Vol. XV No. 2

April - June 2013

NEWS LETTER

OIL TECHNOLOGISTS' ASSOCIATION OF INDIA
WESTERN ZONE

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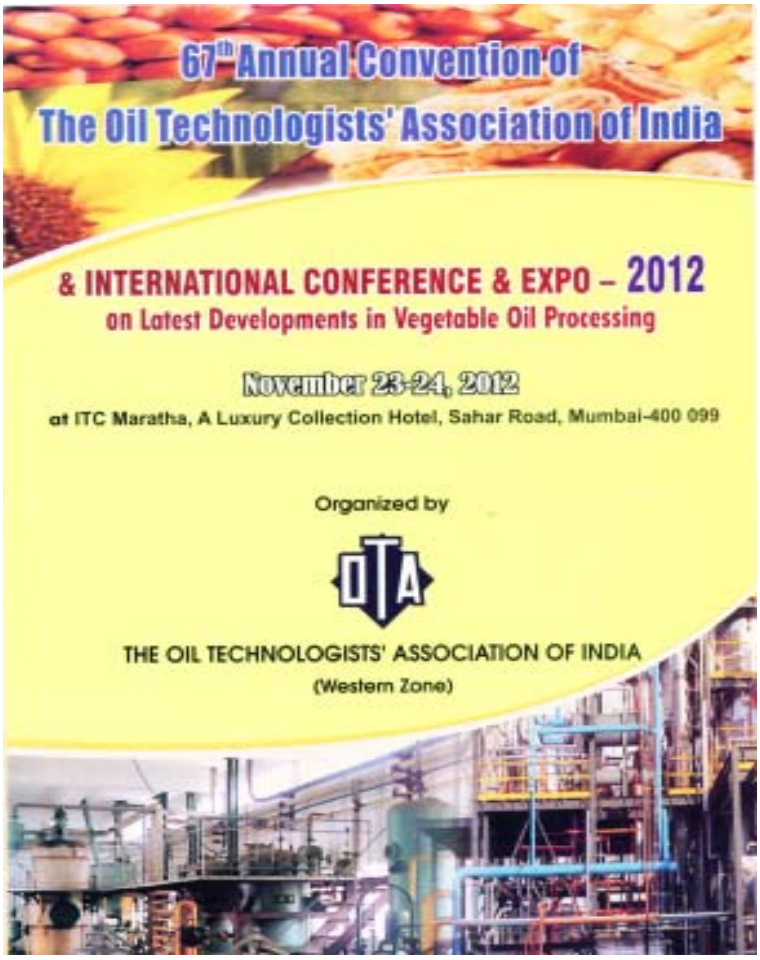

This news letter is for free circulation only to the members of OTAI-WZ

C/o. Department of Oils, Oleochemicals & Surfactants
Institute of Chemical Technology
(Formerly UDCT)
Nathalal Parekh Marg
Matunga (East), Mumbai-400 019
INDIA.

Tel.: 91-22-32972206/91-22-24146526
Fax: +91-22-24124017
Email: info@otai-westernzone.org
Website: www.otai-westernzone.org

OIL TECHNOLOGISTS' ASSOCIATION OF INDIA WESTERN ZONE

From the Editors's Desk

Welcome the New President of our Western Zone ***Dr. Rajeev Churi*** *young and learned, who also is a visiting faculty of UICT. Let us hope for a colorful and dynamic leadership from him. The committee members are a mixture of young and old. Young to bring a fresh outlook,Old who will contribute judicious and seasoned guidance. The Western Zone, by and large, struck new and interesting pathways and the new President will have to further the activities. Undoubtedly all of us will have to put our best foot forward. We will, I believe. Best wishes to the New Team.*

Trade & Commerce

"HEARTENING"

INDIA

THE late arrival of the monsoon affected production of groundnuts and cottonseed. Fortunately the late monsoon saved the soybean crop. As usually happens, the weak summer rainfall was compensated with good winter rains. India is going to harvest one of its biggest rapeseed crops in memory. India is also harvesting a big wheat crop.

Declining prices of palm oil have made it extremely competitive in India. Both Malaysian and Indonesian exporters have been pushing CPO and Olein into India and this has meant that prices of locally produced oils have fallen steadily. India is carrying record stocks of imported oils as well as record stocks of domestic oilseeds. My estimate is that current Indian stocks of all oils - imported as well as domestic- are almost 2 million tonnes, an 80% increase over the same month in 2012.

India's imports of edible and non-edible oils during the oil year Nov 12 to Oct 13 will also break all records.

Let us first look at India's production of vegetable oil. (Oil year November to October).

INDIA'S PRODUCTION

000 tonnes	**2012-13 Estimates**	**2011-12 Actual**	**2010-11 Actual**	**2009-10 Actual**	**2008-09 Actual**
Soybean oil	1650	1575	1600	1150	1200
Cotton oil	1100	1150	1050	1100	1000
Gn oil	160	400	500	450	650
Sun oil	220	240	230	350	500
Rape oil	2250	1770	2250	1700	1800
Sesame oil	120	120	150	160	150
Coconut oil	400	400	400	400	390
RiceBranoii	800	800	720	700	740
Others	400	345	250	250	250
Total	**7100**	**6800**	**7150**	**6260**	**6680**

Let us now look at INDIA'S CONSUMPTION

000 tonnes	**2012-13 Estimates**	**2011-12 Actual**	**2010-11 Actual**	**2009-10 Actual**	**2008-09 Actual**
Soybean oil	2600	2600	2550	2700	2150
Cotton oil	1100	1150	1050	1050	1000
Gn oil	150	400	500	450	650
Sun oil	1200	1320	1000	950	1050
Rape oil	2200	1850	2250	1850	1800
Sesame oil	120	120	150	160	150
Palm oil	8330	7385	6750	6460	6530
Laurics	700	600	600	650	600
RiceBranoil	800	800	720	700	740
Others	350	350	250	250	250
Total	**17550**	**16575**	**15820**	**15220**	**14920**
Pop.Mlns Per cap kg	1260	1240	1220	1175	1160
Per cap kg	**13.92**	**13.36**	**12.96**	**12.95**	**12.86**

"BE INFORMED"

COOIT's Trade Estimate for Rabi Oilseed Production and Availability of Vegetable Oils during 2012-13 Season

34th All India Rabi Seminar on Oilseeds, Oil Trade & Industry was held on 17th March, 2013 at Agra and arrived at trade estimate of Rabi Oilseeds crop and availability of vegetable oils from Rabi Crop during 2012-13 season.

The Food Security programme of the Indian government is question remains one of import duty.

Rabi Oilseeds Area & Crop

Oilseeds	2012-13 Area* Lakh Ha	Crop Lakh T.	2011-12 Area Lakh Ha	Crop Lakh T.	Change Area Lakh Ha	Crop Lakh T.
Groundnut	10.11	17.14	9.11	18.40	(+) 1.00	(-) 1-26
Rape/Mustard	67.49	71.50	65.90	58.80	(+) 1.59	(+) 12.70
Sunflowerseed	5.33	4.65	4.65	5.00	(+) 0.68	(-) 0.35
Sesameseed	2.44	2.61	1.28	3.40	(+) 1-16	(-) 0.79
Safflowerseed	1.53	0.86	1.95	1.00	(-) 0.42	(-) 0.14
Linseed	3.36	1.17	4.29	1.30	(-) 0.93	(-) 0.13
Other Oilseeds	0.67	--	1.23	--	(-) 0.56	--
Total	**90.94**	**97.93**	**88.42**	**87.90**	**(+) 2.52**	**(+) 10.03**

- Area as per GOI data as on 14th March, 2013

Oilseeds Production:

Oilseeds	Kharif	2012-13 Rabi	Total	2011-12	Change
Groundnut(in shell)	26.20	17.14	**43.34**	60.15	(-) 16.81
Soybean	113.40	.-	**113.40**	106.50	(+) 6.90
Rape/Mustard/Toria	1.50	71.50	**73.00**	60.30	(+) 12.70
Sunflowerseed	1.50	4.65	**6.15**	6.20	(-) 0.05
Sesameseed	3.40	2.61	**6.01**	7.60	(-) 1.59
Castorseed	11.43	--	**11.43**	16.20	(-) 4.77
Nigerseed	0.80	--	**0.80**	0.90	(-) 0.10
Safflowerseed	-.	0.86	**0.86**	1.00	(-) 0.14
Lineseed	-.	1.17	**1.17**	1.30	(-) 0.13
Sub Total	**158.23**	**97.93**	**256.16**	**260.15**	**(-) 3.99**
Cottonseed	102.30	--	**102.30**	109.43	(-) 7.13
Copra	6.00	--	**6.00**	6.50	(-) 0.50
Grand Total	**266.53**	**97.93**	**364.46**	**376.08**	**(-) 11.62**

General Observations :-

1. The area under Rabi Oilseeds Crop 2012-13 increased to 90.94 lakh hectares from 88.42 lakh hectares last year i.e. up by 2.52 lakh hectares.
2. Revision of Kharif Crop:
   The following revision has been made in kharif crop 2012-13 estimated earlier at the Kharif Convention held on 5th Nov.2012 at Delhi.

