Vol. XIII No. 3

July - September 2011

NEWS LETTER

OIL TECHNOLOGISTS' ASSOCIATION OF INDIA
WESTERN ZONE

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

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OIL TECHNOLOGISTS' ASSOCIATION OF INDIA WESTERN ZONE

From the Editors's Desk

Watch out ! It is December midway. Grand performance at Nehru Center. An idlyllic location. Ambience at its best. The organizing Committee is leaving no stone unturned to present the best in the field. Top-notch speakers will hold the audience spell-bound. Seasoned experts will share their experience and let out secrets on how to sparkle in the markets. Makes fair skin fairer, hair growth sustained and variety of soaps to cater to different segments. Listen to the eloquence. Not just hear! Carry the ideas to your performance. All this and heaven too.

Trade & Commerce

CLUE TO MORE OIL

Cotton productionrise to a record level for the second consecutive year

COTTON production during 2011-12 may rise to a record level for the second consecutive year as a rally in prices spurns farmers to boost planting. It is indeed a pleasant paradox that in this season when cotton production in India reached a high level, prices have also established a new record. Farmers may boast crop area by about 15% to 20% because of higher prices. Even in Gujarat, the oilseed bowl of the country, there would be diversion of acreage from oilseed to cotton. Farmers are reported to have earned four times more from cotton than oilseeds. The situation in Maharashtra, the second largest cotton producing state is nothing different. The authorities are worried about diversion of acreage from food crops to commercial crops.

These developments assure us that there would be sufficient raw material for our industry to run for the major part of the season. Better we use advantage of present lean period and complete required annual repair and maintenance of machineries to face the bumper harvest in the next few months. We should also start surfing in the international market for export of cottonseed byproducts especially for the new products like 'hull'' deoiled cake etc. There are enquires about export of cottonseed also.

The Association in principle, do not approve export of cottonseed as such. We should process cottonseed indigenously and export cottonseed by-products in the larger national interest. Our industry is mainly based in rural/semi urban areas, providing much needed employment in the hinterland. At present we hardly use about 35 to 40 percent of our installed processing capacity.

(Courtesy : AICOSCA Newsletter, May 2011)

BREAKTHROUGH

"Problem of plenty seen ahead"

IS there food shortage in India? Bet you will say yes. After being rammed by inflation, it's natural. But not true. India has no food shortage. On the contrary, we are now faced with the huge problem of plenty.

There is a bumper wheat and rice crop. In Andhra Pradesh, India's rice bowl, production is up 30%. Millers are offering only Rs 8 for a kilo of paddy though the MSP is Rs 10.30. Angry farmers last week threw paddy into the Krishna river. The state government has borrowed Rs 550 crore from RBI for procurement. The FCI can do little. After buying 50 million t wheat and rice this season, added to 44 million tonnes left from last year, it is exhausted.

The oilseed crop is 20% larger. Import of palm oil from Malaysia and Indonesia is down for the sixth straight month till April, a three-year low. Sugar output is up 28%. Even exports can't prod the bulls into action.

Production of pulses rose by a fifth to cross 17 million tonnes. Planning Commission pegs this year's demand at 19 million tonnes. As the gap narrows, premiums are evaporating.

Cotton prices hit a 140-year high in March on the back of the world market and then crashed by Rs 20,000 per candy within two months. Textile mills can't absorb the record harvest.

In crop after crop, output is higher. In West Bengal, farmers have put 60% of their potato in cold storage, hoping prices will improve. And a 15% jump in onion harvest has pushed wholesale prices in Maharashtra back to Rs 5 per kilo. In January, we paid Rs 70.

What has changed? It's the classic case of

overstimulation by high price expectation. Net returns in most crops were so high that farmers left no stone unturned to maximize gains. They tilled every available inch of land. An extra 2.5 million hectares was cultivated last winter. One million hectares was added to wheat. Area under pulses touched 130% of the normal. Sugarcane acreage rose 15%. This June, farmers intend to plant another million hectares with 'white gold' cotton.

Along with area, productivity increased. Farmers invested heavily in best seed, irrigation and crop inputs. High crop prices make it easier to adopt new technology. Erratic weather was the only party pooper. Within a few short months, the farmer has proved that with enough money on the table, India can overcome its supply side constraints.

Unfortunately, demand failed to keep pace. It never does. Despite what economists and politicians

believe, middle class demand is not endless. A family that bought onions at Rs 70 doesn't buy 14 times more when it sells for Rs 5. We eat what we eat. Total consumption remains relatively stable over a wide range of prices.

Poorer families do want to eat better. But they still can't. Abundant no longer means affordable. The cost of producing crops has increased 20% in the past year, boosted by higher farm wages, expensive diesel and fertilizer. The MSP assures 30% returns on cost. Farmers themselves are satisfied by nothing less than 50% - selling a crop at two times its cost - to compensate for higher cost of living.

It is a piquant situation. Food inflation remains high. So, poor families are in distress. Yet India has produced so much that farmers are in distress.

The immediate challenge is how to manage excess production so that farmers are not left ruing their investment in productivity. There are several quick fixes. Removing inter-state trade barriers, limited export, and improving transportation is one. Increasing storage to keep produce safe for the off-season is another. Procurement by PSUs and private processors is the third.

As usual, government has no plan. It is moot whether policy makers are even aware of farmer distress, given the current obsession with inflation that tells only half the story.

In every other business, when demand falls, manufacturers reduce supply. Agriculture lacks this fundamental market mechanism. Farmers continue to produce even when prices fall because it costs more to idle the land than it does to produce at a loss. The extra land and superior technology, once introduced, won't vanish overnight either. In fact, at low prices each farmer wants higher yields to keep gross income from falling through the floor.

Without proper management, record farm prices can trigger another vicious cycle of debt and distress. The gravest danger today is that India's rural income resurgence may end even before it properly started.

(Economic Times, 31-5-2011)

(Courtesy : AICOSCA Newsletter, May 2011)

RICHE RICH

Per capita income in 2010-11 at Rs. 54,835

PER capita income of Indians grew by 17.9 per cent to Rs 54,835 in 2010-11 from Rs 46,492 in the year-ago period, according to the revised data released by the government on Tuesday.

The new per capita income figure estimates on current market prices is over Rs 8,000 more than the previous estimate of Rs 46,492 calculated by the Central Statistical Organisation.

Per capita income means earnings of each Indian if the national income is evenly divided among the country's population.about 6.5 per cent in 2010-11 if it is calculated on the prices of 2004-05 prices, which is a better way of comparison and broadly factors inflation.

Per capita income (at 2004-05 prices) stood at Rs 35,917 in FY11 as against Rs 33,731 in the

previous year, the latest data on national income said.

The size of the economy at current prices rose to Rs 73,06,990 crore in 2010-11, up 19.1 per cent over Rs 61,33,230 crore in FY10.

The country's population increased to 121 crore at the end of March 2011, from 117 crore in fiscal 2009-10.

(Tecoya Trend, 1-6-2011)

(Courtesy : AICOSCA Newsletter, May 2011)

BROKEN RECORDS

Country set to make record 235.88 MT of food harvest

THE Centre has revised upwards its wheat output estimates for 2010-11 to 84.27 million tonnes (mt), perhaps setting the stage for lifting restrictions on grain exports.

The 84.27 mt figure — based on the third advance estimates of crop output released by the Agriculture Minister, Mr Sharad Pawar, here on Wednesday — is higher than the second advance estimate of 81.47 mt made on February 9.

Mr Pawar's Ministry has also significantly raised its production estimate for oilseeds (especially soyabean), sugarcane and pulses. Sugarcane output, which was put at 324.912 mt in the first advance estimate and 336.698 mt in the second, is now projected to touch 340.545 mt. Whether it would translate into higher-than-anticipated production of sugar is to be seen.

On the whole, 2010-11 is expected to register a record harvest of foodgrains (235.88 mt) — and within that, wheat and pulses (17.29 mt) — in addition to oilseeds (30.251 mt) and cotton (33.927 million bales). Within pulses, arhar (3.15 mt) and urad (1.82 mt) production are slated to hit all-time-highs, just as soyabean (12.589 mt) and castorseed (1.307 mt) are in oilseeds. But the real story is in wheat, the harvesting of which has just started. A crop size of 84.27 mt will, apart from contributing to a further easing of food inflationary pressures, also pose problems for the Food Corporation of India.

As on April 1, total grain stocks in the Central pool were placed at 45 mt (15 mt wheat and 30 mt rice) as against their corresponding normative required levels of 21.2 mt (7 mt and 14.2 mt) for that date.

"Our stocks are more than the buffer norm. In such a situation, we must take a view on exports as soon as possible. I am sure the Government will apply its mind and take an appropriate decision amidst bumper harvests," Mr Pawar told presspersons.

The latest foodgrain production estimate of 235.88 mt surpasses the previous record of 234.47 mt achieved in 2008-09. Exports of wheat have been banned since February 9, 2007, with non-basmati rice shipments, too, prohibited with effect from April 1, 2008.

(The Hindu Business Line, 7th April, 2011

(Courtesy : AICOSCA Newsletter, April2011)

GLIMMER OF HOPE

Indian’s dependence on imported veg oil to decline to 3 year low

INDIA'S dependence on imported vegetable oil is likely to decline by six percentage point to the lowest in three years due to higher production from domestic sources. Higher oilseed output and favourable crushing parity have helped mills to produce more from domestic sources and reduce reliance on imports. Experts believe that the contribution of import in overall vegetable oil consumption will decline this year to 47 per cent as compared to a staggering 53 per cent last year.

Out of 50,71,779 tonne of oilmeals exported from Vegetable oil imports to India declined a staggering16 per cent in the first four months of the oil year 2010-11 (November-October) due to falling demand of imported oil. India imports nearly 85 per cent of crude palm oil mainly from Indone-

sia while the remaining 15 per cent of both crude and refined oil s met through imports from Malaysia and Argentina, among others.

Between November 2010 and March this year, vegetable oil imports plunged to 3 million tonnes as against 3.6 million tonnes in the corresponding period of the previous year. Considering the fall in mport continues, overall import of veg oil in India will decline to 8-8.2 million tonnes.

Dorab Mistry, director of Godrej International attributed the fall in import to higher availability of domestic seeds and dramatic fall in crude palm oil prices.

We are already half a million tonne short in imports this year as compared to last year. But it is too early to say that India's imports will decline to below 8 million tonnes from 8.8 million tonnes last year. Now we must see if the higher production of domestic oils would continue for the rest of the year," said Mistry.

If world prices fall and RBD olein comes down locally to Rs 50,000, then local production of mustard oil will decline. Stockists will prefer to hold stock and wait for prices to improve. So, it is a dynamic situation, Mistry added.

Domestic oil production, meanwhile, is estimated to surpass all previous records and set the new benchmark at 8.52 million tonnes this year as against 7.77 million tonnes last year. The Agriculture Ministry estimated total oilseed output to rise to 30.25 million tonnes in 2010-11 as against 24.8 million tonnes last year. Soybean production is estimated at 12.6 million tonnes and groundnut production at 7.1 million tonnes.

On basis of the additional production of about 6 million tonnes of oilseeds, India would be producing an additional 2 million tonnes of oils during the current year. This should check the unabated imports, said B V Mehta, executive director of the apex trade body the Solvent Extractors Association (SEA).

Meanwhile, SEA urged the government that the industry would have to therefore step up oilmeal exports to dispose off the surplus. In view of the expected bumper oilseed crop, the restriction imposed on export of edible oil in bulk as well as imposition of export duty on deoiled rice bran becomes redundant and needs to be done away.

