushed together out of the oral cavity by normal swallowing or mouth rinsing. *Lactobacillus paracasei*-based pro-t-action reduces tooth decay on average by 27%, BASF says.

"Molecular modelling in connection with bioinformatics and automation is an important basis for enzyme engineering activities at BASF," the company says. "Enzyme engineering today plays a crucial role in extending industrial biotech applications to traditional processes."

BASF says it is looking to add value to its biotech portfolio by combining biotech with its core competencies in chemistry, process know-how, and application technology. "The use of genomics and related technologies results in a better understanding of metabolic pathways," the company tells CW. "Consequently, development times for biotechnology processes can be reduced significantly. By employing proteomics and metabolic flux analysis, we have succeeded in developing microbial strains that produce large amounts of succinic acid or diamino-pentane within only two years," BASF says.

Bioinformatics and genomics have become "essential tools at BASF for discovering and designing new enzymes and metabolic pathways," the company says. "With [these] tools at hand, we are able to constantly enlarge our portfolio of enzymes for biocatalysis, animal nutrition, and specialty applications," BASF says. New applications include BASF's recently developed enzymatic processes to produce acrylic monomers. "Thermostable non-

starch polysaccharides (NSP), enzymes for animal nutrition, are in the launch phase," the company says. The economic and ecological advantages of industrial biotech, in comparison with competing classical chemical processes, have to be verified on a case-by-case basis, however, BASF says.

DuPont is another major chemical company with an established and broadly applied white biotech platform. The company, unlike many other chemical firms, has set itself a target for the amount of value it will generate from bio-sources. DuPont's current target is to generate annual sales of at least \$8 billion from bio-sources by 2015. The activities of DuPont's Applied BioSciences division include production of two types of "100% renewably sourced" bio-propanediol for applications in the detergents and personal care markets. Other products include the firm's Sorona polymer, featuring 37% renewably sourced materials, for the production of fabrics. DuPont's other biotech activities include a major program to develop biofuels. It has established a number of biofuel collaborations including a linkup with Genencor.

Sud-Chemie, a catalyst company with little emphasis to date on manufacturing biotech products, has also joined the biotech race and has a biofuel technology development program in place. The firm's activities include enzyme research at its laboratories in Munich. The key goal is to develop biocatalysts that produce biofuels, and a system is being designed to convert straw into fuels. "Bioinformatics and genomics are essential for this kind of thing. You can't do it without them," says Hans-Joachim Miiller, board member/catalysts at Sud-Chemie.

The progress made by Sud-Chemie during the past few years to develop biotech processes has been on a smaller scale than DuPont's but just as rapid, Sud-Chemie says. "We should have a biocatalyst-enzymes product in place within the next two years," Miiller says. The company recently announced the start up of a pilot plant at Munich for its straw-to-fuels process. It has yet to decide where to build a commercial-scale production facility for its first biocatalyst system, however. The location will be determined by the geographical availability of government grants for the project, he adds.

The next milestones for industrial biotech will include the emergence of bio-refineries that can produce a mix of biomaterials, in the same way that oil refineries generate a slate of petroleum products, Riese says. DSM says it is eyeing the manufacture of biomaterials at bio-refineries and that it has teamed up with Roquette (Lestrem, France), an agricultural materials firm, to develop the concept further (CW, March 9, p. 17). DSM plans to initially work closely with Roquette to optimize a process that will generate a range of chemicals from the "building block" biomaterial succinic acid, which can be produced with the use of renewable resources. DSM, if pilot tests go according to plan, will decide in 2010 whether to build a commercial-scale plant and could start up the plant in 2012, says Volkert Claassen, v.p./white biotechnology at DSM.

Step-changing developments are also on the horizon for the biological systems used to produce bio-based chemicals, which DSM dubs the "software" component of white biotech. The biggest change could take place during the next few years with the introduction of synthetic biology, under which organisms are created and programmed. The current prevailing approach is based on manipulating existing organisms.