Crop	Revised Estimate (17.3.2013)	Earlier Estimate (5.11.2012)
Castorseed	11.43 Lakh Tones	10.70 Lakh Tones
Cottonseed	330.00 Lakh Bales	334.00 Lakh Bales

3. Rabi Groundnut Crop has decreased to 17.14 lakh tones from 18.40 lakh tones of last year.
4. Rapeseed-mustard including Toria crop increased to 73.00 lakh tones from 60.30 lakh tones of last year.
5. The overall Rabi Oilseeds Crop 2012-13 increased to 97.93 lakh tones from 87.90 lakh tones last year.
6. Bales of cotton revised downward to 330 lakh bales from 334 lakh bales estimated earlier at the kharif Convention held on 5th Nov.,2012 at Delhi.
7. The overall 9 oilseed crops (Kharif & Rabi) for the current year (2012-13) is estimated at 256.16 lakh tones compared to 260.15 lakh tones.
8. The total vegetable oil availability from Kharif and Rabi Oilseeds crops for the year 2012-13(Nov-Oct) is estimated upward at 81.97 lakh tones compared to 81.52 lakh tones last year.
9. The import of vegetable oil during 2012-13 (Nov-Oct) is likely to increase by about 5.00 to 7.00 lakh tons and estimated in the range of 107.00 to 109.00 lakh tons from 101.92 lakh tons in previous year (2011-12).

(Courtesy : Sea News Circular, Vol. XV, Issue:12, March, 2013)

"MAKING SWITCHES"

Government considers crop switch to save soil, water

THE government plans to revive cultivation of crops that make Punjab's iconic "makki ki roti and sarson ka saag" -- maize and mustard -- along with horticulture and fodder to breathe life into the stressed soil and the rapidly depleting water table in the green-revolution state.

Prime Minister Manmohan Singh is pushing hard for crop diversification in Punjab and has appointed an inter-ministerial panel on crop diversification led by Agriculture Minister Sharad Pawar to help farmers look beyond paddy that guzzles water, fertiliser and power. Farm experts say eastern India, which has plenty of water and the region chosen for the next wave of the green revolution, is a better location for such crops. The government has already allocated Rs 500 crore to start the programme of crop diversification. The panel will also review infrastructure required to market, support and procure alternative crops. It includes ministers of finance, food and commerce and the deputy chairman of the Planning Commission. Growing alternative crops such as maize, mustard and cotton is expected to reduce water consumption and help revive the water table in Punjab, which is sinking by 33 cm every year.

"We will motivate farmers to go for alternative crops like maize, mustard and cotton. But for that we need to make them equally remunerative. We are devising market interventions and mechanisms to protect their income levels on diversification," said Agriculture Secretary Ashish Bahuguna. (Source : Economic Times dated 4th March 2013.

(Courtesy : Sea News Circular, Vol. XV, Issue:12, March, 2013)

"GOOD NEWS"

Oil Seed Production during 2012-13

34th Rabi Convention organized by COOIT was held at Agra on 17th March, 2013, It is heartening to note that despite the jitters given by erratic monsoon which had decreased the kharif oilseeds availability to 158.23 lakh tones; with better soil moisture available during the rabi season, we expect to harvest a larger rabi oilseeds crop of 97.93 lakh tones, and the total oil seed production is expected to be 256 lakh tones compared to 260 lakh tones last year, thus partly bridging the acute deficiency in oilseeds production this year. The overall availability of vegetable oil would be more or less the same of last year.

(Courtesy : Sea News Circular, Vol. XV, Issue:12, March, 2013)

"MUST READ"

World Agricultural Supply and Demand Projections

WHEAT

U.S. wheat exports for 2012/13 are projected 25 million bushels lower in March boosting projected ending stocks by the same amount. Continued strong competition, particularly from EU-27 and FSU-12, further reduce prospects for U.S. wheat shipments. Projected exports for Hard Red Winter wheat are lowered 25 million bushels. Exports are also lowered 10 million bushels and 5 million busehls, respectively, for Whitewheat. All-wheat imports are unchanged, but small adjustments are made among the classes. Trade changes largely reflect the pace of sales and shipments to date.

Global wheat supplies for 2012/13 are raised 1.8 million tons with higher production. India production is increased 1.0 million tons based on the latest revisions by the government of India for the crop harvested nearly a year ago. EU 27 production is raised 0.5 million tons based on the latest government of Lithuania. Production is estimated 0.3 million tons higher for Nepal in line with historical revisions to the country's production series in the month of March.

COARSE GRAINS

Projected 2012/13 U.S. corn ending stocks are unchanged this month as an increase in imports and lower exports support higher expected feed and residual disappearance. Corn imports are raised 25 million bushels reflecting the strong pace of shipments reported through January. Corn exports are lowered 75 million bushels based on the slow pace of sales and shipments to date and stronger expected competition from South American corn and from competitively priced feed quality wheat. Feed and residual disappearance for corn is raised an offsetting 100 million bushels with continued expansion in poultry production and a 10-million-bushel reduction in projected sorghum feed and residual use. Sorghum exports are projected 10 million bushels higher based on the strong pace of sales and shipments. Smaller trade changes are projected for barley and oats based on shipments todate.

Global coarse grain supplies for 2012/13 are projected 1.0 million tons lower with a 0.8- million-ton decrease in production. Corn production is lowered 0.5 million tons for Argentina reflecting extended dryness in February that reduced yield prospects, particularly for late-planted corn. South Africa corn production is reduced 0.5 million tons as dryness and heat reduce yield prospects in the western areas of the maize belt. Sorghum production is lowered 0.5 million tons for Australia as excessively high temperatures have reduced harvested area as indicated by the latest government estimates and yield prospects as confirmed by satellite imagery. India corn production is raised 0.4 million tons as planting progress reports for the winter crop indicate a year-to-year increase in area.

RICE

The changes made to the U.S. 2012/13 rice supply and use balances this month are confined to the trade categories and ending stocks. The 2012/13 all-rice import forecast is raised 0.5 million cwt to 21.5 million, based largely on the pace of imports reflected in the U.S. Bureau of the Census import data through January-all in long-grain

rice. On the use side, the all-rice export forecast is increased 2.0 million cwt to 108.0 million—all in long-grain rice. The rough rice and milled export (rough-equivalent basis) forecasts are each raised 1.0 million cwt to 35.0 million and 73.0 million, respectively. Increased export commitments to Iran and Western Hemisphere markets support the increase in the 2012/13 export projection.

Global 2012/13 rice production, consumption, trade, and ending stocks are all up from a month ago. World rice production is forecast at a record 468.1 million tons, up 2.3 million from last month, largely due to increases for Cambodia and India. India's rice crop is projected at 102.0 million tons, up 2.0 million from last month, but down 4.3 million from record 2011/12. The increase in India' s crop is due entirely to the larger Kharif rice crop now forecast by the government of India at 90.7 million tons, up 4.5 million from an earlier forecast. The Rabi rice crop is expected to be down from last year due to late planting and a lower expected average yield. World consumption is forecast at a record 470.2 million tons, up 0.9 million from last month, owing mostly to increases for Cambodia, India, and Peru. The increase in global trade is relatively small. Global 2012/13 ending stocks are projected at 103.3 million tons, up 1.4 million from a month ago, but down 2.2 million from last year.

OILSEEDS

U.S. soybean supply and use projections for 2012/13 are unchanged this month, leaving ending stocks at 125 million bushels. Although soybean export commitments through February exceeded last year's pace, U.S. exports are expected to decline in the months ahead as increased competition from a record South American soybean crop limits additional U.S. sales during the second half of the marketing year. Soybean crush is also ahead of last year's pace, but is projected to slow in the second half of the marketing year on declining soybean meal exports as competition from South America, especially Argentina, increases with the new-crop harvest.

Global oilseed production for 2012/13 is projected at 466.8 million tons, down slightly from last month as reduced soybean and sunflowerseed production is mostly offset by increased rapeseed and cottonseed production. Foreign production, projected at 374.1 million tons, accounts for all of the change. Argentina soybean production is projected at 51.5 million tons, down 1.5 million. Despite widespread rains in recent weeks, the extended dry period during planting and early crop development limited plantings and reduced yield prospects. China rapeseed production is projected at 13.5 million tons, up 0.9 million based on increased area and yield indicated in recently released official government statistics. Other changes include higher rapeseed production for Australia and India, reduced sunflowerseed production for Argentina, and increased palm oil production for Malaysia. Cottonseed production is increased for China and reduced for Pakistan and Brazil.

SUGAR

Projected U.S. sugar supply for fiscal year 2012/13 is increased 91,000 short tons, raw value, from last month, as higher sugar imports from Mexico more than offset lower production and tariff rate quota (TRQ) imports. Reduced Florida cane sugar production reflects processors' estimates while lower TRQ imports reflect increased shortfall. Higher imports from Mexico result from increased production which is based on higher-than-expected sugarcane yields to date. Sugar use is unchanged for the United States and ending stocks are increased for both the United States and Mexico.

LIVESTOCK, POULTRY, AND DAIRY

The 2013 forecast of total red meat and poultry production is raised from last month as higher beef, broiler, and turkey production is expected to more than offset lower forecast pork production. Beef production is raised from last month largely due to heavier expected carcass weights. Steer and heifer slaughter is reduced for the first quarter, but cow slaughter is raised. Pork production is reduced based on lower slaughter in the first quarter. The broiler production forecast is raised as producers are expected to respond to stronger forecast first-half broiler prices and lower projected second-half feed meal prices. Turkey production is forecast higher on heavier bird weights and slightly higher slaughter. Egg production is raised based on hatchery data. Poultry and egg

production for 2012 is adjusted to reflect revisions in production data.