Oil mills are processing maximum quantity of seeds to make higher margin this year. Unlike last year around same time, when crush margin was negative at around Rs 1,000 a tonne, the same is positive this year and mills are making profit between Rs 2,500 and Rs 3,000 on every tonne of seed.

Crude palm oil prices turned bearish for the near-month contract to trade currently at 3,360 ringgit in Malaysia.

(The Business Standard, 22nd April, 2011)

(Courtesy : AICOSCA Newsletter, April2011)

DARING

Eye on talent, Godrej looks to build global brand equity

AFTER making seven acquisitions across three continents -Asia, Africa and South Africa-the Rs 13,000-crore Godrej Group is now launching an exercise to build the equity of the master brand 'Godrej' in the international market. The aim is to attract talent for its international companies.

The 114-year-old Godrej brand is well known in India-with products ranging from soaps to cupboards. In a bid to build its equity'globally, the group is considering various options, including hiring an external consultant.

Three years back, a similar initiative was undertaken in the domestic market and the group had roped in UK-based brand consultancy firm, Interbrand, for the task. This had resulted in a younger looking Godrej logo and a vision to treble the turnover of its fast-moving consumer goods (FMCG) business by 2012.

"A lot of thinking has gone into how we could leverage the Godrej brand from the perspective

of attracting talent in the international market. One way of doing that is to try and push the brand more in the international market to build its equity. Earlier, we did a successful brand relaunch with Interbrand and now we are in discussion on how we could take this forward for a geographic expansion of the Godrej brand," Vivek Gambhir, chief strategy offer, Godrej Industries, told media.

The group's FMCG arm, Godrej Consumer Products (GCPL), has acquired a host of companies globally in the last six years. After buying out Keyline Brands of the UK in 2005, GCPL acquired Rapidol (Africa) in 2006 and Kinky (South Africa) in 2008.

Last year, the acquisition of Tura (Nigeria) was followed by the acquisition of Megasari (Indonesia), Issue Group (Argentina) and Argencos (Argentina). Each of these companies have independent brands which are popular in their respective regions. That makes it imperative for the group to build its master brand.

Along with these acquisitions came the task of consolidating the businesses and ensuring that the talent pipeline did not get clogged. Last year, the group took to integrating these businesses which were spread across three continents on a common HR platform. However, building a leadership and talent pipeline continue to be the biggest challenge for the group. That explains the urgency with which the group is moving to build the master brand equity globally.

While no final decision has been taken, the group is likely to rope in an external consultant to enable it to meet this objective.

A number of Indian companies which have established a presence globally, like Tatas, Mahindra & Mahindra, Asian

Paints and Marico, have been pushing their brands in the international markets as well.

According to Jagdeep Kapoor, CMD, Samsika Marketing Consultants, one of the reasons why Indian companies have been slow to establish their brands globally, even as they continued to grow strong in the domestic market, is because of the depth of the Indian market.

"Amu! as a brand, after so many years, is now increasing its presence in India from 1,000 towns to 3,000 towns. The fact is that there are 8,100 towns in India, which can consume all the efforts of a company to expand its presence. But what is important is that Indian companies simultaneously build their brands in the international markets as well. After all, Indian professors have gone global and so have Indian managers. So why not take Indian brands global too?" said Kapoor.

Godrej has also set up a dedicated international centre and roped in Shashank Sinha as president, international business, GCPL. The objective behind the move is to consolidate the business and put it under one reporting structure to drive synergies and collaboration.

Sinha is an MNC veteran with more than twenty years experience with various FMCG multinationals like Sara Lee Corporation and Reckitt Benckiser.

(Courtesy : Soaps, Detergents & Toiletries review, June 2011)

COLUMBUS

Grooving to the local beat

AS reverse innovation finds its way into the FMCG sector, multinationals swear by their made-in-lndia brands. Many of them are racing to introduce their Indian innovations in international markets after seeing their success in India

SOMA DAS AND LALITHA SRINIVASAN

Supermarkets in Singapore stock the popular Gamier Men PowerLight range of skincare products endorsed by Bollywood actor John Abraham, while in downtown Jakarta in neighbouring Indonesia, young housewives find Hindustan Unilever Ltd's (HUL) low-cost water purifier Pureit a lifesaver.

Desi brands have come full circle, with multinational companies swearing by them. Gamier Men PowerLight cosmetics, Kurkure, Pureit, Nimbooz, Aliva —these are all products invented in the Indian laboratories of mutinational companies, originally made for Indian consumers but today a hit in global markets. Pureit, the cheapest variant of which is available for Rs 1000 in India, is sold in countries such as Indonesia, Mexico and Bangladesh. The Gamier Men PowerLight range originally created by cosmetics maker L'Oreal for Indian men is now finding enthusiastic users in other countries. It's the same for Kurkure and Maggi Masala, which with their uniquely Indian flavours, are now attracting attention globally and are being adapted to suit local tastes in overseas markets.

The increasing relevance of what General Electric chief Jeffrey Immelt called reverse innovation —products originally conceived for developing economies but now being marketed in other geographies in their original or modified form —is being clearly felt across categories. Multinational FMCG (fast moving consumer goods) companies are today racing to introduce their Indian innovations in international markets after seeing their success in India. What started off as a trickle is now turning into a flood as multinationals go through their Indian inventories to identify brands that could turn out to be winners in international markets too.

Skin whitening cream Fair & Lovely, from the house of HUL, was perhaps the pioneer. Today, this skin cream which has seen some iconic advertising over the years, and has spawned an entire category of skin whitening products, is marketed in over 30 countries, mainly in Africa and the Middle East. "Scientists at the Unilever Research Laboratories in India were the first to discover the skin lightening action of niacinamide that led to the development of a unique and patented formulation of Fair & Lovely in 1972. In 1978, we launched Fair & Lovely in India," says a HUL spokesperson.

Similarly, L'Oreal last month spelt out its strategy to use reverse innovation in emerging markets to expand its revenue share in the concerned geographies. The company plans to develop beauty products locally for emerging markets and

Innovations are getting bigger and rolling out faster across countries. India, will be one of the top two priority markets for us.

- Paul Polman
CEO, Unilever Pic

eventually modify them for the international markets, through a new research and innovation centre in India.

"India is not only a source of growth for us at L'Oreal, but also a source of inspirat-ion and 'Indovation'," says.

L'Oreal India chief operating officer Dinesh Goyal. "We have created products like Gamier Fructis Shampoo + Oil specifically keeping in mind Indian consumers habit of oiling their hair. Our Gamier Men PowerLight range was created for the Indian male skin, Gar-nier Color Naturals is the first creme hair colour to be created for Indian hair. These 'Indo-vations' are now being rolled out globally."

The emerging markets today account for 38% of L'Oreal's consumer products division's sales, as against 28% five years ago. This is expected to reach 50% in less than six to seven years.

During his recent visit to India,Paul Polman, the CEO of Unilever Pic, stressed on the importance of reverse innovation with India as an inevitable epicenter. "Innovations are getting bigger and are rolling out faster across countries. Companies will shift their innovation capabilities and their new introductions to emerging markets. For instance, we are witnessing premium initiatives coming into

India is not only a source of growth for us at L'Oreal, but also a source of inspiration and 'Indo-vasion'.

- Dinesh Goyal, COD
L'Oreal India

the market in China even before they are rolled out in the US or Europe," he said adding that till two or three years back, Unilever's incremental turnover from innovations stood at around €3-5 million, while today it has crossed the €50 million mark. If Unilever saw nine such initiatives rolling out in 10 countries in 2009, in the following year the same increased to 40 globally. And India, according to Polman, will be one of the top two priority markets for the firm in terms of leveraging the incremental growth pie that the FMCG giant expects would double its business.

This attitudinal shift in multinationals has been brought about by factors such as consumption in emerging markets exceeding the US consumption. Last year, the emerging economies' share of global consumption was close to 35% as against America's 27%. The former stood at 23% till early 1990s, according to investment bank JP Morgan.

Within the next 20 years, the middle-class population in emerging markets is expected to cross 1.8 billion agaii a meager 266 million at the turn oft century. Developed markets which \ day have a 830-million strong midc class population would by then or have 1 billion people in that segmei according to World Bank projectior Multinationals expect about 70% of tl world's growth over the next few yea to come from emerging markets, wi 40% coming from just two countrie China and India.

A promising future for the FMCG se tor in India is an added bonus. The Inc an FMCG industry has grown 11% ai nually in the last decade and at the ral of 17% since 2005 to touch R 1,30,00 crore (in FY2010), thus accounting fc 2.2 % of the GDP. A CM and Booz Company estimate predicts that th FMCG industry will continue to grow i a base rate of at least 12 % annual! to become an R 4,00,000 crore Indus try by 2020. Additionally, if some of thi factors play out favourably within an en vironment of enabling policy and eas ing of supply constraints, 17% growtr may be expected over the next decade leading to an overall industry size of F 6, 20,000 crore by 2020. These mouthwatering prospects are hard to ignore for the FMCG biggies, who are redefining 'innovation'.

(Courtesy : Soaps, Detergents & Toiletries review, July 2011)

CASH & CARRY

Godrej sharpens focus on 'usage experience'

Interbrand study helps identify action lines for the future

SAGAR MALVIYA

GODREJ group's Indian brands have been valued at Rs 12,806 crore ($ 2,863 million) by brand consultancy Interbrand, company officials have revealed. Of this, Rs 10,104 crore ($2,259 million) was the valuation of the 'Godrej' mother brand.

Godrej embarked on the exercise to 'understand brand value drivers for equity building and monetisation'.

The exercise has helped identify action lines for the future, according to the company.

Mr Adi Godrej, Chairman, Godrej Group, said, "This valuation enables us to springboard towards aligning our diverse business units under the same compelling brand idea, enabling businesses to maximise return on brand investment across the portfolio."

Ms Tanya Dubash, Executive Director and President - Marketing, added, "Interbrand's valuation helps us to construct a brand-focused framework that will guide future decision-making and create a common language understood by all our business units across India and beyond."

According to the study, factors that helped consumers choose brand Godrej were performance, features and price, in that order.

Areas for improvement have been identified as usage experience, sales service and design.

Godrej will now align — or re-state — its brand propositions around the usage experience. This means that most of its brands would move towards claims relating to user experience, and other propositions would be re-jigged accordingly,

informed Mr Ashutosh Ti-wari, Executive Vice-President - Strategic Marketing, Godrej Group.

While Good Knight and Eon have already been through such a re-alignment, Interio is in the process of making the shift.

TO REWORK INSIGHT-GENERATION PROCESS

He explained that the process also involved reworking consumer-insight generation processes to gather proactive insights, leading to co-creation of products that promise and deliver the expected usage experience.

To create those experiences, the company will focus on empathy-based research.

"We are likely to be investing a lot more in re-jigging the information systems around the brand. Also, giver diversity of our portfolio, we are v\ ing on a shared knowledge man ment system across the organisat added MrTiwari.

The company is also committf investing in design and 'institutior ing it across the organisation', sai Tiwafi.

OVERALL BRAND STRENGTH

On overall brand strength, G brands scored high on rele\ (6.2/10), commitment (6.0) am sponsiveness (6.0), but fell she clarity (4.6), consistency (4.5) ar derstanding (5.5), according to i terbrand study.

(Courtesy : inform June 2011, Vol.22 (6))

GOING THROUGH THE ROOF

Global oilseed production expected to reach 447 million metric tons

GLOBAL oilseed production for 2010/2011 is likely to reach a total of 447 million metric tons, according to a US Department of Agriculture's World Agriculture Supply and Demand Estimates (WASDE) report released on April 8, 2011.