Synthetic Genomics (La Jolla, CA), a privately owned research group that has a project partly funded by the U.S. Department of Energy, is at the forefront of developing synthetic biological systems. The company, led by its co-founder and biologist J. Craig Venter, has been developing synthetic organisms to generate biofuels from cellulosic materials since 1995. The project is still at the pre-commercial phase, and the process involves creating a new cell and organism with optimized functions.

"We're using our pioneering genomic science to explore new biologically driven sources of energy," Synthetic Genomics says. "Using the genome as a bio-factory, a custom designed, modular 'cassette' system will be developed to serve as a platform for biologically based software," it adds.

The convergence of biotech, bioinformatics, and chemical processing makes it all the more likely that bio-manufacturing "will become a significant part of the manufacturing base of the [chemical]

industry in decades to come," Schilling says.

The key question for chemical companies, in light of the knowledge that fossil fuels will one day be in short supply, is when to start adopting or developing bioprocesses, industry executives say. The point at which companies should ideally begin to switch their processes from petchem to bio-routes remains unclear, however, and depends on a variety of factors including production scale and costs, as well as product value, they say.

The recent low price of oil may have caused some chemical firms to delay plans to develop bioprocesses, although many economists predict that the price of oil and gas will rise substantially over the long term. Oil prices have already risen from \$34/bbl in February, to \$60/bbl more recently. The economic benefits of white biotech, especially when combined with the rapid technology developments achieved by companies such as Genomatica, could arrive sooner than expected, industry executives say.

- ALEX SCOTT.

Source : Chemical Week, May 18/25, P 27-30.

NANO PHEONIX

Nano Technology : Chalking up success in the downturn

Technology developments and sales growth for nanomaterials have slowed markedly as a result of the global economic downturn. The nanomaterial business also faces growing concerns about potentially serious adverse health and environmental impacts from its products. Analysts nevertheless predict that the diversity and size of the nanomaterials market will continue to grow.

All boats fall in an ebbing tide, and nanotech's ship is no different," says market research firm Lux Research (Boston), which recently published a report on how the world's economic woes have blunted growth of nanotechnology. The crisis in certain end markets, most notably the automotive

sector, is a major cause of the slowdown in the growth of nanomaterial sales, the company says.

The economic downturn, as it drains demand in several nano-enabled product market segments, is eroding growth along the entire value chain from nanointermediates to nanomaterials, says Jurrón Bradley, senior analyst at Lux Research. Products incorporating nanotechnology should generate total sales of \$2.5 trillion in 2015, the report says. "But that signals a 21% drop from earlier projections," Bradley says.

"The recession has hit automotive, construction, and to a smaller degree--electronics the hardest," Bradley says. "But we expect opportunities in health care and life sciences to remain largely unscathed, and recover from the recession more quickly. Among nanomaterials, carbon nanotubes and ceramic nanoparticles will suffer the most due to their broad exposure to automotive and construction. Nanocomposites and coatings will see the biggest declines among nanointermediates," the Lux Research study says.

Sales of products incorporating nanotechnology are growing faster in Asia/ Pacific than in the U.S. and Europe. The U.S. and Europe account for more than two-thirds of all nanomaterial sales, but through 2015 each region's share of the market will drop 2%-3%. Sales in Asia/ Pacific during the same period should rise 5% in part due to the region's more competitive automotive industry, Lux says.

Environmental applications for nanomaterials are projected to grow strongly. Market research firm BCC Research (Wellesley, MA) predicts that the global market for nanotechnology in environmental applications will achieve a compound annual growth rate (CAGR) of 61.8% in 2008-14 with sales reaching \$21.8 billion in 2014 compared with \$1.1 billion in 2008.

BASF is one of the leaders in developing nanomaterials for a range of applications including printed electronics. BASF says it is collaborating with engineering electronic equipment firm Heidelberger Druckmaschinen (Heidelberg, Germany) and Darmstadt Technical University (Darmstadt, Germany) in a technology consortium that is developing a series of processes with nu-

merous applications for flexible electronic components. Many of the products being developed by the consortium are based on nanoparticulate functional materials. The consortium plans to print its first organic electronic products within three years, BASF says.