The beef export and import forecasts for 2013 are lowered based on slower-than-expected shipments in January. Pork exports are lowered from last month as export demand has softened. The broiler export forecast is unchanged from last month. The milk production forecast for 2013 is raised from last month largely due to a slower pace of herd reduction and higher first-quarter milk per cow. The 2013 fat-basis export forecast is raised largely on stronger shipments of butter. Skim-solid exports are raised based on greater nonfat dry milk (NDM). Imports are unchanged on both a fat and skim-solids basis. Changes in 2012 estimates of supply and use reflect revised annual data.

COTTON

The 2012/13 U.S. cotton estimates include larger exports and lower ending stocks relative to last month. Production and domestic mill use are unchanged. Exports are raised 250,000 bales based on strong sales and shipments in recent weeks. Ending stocks are now forecast at 4.2 million bales, equal to 26 percent of total use. The forecast range for the average price received by producers of 70 to 73 cents per pound is raised 1 cent on thelowerend.

This month's 2012/13 world cotton estimates show higher production, consumption, and trade, with ending stocks reduced marginally. World production is raised about 900,000 bales from last month, including a 1.0-million-bale increase in the China crop, based on recent statistical reports for the eastern provinces and on classification data for Xinjiang. Production also is raised for Uzbekistan. Mexico, and Turkmenistan, but is reduced for Pakistan and Brazil. Consumption is raised for China, India, and Bangladesh. World trade is raised 1.5 million bales, due mainly to higher imports by China, Pakistan, and Bangladesh. Exports are raised for India, the United States, Australia, Turkmenistan, and Uzbekistan, but are lowered for Pakistan. Global ending stocks are now forecast at 81.7 million bales.

(Courtesy : Business Star. March 2013).

Technology

"SPARKLING"

Medicinal Properties and uses of Neem

J. Selvi, Devi Priya J, Punnuswami V & T.L. Preethi

NEEM, also called Azadirachta indica is an original tree found in tropical and semi-tropical countries like Burma and India; Neem has been declared non-toxic to humans and each part of the tree is used as an active ingredient in different industries. Neem tree has been given its due recognition, with a number of researches being conducted on an international level to understand the benefits and potential of neem. Today neem is used on a commercial basis and finds immense use in a number of products in industries ranging from cosmetics to agriculture, from pharmaceuticals to Ayurveda.

Botanical Name: Azadirachta indica
Family: Mahogany

Varied Names:
Neem (Hindi, Urdu and Bengali), Nimm (Punjabi), Arya Veppu (Malayalam), Azad Dirakht (Persian), DogonYaro (in some Nigerian languages), Nimba (Sanskrit and Marathi), Margosa, Neeb (Arabic), Nimtree, Vepu, Vempu, Vepa (Telugu), Bevu (Kannada), Kohomba (Sinhala), Tamar (Burmese), Vembu (Tamil), Paraiso (Spanish), and Indian Lilac (English).

Neem History:

Neem tree is native to India and Mynammar. Neem history dates back to Harappa Mohenjo-Daro civilizations in India where the medicinal properties and its use in household things began. India was number one in importing the medicine. When Julius Caesar established the Roman Empire, a public complaint was issued by Pliny the Elder against the volume of export and drainage of Roman gold to India owing to this. So when the early explorers came to India for trade, they compiled all the Indian medicines and brought back to their countries.

This included neem in abundant. But with the advent of British empire in India all the local things were being discouraged and were named as backward. So with this practices like use of neem as insecticide, use of neem leaves to protect crops etc were discouraged. More modern chemicals replaced the old traditions of India including the medicinal plants and other products. But in 1920s commercial use of Neem oil and neem cake was done by the Indian Institute of Science in Bangalore. For an experiment neem cakes were used in sugarcane fields and it really worked as it had kept the termites at bay.

Neem uses:

Neem is known as the Wonder Tree for its multiple uses. Neem leaves, oil, and neem extracts are used to produce a wide range of medicinal and beauty care products. Neem oil has insecticidal and medicinal properties due to which it has been used in pest control, cosmetics, medicines, etc. Neem leaves have anti-bacterial properties which help in treating skin problems. Neem leaves are also used in storage of grains. Twigs of neem are used as toothbrushes. Neem produces pain relieving, fever reducing and anti-inflammatory compounds that can help in the healing of burns, cuts, earaches, fevers, headaches and sprains. Neem bark and roots in powdered form help in controlling fleas and ticks on pets. Neem extracts also help in treating diabetes, heart disease, AIDS, cancer, hepatitis, ulcers, and several other diseases.

Neem Products:

Neem Seed Cake, Neem Oil, Powder, Soap, Hair & Skin Products, Medicines, Oral Hygiene

Products, Neem Repellent, Neem Coir, Neem Gel, Neem Tea, Neem Spray, Candles, Incense Sticks, Neem Fertilizer, Insecticide.

Neem Used in Industries:

• **Raw Neem** - has been used by households and industries for a number of uses.

• **Neem Extract** - Part of neem tree like leaf, seed or bark is either soaked in water or organic solvents and alcohol to get the concentrated compounds.

• **Neem Finished Products** - Neem is used in a number of products the world over in the form of pesticides, insecticides, manure, cosmetics, hair lotions and oils, toothpastes and tooth powders, incense sticks and mostly, it is widely used to manufacture a number of traditional and modern medicines. Ayurveda and Unani system of medicines makes use of neem for a quite a few of medicinal preparations.

Medicinal Properties of Neem:

• Medicinal properties of neem have been known to Indians since a very long time. The earliest Sanskrit medical writings mention the uses and benefits of neem fruits, leaves, seeds, oil, roots and bark. Each and every part of the neem tree has been used in the Indian Ayurvedic and Unani systems of medicine.

• "Neem bark is cool, astringent, bitter, acrid and refrigerant. It is useful in cough, fever, tiredness, loss of appetite, worm infestation. It heals wounds and vitiated conditions of kapha, excessive thirst, vomiting, skin diseases, and diabetes.

• Neem leaves are beneficial for insect poisons and eye disorders . Neem herb treats Vatik disorder. It is anti-leprotic. Neem fruits are purgative, bitter, anti-hemorrhoids and anthelmintic."

• Thus neem has been widely used in traditional system of medicine for centuries now. Each part of neem is used in medicines and thus commercially exploitable.

• Neem has been evaluated for safety and efficacy and after numerous research by leading organizations and companies, it has been considered as a universal cure for diseases. It is a revered tree in India with close to 150 compounds have been obtained from different parts of the tree. It is also considered to be a natural source for a medicines and industrial products.

Medicinal uses of Neem:

It is claimed that neem provides a treatment to many incurable diseases by using neem capsules, neem antiseptic cream, oil etc. Traditionally raw neem leaves, neem bark & fruit have been used against a wide variety of diseases which include wounds, jaundice, heat-rash, boils, leprosy, stomach ulcers, skin disorders, chicken pox, etc. Modern medical studies also confirms neemacurative powers in case of many diseases. Check out more on Neem Benefits.

- Neem Bark: acts as an analgesic and can cure fever.
- Neem Flower: Used to cure intestinal problems.
- Neem Leaf: Raw leaf and leaf extract can be used for body weight problems, skin problems and ulcers, gastrointestinal problems.
- Neem Twig: Can be used to cure common cold and cough,asthma and bronchitis, urinary track disorders, diabetes and blood pressure.
- Neem Seed: Can be used to cure leprosy and other gastrointestinal problems.

Unani Medicine:

Neem is popularly known as 'Yavan Priya' meaning the beloved of muslims. It has for long been used in the traditional unani system of medicine for its beneficial properties. All parts of neem i.e. the roots, stem, leaves, fruits, bark and seeds have therapeutic value.

Leaf: Fresh leaves are more commonly used than any other part of the tree. Dried leaves are also used in unani medication, though they are said to be less effective. Also used in skin diseases and intestinal diseases.

Seeds: Are very effective in treatment of boils, leprosy, eczema and other skin diseases; headaches, ulcer, diarrhoea, intestinal problems.

Stalk: Are used as tooth sticks which help to prevent infection of teeth and gums; control bad breath and also prevent oral cavity'. It is also used to manufacture medicines that cure cough, asthama, intestinal worms and also improving the eye sight.

Bark: It is mosdy used in blood purifying preparations and anti-pyretic medicines. Bark extracts are also used in preparation of medicines curing paralysis, joint pains, nervous weakness etc.

Flowers: Are used in medicines curing eye problems, is also used to treat certain dental problems, flowers are also anti inflammatory in nature, therefore very helpful in treating diseases.

Fruits: Are used as laxatives and blood purifier. It is also used as an ingredient in medicines curing leprosy, piles etc.

Gum: Used as a blood purifier and is also used in body stimulants and tonics. The pharmacological action and the therapeutic efficacy of neem includes anti-inflammatory action, blood purifying, anti-leprosy, anti-vitiligo, anti septic and anti arthritic properties.

Department of Food Science and Nutrition, Home Science College and Research Institute, Tamil Nadu Agricultural University Madurai-625104. Email : elvisathi81 @ rediffmail.com.