The projection is based on expectations that higher soybean, sunflowerseed, and rape-seed production will more than offset lower cottonseed production. Global soybean production has already increased 2.6 million metric tons (MMT) to 261 MMT, and Brazil is expected to produce a record 72.0 MMT (2 MMT more than was last projected) due to ample moisture and favorable late-season weather in the southern states that improved yield prospects. Meanwhile, soybean production for Paraguay is projected at 8.1 MMT, up 0.6 MMT, also based on higher yields.

The forecast for global rapeseed production was raised 0.2 MMT to 58.6 MMT owing to increased output in Russia, whereas global sunflowerseed production was also projected to be higher as increased production in Argentina and Turkey more than offset reductions for India and Russia.

Other changes include reduced cottonseed production for Pakistan and Turkey, and higher cottonseed production for Brazil. Malaysian palm oil production is reduced 0.5 MMT to 17.5 MMT owing to lower than expected yields.

Meanwhile, a lower soybean crush led by Argentina and China is expected to be only partly offset by increased rapeseed crush, with the largest gains expected in Mexico, Pakistan, and United Arab Emirates. Global oilseed stocks were raised 2.5 MMT, with the largest gains for soybeans in Brazil and Argentina.

(Courtesy : inform June 2011, Vol.22 (6))

Technology

FOOD FOR THOUGHT ?

Damage Control & Effective Storage of Cotton seed

Abhay Cotex Private Ltd., Jalna (M.S.) India

COTTONSEEDS are highly perishable living commodity especially when the moisture content of the seed exceeds 10 or 11 % and adequate storage facilities are not available. It was the observation that the biological changes are occurring in the cotton seed either in the field before reaching for ginning or during its storage after ginning. Further the seeds results to develop interior heat and cause for increase of free fatty acid content of the seeds. There are 3 major factors which influence the effective storage of cotton seeds viz., Heating and chemical changes, Respiration and lipolysis & Pigment changes:

Excessive rainfalls are one of the reason for the field damage of cottons seed. Atmospheric humidity under which the seeds matured and dried in the boll are of prime importance in determining the extent of field damage. Seeds which matured under conditions of low humidity are suffered little field damage than the other. If, however rainfall and high atmospheric humidity prevail during the 10-15 days period following opening of the bolls, field damage will result.

The intensity of biological activity in cottonseeds during storage can be related to their moisture content and to the nature of dehydration or extent of prior field damage visible or invisible. It means the field damaged cottonseeds are more difficult to store without self-heating than the prime cottonseed. In such case the seeds may be dried rapidly enough to prevent detectable field damage.

Field damage preventive measures ginners to take care: It is not possible to control the field damages as it occurs from unfavorable atmospheric conditions during the period of boll opening. It is suggested that the boll: should be picked as soon as they open even il in a wet condition and the seed cotton dried before ginning. In general the cotton seeds with less than 10 % moisture content can be stored, especially at a low temperature, those above of 14% will deteriorate if not dried and cooled immediately.

Some times the wet cottonseeds with moisture content above 11 % should be dried and cooled before they send for storage in order to prevent the heating and deterioration of the seeds. Excessive moisture in the seeds generates heat and hydrolysis of triglycerides and form the fatty acid content and further retard the internal spongy kernel into brownish and darkish red. So a well designed cotton seeds driers cum deareator could be installed in the cotton seed oil mills and feed the seed after perfect cleaning i.e., on removal of immature bolls, immature seeds, debris, bollie seeds, plant stems, stones, sand and soil etc., This is one of the essential process to segregate all the unwanted foreign matter from the seeds prior to the drying process.

Respiration is a process which normally takes place in every living cell in the presence of atmospheric oxygen which acts like an oxidizing agent, by liberating the energy usually in the form of water and carbon dioxide. In case of cotton seeds the immature seeds respire at a higher level of intensity than mature seeds of equal moisture content. So it is suggested to separate the immature seeds prior to the damages control process by way of mechanical cleaning. In case of Lipolysis it is the chemical process of hydrolysis of triglycerides to form free fatty acids which takes place in germinating seeds as a result of PDF created with pdfFactory trial version www.pdffactory.com lipase activity which normally it takes place in stored seed. The rate of Lipolysis is influenced by the moisture content, storage temperature, immaturity of seed etc.,

Damage control measures and observations:

It was observed that a considerable decrease in there ate of lipolysis on drying the seed cotton at elevated temperatures and storing the seed. The heat treatment was rapid and completely effective if would arrest the Lipolytic activity by in activating the enzymes. It was also observed that if the heat treatment is slow the seed would be left with high level of favorable conditions of biological activity of a given level of moisture. It was further noticed that the rapidly drying the seed and in destroying the enzymes responsible for FFA formation while during its storage. Also it was noticed that the flash heating (at least of not less than of 100 °C of depends upon the moisture content of the seeds) of cotton seed is effective in storage with immediate cooling down the seed after drying at least of ambient +3 °C. Such treated cotton seeds are to be stored either in respiratory jute sacks or openly with adequate controlled aeration methods. However the most important things is to do the drying only on completely removal of all kind of solid impurities from the seed otherwise it will not be effective. Also it was observed that the drying aspect is more effective followed by immediate cooling of the seed surface. This will enable us to give more time of storage at least of not less than 180 days.

(Courtesy : Soaps, Detergents & Toiletries Review, June 2011)

AT LONG LAST !FOOD FOR THOUGHT ?

Ayurveda to the rescue

Radhika Ravi

AYURVEDA is the supreme source of cosmetic aids and all you have to do is pic^ and choose the correct natural herbal shampoos/ facials/ bleaches.

As your head is where all the action is try these ayurvedic solutions to combat the problems that affect your face eyes, nose, mouth, hair and skin.

Hair brings out the vanity in even the most detached person, so it deserves to be treated right! The cardinal rule of ayurvedic hair care is stay away from strong chemical- shampoos because they strip your hair of protein and moisture. Herbal and natural shampoos are much better for the tresses. The easiest way to ensure shining and healthy hair is to brush it firmly in order to stimulate the sebaceous glands in your scalp. This produces natural oil, which is nourishing for your hair.

Dandruff is a common affliction and can make your hair lose all its vitality. Since a dry scalp creates dandruff, you need to moisturise it. You may use either of these remedies. Massage a mixture of one teaspoon of castor, mustard and coconut oil each into your scalp or a mixture of lemon juice and coconut oil. Allow these mixtures to seep into your scalp for three to four hours or overnight before washing it off with warm water. For premature greying -the bane of every young girl's life! - eat a teaspoon of grated ginger and honey everyday. If you want a ayurvedic hair dye you can make one out of two teaspoons of henna powder, one teaspoon of curd, one teaspoon of fenugreek powder, one tablespoon of coffee, two tablespoons of mint juice and two tablespoons of basil juice. Leave this paste in your hair for two hours or more, according to how dark you want it, and then wash it out with any natural shampoo. You will get nearly the same effect as any commercial hair dye.

Why use chemicals to whiten your skin when you can use the power of herbs to bleach naturally? These days herbal bleaches are available in the market for sensitive-skin, so people who have sensitive skin should choose them. Herbal

face bleach not only bleaches the skin but also nourishes it with the goodness of nature's wonders like haldi (turmeric), chandan, nimbu (lemon) and aloe vera. While haldi (turmeric) protects the skin from inflammation and works as an antioxidant, nimbu acts as an effective antiseptic. Aloe vera adds life to the skin and chandan (sandalwood) soothes and adds glow to it.

Start your day with some yogic eye exercises. Roll your eyes in all direction and then focus on an object that moves from close to you to a distance. This will exercise your optic nerve and your eyeball muscles. Bathe your eyes in cool water when you get up. Ayurvedic doctors also advise putting a drop of honey in your eyes every day. It may sting but it cleanses your eyes thoroughly. Carrots, almonds, apples and sprouted chickpeas in your diet will provide your eyes with the vitamins they need.

Your skin needs to be pampered in order to stay blemish-free and glowing. You can use several ayurvedic face packs to keep acne and pimples at bay. A paste of a teaspoon of coriander juice with a pinch of turmeric or a paste of one teaspoon of cumin seeds will clean the pores of the skin. You can make your skin fairer by making a paste of almonds, fresh cream and lemon juice and applying it to the face. Papaya is a natural bleach. Grated cucumber cools and rejuvenates the skin. Massaging the skin with almond oil will also naturally moisturise it.

So live life ayurvedically and live life longer and healthier! (MF).

(Courtesy : Soaps, Detergents & Toiletries Review, June 2011)

EXPERT SPEAK !

Toilet Soaps and Bathing Bars

Sitaram Dixit

SOAP you are aware is the alkali salt of a fatty acid with a general formula NaOOC(CH2)nCH3. Soap properties exist when (n+2) is greater than 8 and less than 20. The best properties occur when (n+2) equals 12 to 18. We obtain fatty acids used to make soap from fats and oils. The fatty acids have varying chain lengths, which are all straight chain and contain even number of carbon atoms. There are about 40 different fatty acids occurring in nature, the largest is the group containing 18 carbon atoms.

Of the different fatty acids the most important with respect to soap manufacture are :

Lauric Acid	12 Carbon Atoms
Myristic Acid	14 Carbon Atoms
Palmitic Acid	16 Carbon Atoms
Stearic Acid	18:0 Carbon Atoms
Oleic Acid	**18:1 Carbon Atoms**
Linoleic Acid	**18:2 Carbon Atoms**
Linolenic Acid	**18:3 Carbon Atoms**
Ricinoleic Acid	**18:1 Carbon Atoms**

The last four fatty acids in bold letters, are unsaturated fatty acids. Un-saturated fatty acids give softer soap with lower melting point and are less stable.

Hard fats like, Mutton tallow, beef tallow, Lard and Palm oil contain longer chain saturated fatty acids and soaps made from these fats are firm, slowly soluble, milder and have a good detergency.

Lauric Oils like Coconut Oils, Palm Kernel Oils, have shorter chain fatty acids which form soap that give faster tighter more copious lather which are less mild than soap from hard fats.

Soft Oils like Groundnut Oils, Cotton seed Oils, Rice Barn Oils, contains more unsaturated fatty acids. Soaps made from these oils are softer less white and less stable.

Soft Oils are hardened by catalytic hydrogenation and bleached to improve the properties of soap. There is usually a loss of natural antioxidants found in the oil during the process of bleaching and hydrogenation. Antioxidants may be necessary to prevent rancidity developing in the oils arfd soaps made out of these oils. Excess Linoleic Acid and Linolenic Acid in soap oil blend is not

Oils Fatty Acids	Coconut Oil	Mowrah	Rice Barn Oil	Palm Oil	Castor Oil	Neem Oil	Groundnut Oil
Lauric $C_{12}H_{24}O_2$	48						
Myristic $C_{14}H_{28}O_2$	17.3						
Palmitic $C_{16}H_{32}O_2$	8.8	24	17	42.5		14	7
Stearic $C_{18}H_{36}O_2$	2	19	2.7	4	0.3	19	5
Oleic $C_{18}H_{34}O_2$	6	43	45	43	8.2	49	60
Linoleic $C_{18}H_{32}O_2$	2.5	14	27.7	9.5	3.6	16	21
Linolenic $C_{18}H_{30}O_2$							
Ricinoleic $C_{18}H_{34}O_3$					87.6		
Iodine Value	10	62 to 70	92 to 109	50	85 to 72	69	90
Sap Value	252 to 260	188 to 192	183 to 194	196 to 206	177 to 187	190 to 204	189 to 193
Tiler C	20 to 23	38 to 42	26.9	38 to 47	3	35 to 36	28 to 32

advisable as they develop rancidity faster.