"The electronics of the future are flexible and bendable," says Bernd Sachweh, BASF's leader for the project. "It will soon be possible to print low-cost and resource-conserving electronic components with gentle methods on flexible substrates," he says.

BASF, in a separate announcement during the past few weeks, confirmed that it has extended a joint research program with IMEC (Leuven, Belgium), a nanoelectronics research group, to codevelop process chemicals for the semiconductor industry. The BASF-IMEC collaboration covers selective cleaning solutions that reduce the number of steps required for the production of 22-nanometer chips. The first products from the collaboration will be available in 2011, BASF says. BASF's other developments include the creation of nanocubes for hydrogen storage.

Evonik Industries is another major chemicals manufacturer with a big R&D effort ongoing to develop nanomaterials. "Evonik sees major prospects in the use of this new technology to improve the production of products such as photovoltaics and batteries, and in areas such as surface treatment, mobile electronics, catalysts, ceramics, and composite materials," says Peter Nagler, head of innovation management/chemicals for Evonik.

"One promising solution is the flexible ceramic separator membrane for high-performance lithium-ion batteries designed to power hybrid and electric vehicles for climate- and eco-friendly mobility," Nagler says. Nanomaterials being developed by Evonik enable the sintering process required to stabilize and bond the particles, to form a ceramic material to be carried out at temperatures low enough for use with non-woven polymer fabrics. They also produce a porous, flexible ceramic material.

"Another equally exciting field of application [for nanomaterials] is bonding on demand," Nagler says. Applications include bonding materials such

as metals and plastics for the automotive industry. In the future, such bonded joints will be designed to deactivate or come apart again for such purposes as easier recycling," Nagler says.

Consulting firm Nanomarkets (New York), which directs much of its research into nanotechnology's applications in energy and electronics, says it is seeing a lot of activity in the development of nano-inks, including nanosilver, which is used in a range of electronic applications such as flexible displays and photovoltaics (PV). The market for nano-silver ink in PV applications is valued at about \$200 million/year globally and rising, says Lawrence Gasman, CEO of Nanomarkets.

The downturn has also caused a host of nanomaterial development projects to be put on hold, Gasman says. Nanomaterial markets that just one year ago were expected to generate phenomenal growth are now expected to show only modest growth, Gasman says. "A nanomaterial with a market of \$5 million/year one year ago may have been projected to generate sales of \$20 million in 2010 but now may only grow to about \$6 million," Gasman says. The slowdown has had a serious impact on producers because many markets such as nanometallic powders, nanotubes, and inorganic nano-structure preparations have just started growing from a very small base, he adds.

Carbon nanotubes and graphene are key materials for the electronics market that are in demand despite the recession because of their specific applications, says Raghon Das, CEO at IDTechEx (Cambridge, U.K.), a consulting firm focussed on printed electronics. "Carbon nanotubes have extraordinary properties and we think electronics will be one of the biggest applications," Das says. "However, they also exhibit properties making them applicable for cabling, and heat dissipation." Beyond carbon nanotubes and graphene, "we see a lot of interest in metal oxide materials for transparent transistors for display applications, along with nanosilicon-based inks, enabling near silicon[-like] bulk properties but without the high conventional silicon-manufacturing fabrication cost. Companies such as NanoGram (Milpitas, CA) and Kovio (Milpitas) are the leaders here," Das says. Vorbeck (Jessup, MD) is an "interesting" company because it is improving the conductivity of graphene and making it printable, as an alternative to expensive

silver flake ink. Vorbeck's research partners include BASF, Das says.

The application of nanotubes in touch screens and transparent conductors is likely to be realized during the next five years. "Those involved in conductor applications report that sales are growing by several hundred per cent each year," Das adds.

Health and environmental concerns continue to overshadow the huge market potential of many newly developed and commercialized nanomaterials, however. Hundreds of nanomaterials in commercial use have not undergone full toxicology testing. The current opinion of respected authorities such as the European Union's (EU) Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) is that nanomaterials are not dangerous in themselves, but that scientific uncertainty remains about many aspects of their safety. As a result, safety assessments of nanomaterials should be carried out on a case-by-case basis, it says.