(Courtesy :Plant Horti Tech Magazine - Feb Mar 2013)

"KNOW THE TRUTH"

The Truth about Coconut Oil

Excerpt from www.whfood.org

THE truth about coconut oil is obvious to anyone who has studied the health of those who live in traditional tropical cultures, where coconut has been a nutritious diet staple for thousands of years. Back in the 1930's, a dentist named Dr. Weston Price travelled throughout the South Pacific, examining traditional diets and their effect on dental and overall health. He found that those eating diets high in coconut products were healthy and trim, despite the high fat concentration in their diet, and that heart disease was virtually non-existent. Similarly, in 1981, researchers studied populations of two Polynesian atolls. Coconut was the chief source of caloric energy in both groups. The results, published in the American Journal of Clinical Nutrition, demonstrated that both populations exhibited positive vascular health.

In fact, no evidence exists that the naturally occurring high saturated fat intake had any kind of harmful effect in these populations! That's not what you expected, is it? Based on 60 years of negative public policy towards naturally occurring saturated fats, you would expect these cultures to be rife with clogged arteries, obesity and heart disease. It may be surprising for you to realize that the naturally occurring saturated fat in coconut oil actually has some amazing health benefits, such as:

- Promoting your heart health
- Promoting weight loss, when needed
- Supporting your immune system health
- Supporting a healthy metabolism
- Providing you with an immediate energy source
- Keeping your skin healthy and youthful looking
- Supporting the proper functioning of your thyroid gland

But how is this possible?

Does coconut oil have some secret ingredients not found in other saturated fats?

The answer is a resounding "yes".

Coconut Oil's Secret Ingredient:

50 percent of the fat content in coconut oil is a fat rarely found in nature called lauric acid. Lauric acid's a "miracle" ingredient because of its unique

health promoting properties. Your body converts lauric acid into monolaurin, which has anti-viral, anti-bacterial and anti-protozoa properties. Monolaurin is a monoglyceride which can actually destroy lipid coated viruses such as:

- HIV, herpes
- Measles
- Influenza virus
- Various pathogenic bacteria
- Protozoa such as giardia lamblia.

Lauric acid is a powerful virus and gram-negative bacteria destroyer, and coconut oil contains the most lauric acid of any substance on earth! Capric acid, another coconut fatty acid present in smaller amounts, has also been added to the list of coconut's antimicrobial components. This is one of the key reasons you should consider consuming coconut oil, because there aren't many sources of monolaurin in our diet. But the health benefits of coconut oil don't stop there.

The Benefits of Medium-Chain Fatty Acids:

Coconut oil is about 2/3 medium-chain fatty acids (MCFAs), also called medium-chain triglycerides or MCTs. These types of fatty acids produce a whole host of health benefits. Coconut oil is nature's richest source of these healthy MCFAs. By contrast, most common vegetable or seed oils are comprised of long chain fatty acids (LCFAs), also known as long-chain triglycerides or LCTs. Let me tell you why these long-chain fatty acids are not as healthy for you as the MCFAs found in coconut oil:

- LCFAs are difficult for your body to break down — they require special enzymes for digestion.
- LCFAs put more strain on your pancreas, liver and your entire digestive system.
- LCFAs are predominantly stored in your body as fat.
- LCFAs can be deposited within your arteries in lipid forms such as cholesterol.
- In contrast to LFCAs, the MCFAs found in coconut oil have many health benefits, including the following beneficial qualities:
- MCFAs are smaller. They permeate cell membranes easily, and do not require special enzymes to be utilized effectively by your body.
- MCFAs are easily digested, thus putting less strain on your digestive system.
- MCFAs are sent directly to your liver, where they are immediately converted into energy rather than being stored as fat.
- MCFAs actually help stimulate your body's metabolism, leading to weight loss.

Coconut Oil Helps Fight Diabetes:

Your body sends medium-chain fatty acids directly to your liver to use as energy. This makes coconut oil a powerful source of instant energy to your body, a function usually served in the diet by simple carbohydrates. But although coconut oil and simple carbohydrates share the ability to deliver quick energy to your body, they differ in one crucial respect.

Coconut oil does not produce an insulin spike in your bloodstream. You read that correctly, Coconut oil acts on your body like a carbohydrate, without any of the debilitating insulin-related effects associated with long-term high carbohydrate consumption! Diabetics and those with pre-diabetes conditions (an exploding health epidemic in America), should immediately realize the benefit of a fast acting energy source that doesn't produce an insulin spike in your body. In fact, coconut oil added to the diets of diabetics and pre-diabetics has actually been shown to help stabilize weight gain, which can dramatically decrease your likelihood of getting adult onset type-2 Diabetes.

Cococut Oil, the Friend to Athletes and Dieters:

If you live in the United States, you have an almost 70 percent chance of being overweight. And, by now, I'm sure you're well aware that obesity affects your quality of life and is linked to many health concerns. One of the best benefits of coconut oil lies in its ability to help stimulate your metabolism. Back in the 1940s, farmers found out about this effect by accident when they tried using inexpensive coconut oil to fatten their livestock.

It didn't work! Instead, coconut oil made the animals lean, active and hungry. However, many animal and human research studies have demonstrated that replacing LCFAs with MCFAs re-

sults in both decreased body weight and reduced fat deposition. In fact, the ability of MCFAs to be easily digested, to help stimulate the metabolism and be turned into energy has entered the sports arena. Several studies have now shown that MCFAs can enhance physical or athletic performance.

Additionally, research has demonstrated that, due to its metabolic effect, coconut oil increases the activity of the thyroid. And you've probably heard that a sluggish thyroid is one reason why some people are unable to lose weight, no matter what they do. Besides weight loss, there are other advantages to boosting your metabolic rate. Your healing process accelerates. Cell regeneration increases to replace old cells, and your immune system functions better overall.

Coconut Oil on Your Skin:

Besides the mounting medical and scientific evidence that coconut oil has powerful positive health benefits when eaten, it has also been used for decades by professional massage therapists to knead away tight stressed muscles. However, you don't have to be a professional massage therapist to gain the skin and tissue support benefits of coconut oil. Just use coconut oil as you would any lotion.

Coconut oil is actually ideal for skin care. It helps protect your skin from the aging effects of free radicals, and can help improve the appearance of skin with its anti-aging benefits. In fact, physiologist and biochemist Ray Peat, Ph.D. considers coconut oil an antioxidant, due to its stability and resistance to oxidation and free radical formation. Plus, he believes it reduces our need for the antioxidant protection of vitamin E.

Like Dr. Peat, many experts believe coconut oil may help restore more youthful-looking skin. When coconut oil is absorbed into your skin and connective tissues, it helps to reduce the appearance of fine lines and wrinkles by helping to keep your connective tissues strong and supple, and aids in exfoliating the outer layer of dead skin cells, making your skin smoother.

Coconut Oil and Your Heart:

Heart disease is the number one cause of death in the U.S. And heart disease is often a silent killer. The first sign of cardiovascular disease is commonly a heart attack, and sadly, over one third of heart attacks are fatal. And despite the propaganda, the truth is this: it is UN SATURATED fats that are primarily involved in heart disease, not the naturally occurring saturated fats, as you have been led to believe. Plus, the polyunsaturated fats in vegetable and seed oils encourage the formation of blood clots by increasing platelet stickiness. Coconut oil helps to promote normal platelet function.

Coconut Oil in Your Kitchen:

I only use two oils in my food preparation. The first, extra-virgin olive oil, is a better monounsaturated fat that works great as a salad dressing. However, it should not be used for cooking. Due to its chemical structure, heat makes it susceptible to oxidative damage. And polyunsaturated fats, which include common vegetable oils such as corn, soy, safflower, sunflower and canola, are absolutely the worst oils to use in cooking. These omega-6 oils are highly susceptible to heat damage because of their double bonds. Why?

Reason 1: Most people believe that frying creates trans-fat. That is not the major problem, in my opinion. Although some are created, they are relatively minor.

There are FAR more toxic chemicals produced by frying omega-6 oils than trans-fat. Frying destroys the antioxidants in oil and as a result oxidizes the oil. This causes cross-linking, cyclization, double-bond shifts, fragmentation and polymerization of oils that cause far more damage than trans-fat.

Reason 2: Most of the vegetable oils are GMO. This would include over 90 percent of the soy, corn and canola oils.

Reason 3: Vegetable oils contribute to the overabundance of damaged omega-6 fats in your diet, which creates an imbalance in the ratio of omega-6 to omega-3. Excessive consumption of damaged omega-6 fats contributes to many health concerns. They are all highly processed and consumed in amounts that are about 100 times more

than our ancestors did a century ago. This causes them to distort the sensitive omega-6/omega-3 ratio which controls many delicate biochemical pathways which results in accelerating many chronic degenerative diseases.

There is only one oil that is stable enough to resist mild heat-induced damage, while it also helps you promote heart health and even supports weight loss and thyroid function — coconut oil. So, whenever you need an oil to cook with, use coconut oil instead of butter, olive oil, vegetable oil, margarine, or any other type of oil called for in recipes.

Coconut Oil Safety:

The medium-chain fats in coconut oil are considered so nutritious that they are used in baby formulas, in hospitals to feed the critically ill, those on tube feeding, and those with digestive problems. Coconut oil has even been used successfully by doctors in treating aluminum poisoning.

Coconut oil is exceptionally helpful for pregnant women, nursing moms, the elderly, those concerned about digestive health, athletes (even weekend warriors), and those of you who just want to enhance your overall health.