It is seen that a judicious blend of oils and fats are necessary to obtain soap with ideal properties. It is also necessary to blend different oils for economic reasons.

Blends are so adjusted to control hardness, plasticity, lather, mush, cracking, mildness, and discoloration.

The following are some of the major vegetable oils used in India for soap making. The table lists the fatty acid constituents and their percentage in these oils.

Total Fatty Matter is historically considered a beneficial ingredient in Toilet soap. Acute Shortage of Oils and Fats in India led to Research by (HLL) Hindustan Lever Limited to create lowTFM soaps that performed at par with High TFM Soaps. These Low TFM Soaps were also termed as Bathing Bars or Structured Toilet Soaps.

We know that the properties of soap depend on the following parameters.

- €The chain length of fatty acids in blend
- €Amount of saturation and unsaturation (Double bond in the structure)
- €Formulation
- €Soap Structure

Soap consists of Solid crystals in a continuous liquid crystalline matrix. The solid crystals represent the "bricks" and the liquid crystalline matrix represents the "motor". The particulate size is in the micron range.

"Bricks" - "Insoluble Soaps" are responsible for Bar Hardness, Lather Stability, and facilitate in easy processing

"Motor" - "Soluble Soaps" are responsible for Lather Volume, Deter-gency / Cleaning, Perfume Carrier and perfume retention.

Solubility of soaps made out of various fatty acids is related to the chain length as well as the extent of unsaturation.

- €Short Saturated (CNO / PKO)
  -C8 -C14 Slightly Soluble
- €Long Saturated C16 -C18 Insoluble
- €Unsaturated C 18:1 Very Soluble
- €Hydrogenated RBO / Tallow 50%
  Soluble + 50% Insoluble

All Soaps Ex Drier (as per X Ray De-fraction studies) undergo Rapid solidification with non-equilibrium crystals. The soap obtained consist of Sodium laurate + Sodium Stearate complex (Solid Component) and Sodium Oleate + Super Saturated Sodium Stearate + Sodium Laurate (Liquid component). The soap structure is brought to equilibrium by milling during which the Insoluble Solid Soap (Sodium Stearates and Sodium Palmitates) and the highly soluble liquid Soap (Sodium Laurates / Sodium Oleates) are evenly distributed.

In short we can say that a 78 TFM soap contains 39 TFM - Soluble Soaps (Sodium Laurates and Sodium Oleates) and 39 TFM - Insoluble Soaps (Sodium Stearate and Sodium Palmitate).

Accordingly, HLL contends that if 39 TFM -Insoluble Soaps (Sodium Stearate and Sodium Palmitate) in the formula is replaced with Starch, Talc, Kaolins, Phosphates, China Clay we get structured Soap or Bathing Bar or Low TFM Soap that has performance almost at par with toilet soaps. Moreover, it saves valuable Vegetable Oil and prevents wastage of Sodium Laurates and Sodium Oleates Soaps that complex with Sodium Stearates and Sodium Palmitates insoluble soaps during use. According to HLL, Consumer tests have proved that:

- €Low TFM Soap are at par with
  conventional 78 -80 % TFM Soaps with
  respect to
- €Lather and detergency
- €Mildness to skin
- €Good Perfume Retention
- €Economical, Fat Charge manipulation in case of Oil shortage.

The only negative is that Fine Talc added to can affect sensitive eyes.

Major Odours observed in Sodium Soaps of fatty acids (Vegetable Oils)

- €Lauric Acid: Creamy, Fatty, Rancid
- €Oleic Acid: Oily Green, animalic
- €Stearic Acid: Almost Odourless
- €Palmitic Acid: Dry, Chalk, Chemical?
- €Recinolic: Peroxide odour
- €Linoleic: Leafy, green, metallic, hy-drogenated

In case of low TFM Sodium Soaps the odours of insoluble matter plays an important role.

- € Cosmetic Talc: Almost Odourless.
- €Kaolin: Chalky
- €China Clay: Muddy, Earthy
- €Starch: Carbohydrate odourif spoiled then foul decomposing odour

HLL principally uses Cosmetic as filler. Talc is a naturally occur mineral. Chemically it is hydrated rr nesium silicate; [Mg6Si8O20 (OH Structurally talc is a layer-lattice r eral, composed of a brucite sf Mg6(OH)12 sandwiched betw sheets of silica. The electrically r tral layers are held together by w Van der Waals forces. Cosmetic Gr; Talc is prepared by milling from lected mines of very high quality i purity. Pure talc is white in colour v a slippery feel and good powers ol absorption. It is inert to most chem reagents and is very soft in nature h ing only a hardness of 1 on the Me hardness scale. Cosmetic Grade 1 when dispersed in water, it has an al line pH of 9 to 9.5. Talc used in sho have a smooth feel with the talc p tides passing through standard 21 mesh sieve and is not gritty.

Talc acts as a carrier for perfun Perfume stability and its final imp; in toilet soap mainly depend on the of talc used, and the heavy metal i purities present in it. Impurities of he minerals like silica, quartz, adversi affect the smoothness of talc and have to be eliminated. Mineral impi ties such as quartz, chlorite, dolomi magnesite, calcite, specks of mi and ultrabasic silicates having a che silicate structure like amphiboles th include termolite, anthophyllite, actin lite, etc. should be absent. Carbonati such as dolomites, calcite, magnesit and phosphates like apatites are oth major contaminants in talc can also a feet the perfume integrity due to the potential reactivity with perfumery ingredients.

When Talcum powder is used, asfilli we should complex the heavy metal in purities present in it

by use of chelate or sequestering agents. Synergists chelating compounds, complex meta lie ions, primarily coppers, iron, am nickel that act as catalyst in lipid oxida tion. Synergists are generally used ii a combination as stabilisers system ii to retain the pleasant appearance (e.g. colour, odour, etc.) and to ensure stability and efficacy of incorporated active ingredients (e.g., fragrances). Syner-gists also increase the effectiveness or the activity of primary antioxidants although they have very little or no effect on lipid oxidation. EDTA salts (Ethylene diamine tetra acetic acid as di & tetra sodium salt), Citric acid, Tartaric acid, Phosphoric acid, EHDP (Ethane hy-droxy 1,1 diphosphonic acid), Magnesium Silicate, are perhaps most commonly used as sequestrants.

We know that the fragrance used should mask base odour, enhance product appeal, and should be compatible with the base component. The fragrance used should be stable during the accelerated storage study to confirm the stability of the fragrance throughout the shelf life of the final products at varying environment. In case of bathing bars, one should also consider the comparatively higher temperatures encountered during processing.

The physico chemical principles that govern stability of the fragrance in a Soap include:

€ Adsorption of Fragrance by Soap
€ Evaporation of Fragrance
€ Auto Oxidation of Soap and Fragrance
€Reactivity of fragrance due to the following equilibrium
RCOONa + H2O . RCOOH + NaOH
Used in Soaps,

€ Some Fragrance will blend and remain in the aqueous phase,
€ Some of Fragrance will be n the outer surface of the soap, adsorbed
€ Some fragrance may be absorbed between the methyl tails and
€ Some fragrance will become oriented in the micelle forming more or less stable complex.

The different classifications of soap, as per Indian laws as below. You will notice that soap cartons now mention Grade I, II, or III.

It is logical to question as to "Why would a soap maker spend more money to put a higher TFM soap on the market if there are no extra benefits over a low TFM soaps it does not make economic sense."

As per BIS (Bureau of India Standards) Soap grades are as given below :

Grade I	Minimum TFM 76%
Grade II	Minimum TFM 70%
Grade III	Minimum TFM 60%
Bathing Bar	**Minimum TFM 40%,**

Minimum Surfactant 4% (Mandatory) To pass Performance specifications of BIS.

Now can one generalise to say that all higher TFM soaps provide additional benefits over a lower TFM soap. The answer according to HLL study is NO.

If the Oil blend (20 Lauric Oils: 80 Other Oils) (In light of the above discussion) used is same then a higher TFM soap is better than the lower TFM soap. However, Lauric Oils are expensive so manufacturers reduce the Lauric content in the oil blend, but keeping the Oil content in the total soap same. In this case, you get Toilet soap with higher TFM but with lower performance. In fact, even if the TFM content is lower the resultant soap will perform better if the Oil blend has a higher percental of Lauric Oils.

As an example for better unde standing let us, consider the following:

Soap A: TFM 60%, Oil Blend approx. 20% Lauric Oils 80 % Other Oils.
Soap B: TFM 80%, Oil Blend approx. 10% Lauric Oils 90% Other Oils.
Soap C: TFM 70 %, Oil Blend appro 10% Lauric Oils 90% Other Oils.

As per BIS regulation, **Soap A is Grade III** quality, **Soap B is a Grade I**, and **Soap C is a Grade**

II quality. Tr gradation is done based on TFM.

According to this theory, Soap A will have better or almost equivalent perfo mance as Soap B or Soap C although is Grade **III soap with only 60% TFM.**

It is logical to question as to "Wh would a soap maker spend more mor ey to put a higher TFM soap on th market if there are no extra benefil over a low TFM soaps it does not mak economic sense."

To answer, we can say that replat ing TFM with Talc (Filler) is benefici; to the manufacturer as Talc is les: expensive compared to Oil (appro; Rs. 40 : Rs. 4). However, if the perfoi mance is to be bettered then the Lauri Oil content has to be increased. In spit of this increase in cost in the Oil blenc the manufacturer ends up in makin good savings. This savings can the be used to improve the soap qualit further by using a part of the saving to increase fragrance dosage, add ar timicrobials TCC / TCS, Speciality ac ditives, improve finish like pearlescen better wrapper, better promotion in P and press, etc.

HLL does exactly this giving vab for money to the buyer. Another manu facturer sells only Grade I soap and sti make substantial profits by reducini the Lauric Oil content in the Oil bleni but gives higher TFM.

FASHION / BEAUTY

So is it right in saying that the Lauric content in soap is a major determinant of quality regardless of TFM content. If yes, then all manufacturers would prefer the "LUX" route of lower TFM but higher Lauric content and therefore a better quality soap (at a lower cost?).

HLL because of their muscle power and being a pioneer of this formulation, was able to carry out the technique better. Political lobbying also had a large role to play. In the early 90's, lauric oils were not available due to poor agricultural output and so this theory worked. In the last 5 years, there has been a good monsoon and availability of lauric oil has improved substantially in the country.

The farmers lobby has been forcing the Government to reconsider use of Lauric oils for soap making so that they can profit.

The Talc manufacturers (Rajasthan) lobby wants to continue use of Talc in soap. In fact, most Indian soap manufacturers in India blindly following the footsteps of HLL used talc at one time or the other to make soaps. However many of them only added talc but did not increase the lauric content in the oil blend.

They were not very successful as only adding talc without subsequent increase of lauric oil content actually made their soaps poorer in performance. To improve performance, AOS (a -Olefin Sulphonate - Surfactant) manufacturers, insisted on using 4% AOS in bathing bar and to some extent have succeeded in getting a bathing bar specification modified accordingly.

To the chagrin of the AOS manufacturers HLL increased their TFM content to 60 % TFM from the earlier 50 % TFM and are marketing their soap as G III. This helps them not buy AOS, their competitors as Grade III does not require AOS. Economi favourable if one can get Lauric c lower prices.

This is possible for big players makes substantial profits using route and uses the savings for pr tions on TV and Press. This pushe ume/sales further making more p and better bargaining power will Lauric oil dealers.