The EU's Registration, Evaluation, and Authorisation of Chemicals (Reach) program is likely to be the first broad body of chemicals legislation specifically to regulate nanomaterials. Safety data on certain nanomaterials will have to be registered with the European Chemicals Agency (ECHA; Helsinki) from December 2010. Individual companies will be required to register their nanomaterials under Reach if selling the products in the EU and only if they are making them at a scale of more than 1 m.t./year. The deadline for registering nanomaterials under Reach will vary according to each material's tonnage and hazard classification.

"Just because they're nanomaterials doesn't make them exempt from registration or other parts of Reach," says Lisa Alien, technical manager for ReachReady, a Reach services group that is affiliated to the Chemical Industries Association (CIA; London). "Additional testing and data generation may be needed to assess the risks of a nanosubstance," Alien says.

A specific, stand-alone regulation for nanomaterials "is not necessary," Nagler says. "Present sector-specific regulations and Reach are, in principle, capable of covering nanomaterials, ensuring their safe handling and use," he says.

No equivalent legislation is in the pipeline in the U.S. "It won't happen [in the U.S.] for the next four or five years," Gasman says. "I wouldn't be surprised if an omnibus health and safety regulation on nanotechnology is introduced in the U.S. after that, but it's not in sight right now."

The debate about nanomaterials safety is building in the U.S., however. Advocacy groups such as Greenpeace and the Natural Resources Defense Council (NRDC; New York) are driving the U.S. debate about nanomaterials safety and have published a series of reports on the subject, says Skip Lockard, partner at law firm Alston & Bird's (Atlanta) environment and land use litigation group.

The debate has not evolved very much, however. Many U.S. consumers are unaware of the risks posed by nanomaterials, analysts say. Experts, meanwhile, continue to grapple with how to identify and characterize the risks of certain nanomaterials. A real danger is that one nanomaterial could emerge as "the next asbestos," Lockard says. The U.S. EPA is sensitive to the issue and although it has published no specific industry requirements, it has made some recommendations for industry to follow and reduce risks. Alston & Bird in conjunction with consulting firm Scott Madden (Atlanta) is offering manufacturers of nanomaterials an assessment tool to enable them to be proactive and avoid possible risks, Lockard says.

The U.S. chemical industry says it is not complacent in its approach to safety issues associated with nanomaterials. Socma has created the Nanotechnology SME Manufacturers Coalition to address standards and definitions in nanotechnology, as well as act as an industry voice. The coalition aims "to dispel the myth that industry is not engaged, or [is resisting] the regulatory process," Socma says.

Nano-safety initiatives emerging in Europe include AssuredNano, an accreditation scheme introduced last June and run by the Centre for Process Innovation (Wilton, U.K.), a U.K. government agency. "Most people I have spoken to are delighted that a guidance framework is now available to enable provision of demonstrable Responsible care," says Martin Pick, sales director at AssuredNano. "They are relieved that a scheme

exists, which will identify and update good practice while providing operational conformance through the use of acceptable procedures and audit techniques."

Industry has welcomed the emergence of AssuredNano, which "fills a real market need by providing manufacturers with a comprehensive assurance scheme that continually refreshes good practice and provides a mechanism that will ensure compliance," says Harry Swan, managing director at Thomas Swan (Consett, U.K.), a manufacturer of carbon nanotubes.

Such Responsible Care initiatives are likely to help stave off prescriptive regulatory controls which industry fears. When one also takes into account the ongoing surge of innovation, and market projections, nanomaterials-even in the heart of a global economic recession-appears to be one sub-sector that the chemical industry can continue to rely on.

- ALEX SCOTT

Source : *Chemical Weekly*, Aug. 3/10 2009, P 20-22.

THE ALADDIN LAMP

**Paladin Labs launches
Omega 3 supplements Gelicious! &
Gelmeg3**

PALADIN Labs Inc, a leading Canadian specialty pharmaceutical company, announced the launch of Gelicious! and GelmegS, the first and only Omega 3 supplements in a tasty gel format, specifically designed for those among us who do not like to and/or cannot swallow pills. Both Gelicious! for kids and GelmegS for adults contain Health Canada approved key levels of DHA (docosahexanoic acid) and EPA (eicosapentaenoic acid) that previously could have proved difficult for non-fish eaters to ensure they consume as part of their normal daily nutritional intake.