(Courtesy :Plant Horti Tech Magazine - Feb Mar 2013)

"HOW IS THAT"

Omega-3 fatty acids and oxidative stress

Michael Logli

FOR many years, long-chain omega-3 (n-3) fatty acids have been touted for their health benefits. Eicosapentaenoic acid (ERA; 20:5n-3) and docosahexaenoic acid (DMA; 22:6n-3) have been found to lower the risk of cardiovascular disease and improve mental health, among other positive health effects. But could omega-3 fatty acid supplementation—when taken as part of a diet already high in omega-6 fats—actually cause oxidative stress, particularly in the elderly?

Findings from a study in mice that appeared in the British Journal of Nutrition (doi:10.1017/S0007114512005326, 2013) suggest just that conclusion. Researchers led by San-joy Ghosh and Deanna Gibson at the University of British Columbia-Okanagan campus (UBC; Kelowna, Canada) fed three groups of two-year-old mice differing amounts of omega-6 fatty acids: a "normal" diet with fat at 9% daily energy, a high-fat diet with fat at 40% daily energy, and a high-fat diet (also 40% daily energy) that included ERA + DHA.

Ghosh, in a UBC news release, said: "Our hypothesis is that levels of omega-6 are so high in our bodies that any more unsaturated fatty acid—even omega-3, despite its health benefits—will actually contribute to the negative effects omega-6 PUFA [polyunsaturated fatty acids] have on the heart and gut."

In their study, aged mice on a diet high in n-6 PUFA experienced bacterial overgrowth, weight gain, and changes in the gut microbiota. Based on results from the high-fat supplemented with EPA + DHA diet, the addition of n-3 fatty acids apparently countered these changes, reducing weight gain and inflammation. However, the combined n-3 and n-6 diet also led to the creation of a product of lipid peroxidation-4-hydroxynonenal-in the intestines, potentially signifying oxidative stress, which can damage a cell's ability to recover and communicate with other cells.

The Global Organization for EPA and DHA Omega-3 (GOED), a trade group based in Salt Lake City, Utah, USA, took issue with the study results. GOED Executive Director Adam Ismail and Vice President of Regulatory and Scientific Affairs Harry Rice responded to press reports of the study, critiquing its methods and conclusions. Bruce Holub, professor emeritus of the University of Guelph in Ontario, Canada, provided additional comments. Emailed correspondence

among Inform, the GOED team, and Ghosh and his team delineated the following points of contention.

POINT

- It is not clear what role oxidative stress in the small intestine plays in the pathogenesis of small intestinal diseases in old mice, not to mention humans. Numerous human trials have supported the cardiovascular benefits of omega-3 fatty acids in fish oil, and the American Heart Association advises supplementary n-3 fatty acids daily for those with coronary heart disease. According to Holub, the fish oil, while yielding more oxidation, actually reduced the infiltration by inflammatory cells in the intestines of these mice when they were fed maize [corn] oil (high in n-6 fatty acids).
- Within the last two years, both the European Food Safety Authority (EFSA; http://tinyurl.com/EFSA-UL) and the Norwegian Scientific Committee for Food Safety (VKM; http://tinyurl.com/VKM-n-3) published safety evaluations of n-3 long-chain PUFA and reported no evidence that they induce changes in lipid peroxidation [that] might raise a concern with respect to risk for any disease.
- According to Holub, quality fish oil supplements with omega-3 fatty acids are in encapsulated form to protect the omega-3 from oxidation. They are not administered as liquid, unprotected fish oil added to a dry diet, as was the case in the study in mice.
- Methods used to assess lipid peroxidation in tissue samples are indirect, and the evidence that the methods actually reflect lipid peroxidation in vivo is limited. Due to the lack of validation of lipid oxidation or oxidative stress end points as biomarkers for disease or health-compromised states, or risk thereof, it is not possible to interpret the present results in old mice to determine any potential hazard tp.. health in humans from ingestion of ERA +DHA.

COUNTERPOINT

- Although the influence of oxidative stress to small intestinal problems is speculative at this moment, it is important to note that increased oxidative stress in human intestines alters the intestinal gene expression profile, which can have long-term effects in humans [1]. With regard to fish oil decreasing inflammation, this was indeed true and would be potentially beneficial for anyone suffering from chronic inflammatory conditions.

However, we question whether the entire population, including susceptible populations such as infants and the elderly, should be consuming unregulated amounts of omega-3 fatty acids, considering another recent study of ours published in PLOS ONE, Fish oil attenuates omega-6 PUFA-induced dysbiosis and infectious colitis but impairs IPS [lipopolysac-charide] dephosphorylation activity causing sepsis (http://dx.plos.org/10.1371/journal. pone.0055468), where we found that fish oil supplementation led to sepsis and increased mortality in mice due to impaired inflammatory responses when faced with an intestinal bacterial pathogen. Safety documents from the EFSA and the VKM reports agree that no tolerable upper limit could be established for n-3 PUFA intake due to lack of data. We would like to emphasize that the lack of information does not equate to safety.

- In studies presented in the VKM (page 36) and EFSA (page 22) reports, vitamin E was incorporated along with fish oil to diminish oxidative stress and establish safety. Thus, it seems to be well known that oxidative modification of fish oil can be actually harmful, but yet, in 2012, GOED has deemed the practice of adding antioxidants to fish oil supplements as optional (page 21, last paragraph, EFSA document).

Both the VKM and EFSA documents conclude safety of fish oil pills based primarily on the presence of two oxidative markers, F2 iso-prostanes and low-density lipoprotein (LDL) oxidation, in human n-3 PUFA supplementation studies. But we find determining plasma or urinary F2 isoprostanes as a marker for lipid peroxidation in n-3 PUFA supplementation to be inadequate. F2 isoprostanes are produced specifically from arachidonic acid (ARA; 20:4n-6) and not n-3 PUFA. Because EPA/DHA replace ARA in membranes, it is expected that F2 isoprostanes will not rise or be decreased following n-3 PUFA supplementation. Peroxidation of a-linolenic acid (18:3n-3), ERA, and DHA produces Fl, F3, and F4 isoprostanes [2,3], which were never measured in any of these trials on which the safety assump-

TABLE 1. Reported adverse events related to EPA and DHA as drugs, from the WHO Adverse Drug Events Database (accessed April 1, 2010)°

Adverse events	Frequency
Nausea	23
Blood triglyceride increase	21
Eructation	20
Abdominal distension	17
Rash	17
Chest pain	16
Pruritus	15
Diarrhea	13
Dizziness	13
Blood glucose increase	12
Constipation	12
Abdominal discomfort	10
Flatulence	10
LDL-cholesterol increase	10
SUM	209

"Adapted from Froyland et al., Evaluation of negative and positive health effects of n-3 fatty acids as constituents of food supplements and fortified foods, Report by the Norwegian Scientific Committee for Food Safety (VKM), published June 28, 2011; http:// tinyurl.com/VKM-n-3, accessed February 15, 2013.

tions are based. Although the exact roles of these novel isoprostanes are yet unclear, a positive correlation between F4 and Fl isoprostane levels has been suggested in patients with Alzheimer's disease and in immune modulation [4-6]. In fact, one of the earlier groups who reported a lack of F2 isoprostanes with fish oil supplementation (Barden 2004, EFSA) later reported an increase in Fl phytoprostanes with flaxseed supplementation in humans [7]. Such evidence contradicts the assumption that lipid peroxidation is not increased after n-3 PUFA supplementation. It could simply be that the wrong biomarkers (i.e., F2 isoprostanes derived from ARA) were used to measure lipid peroxidation in n-3 PUFA supplementation studies in humans. This was even recognized as a potential confounding factor in the VKM publication (page 37, comment section).

n-3 PUFA supplements are (usually) taken by middle-aged to elderly persons with various chronic diseases who-in North America-are presumably on a high omega-6 PUFA diet. The antioxidant levels necessary to combat the oxidative effects of n-3 PUFA are much lower in these patients, leading to a chance for higher lipid peroxidation. If we consider the data presented in the VKM document (see Table 1), we see that a number of adverse effects have been reported with high n-3 fatty acid intakes in humans. Interestingly, a vast majority of these events are associated with gut-related phenomena such as diarrhea, nausea, constipation, abdominal discomfort, and flatulence, which can be related to oxidative stress. Therefore, our findings in the small intestine of mice on a high omega-6 PUFA diet are consistent with results demonstrated in humans.

We additionally wonder: If it has been deemed optional to stabilize n-3 PUFA, how can we guarantee that fish oil we consume has not been altered? Because these pills are covered in a gelatin shell, consumers cannot identify whether rancidity has occurred during the manufacturing process. Moreover, the labels of most fish oil supplements do not indicate peroxide values to ascertain their state of stability or vitamin E incorporations, required to stabilize the n-3 PUFA.

- Eating fish and supplementing with fish oil are two different strategies. Most human studies demonstrate problems with supplementation but not fish intake. Human populations consuming fish do not naturally ingest high levels of omega-6 PUFA. We believe that the oxidizability of fish oil pills and a concomitant presence of high doses of omega-6 PUFA are at play in causing increased lipid peroxidation.