In short, it is a win -win situatk HLL. Apart from the fatty matter tent, other important determinan soap quality are a good fragrance ter packing, good looks or aesth speciality & herbal additives et that a consumer gets a produci performs and is GOOD VALUE MONEY.

(Courtesy : Soaps, Detergents & Toiletries Review, July2011)

HAIL ZYME !

Has degumming with enzymes come of age?

Flavio Galhardo and Tim Hitchman !

THE use of enzymes for degumming vegetable oils is hardly new. Such enzymes were first introduced to the industry in the early 1980s. Since then, a steady stream of technical publications has demonstrated that degumming using enzymes is feasible and can be applied to deliver oil that exceeds standard quality specifications. In recent years, the economic benefits of enzyme degumming have also been quantified by several oilseed processors. Although there is a growing body of evidence in favor of enzyme use, many in the industry have hesitated to use the technology. Nevertheless, those processors who have taken the lead in adopting the technology for degumming of crude soybean oil are documenting yield gains of up to 2%. These data allow the industry to establish benchmarks for overall economics of investment for future implementations.

What exactly do degumming enzymes do?

Let's start with the basics of how enzymes can be used in oil processing.

Degumming is the removal of phospho-lipid impurities from the oil. This step results in the majority of yield losses associated with purification of crude soybean and canola oils. The reason for the yield loss is that phospholipids are emulsifiers, which "drag" oil with them as they are removed (Fig. l).

Unlike industrial chemical catalysts, an enzyme is very specific in the reaction it causes. Enzymes used in degumming, called phospholipases, specifically act on the phospholipids without degrading the oil itself. Use of enzymes diminishes the emul-sification properties of the phospholipids, allowing for the reduction of oil loss. This happens for two reasons: The total mass of emulsifier is reduced, and the new compounds formed in the reaction have little or no emulsification capability. In short, degumming enzymes cause a reaction of phospholipids and thereby enable a higher yield of oil. The different enzymes that are commercially available for oil degumming differ by the way they act on phospholipids, but all increase the yield of fatty matter recovered through the degumming and refining process.

When implemented correctly, an enzyme-based process is robust, versatile, and creates significant value. Degumming assisted by enzymes can be performed in two different ways: as a substitute for water degumming, leaving 50-200 ppm residual phosphorus in the degummed oil; or as a substitute for acid degumming, leaving just 0-15 ppm residual phosphorus in the oil. The latter process creates oil that can be used directly in physical refining processes and is therefore also a substitute for chemical refining. Let's be clear, however; degumming enzymes are not a panacea and will not solve all process problems. For instance, enzymes degrade phospholipids and therefore may not be compatible with the production of lecithin.

In both enzyme-assisted degumming processes it is critical to establish and control the process conditions to ensure the maximal conversion of phospholipids by the enzyme. This entails installation of equipment to control enzyme dosage and

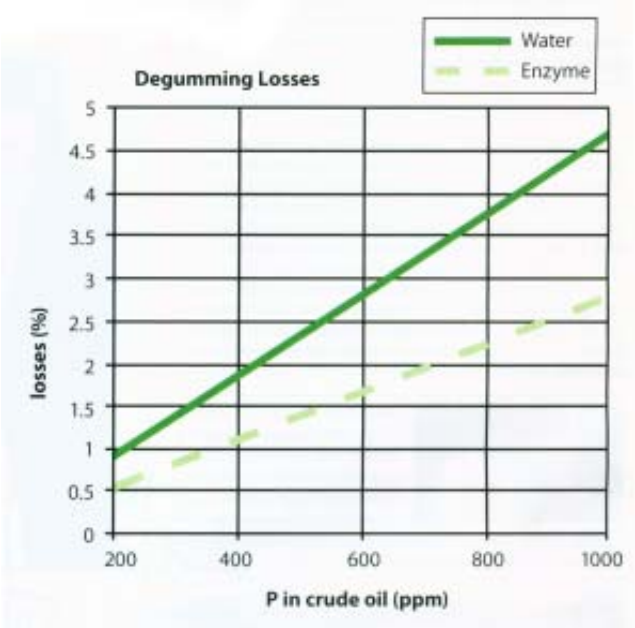


FIG. 1. Predicted losses of fatty matter from water degumming and enzyme-assisted degumming of crude oils relative to phosphorus content of the oil.

oil temperature, to ensure adequate mixing of enzyme and water into the oil, and to provide sufficient residence time for the reaction to go to completion. In addition, it is likely that separator settings will need to be modified to account for the reduced volume and changed properties (lower viscosity, higher density) of the gums. Finally, a temperature-controlled storage facility is required to maintain enzyme quality. Without these modifications, sub-optimal reaction performance will reduce or negate the economic benefits of using the enzyme. The only ways to be sure of process performance are to work with the enzyme suppliers to measure the reaction caused by the enzyme, and to carefully monitor oil yields in the plant.

Elements for a successful implementation

The industry today has become accustomed to engineering service and equipment providers offering performance guarantees for conventional processes that are based on simple analytical methods and controls. In the case of degumming assisted by enzymes, some new elements are necessary in order to elucidate plant performance and, therefore, the value of the technology:

€Measurement of performance of existing processes. Unfortunately, baselines for conventional process losses in plants are often not clear. This is particularly true for water degumming, where very little attention is paid to the causes of oil losses. The yield gains generated by new processes based on enzymes are calculated relative to losses in conventional processes. Therefore, great care should be spent on evaluating (or modeling, in the case of plants proposed for construction on undeveloped land, i.e., greenfield plants) losses occurring while operating water degumming. The solution is to invest in yield-monitoring tools such as mass flow meters and custody transfer automation before converting to the new enzyme-based process. After the new process is implemented, the same measurements can then be used to confirm the improved performance of an enzyme-based process relative to the traditional process.

€ Measurement of enzyme performance in plants. Since the industry is accustomed to performance guarantees, there is an expectation that new processes will be implemented under similar terms. Obtaining the yield gain benefit from an enzyme-based process is based on the enzyme reacting well and on the capture of the extra oil through the equipment used in the process. The former is met by quality assurance guarantees provided by the enzyme manufacturer. Proving the quality and reaction performance requires advanced analytical methods not available in the plant, but can be achieved by regular and frequent transfer of process samples from enzyme customer to enzyme supplier for analysis. Ensuring capture of the yield gain means that equipment suppliers must also provide mechanical guarantees for the equipment used in the process, particularly components that impact enzyme reaction and separation of the reacted materials from the oil.

Ultimately, though, technical success of implementing a new process is not enough. The plant has to realize the benefits that were expected. These can only be accomplished if all stakeholders—processors, engineering companies, and enzyme suppliers—come to a common understanding of the language and metrics to describe the process.

Current market drivers for introducing enzyme-assisted degumming processes

Several recent changes in the oilseed processing industry are accelerating adoption of degumming assisted with enzymes. Some of the most important relate to the economic gains expected from these processes:

€High oil prices. Current market conditions may allow the cost of plant modifications to be paid back through gains sooner than previously anticipated. However, return on capital investment depends on many factors, including the value of meal (if gums are sent back to the crushing operation) and the cost of enzymes.

€Growth (and consolidation) of the biodiesel industry. Biodiesel production is growing rapidly, particularly in South America, so biodiesel producers integrated with crushing operations can take full advantage of the additional oil yield. There are now several examples of installation of enzyme-based oil pretreatment processes in biodiesel production. These are providing the whole industry

with robust examples that will reinforce the coordinated role of enzyme and equipment suppliers in enabling predictable return on investments.

€Increased automation and analytical capabilities in plants. Practices common in petrochemical, oleochemical, and dairy industries are becoming more usual in oilseed plants. Tools more commonly used include advanced process controls, such as mass flow meters, and advanced analytical tools that give plant operators the confidence that they can reliably extract the full value created by the enzyme. The result is a great reduction in the perceived gap between normal practice and the required sophistication ot enzyme processes.

Expectations of value created by degumming with the assistance of enzymes

It is impossible to provide a one-size-fits-all scenario for the value created by adopting processes using enzymes. This is partly because the impurity content and profile of the crude oil extracted from the seeds differ greatly from plant to plant (and over time in the same plant), and also because the nature of gums in crude oil depends on several factors such as source of beans or seeds, preparation and extraction techniques, and others. However, the 1-2% yield gains being reported from use of degumming enzymes are greater than any other recent process improvements have been able to provide. This magnitude of value addition is compelling to an industry challenged to continually improve oil yields. Furthermore the economics of investment are very att live. In greenfield projects, the additional of implementing an enzyme-based proce small compared with the overall project c and the cost of modifying existing plan quickly returned through the extra oil gei ated. All things considered, we are confic in saying, "Yes, degumming with enzymes come of age."

(Courtesy : inform June 2011, Vl. 22(6))

HOT PURSUIT ? JATROPHA

Yale University/Boeing release jatropha sustainability study

AT the end of March, The Boeing Company released the results of a study it had funded on the potential for the sustainable production of aviation fuel from seeds of Jatropha curcas. The research, carried out by Yale University's School of Environmental Studies, concluded that jatropha can deliver environmental and socioeconomic benefits in Latin America, if cultivated properly, and can reduce greenhouse gas (GHG) emissions by up to 60% when compared with petroleum-based jet fuel.

The Yale study, conducted from 2008 to 2010, used sustainability criteria developed by the Roundtable on Sustainable Biofuels to assess actual, not theoretical, farming conditions in Latin America.

Jatropha farmers were interviewed, and field measurements were used to develop a comprehensive sustainability analysis of actual projects. The peer-reviewed data are applicable to conditions in Mexico and also provide guidance to Brazilian efforts to develop a commercial aviation biofuels market.

Small- to large-scale farms, ranging from under 10 hectares to more than several thousand hectares, formed the basis of the study. Robert E. Bailis, assistant professor, Yale School of Forestry and Environmental Studies and principal investigator on the project, said in Boeing's account of the research, "Our team identified dozens of jatropha farmers willing to participate in our research, despite some challenges many encountered with this new crop. For most, this was the first time anyone had studied their efforts. Working with them allowed us to collect detailed data needed to build a comprehensive picture".

A major finding was that prior land use was the most import factor in determining the GHG benefits of a jatropha jet fuel. If jatropha is planted on land previously covered in forest, shrubs, or native grasses, benefits may disappear entirely. If the crop is planted on land that was already cleared or degraded, then emissions reductions can exceed the 60% baseline.

A second finding was that early jatropha projects suffered from a lack of developed seed strains, which led to poor crop yields. Advancing jatropha seed technology is critical, and many Latin American countries are now engaged in supporting such technology development.

The original refereed paper appeared in Environmental Science and Technology 44:8684-8691 (2010).

(Courtesy : inform June 2011, Vol. 22 (6))

FLYING HIGH !

Jatropha fuels Mexican flight

MEXICAN airline Interjet and plane manufacturer Airbus successfully tested the first jatropha oil-based flight in Mexico on April 1. The A320 flight flew from Mexico City's International Airport to Angel Albino Corzo of Tuxtla Gutierrez airport in the southern state of Chiapas. One of the two engines was fueled with 27% biofuel from jatropha, which was harvested in Chiapas. The fuel was processed by Honeywell's UOP.

Miguel Aleman, Interject president, said, "The test flight is the realization of a two-year ambition for Interjet to develop a production chain for renewable biofuel, with the purpose of creating a Mexican platform for sustainable aviation bio-kerosene."