With these branded products Paladin is excited

to extend its innovative approach from prescription and OTC products into the realm of nutritional supplements via the BioEnvelop division. Both Gelicious! and GelMegS are not only unique given their creamy orange texture, but both brands are truly satisfying a unique need in the marketplace as research indicates that at least 40 per cent of adults have issues with swallowing pills. For the first time in Canada - a convenient Omega three daily supplement that tastes great at room temperature or cold.

The Omega 3 fatty acid is a form of highly poly-unsaturated fat, one of the 'good' fats not naturally manufactured by the human body, is clinically proven to contribute to good health overall, with specific links to brain function, cognitive skills and heart health. Gelicious! is specifically formulated to help support the development of the brain, eyes and nerves among school-aged children, four to 17, in addition to helping to support cognitive skills such as communication and reasoning.

GelMeg3 contains 1000mg of DHA (343mg) and EPA (658mg), recognized by Health Canada as contributing to the maintenance of good cardiovascular health overall and specifically as an aid in lowering serum triglycerides.

Paladin Labs, headquartered in Montreal, Canada, is a specialty pharmaceutical company focused on acquiring or in-licensing innovative pharmaceutical products for the Canadian market.

Founded in 1998, BioEnvelop designs and manufactures state-of-the-art Delivery Systems of Active Ingredients in both film and gel formats that have wide applications in the Medical & Dental, Health & Wellness and Oral Care industries.

Source : Ingredients, Vol.2, Issue 29, P 31.

BURN YOUR FINGERS

Sizzling fats and oils

By Doris De Guzman, New York

Industrial use of fats and oils has been rapid growth and development over the past few years, driven

mainly by high petroleum and natural gas prices, as well as growing demand for nature or renewable based products.

US fats and oils used for industrial applications rose last year to an estimated 11.9bn 1 bs (5.4 tonnes), up by 9% from 2007, and by 24% from 2006 figure of 9bn 1 bs, according to the US Department of Agriculture's (USDA) Economic Research Service (ERS).

Methyl Esters, or biodiesel, was the biggest factor in the increase in fats and oils use, while applications in lubricants and similar oils also had significant spikes, the USDA reported in its 2009 Oil Crop Yearbook.

An estimated 700m gallons of US biodiesel was produced last year, according to the trade body the National Biodiesel Board (NBB). Around 34% of biodiesel raw material came from refined soybean oil, 31% from crude soybean oil, 11% from inedible tallow and grease and 24% from other fats and oils.

The production of US biodiesel, which now accounts for over 75% of soybean oil's industrial use, experienced an annual average growth rate of an astonishing 90% for most of this decade," says Kenneth Doll, research chemist, Food and Industrial Oil Research Unit at the USDA's Agriculture Research Service(ARS).

The use of soybean oil in surfactants, speciality coatings, and bio-based lubricants is also a growth area, says Doll.

"The bio-based lubrication markets was 15m gallons in 2007 but is expected to reach 30m gallons by 2017. This is despite a relatively flat market for all of the lubrication industry," he adds.

For the marketing year 2008-2009 (October – September), the global industrial use of vegetable oils is estimated to be 25m tones, up by 7% from 2007, according to Keith Menzie, senior oilseed economist at the USDA's World Agriculture Outlook Board. Menzie presented his projections at the annual American Fats and Oils Association (AFOA) meeting held late last year in New York.

"Industrial use now accounts for 20% of the glo-

bal total vegetable oil consumption compared to 10% in 2001-2002," said Menzie. "Growth was mostly from the European Union, US, Argentina and Malaysia."

EU industrial use of vegetable oil grew by 25% year from 2001/2002 through 2006/07, added Menzie. For 2001/02 through 2006/07, added Menzie. For 2008/09, 6% of global vegetable oils production used by EU will be biodiesel according to USDA.