- It is true that direct measurement of free radicals is often not feasible in clinical studies. However, oxidative stress biomarkers have been implicated in various diseases ranging from Alzheimer's disease to diabetes. We are not claiming that intakes of fish are harmful; but instead we want to highlight the risk for fish oil supplementation and unregulated addition of n-3 PUFA in common food items such as bread and yogurt. In light of recent negative data on the efficacy of such supplementation strategies in various chronic diseases [8-10], in people who are again presumably on a high n-6 PUFA diet, we are concerned with the total content of n-3 fatty acids in the current food supply, the quality of fish oil used in supplements without antioxidants, and especially on the effect of the background high n-6 PUFA that may negate beneficial and/or exacerbate the harmful effects of fish oil pills.

(Courtesy : INFORM, April 2013, Vol. 24 (4)

"GREAT"

Yoghurt- The New Superfood!

OF LATE, the yogurt category has been buzzing with activity with a number of innovative launches in the Indian market. Considered both a dessert and a healthy indulgence, the sweet treat has shown increasing demand in the country in the last two years.

Yogurt's makeover has brought about all the difference. It is now seen as a better alternative to icecreams. It is a good substitute for not only the fatty and high-in-calories icecreams but also for ghee-laden sweets. Yogurt is not only low in fat but also helps in digestion. Other factors responsible for the growth of the yogurt market in India are the wide availability of raw material (milk), a growing willingness among consumers to experiment and increasing disposable incomes.

Spoilt for choice, the consumers can now take their pick from plain, flavoured, fruit or frozen yogurts. The packaged yogurts are priced ? 30-50 for a 50 gm pack, while the fresh and frozen ones are sold at 100 per serving. Amul and Mother Dairy have their own brands. Karnataka Cooperative Milk Producers Federation, Parag Milk & Milk Products and Himalya International have all launched their variations of yogurt over the last couple of years. Fruited spoonable yogurt from Tirumala Milk Products, Buttermilk from The Nilgiri Dairy Farm and Paras Lite from VRS Foods were amongst notable launches from regional players in 2010 and 2011.

"As the fastest-growing category within dairy products in India, yogurt and sour milk drinks are expected to account for a 10 per cent share of total dairy sales by 2016 from 6 per cent in 2011," says Euromonitor International in a 2012 report.

(Courtesy : Indian Dairyman, March 2013)

"AMAZING"

Nanoparticles found in soybean plants

TWO of the most widely used nanoparticles (NP) accumulate in soybeans in ways previously shown to have the potential to adversely affect the crop yields and nutritional quality, a new study has found. It appears in the journal ACS Nano (doi:10.1021/nn305196q, 2013).

Jorge L. Gardea-Torresdey and colleagues at the University of Texas at El Paso (USA) cite rapid increases in commercial and industrial uses of NP, the building blocks of a nanotechnology industry projected to put SI trillion worth of products on the market by 2015. Zinc oxide and cerium dioxide are among today's most widely used NP. Both are used in cosmetics, lotions, sunscreens, and other products. They eventually go down the drain, through municipal sewage treatment plants, and wind up in the sewage sludge that some farmers apply to crops as fertilizer. Gardea-Torresdeys team previously showed that soybean plants grown in hydroponic solutions accumulated zinc and cerium dioxide in ways that alter plant growth and could have health implications.

The question remained, however, as to whether such accumulation would occur in the real-world conditions in which farmers grow soybeans in soil, rather than nutrient solution. Other important questions included the relationship of soybean plants and NP, the determination of their entrance into the food chain, their biotransformation, toxicity, and the possible persistence of these products into the next plant generation. The researchers new study, performed at two synchrotron facilities—the SLAC National Accelerator Laboratory in California and the European Synchrotron Radiation Facility in Grenoble, France, addressed those questions. (A synchrotron is a cyclotron in which the magnetic field strength increases with the energy of the particles to keep their orbital radius constant.).

"To our knowledge, this is the first report on the presence of cerium dioxide and zinc compounds in the reproductive/edible portions of the soybean plant grown in farm soil with cerium dioxide and zinc oxide nanoparticles. In addition, our results

have shown that cerium dioxide NP in soil can be taken up by food crops and are not biotransformed in soybeans. This suggests that cerium dioxide NP can reach the food chain and the next soybean plant generation, with potential health implications," the study notes.The authors acknowledge financial support from the National Science foundation and the US Environmental Protective Agency.

(Courtesy : INFORM, April 2013, Vol. 24 (4)

"INDEED"

Chemical industry focuses on sustainability

THE chemical industry is increasingly focusing on sustainability, according to a new survey by Genomatica and ICIS Chemical Business magazine.

According to the survey, 71% of the over 700 participants indicate that they have a sustainability strategy in place or under development. Almost half of producers (44%) said it was "very important" that they are a front-runner in sustainable chemicals and 72% of producers said their customers have expressed interest in sustainable chemicals. Both producers and users are incorporating sustainability in their current practices and renewable materials have become increasingly important.

One of the most important factors for users is minimal impact on product performance or characteristics; similarly, for producers it is minimal impact on downstream products and customers. Most companies reported that they are taking a pragmatic approach and looking for drop-in or near-drop-in biobased alternatives to petroleum products in an attempt to minimize development time and costs associated with reformulation and re-equipping production facilities.

"We've seen a big shift from several years ago, when increasing sustainability was viewed more as a cost than a benefit," said John Baker, global editor of ICIS, and organizer of the survey. "A majority of companies in the chemical industry have now incorporated sustainability into business practices and are looking to it as a way not only to reduce environmental impact but also to lower costs and meet customer requirements. These are all strong drivers toward more sustainable everyday products being made from renewable-based chemicals."

The Genomatica and ICIS survey was completed by over 700 ICIS Chemical Business readers working globally in the petrochemicals, specialty chemicals, and polymers segments of the chemical industry. The respondents were generally senior executives (27% board level and 24% general manager) and worked mainly in the specialty (22%) and commodity/polymers (30%) sectors, with a further 12% in chemical distribution.

Genomatica develops new technologies for manufacturing intermediate and basic chemicals from renewable feedstocks. The company is based in San Diego, California,USA.

(Courtesy : INFORM, April 2013, Vol. 24 (4)

"BEWARE"

Formulation tools and eco labels

THE US Environmental Protection Agency (EPA) and several other organizations have introduced some useful tools for product formulators.

First, EPA developed an online list of more than 500 safer chelating agents, colorants, defoamers, enzymes, fragrances, oxidants, polymers, preservatives, solvents, surfactants and other ingredients for cleaning products. Ingredients are grouped by their funtional class and are rated in decreasing order of environmental safety, marked with either a green circle, a half-green circle, or a yellow triangle. See http://www.epa.gov/dfe/safeingredients for the Safer Chemical Ingredients List.

GreenBlue, a nonprofit organization working toward more sustainable products, provides an online list at http://www.cleangredients.org of about 430 preferred surfactants, solvents, chelating agents and fragrances along with the companies that distribute the chemicals. The group which is based in Charlottesville, Virginia USA, is expanding the categories to include all of those in the EPA list.

Finally, the American Cleaning Institute (ACI; a trade organisation in washington, DC) provides a

list of more than 900 chemicals used by ACI member companies to formulate cleaning products.

Once a "green" product is formulated and ready for production, the issue of certification arises. A number of possibilities exist, including programs administered by the US government. The EPA runs the Design for the Environment (DfE) program. The DfE label is on more than 2,800 products - mostly cleaners - for institutional as well as some consumer applications. "Plans are to extend the DfE label to personal care products," according to *Chemical & Engineering News (C&EN)* magazine.

The US Department of Agriculture administered the BioPreferred program (www.biopreferred.gov), which certifies the percentage (by weight) of biobased content used in products and packaging. Roughly 900 products were certified before lack of funding caused the program to be suspended in 2013.

The EU Ecolabel, which was introduced in 1992, has been placed on more than 17,000 products, of which about 30% are house hold cleaning products, according to C&EN. "The label's administrators strive to harmonize assessment criteria with that used by national labelling programs such as the Nordic Swan and Germany's Blue Angel," the magazine report noted. More information is available at ec.europa.eu/environment/ecolabel.

Green Seal (www.greenseal.org), a nonprofit based in Washington, DC, calls itself the oldest life-cycle-based environmental sustainability label for "products, services and companies". Founded in 1989, the organization certifies products in 11 categories such as paints and coatings, printing and writing papers and institutional products. In January 2013, Green Seal announced the publication of new standards to address the life cycle impacts of laundry care products.

GS-48 covers more than 17 categories of laundry care products including detergents, stain removers, bleaches fabric care products such as fabric softeners and antistatic treatments, as well as antiwrinkle products and starch. "THe standard is designed to make it easier for consumers to identify household laundry care products that meet the highest levels of sustainability available in the market today," said Green Seal in a statement.

GS-51 covers morethan 20 categories of products for conventional laundry and dry cleaning, including detergents, prewash products and spot removers, additives such as alkali boosters; and fabric care products such as antistatic treatments, starches and fabric softeners.

(Courtesy : INFORM, April 2013, Vol. 24 (4)

"USEFUL FOR INDIA?"

What does it take to start a biodiesel industry?

Marguerite Torrey

If you wanted to start a business making biodiesel in a developing nation like Haiti, how would you go about it? What would you need to get it off the ground?

Kathleen Robbins found that—no matter how improbable the connection may seem at first—she needed to add "develop biodiesel" to the list of things to do for a project bringing modern communications technology in the form of cell (mobile) phones to Haiti.