According to the Interjet web site, the goal of Mexican aviation is to satisfy 1% of fuel demand with biofuels by 2015, or 40 million liters, and 15% by 2020.

In testing jatropha as an aviation fuel, Interjet is following in the footsteps of Japan Airlines, Air New Zealand, Continental, and Brazil's TAM Airline, as well as the US military.

ALGAE YA ?

Are algae really feasible as fuel?

GREAT effort—and lots of money—is being expended to develop algae as a feedstock for transportation fuel. There doesn't seem to be a clear answer yet, however, as to whether algae will ever be economically viable for this purpose.

Research out of the US Pacific Northwest National Laboratory (PNNL; Richland, Washington). One of the biggest questions relating to growing algae for fuel is the amount of water needed for these microscopic plants. Researchers at the US Department of Energy's PNNL found that water use for this purpose will be much less if algae are grown in the US regions having the sunniest and most humid climates, that is, the coast of the Gulf of Mexico, the southeastern seaboard, and the Great Lakes.

Mark Wigmosta, lead author and a PNNL hydrologist, analyzed previously published data to determine how much algae can be grown in open, outdoor ponds of fresh water using current technologies. (For the purpose of the study, algae grown in salt water and covered ponds were not considered.)

First, the scientists developed a comprehensive national geographic information system database that evaluated topography, population, land use, and other information about the contiguous United States. This information allowed them to identify available areas that are suited for algal growth. Next, the scientists gathered 30 years of meteorological information to help them determine the amount of sunlight that algae could realistically use to photosynthesize, and how warm the ponds would become.

The researchers found that 21 billion gallons (79.5 thousand million liters) of algal oil, equal to the 2022 advanced biofuels goal set out by the Energy Independence and Security Act of 2007, can be produced with American-grown algae, or 17% of the petroleum that the United States imported in 2008 for transportation fuels. Furthermore, it could be grown on land roughly the size of South Carolina.

The authors also indicated that algae's water use isn't very different from most other biofuel sources. For a standard light-utility vehicle, they estimated growing algae uses 8.6-50.2 gallons of water per mile driven on algal biofuel. Previous research indicated that corn ethanol requires 0.6-61.9 gallons of water per mile driven. For comparison, conventional petroleum gasoline, which doesn't need to be grown—as do algae and corn—uses 0.09-0.3 gallons of water per mile.

Other advantages of algae are that they are productive (algae produce more than 80 times more

oil than corn per hectare per year), that algae are not a widespread food source for humans, that they are considered a carbon-neutral energy source, and that they can grow in and clean municipal wastewater of pollutants such as nitrogen and phosphorus.

In a statement from PNNL, Wigmosta said, "Water is an important consideration when choosing a biofuel source.... Algae could be part of the solution to the nation's energy puzzle if we're smart about where we place growth ponds and the technical challenges to achieving commercial-scale algal biofuel production are met."

Further information is available at www.pnl.gov/news/release. aspx?id=859. The original research maybe accessed at http://tinyurl. com/PNNL-algae-oil.

Research out of Kansas State University (K-State; Manhattan, Kansas, USA). Peter Pfromm led an interdisciplinary team at K-State that analyzed oil produced by algae as a source of biodiesel. The team applied engineering fundamentals—mainly a carbon mass balance— to evaluate the sustainability of algae-derived biodiesel.

The first part of the study focused on the science and technology of algae biodiesel. It showed that from a technical standpoint, producing algae-based biodiesel in a sustainable way works—but not to the extent needed to eliminate dependence on petroleum diesel. From the standpoint of sustainability, they found that the amount of algae diesel produced per day was drastically lower than the projected ideal quantities from many algae production concepts.

Pfromm commented, "We found that phycologists—algae scientists—maintain that some popular estimates of producing 200 to 500 grams of algae per square meter of open pond per day weren't feasible because there's simply not enough sunlight coming through the atmosphere to do so. Unless we can change the sun, such production is physically impossible."

Using a more realistic production number—50 grams per square meter per day—they determined it would take 11 square miles of open ponds making 14,000 tons of algae a day to replace 50 million gallons of petroleum diesel per year, or about 0.1% of the US annual diesel consumption.

The team is now analyzing data on the economics of algae production. Pfromm said, "Once money is involved, technological sustainability becomes theoretical because nobody is going to use the technology or science unless there's an incentive ... [I]f it takes 20 years before anyone starts making a buck in profit, no one's going to back it."

Open ponds are the cheapest containment unit in which to grow algae. But as a production facility increases in size, so do the number of ponds it operates—and a facility close to 11 square miles in size is a steep investment. These ponds are also problematic because they are prone to invasions by algae-eating organisms or microorganisms that can be spread by the wind.

Growing algae in photobioreactors will stop algal predators and other contamination, but they are much more costly. Cooling becomes a necessity, because sunlight warms the containers and can overheat the algae. A refrigeration unit is too costly, but cooling half-a-million containers with water spraying is also costly. Additionally, the dirty containers have to be cleaned periodically to avoid sunlight-blocking buildup that would limit production.

Pfromm concluded, "Right now, the fundamentals are the problem. . . . The best option right now is to invest in fundamental research and design so that the yield can hopefully reach beyond the 50 grams per square meter per day on our most optimistic assumption."

Further information is available at wv/w.eurekalert.org/pub_ releases/2011-04/ksu-epa04051 l.php. The original report appeared inBioresource Technology 102:1185-1193 (2011).

(Courtesy : inform June 2011, Vol. 22 (6)).

YAK !

Nutritional and industrial applications

Abdalbasit Adam Mariod

IN searching for new sources of oils, many researchers have investigated wild plants, but our research group took a different approach: We looked at insects as an oil source for both nutritional and industrial applications.

ACCORDING to Sudanese indigenous knowledge, many insects have food and medicinal uses. We targeted two of these insects for our research: Aspongopus vidiuatus (melon bug) and Agonoscelis pubescens (sorghum bug).

The melon bug (Pentatomidae) is about 20 mm long. It is found in most African countries, where it causes damage to watermelon and other cucurbit shoots. The adult bugs can usually be found by lifting the young melon plants from the ground and inspecting the undersides of the leaves. The nymphs pierce the leaves, stems, and young fruits and suck the sap, resulting in wilting, fruit drop, and the death of the plant. Melon bugs are considered to be edible in Namibia, where the last nymph stage is called "nakapunda." In this soft stage, the bug is cooked and eaten. Melon bugs are widely distributed in Kordofan and Darfor states of Sudan (locally known as Um-buga), where field watermelons are one of the most important crops for the traditional rain-fed agriculture. There, tons of melon bug adults can be collected in infested fields. Elobied Agricultural Research Station (North Kordofan state of Sudan) designed a hand-picking program for melon bug adults in plots of about 5,000 hectares in four different areas of the state, for two seasons. A total of 15 tons of melon bug adults were collected in the first season and 226 tons in the second one (Bashir et al, 2002).

The adult sorghum bug (Pentatomidae), commonly known in Sudan as Dura andat, is shield-shaped, about 11-13 mm long, and 6-7 mm wide. Both the upper- and undersides of its body are covered with a fine silvery pubescence after which it is named. Agonoscelis pubescens is found in a number of African countries south of the Sahara. In Sudan, the Dura andat has a wide distribution throughout the country. The adults infest sorghum during the olant's milky stage. In Western Sudan, adult sorghum bugs are collected, fried, and eaten.

Additionally, in some areas of Sudan the collected bugs are pressed, and the expressed oil is used for cooking and some medicinal purposes. In the Botana area of central Sudan, nomads use the tar obtained from high-temperature rendering of the bugs to protect their camels against dermatological infections (Mariod et al., 2004).

What is the chemical composition of bug oil?

Oils extracted from these two Sudanese edible insects (Figs. 1,2) have interesting physicochemical properties and fatty acid compositions. For instance the amounts of saturated and unsaturated fatty acids they contain are comparable with those of oils commonly used in Sudan, such as sesame, groundnut, sunflower, and cottonseed (Table l).

Acting as chain-breaking antioxidants, tocopherols, which are minor components of naturally occurring oils, react with lipid radicals to convert them into more stable products. Tocopherols protect food lipids against autoxidation and thereby increase their storage life and their value as wholesome foods (Kamal-Eldin and Appelqvist, 1996). The oils of melon and sorghum bugs contain only low amounts of tocopherols in comparison to other common Sudanese edible oils (Table 2).

In our experiments the amount of sterols in melon bug oil (MBO) was 17.5 mg/100 g. In sorghum bug oil (SBO), the amount of sterols was 449.9 mg/100 g (Table 3). The main sterol of the

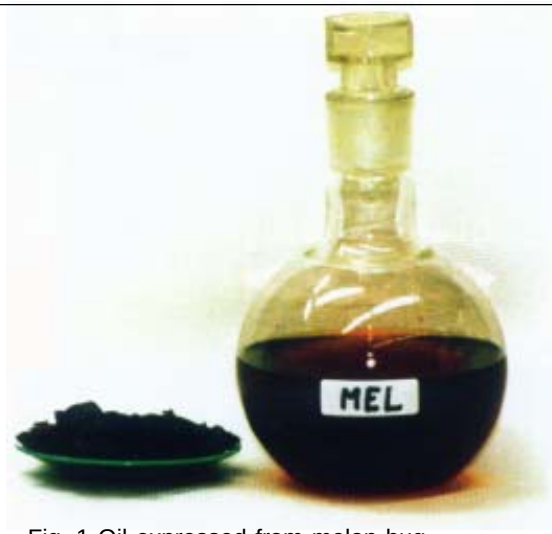


Fig. 1 Oil expressed from melon bug (Aspongopus vidiuatus)

Fig. 2 Oil expressed from the sorghum bug (Agnoscelis pubescens)

TABLE 1. Fatty acid composition (% of total) of melon and sorghum bug oils compared with oils commonly used in Sudan[a]

Oil	12:0	14:0	16:0	16:1	17:0	18:0	18:1Δ9	18:1Δ11	18:2	18:3	20:0	20:1	22:0
MBO	0.02	0.33	30.95	10.7	2.43	3.47	46.63	0.46	3.90	0.09	0.23	0.17	0.00
SBO	0.00	0.21	12.22	1.04	0.14	7.27	40.97	0.73	34.53	1.14	0.77	0.23	0.23
SEO	n.d	0.02	9.76	0.17	0.10	6.17	39.83	0.97	41.43	0.34	0.68	0.17	0.19
GNO	n.d	0.03	10.95	0.10	0.10	3.55	45.83	0.64	29.85	0.10	1.61	1.20	3.43
SFO	n.d	n.d	n.d	15.2	n.d	n.d	33.1	n.d	51.52	n.d	n.d	n.d	n.d
CSO	0.02	0.92	23.63	0.61	0.20	2.61	17.46	0.92	48.82	0.16	0.31	1.34	0.22

[a]Data are means of triplicate results. Abbreviations: n.d, not determined; MBO, melon bug oil; SBO, sorghum bug oil; SEO, sesame oil; GNO, groundnut oil; SFO, sunflower oil; CSO, cottonseed oil. Source: Mariod *et al.* (2009).

TABLE 2. Tocopherol content (mg/100 g) of melon and sorghum bugs oils compared with oils commonly used in Sudan[a]

Oil	α-T	β-T	γ-T	PB	δ-T	Total
SCO	0.36	0.00	13.05	0.00	0.32	13.73
MBO	0.17	0.00	0.13	0.00	0.00	0.30
SBO	0.88	0.00	32.16	0.21	0.78	34.03
SEO	0.60	0.00	63.32	0.23	0.59	64.74
GNO	12.66	0.56	12.99	1.02	0.72	27.96
SFO	91.17	3.02	2.51	0.87	0.00	97.58
CSO	28.62	0.35	45.88	2.61	0.33	77.83

[a]Data are means of triplicate results. Abbreviations: T, tocopherol; PB, plastochromanol; SCO, *Sclerocarya birrea* (Marula tree seed) oil; for other abbreviations see Table 1. Source: Mariod *et al.* (2009).