But with fats and oils prices rising amid a lower petroleum price, the question remains over whether development and used for fats and oils based chemicals will stagnate. "The volatility of petroleum prices increased the competitiveness of bio-based materials in petroleum-dominated markets. However, this window of opportunity was somewhat short-lived as agricultural commodity prices also increased and later petroleum prices lowered," says Doll.

Economic impact

While being green for bio-based product development as drivers for bio-based product development, they tend to be tie-breakers, says Andy Shafer, vice-president, sales and market development Illinois, US based Elevance Renewable Sciences.

"The most significant challenge for renewable based industrial product is to provide improved performance at competitive economics," says Shafer. "The chemical industry is looking for innovative solutions that provide advantages in performance, economics, security of supply and stability of pricing.

Shafer adds that while the current recession certainly affected sales of most consumer-driven goods, the specially green chemical company's business appears to be less significantly affected than other alternatives based on petroleum products.

"New products are being introduced using our technology in candles and personal care products. Our established products also continue to sell well," he says.

US based natural oil polyol producer Bio-based

Technologies notes that there has been reduced consumption of polyols at its existing customer base.

"But new customers and new applications for natural oil-based polyols have buoyed us through the downturn," says directors of sales and marketing Larry Armbruster.

Customers, however, are still not willing to pay a premium for green, adds Armbruster. "Customer push for green as long as it is cost competitive with existing products on the market."

Among all industrial applications, biodiesel is projected to be the leading contributor to the reduction to the UDA_ERS. Soybean oil use in biodiesel production is forecast to decline from 2.9 bn to 2,2 bn lbs for the 2008/09 marketing year.

"Soybean oil demand from this market was already tightening, as diesel fuel prices collapsed faster in 2008 than the feedstock costs for biodiesel," says Mark Ash, USDA-ERS oilseed analyst. "For January 2009, domestic consumption of soybean oil for biodiesel already plunged by 53% from the same month last year.

The slowdown in biodiesel leaves available soybean oil for smaller but more value-dense markets, notes Doll. "Our production agricultural oil will certainly be affected by various market conditions, like all industries. Still we will always have to make our chemicals, materials and fuels out of something. Environmental concerns and finite in the use of renewable resources." He adds.

Amid the current price drop in petroleum, soy chemistry is still economically competitive in many more markets, according to US-based consulting firm Omni Tech International. In September, Omni Tech issued a report for the US soybean group United Soybean Board (USB) about the potential impact of rising petrochemical prices on soy use for industrial applications.

"Relative increases in natural gas and petroleum pricing will continue to lead to increased use of soy material in markets where performance issues have been sufficiently addressed," reported Omni Tech.

"In those markets where performance and/[or] processing costs are still an issue, the competitive motivation for seeking improved performance of soy products while still remaining economically competitive is significantly increased."

New Products Sprout

The USB need a total of 28 soy-based products last year with its soybean checkoff program, compared with 26 products launched in 2007. Application include polyurethane (PUs) and other resins, solvents, adhesives, printing inks and coatings.

"The US soybean checkoff looks for industry partners to grow demand for our product by partnering with them of research and create new soy technologies," said Todd Allen, USB new uses chairman in a statement. He noted last year's success such as soy polyols-based foam now being used in Ford Motor automobiles.

Ford uses soy-based seat cushions and backs in more than 1 m vehicles, which is equivalent to using more than 76,000 bushels of soybean, says Debbie Mielewski, technical leader of Ford's plastic group.

"We are extending our partnership with the USB through investigating soy meal and flour as filler for several automotive plastic. With the soy foam, we are now conserving over 1 m lbs of petroleum and reducing over 5 m lbs/year of carbon dioxide emissions," adds Mielewski.

The rigid foam market and flexible foam market have reportedly seen much growth in the use of natural oil polyols, says Armbruster.

In August last year, the company launched its second-generation natural oil polyols Agrol Diamond for the rigid foam market. The company says it has made a significant investment in its research and development capabilities.

"Some products acts as fillers and can be used only at lower levels, while others perform more similarly to petroleum-based products. There is also a lot of work being done with the additives to

improve natural oil polyol performance," he adds.