OPPORTUNITIES FOR JATROPHA

The solution to the problem of how to charge these cell phones in a way that Haitians can afford lay in using what is available in Haiti as opposed to what works somewhere else.

One possible solution happened to be growing right on the island. Jatropha curcas (gwo medisyen, or "big medicine," in Haitian Creole) is a shrubby tree that is native to Haiti. Its seeds are known for their high oil content, and efforts are already under way outside of Haiti to use jatropha oil to make biodiesel and aviation fuel. So, why couldn't Haitians use this native plant to make biodiesel that could then be used to fuel genera-

tors to charge the cell phones — and by extension to stimulate the Haitian economy? Furthermore, doing so would encourage the planting of more perennial jatropha trees, which could alleviate two other problems that plague the country: deforestation and erosion (see Sidebar, Facts about Haiti).

Robbins points out that since jatropha is a native plant, it is already adapted to the boom-or-bust rainfall regime of Haiti. It likes a warm climate, and cannot grow where frost occurs.

During the dry season in Haiti, jatropha plants shed their leaves and remain dormant until rain comes. Then, within three months, the plants produce leaves, flowers, and finally seeds. Under these conditions jatropha can produce at least two crops a year. If irrigation is available, it may even be possible to obtain three crops a year, as research in the Dominican Republic, Haiti's neighbor on the island of Hispaniola, has already demonstrated.

Jatropha seeds can contain as much as 35% oil (the University of Illinois Sustainable Technology Center tested one sample having a 49.9% oil content), which in rural Haiti can be used to fuel lamps and stoves. If the oil is transesterified, the resultant biodiesel can also be used to fuel diesel generators and vehicles, and the by-product glycerine can be used to make soap.

It may even be possible to use the jatropha seed cake as animal food if varieties without toxic phorbol esters are commercially developed. The seed cake from which the oil has been removed contains more nitrogen than chicken manure, and its protein content is higher than soybeans. Without phorbol esters, the seeds could be fed to swine, poultry, and fish such as tilapia.

Bees pollinate jatropha flowers, so honey might also be a product that results from jatropha cultivation.

STARTING A BIODIESEL INDUSTRY IN HAITI

Digicel, the main cell phone provider in Haiti, is presently powering each of its 500+ cell towers in the country with petrodiesel generators. The company has committed to buying all the biodiesel that Jatropha Pepinye (Haitian Creole for "jatropha nursery") can produce, so long as it meets standards.

Robbins emphasizes that establishing a jatropha industry in Haiti requires one to accept conditions in the country just as they are. The infrastructure on which developed nations depend is not there—no electricity, few wells for water and no electricity to drive pumps, poor roads, no mechanical harvesters ... the list goes on and on.

Robbins and Rob Fisher (former University of Georgia-Athens professor and landscape architect), who are team members of the US non-profit organization Partner for People and Place (www.peopleandplace.org), have been working with Haitians in the northeastern mountains of the country near Terrier Rouge to develop a jatropha industry since 2007. Partner for People and Place brings together sponsors and specialists, looks for solutions that respect the culture and ecology of Haiti, and uses local people to administer and implement development..

Taking account of the limitations in Haiti requires a change in attitude. Whereas in a developed nation the primary goal of a company is profits, in Haiti job creation is more important, at least in the short term. No Western nation would consider harvesting jatropha by hand, but that is the method of choice for Haiti because (i) there are no mechanical harvesters and (ii) there is a desperate need for jobs. As a start, Partner for People and Place envisions 1,000 growers, each farming 1-2 hectares of jatropha. Seeds are harvested by individuals, passing through the groves every 5-7 days, because the native jatropha varieties ripen unevenly over a period of 6-8 weeks. Calculations indicate that the total production from these 1,000 growers could be 1,000,000 gallons (3,800,000 liters) of biodiesel annually.

Jatropha Pepinye, a farmers' co-op jointly sponsored by Partner for People and Place and Esperance et Vie (www.esper-anceetvie.org), has been growing jatropha seedlings for five years to provide planting stock for co-op members. So far, approximately 50 hectares have been planted. The decision was made early-on to start the business with seeds from local plants, since they are already adapted to a climate having wide swings in annual rainfall. In its initial efforts to collect native seeds, Jatropha Pepinye of-

fered to give the first 100 people to bring in two coffee cans full of jatropha seeds a hand-cranked charger for a Digicel cell phone. From the enthusiastic response, Jatropha Pepinye started its work.

Two members of the University of Illinois Urbana-Cham-paign (UIUC; USA) Sustainable Technology Center, Tim Lindsay and Joseph Pickowitz, identified a diesel-powered Desmet Rosedowns Mini 40 expeller that had been used by UIUC; according to company specifications, it has a nominal capacity of 40 kilograms/hour depending on what kind of seed is being processed. Lindsay and Pickowitz helped set up the expeller at Jatropha Pepinye in 2009, and got it up and running. In the initial work to develop procedures, seeds and any accompanying dirt have been fed straight into the expeller, meaning that the resultant oil is not especially clean.

Thus, there are no immediate plans to sell the oil as such for fuel without further processing. To use the triglyceride oil without treatment could void the warranty of, for example the Caterpillar diesel engines Digicel presently uses to power its cell towers.

PROGRESS

Plants. Jatropha Pepinye already has 50 hectares of jatropha planted in seven plots at Terrier Rouge. About 6 hectares are planted with a non-toxic variety of jatropha, developed by CHIBAS Bioenergy founder Gael Pressoir, a Haitian Ph.D. who initially worked in Mexico on breeding this cultivar.

Seedlings are planted at a rate of 1,650 plants per hectare at a spacing of 2 meters x 3 meters. Planting has been carried out by hand (again, the need to provide jobs), and the work has been arduous. The land on which the trees are being planted has not been cultivated for 30 years, and the predominant plant growing on the land is mesquite trees, which are well known for the reach of their lateral roots and the depth to which their taproots will grow in search of water.

Yields of jatropha seeds from the plantings in Haiti have not yet met expectations. Less than 50 kilometers away, in research plots located in the Dominican Republic, yields have been about 4-5 metric tons (MT) of seed per hectare, whereas with the same fertilizer and a basically similar soil at Terrier Rouge the number is 0.5 MT/ha. One contributing factor to the difference may be that the Dominican Republic trees are flood-irrigated during the dry season, allowing a third harvest each year. Another is that the Haitian plants are less than two years old, whereas the Dominican plants have reached full production maturity.

Products. By-product glycerine from the production of biodiesel is being used to manufacture soap. This is being sold in the cities of Port au Prince and Cap Haitien and to the Royal Caribbean Cruise Ship Line, which docks at the port of Labadee.

Pickowitz and Lindsay have found that more oil can be expelled from jatropha seeds if they are first heated to 100°C. They are presently using a rocket heater (a 95+% efficient stove that uses biomass) to warm the heat transfer fluid for the expeller, but they are developing plans to use a solar heater that would be augmented by a rocket heater. To date, the biodiesel being produced by Jatropha Pepinye is being used on-site to fuel generators.

As anticipated, the efforts to produce jatropha oil are leading to other saleable products that benefit the Haitian people. For example, the Jatropha Pepinye plots are fenced in for purposes of the study. These trees provide shade to the soil, making it cooler and more productive of grass. Sheep have been grazed in some of these plots—sheep will not eat jatropha leaves—and their meat has been sold to the Jordanian troops stationed in Haiti by the United Nation. The Haitians working on the project would have preferred to raise goats in the enclosures, since the national diet favors goat meat, but goats are notorious for their ability to climb over fences and escape. When that problem is solved, plans are to raise goats between the trees, for they too will not eat jatropha. Obviously, much needs to be done to make Jatropha Pepinye a profitable, sustainable business, but those who are involved in the project are making every effort to do the things necessary to make it succeed—taking account of conditions as they are, working with people “where they are,” and looking to innovate wherever they can and with whatever they can.

(Courtesy : INFORM, April 2013, Vol. 24 (4)

- Rice bran oil has an ideally balanced fatty acid

Rice bran oil: nature's healthful oil

A.G. Gopala Krishna

RICE is grown in as many as 60 countries, but only 12 produce major amounts. In 2009, total world production of rice was 455.7 million metric tons (MMT).

profile, is rich in natural antioxidants and nutraceuticals, and can reduce low density lipoprotein (LDL) and serum cholesterol.
- Global production currently realizes only 19% of rice bran oil's potential.
- Better extraction and by-product recovery are needed to achieve its potential.

Rice bran is a by-product of rice milling, and is produced during the polishing of brown rice to prepare white rice. The bran contains 15-25% oil depending on the cultivar, agricultural practices, and the extent of polishing. The potential for production of rice bran and rice bran oil (RBO) in major rice-growing countries is presented in Table 1. Although rice bran has reached its full potential, only 19% of RBO's potential is realized—even though paddy (rough rice) is produced in as many as 15 major rice-growing countries in the world.

While China realizes only 4.9% of its potential for RBO (90,000 metric tons, or MT), India produces 65.7% of its potential (820,000 MT). Indonesia does not produce any RBO at all. Tables 1 and 2 (next page) show the production of the oil and its uses in food and for other purposes in various countries.