TABLE 3.
Distribution of sterol contents (mg/100 g oil) of melon and sorghum bug oils compared with oils commonly used in Sudan[a]

Oil	SCO	MBO	SBO	SEO	GNO	SFO	CSO
Cholesterol	1.0	1.4	2.2	0.0	1.6	1.4	3.2
Campesterol	2.1	1.8	11.6	13.0	42.9	39.1	43.9
Stigmasterol	13.4	0.8	25.4	48.1	24.3	29.7	5.3
β-Sitosterol	180.1	10.6	268.8	467.7	183.9	252.3	403.3
Δ5-Avenasterol	47.6	0.5	16.3	70.6	28.7	10.6	15.5
Δ7-Avenasterol	4.8	0.0	1.6	8.4	2.9	12.7	2.1
Δ7-Stigmasterol	4.8	0.9	2.8	6.4	0.7	46.9	3.4
Others[b]	32.8	1.5	121.2	170.7	9.0	24.7	15.7
Total	286.6	17.5	449.9	774.9	294.0	417.4	492.4

[a]Data are means of triplicate results.
[b]Others include 24-methylcholesterol, campestanol, chlerosterol, sitostanol, 5,24-stigmastadienol. For abbreviations see Tables 1 and 2. Source: Mariod *et al.* (2009).

two oils is (3-sitosterol. In comparison with other oils usually used in human nutrition, SBO had higher amounts of total sterols than either sunflower or groundnut oils.

There is increasing interest in isolating sterols for nutraceutical applications and as ingredients for functional foods (Holser et al., 2004). Sterol fraction analysis can be used to identify a fat or oil, to detect the adulteration of more expensive oils with cheaper oils, and to distinguish between different qualities of the same oil.

Insect oils are highly stable

The oxidative stability of MBO expressed as the induction period determined by the Rancimat method at 120°C is remarkably high (38.0 hr) in comparison to other edible oils. For instance, the oxidative stability of sesame oil is 1.6 hr and for sunflower oil, 5.4 hr. The stability of SBO (5.1 hr) is also in this range. The high oxidative stability of MBO may be due to the low amounts of polyunsaturated fatty acids (PUFA) such as linoleic and linolenic acid. On the other hand, in spite of the higher content of tocopher-ols in SBO, the high portion of PUFA in this oil seems to be mainly responsible for its low induction period. Therefore, in this case the fatty acid composition has a much higher influence on the stability of the oil than the antioxidants present in the oil.

Blending sunflower oil with MBO resulted in an increase of oleic and a decrease of linoleic acid and improved the oxidative stability of sunflower oil. This stability increased with an increase of the percentage of MBO in blends (Mariod et al, 2005). When MBO and SBO were stored at 30 ± 2°C in the dark for 24 months, their fatty acid compositions remained almost unaltered. On the other hand, the tocopherols of the two oils gradually decreased. The two oils showed slight changes in their oxidative stability as indicated by the peroxide value (PV), and when this stability was measured by Rancimat method as an induction period, MBO showed a slight decrease with loss of 10% of its induction period during two years of storage (Mariod et al, 2008). SBO showed a gradual increase in the PV and a gradual loss of stability as measured by induction period IP during storage.

In laboratory refining experiments of crude oils, phosphatide, peroxide, tocopherol, and sterol contents as well as oxidative stability fell during processing, while free fatty acids were almost totally removed. The amounts of total volatiles as well as the amounts of hexanal were decreased during the different processing steps. The color decreased throughout the processing steps up to bleaching, then in the deodorization step it darkened sharply in all samples. No change in the fatty acid composition was observed.

Biodiesel from insect oils

MBO and SBO were transesterified using methanol and ethanol in the presence of sulfuric acid. The resultant fatty acid esters were compared with the DIN 51606 specifications forbiodiesel. Most of the insect oil biodiesel characteristics met the DIN specifications (water content, iodine number, phosphorus). However, the kinematic viscosity values of all samples were much higher than those for biodiesel standards. These can be reduced by blending with other low-viscosity biodiesels.

(Courtesy : inform May 2011, Vol. 22 (6)).

MORE ON IT !

JATROPHA

Environmental groups protest against jatropha in Africa

ACTIONAIDE, an international agency working to end poverty and injustice for poor and disadvantaged people in 40 countries, released information in March from a study carried out by the North Energy Associates consultancy (Stocksfield, Northumberland, UK) indicating that biofuels made from jatropha could lead to the release of 2.5-6 times more greenhouse gases during the production and consumption of jatropha oil than the emissions associated with production and burning of fossil fuels. The study, which centers on a proposed plantation in the Dakatcha Woodlands in Kenya, was also funded by the Royal Society for the Protection of Birds (RSPB) as well as NatureKenya.

The Dakatcha area is one of the last tracts of coastal forest remaining in Kenya. The forest will have to be cleared to make way for the plantation, and over 20,000 people, members of the indigenous minority Watha and Giriama tribes, will be evicted, destroying their livelihoods and sacred burial sites. The Dakatcha Woodlands is also an Important Bird Area, according to international wildlife organizations (e.g., NatureKenya, RSPB,

Audubon Society), and is home to a number of globally threatened bird species, particularly Clarke's weaver bird.

In 2009, Kenya Jatropha Energy Ltd., owned by Italian company Nuove Inizia-tive Industriali Sri, proposed clearing 50,000 hectares in the Dakatcha area to develop the plantation. Protests from the local population forced the Kenyan government to put the project on hold, but Nuove Iniziative Industriali has come back with a proposed pilot project of up to 10,000 hectares.

Much of the fuel that could be produced in the Dakatcha area would be slated to go to Europe, because of the European Union target requiring that 10% of transport fuels be renewable by 2020, rather than to Kenya.

(Courtesy : inform May 2011, Vol. 22 (6)).

FOLLOW IT

Planning affects jatropha success in Africa

IN Zambia, 8,000 farmers in the North Western Province who are participating in their first season of a three-year trial of jatropha are expected to harvest more than 100 metric tons of seeds. North Western Bio-Power, which is managing the project, plans to install an expeller machine for processing the crop.

Allan Mbale, manager for North Western BioPower, told the Post Zambia (www.postzambia.com/post-read_article.php?articleId= 19368) that the company will have no capacity to sustain the activities of the farmers if the European Union-funded project is not renewed.

A biodiesel plant in Zimbabwe is also struggling to continue. The plant, located about 15 km northwest of the capital of Harare, was the product of joint efforts between the Reserve Bank of Zimbabwe and Korean investors. It has been designed to process oils from feedstocks such as sunflower seeds, jatropha seeds, cotton seeds, and soybeans. At full capacity it should be able to produce 100 million liters annually.

However, the plant has never operated on a commercial basis, according to The Herald, a newspaper published by the government of Zimbabwe. Several issues were overlooked in the planning of the facility. One was the ability of local farmers to grow and supply enough oil seeds. A second was insufficient training for these farmers in growing these crops. A third was the absence of crushing plants in the area to extract oil for processing into fuel.

The Herald quoted Munyaradzi Kereke, advisor to the governor of the Reserve Bank of Zimbabwe, as saying, "It's very sad that such a noble innovation has been allowed to be seriously underutilized for what reason the authorities do have." He added, "The biodiesel project is as relevant today as it was when it was officially launched [three years ago] by ... President Mugabe."

(Courtesy : inform May 2011, Vol. 22 (6)).

THE GOOD OF IT

"Good cholesterol" 'EJ structure identified, could help explain protective effects

RESEARCHERS at the University of Cincinnati (Ohio, USA) have determined the structure of human high density lipoprotein (HDL) cholesterol and say the finding could help explain how this "fat packet" protects against cardiovascular diseases, including heart attack and stroke.

The study, led by W. Sean Davidson, a professor in the university's Pathobiology and Molecular Medicine Graduate Program, appeared online on March 13, 2011, in the journal Nature Structural & Molecular Biology.

HDL, also known as "good cholesterol," is composed of packets of protein and fat, which deliver

fat to specific locations within the body.

Studies of synthetically derived HDL have shown that apolipoprotein A-I (ApoA-I), an abundant protein in HDL, plays a key role in HDL's cardioprotective, anti-inflammatory, and anti-oxidative properties.

"Unfortunately, we've known very little about the molecular details that explain HDL's protective effects," said Davidson. "A major reason for this is an almost complete lack of understanding of HDL's structure and how it interacts with other important plasma factors."

Rong Huang, a post-doctoral fellow in Davidson's laboratory, has isolated human HDL and analyzed its three-dimensional structure as it circulates in human plasma.

"Previous studies have only focused on synthetic HDL made in the test tube," David-son said. "By isolating human HDL, we were able to focus on the broad range of HDL particles actually circulating in humans."

Team members used spectroscopic and mass spectrometric techniques to find that proteins of HDL form a cage-like structure that encapsulates its fatty cargo. They determined that most of the HDL particles circulating in human plasma are remarkably similar in structure; however, they found evidence that the particles have a twisting or shock absorber-like motion that allows them to adapt to changes in particle fat content.

By determining the structure of HDL, Davidson and his team were able to conclude that the majority of physiological interactions occurring with HDL—including its twisting movements—occur at the particle surface, which is dominated by the cardioprotective protein ApoA-I.

This monopolization of the particle surface, Davidson said, suggests that other proteins have very little room to bind to HDL and probably have to interact with the protein itself, which could explain how ApoA-I plays such a dominant role in HDL function and it protective effects.

(Courtesy : inform May 2011, Vol. 22 (6)).

NEW LOOK !

Major soy bean processing complex increases yields via enzymatic degumming

VERENIUM Corporation, a pioneer in the development of high-performance specialty enzymes, announced on February 28, 2011, that Terminal 6, a major producer of soybean meal, oil, and biodiesel, successfully began using Verenium Corporation's Purifine© enzymatic degumming process at its Puerto General San Martin facility in Argentina. Purifine enzymatic degumming is a novel process that significantly increases yields in edible oil production and can have additional benefits in refining the Purifine-degummed oil.

Implementation of the enzymatic degumming process at the Puerto General San Martin facility, a joint venture between Bunge Argentina and Aceitera General Deheza, has "resulted in a significant increase in oil yields and processing margins, enabling our facility to more fully reach its potential," said Enrique Humanes, chief executive officer of Bunge Argentina.

The Terminal 6 industrial facility has been built to take advantage of large-scale process efficiencies that enable maximum yields of oil and meal from soybeans at low cost. Integration of Verenium's enzyme further improves the plant's performance, because the oil loss in the enzyme-based process is low£r than in nonenzymatic processes.

(Courtesy : inform May 2011, Vol. 22 (6)).

REALLY ?

Rice bran, a potential source of biodiesel production in Indonesia

Gunawan, S., Ind. Crops Prod. 33:624-628, 2011.