Shafer note emerging renewable products in sectors such as personal care and cosmetics, candles, corrugated and packaging, lubricants and antimicrobials.

Soy and vegetables waxcandles are said to be the fastest-growing sector of the candle industry. Elevance recently introduced a soy-based wax for use in compression candles, which adds Shafer, was difficult for soy waxes to do without Elevance's novel technology.

"Our collaboration with [US polymer research firm] Tetramer Technologies has resulted in the synthesis of over 100 novel waxes. We are now beginning the commercial screening of a select few of these interesting products," he says.

Elevance's soy wax collaboration with US speciality chemical company Dow Corning also resulted in multiple cosmetic and personal care products on store shelves in Latin and North America says Shafer.

"We expect that our development efforts will result in additional products being introduced very soon, expanding this product line, he adds.

Also in cosmetics and personal care is the USDA-ARS recent development of a soybean oil-based biodegradable sunscreen called Soyscreen, and soy-based hydrogel for use in hair care.

"The hydrogel can expand and contract in response to changes in temperature or acidity levels, which makes it suitable for hair care applications and drug-delivery-two high-value markets," say Doll.

He also notes the recent increasing use of soy extenders in the manufacturers of wood composite materials. "The acceptance of this biobased product is high because of the lower emissions compared to formaldehyde based resins," he adds.

(Source : ICIS Chemical Business, April 27-May3, 2009)

Safety

THINK NO accidents : Industry processes safety changes

Pressure mounts as the chemical sector braces /for wholesale change 1 in its approach to best practice for safety

THE GLOBAL chemical sector is striving to give more prominence to process safety within Responsible Care programs, as governments move to bring the whole area of accident prevention in hazardous industries under greater regulatory control.

The European Commission is reviewing the 13-year-old Seveso II directive on the control of major accident hazards, with the objective of making more effective obligatory safety management systems in plants, including those covering process safety.

In the US, the Occupational Safety and Health Administration (OSHA) has been urged, particularly by the country's Chemical Safety Board (CSB), which investigates chemical accidents, to enforce existing legislation on process safety more effectively.

However, process safety is such a complex subject that providing it with a higher profile with Responsible Care is proving difficult. There are even problems achieving a uniform approach to the issue.

Currently, the industries in the US and Europe have different views on the matter. Earlier this year, there had been hopes that these would be resolved within the next few months, so that a large section of the global industry would have a common platform from which standards could be raised throughout the world.

However, after recent talks on the matter, Cefic - the European Chemical Industry Council - and the American Chemistry Council (ACC) were unable to reach agreement on what process safety data should be monitored.

A series of major accidents within the chemical sector and the closely related segment of oil and petroleum products have prompted both regulatory authorities and the general public to expect the industry to do more to prevent incidents that have killed or injured people and caused extensive damage to both industrial and residential buildings.

In the health and safety area, the industry has tended to concentrate on collecting data on personal injuries resulting from trips and falls.

Most companies now publish in annual and sustainability reports data on items like (/ lost working time due to personal accidents. I/ Since it is a duty under Responsible Care for chemical companies to record personal accident data, chemical associations also provide it on a national basis.

Until recently, little information from either chemical companies or associations was published specifically on incidents arising from disruptions to manufacturing processes, which have caused spills, fires, explosions or injuries. The ACC has been one of the few national associations to annually report process safety incidents. Since 1995, its members have been required under its Responsible Care program to report "significant" fires, explosions, chemical releases and injuries involving a chemical process. As a result, it says incidents of this type had declined by 46% up to 2007.

Pressure has been mounting on the industry for the collection and publication of process safety data on a much wider scale. This is particularly since disasters like the explosion at a fertilizer plant in Toulouse, France, which killed 29 people and injured hundreds more in 2001.

However, the event that has probably done more to raise awareness in the industry about the issue was a blast at global producer BP's Texas City refinery in Houston, Texas, US, in March 2005, which killed 15 and injured 170.

The accident was extensively investigated, not only by the CSB but also an independent commission led by former US Secretary of State James Baker, which / assessed safety culture and supervision at all five of BP's US refineries.

It recommended in early 2007 that BP "develop, implement, maintain and periodically update an integrated set of leading and lagging performance indicators" to monitor its process safety performance more effectively. A similar recommendation was made by the CSB in its report on the explosion.

There has been a recognition across large sections of the industry that the principles behind the Baker proposals on process safety performance indicators should be applied to the vast majority of chemical producers.

LEADING OR LAGGING?

The problem has been the huge variety of data that can be categorized as being indicators. Lagging indicators provide information on incidents, big and small, after they have happened, while lead indicators should help to measure the effectiveness of procedures, operating disciplines and protections preventing incidents. In addition, there are near misses, which are not serious but could lead to severe incidents.

"The choice of lagging and lead indicators, as well as near misses, is causing a great deal of confusion," says one process safety specialist. "What some experts classify as a lagging indicator, others would categorize as a lead indicator."

Nonetheless, a lot of progress has been made by chemical engineering organizations like the Center for Chemical Process Safety (CCPS) in the US and the UK-based European Process Safety Centre to achieve uniformity in the application of indicators.

A consensus has now emerged that the choice of lead indicators should be left to individual companies or even sites within companies because different lead indicators are required for different products and processes.

After consultation with a range of chemical and

petroleum associations, regulatory bodies, trade unions and academics, CCPS drew up a list of process safety metrics in late 2007, which has now gained support in North and South America and in a few European countries.

It recommends a list of lagging indicators based mainly on the monitoring of releases or loss of containment of chemicals or energy above certain thresholds.

"There will be opportunities for adjustments to be made to the metrics and for continued improvements," explains Scott Berger, director of CCPS, which is part of the American Institute of Chemical Engineers. "Our priority has been to get a consensus behind the metric system," he says. "The thresholds were set after an online voting process by company representatives."

The ACC is adopting CCPS metrics from this year so that its members will have, under Responsible Care, to adhere in many cases to lower threshold quantities when reporting losses of primary containment (LoPC) from equipment like pipes and storage facilities.

The CCPS thresholds are based on those of the UN Dangerous Goods categories, rather than those of the US Environmental Protection Agency (EPA). Furthermore the number of chemicals included is more than double that on the EPA list - over 1,800 specific chemicals and more than 450 generic chemicals, compared with fewer than 1,000. Brussels-based Cefic has misgivings about some aspects of the CCPS but nonetheless has been showing willingness to back much of it in its negotiations with the ACC on a uniform process safety strategy. These have been taking place under the umbrella of the International Council of Chemical Associations, the world body for chemical trade associations.

DIFFERING APPROACHES

The difference between the European and US approaches to the issue has been highlighted by a current test project in Germany. While the CCPS system focuses mainly on release of hazardous substances, the German chemical industry association is piloting a monitoring, program with compatriot producers BASF, Evonik Industries and

Bayer, in which the objective is zero releases of all substances.

"All losses of primary containment, not just the releases of hazardous substances, show in some way that a process is not working properly' says Peter Schmelzer, head of compliance HSE at Germany's Bayer Healthcare and chairman of Cefic's issue team on process and plant safety.

"The ultimate goal should be no losses, just as in the occupational health area, the ultimate target is no personal accidents. It is the sort of high expectation that the public would appreciate and understand.

"But we want to reach a compromise with the ACC because our priority is to have a global approach so that as many companies as possible - especially SMEs - are reporting process safety incidents across the world," he says.

The compromise is likely to be an agreement to concentrate on monitoring of LoPCs, based on the UN Dangerous Goods list, with Cefic pressing for low thresholds.

"The idea will be to keep it relatively simple in order to build up an awareness within companies globally and to create a reporting culture across the world," says Schmelzer.

Once recording of data on losses of containment becomes a core part of Responsible Care, they should gain a similar importance to that of occupational health data, such as loss of working time through personal injuries. Companies would then feel free to publicize the competitiveness of their process safety data in annual and sustainability reports.

Source : ICIS Chemical Business, June 8-14, 2009, P 24-25.