BIODIESEL is a biodegradable, renewable, nontoxic, and environmentally friendly alternative fuel. The cost of raw materials comprises 60-88% of the production cost in commercial biodiesel (fatty acid methyl esters, FAME) production. Therefore,

the use of low-cost raw material as a substrate and an in situ process for biodiesel production are preferred. In this case, rice bran, which contains 13.5% oil, was an interesting substrate. In situ esterification of high-acidity rice bran with methanol and sulfuric acid catalyst was investigated. The individual and interaction effects of methanol-to-rice bran ratio, sulfuric acid catalyst concentration, and reaction time on purity and recovery of biodiesel were discussed. Our results suggest that under the following operation conditions—methanol-to-rice bran ratio of 5 mL/g, sulfuric acid concentration in methanol of 1.5 vol%, and reaction time of 60 min—an in situ esterification operated on rice bran could yield FAME with a high purity and recovery. By applying an in situ esterification with n-hexane/ water extractions, Indonesia will be successful in obtaining biodiesel from rice bran up to 96,000 metric tons per year.

(Courtesy : inform May 2011, Vol. 22 (6)).

NOW WHAT ?

Using Enzymes as Catalysts ... in interesterification

IN a previous article, the use of chemical catalysts for interesterification was described from a historical as well as a technical point of view.The technology which was developed in the 1920s served the oils and fats industry well for much of the 20th century - and still does - but progress in other fields, particularly degumming of oils rich in phosphatides, eventually meant that an alternative to chemical interesterification became a practical reality. The patent literature is in fact replete with claims for the use of enzymes to degum oils such as soybean oil. Such patents began to appear in the last quarter of the 20th century, and their success encouraged the search for other uses for enzymes. Initially the enzymes used were derived from animal material but before long plant sources were found to match the performance of the earlier products. This produced a number of benefits, including versatility, acceptability and cost.oils and fats. Of principal interest in this field are the lipases, which are ubiquitous in nature, being present in the animal, microbial and plant kingdoms.They are able to detach the fatty acid chains from the triglyceride molecule, either selectively or comprehensively, but can also promote the reverse reaction - i.e. they can also be used to promote the synthesis of esters such as fats.The most extensively studied lipases are those from microbial sources, as these are more readily available and are considered to be more stable than plant or animal lipases.They are particularly interesting because different types display a wide range of activities. However; they have to be handled with great care, as they are very temperature-sensitive and lose their activity rapidly when used above 70 C. A fuller explanation of the functionality of the various lipases can be found in a paper in the journal INFORM, which is listed at the end of this article.

Although enzymes have a long history of use in food they have Of course lipases are not the only enzymes to find only recently been developed for the large-scale modification of applications when processing oils and fats. Phospholipases had for some time already found an application in degumming of vegetable oils.

Fundamentally, lipases catalyse the hydrolysis of fats, but in the presence of low levels of moisture the lipase introduced will catalyse interesteriflcation reactions.This produces results similar to those found when using chemical catalysts for interesteriflcation. Certain lipases have the additional facility of being regio-selective, i.e. of being able to replace fatty acids in specific positions on the triglyceride molecule, a feature which turns out to be very useful in the production of fats having properties that rely on molecular arrangement. As lipases (and other enzymes) are generally not very stable it is usual to deposit them on a carrier prior to use, and various carriers have been tested for suitability, comprising mainly the ability to bind the lipase to the carrier, to ensure lipase stability during the process of immobilisation and to ensure particle porosity sufficient to allow full use to be made of the enzyme for the reaction.

The stereo-specific lipases, which act on specific positions on the triglyceride chain, are particularly important due to their ability to act on specific positions in the triglyceride molecule. Of these the best-known are the 1,3-specific lipases, i.e. lipases which specifically act on the fatty acids at the 'outer' positions on the glycerol molecule that forms the 'backbone' of the triglyceride molecule. These can be used to produce symmetrical trig-

lycerides, which are important confectionery fat constituents. Reactions in this category are preferably carried out in a fixed bed, as this facilitates repeated use of the enzyme, thus reducing their unit cost. A further feature of the enzyme-based process is that, compared with that used in the corresponding operation using a chemical catalyst, lower temperatures are needed to achieve interesterification. A temperature of approximately 70 C appears to be most generally advocated for this process, and it has been stated that the enzyme would begin to lose activity if a temperature of 80°C is used.

As in the case of the process using one of the chemical catalysts, the enzymatic process for interesterification requires great attention to safety aspects, in particular focusing on containment of the enzyme. In this respect the enzyme immobilised on an inert carrier is obviously less hazardous than an enzyme freely suspended in the material being processed. Immobilised enzymes offer the user several advantages.The subject of reactor loading with enzyme and end-of-reaction discharge also warrants careful consideration from the point of view of personal safety.

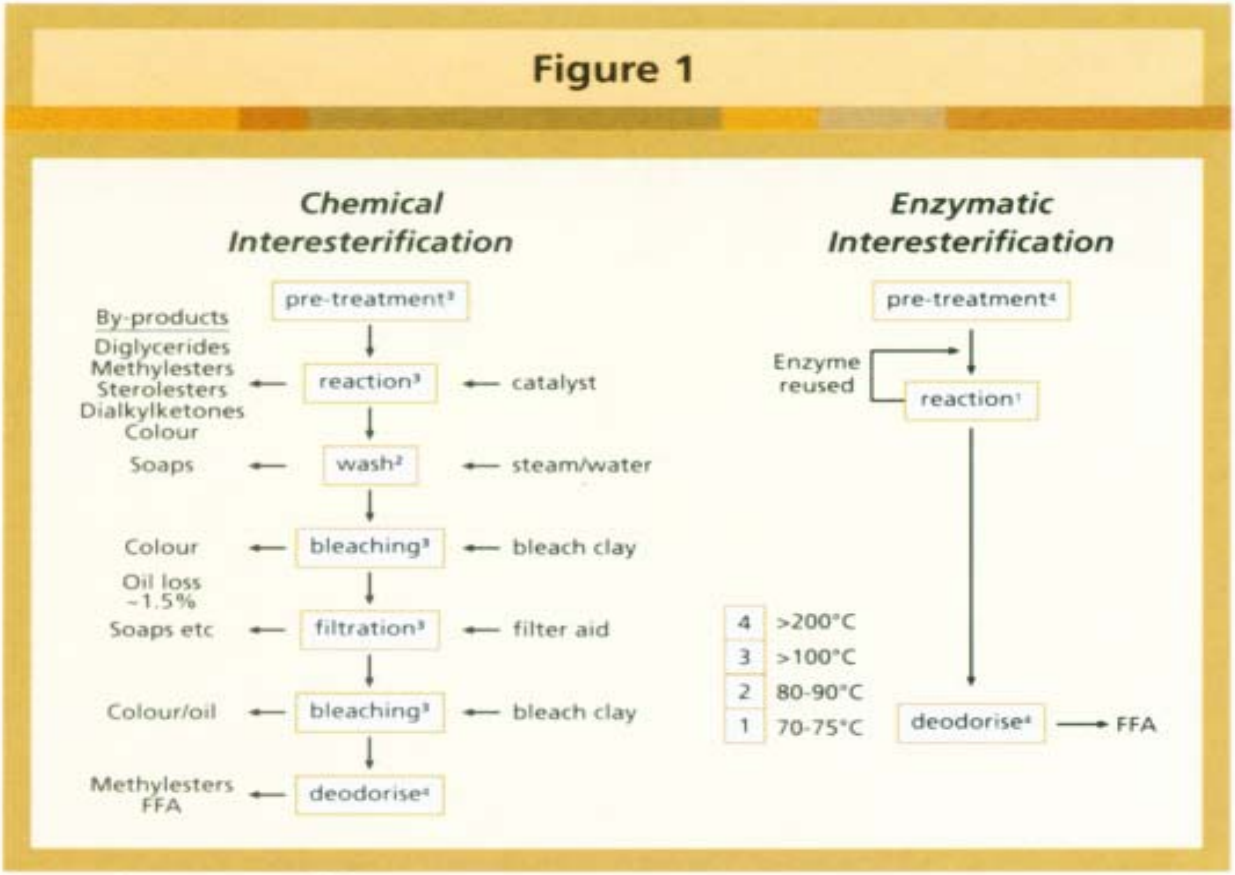
Chemicals versus enzymes

The enzyme-based process has been used for the production of specialty fats, requiring regio-selective enzymes, and has also been shown to be applicable to the production of fats requiring random interesterification. Although, as pointed out earlier; a wide range of enzymes is available for fat modification, in practice the alkali catalysts, and in particular sodium methoxide, have dominated the field of interesterification applications. Whereas chemical catalysts are single-use initiators of the reaction, enzymes can be re-used, although their activity declines with multiple re-use or with continuous use over an extended period. To operate in this mode in a production environment would result in fluctuating output from the reactor, which is not desirable, and the logical solution is to have several reactors in series. By operating several columns in series, it is not necessary to have full conversion in the first column, as the load can be spread over several reactors. This results in a more even flow and output from the reactor series.Two groups of compounds that have specific relevance for enzyme working life have been identified and are residual inorganic acids from degumming or bleaching earth together with citric acid from deodorisation and oxidation compounds, specifically those contributing to the measured Peroxide Value.

The formation of diglycerides as by-products is an important consideration when interesterifying chemically but is relatively insignificant in the case of the enzyme-based process. The fact that the regio-selective properties of specific enzymes provide a functionality not easily obtained with the existing chemical catalysts is another factor to be borne in mind when comparing the chemical and the enzymic catalysts as the agents of the change required.These may be particularly valuable in the case of structured lipids. The production of diglycerides, which are considered to be useful in managing obesity provides another application of enzymatic modification of fats. Symmetrical diglycerides produced using enzymes are now being marketed in Japan with the aim of promoting obesity reduction.The range of conversions using enzymes is constantly growing, though in most cases these are niche products having high added value and not large in volume.

At the present time, it is likely that the most important application of the process of interesterification is to be found in its combination with full hydrogenation in order to avoid the formation of trons-fatty acids when producing a plastic fat. It remains to be seen whether this is a long-term solution to the trons-fats problem. Enzyme interesterification has proved to be of greatest interest because of the wide and growing range of modifications shown to be possible. The cost of enzyme use remains a handicap to the wider use of the technology resulting, at least at present, in the technology being primarily applicable to high value-added products. Studies on enzyme re-use are narrowing the cost gap relative to the use of chemical catalysts, bearing in mind that post-refining costs as well as other processing costs should also be lower in this case.

The methodology of Life Cycle Analysis (LCA), which has been employed in recent years to assess the global impact of various technologies, is also now being used to compare the longer-term effects of the two routes for interesterification discussed above. LCA is coming to be of growing interest in food production across the whole spec-



Source: Novozymes A/S

trum of its potential relevance. It will be of considerable interest to study the outcome of this comparison, although it needs to be remembered that to a considerable extent the two routes at present target different product areas.

The comparison of chemical and enzymic interesterification processes is shown in diagrammatic form (Figure I). This illustrates very clearly how much simpler the enzymatic process is than that using a chemical catalyst. On the other hand, the enzymes used are significantly more expensive than the alkaline catalysts generally used when using the chemical process, although multiple re-use of the enzyme - not possible when using a chemical catalyst - reduces this cost difference significantly.

The diagram also shows the temperature ranges prevailing in the various stages. Spent enzyme is generally combined with spent bleaching earth for disposal, thus creating additional solid effluent but no liquid effluent from this source. Whereas chemical interesterification gives rise to a small amount of aqueous effluent (plus oil and fatty acid losses when deodorising the product), enzymic interesterification largely avoids these losses. Overall, the environmental impact of the enzyme-based process is less than that of the process using a chemical catalyst.The enzyme process is also more effective at conserving the tocopherol content of the oil, an important consideration where palm oil is one of the constituents of the blend being processed.

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(Courtesy : Global Oils & Fats Business Magazine, Vol. 8, Issue 2, 2011)