RBO is produced by solvent extraction. Among other properties, RBO:

- has an ideally balanced fatty acid profile and is rich in natural antioxidants and nutraceuticals.
- can reduce low density lipoprotein (LDL) and serum cholesterol.
- contains antioxidants such as oryzanol, tocopherols and tocotrienols, phytosterols, and squalene. In India, RBO is considered a

Fig. 1. Photograph illustrating neat crude oil extraction from rice bran at 5°C. (1) Hexane extract (normal extraction); (2) hexane extract at 5°C; (3) hexane extract (normal extraction of residual bran) (from 5°C extracted spent rice bran); (4) acetone extract (normal extraction); (5) acetone extract at 5°C; (6) acetone extract (normal extraction of residual bran) (from spent rice bran). Source: Gopala Krishna et al., 2011

nutraceutical (food as medicine) oil that is suitable for all cooking needs.

CHEMICAL COMPOSITION OF RBO

According to the literature, crude RBO comprises 95% saponifiable and 4.2% nonsaponifiable lipids. The saponifiable components include triacylglycerols (71%), diacylglycerols (3%), monoacylglycerols (5%), phospholipids (4%), and glycolipids (6%); on saponification these yield alkali salts of fatty acids (FA) and glycerol. Waxes (3%) and oryzanol (1.8%) are also present in the oil. These saponify with difficulty and may be found in the unsaponifiable matter (as such or in the saponified forms, viz, long-chain alcohols from waxes, phytosterols from oryzanol). If proper care is not exercised, this may eventually increase the level of unsaponifiable matter in the oil.

Like groundnut oil, sesame oil, and corn oil RBO contains a high proportion of monounsaturated (40-50%) and diunsaturated FA (29-42%). It has comparatively higher amounts of different classes of unsaponifiable matter than other edible oils.

The triacylglycerol composition of RBO is similar to other edible oils, although some differences in the content of triolein (OOO) and palmitodilinolein (PLL/LPL) have been observed (a detailed table can be found in the digital edition of inform. Log in to read the April 2013 issue at aocs.org/login).

SPECIFICATION FOR RBO

Japan and India have formulated specifications for RBO, and a Codex Alimentarius Commission standard for the oil also exists (detailed tablescan be found in the digitaleditionof *inform*. Log in to read the January 2013 issue at aocs.org/login). The limit for unsaponifiable matter for different vegetable oils under Indian and Codex standards indicates a higher unsaponifiable matter content for RBO under both the Indian (3.5%, 4.5%), and the Codex (6.5%) standards specification. Processing of the oil (chemical or physical refining) contributes to oryzanol retention, acidity variation, unsaponifiable matter content changes, color variation, and haziness in the refined oil.

Realizing these problems, the Prevention of Food Adulteration Act, 1954 (PFA), India, [currently known as the Food Safety and Standards Authority of India (FSSAI)] rules have been amended from time to time for the specification of RBO by raising the limit of unsaponifiable matter of 3.5% to 4.5% with 1 % oryzanol in the oil. For chemically refined oils, the earlier limit of 3.5% unsaponifiable matter level still holds, and for physically refined RBO this level is increased to a maximum of 4.5% with 1% oryzanol in the oil (detailed table in the digital edi-

TABLE 1. Production of rice, the potential for rice bran production, and the potential for and actual production of rice bran oil in different major rice-growing countries during 2009[0]

		Production of:		
			Rice bran oil	
Country	Rice (MMT), actual	Rice bran (MMT), potential*	Potential (MMT)	Actual (MMT)
China	131.186	9.18	1.84	0.090
India	89.178	6.24	1.25	0.820
Indonesia	42.954	3.01	0.60	-
Bangladesh	31.832	2.23	0.45	0.002
Vietnam	25.943	1.82	0.36	0.011
Myanmar	21.799	1.53	0.31	0.101
Thailand	21.421	1.50	0.30	0.045
Philippines	10.850	0.76	0.15	-
World	455.707	31.90	6.38	1.20

"Source: www.fao.org/crop/statistics/en. Accessed 10 September 2012.
""Calculated as 10% of brown rice; brown rice is equivalent to 70% of rough rice or paddy.
'Calculated as 20% of rice bran. Abbreviation: MMT, million metric tons.

tion of the April 2013 issue of inform at aocs.org/login). Dark color in physically refined oil is still a problem in marketing the oil.

EXTRACTION, PROCESSING, AND REFINING

RBO was first extracted with food-grade hexane in India starting in the 1960s. There is considerable lipase activity in rice bran, though, and with storage the free fatty acid (FFA) levels in the extracted oil increase. Therefore, oil extraction should be done on fresh bran or on the bran obtained soon after milling, to prevent the lipase action on bran oil and to ensure the quality of the extracted oil.

Refining of RBO is accomplished by two methods, one by chemical reaction with alkali, known as alkali refining/chemical refining; the other by steam stripping-vacuum distillation of FFA, known as physical refining. In addition to removing FFA, both processes involve the steps of degumming, dewaxing, and bleaching. Chemical refining involves the additional step of deodorization. Chemical refining. Problems encountered during refining of RBO are (i) excessive refining loss, (ii) color fixation, (iii) loss of oryzanol, and (iv) loss of bioactives. Refining losses were addressed during the 1990s, but the color fixation problem is still not completely eliminated. The loss of oryzanol and bioactives is generally accepted, as keeping to specification makes these losses unavoidable.

Physical refining. During the mid-1990s, the same technology used to refine palm oil was applied to RBO. This was not very successful owing to a lack of pretreatment technologies that can lower the phosphorus content of crude RBO to below 5 ppm, a prerequisite for physical refining. Since then, several pretreatment technologies have been introduced. The National Institute of Inter-disciplinary Science & Technology (NIIST; Thiruvananthapuram, India — earlier known as Regional Research Laboratory) developed a pretreatment technology known as simultaneous degumming and dewaxing, in which CaCl, is used to remove phosphorus-containing lipids known as phosphatides (or gums). Likewise, the Indian Institute of Chemical Technology (IICT, Hyderabad) developed an enzymatic degumming process to remove phosphorus to desired levels. These pretreatment technologies have revolutionized RBO processing in India. Several new RBO refining plants incorporating these new technologies have been built, the majority of which are based on IICT technology.

Until recently, the issues of higher unsaponifiable matter (>3.5%), increased FFA values (>0.25%), and haziness/cloud point found in physically refined RBO posed problems in marketing of the oil. No such problems were encountered in the marketing of chemically refined RBO, which passed all the tests (values of unsaponifiable matter <3.5% and FFA content <0.25% could be achieved) prescribed by the PFA.

The apparent FFA content of chemically refined RBO is within the permitted limits of 0.25%, but FFA amounts in physically refined RBO are higher. Gopala Krishna et al. (2006) investigated the composition of physically refined RBO and its higher FFA value and developed the following formula for calculating real FFA content of vegetable oils containing oryzanol:

Real FFA content (% as oleic) = observed FFA content - (% oryzanol content x 0.425)

when phenolphthalein is used as the indicator. This equation clearly indicates that physically refined RBO containing oryzanol show an acidity due to oryzanol, not to FFA. Recently, the PFA amended the rules regarding unsaponifiable matter levels in physically refined RBO, so that physically refined RBO, which contains five to six times the oryzanol found in chemically refined RBO, can be sold. Table 2 shows (i) a typical apparent FFA content analysis of chemically and physically refined RBO produced in India and (ii) the corrected value (the real FFA due to oleic acid). This is normal FFA content (real FFA) and, due to the presence of oryzanol, the physically refined RBO which contains oryzanol shows an apparent acidity which should not be mistaken for FFA content due to the presence of oleic acid termed as the real FFA. The real FFA content may be calculated and used for evaluating the physical refined RBO for specification purposes.

FRYING AND BLENDING

Processed RBO that have been refined chemically or physically were studied for frying performance compared to sunflower oil. Although there

are claims for low absorption of the RBO during frying, laboratory experiments in the author's laboratory (Gopala Krishna et al, 2005; Rekha et al, 2011) showed that the RBO behaves like other oils, and there is a marginal reduction of oil absorption during frying compared to others such as groundnut, coconut, palm, and sunflower oils and ghee (milk fat).

The Government of India has permitted the blending of oils to extend the oil supply in the country. RBO (20 parts) was blended with either groundnut (80 parts), or mustard (80 parts), or sunflower oils (80 parts) and blends of RBO with the mentioned oils (two-oil blend) in the ratio of 20:80 were prepared. A combination of four vegetable oils (to provide vegetable blends) containing RBO (20 parts), sesame oil (20 parts), and red palm olein (20 parts) were blended with either groundnut (40 parts) or sunflower (40 parts) or mustard oils (40 parts) wt/wt to provide nutritional benefits of the natural antioxidants [oryzanol and tocotrienols in RBO, lignans (sesamin and sesamolin) in sesame oil, and carotene and tocotrienols in red palm olein present in them (Shiela et al., 2004). From the work carried out at our laboratory, the oil extracted from parboiled bran showed a drastic reduction in the tocopherol/tocotrienol levels (Khatoon and Gopala Krishna, 2004). Chemically refined RBO is a poor source of oryzanol (Gopala Krishna et al., 2006) while physically refined RBO has good amounts of oryzanol and tocopherols + tocotrienols to provide health benefits (Raja Rajan and Gopala Krishna, 2009).

PREPARATION FOR NUTRACEUTICAL PURPOSES

RBO produced by either physical or chemical refining processes contains health-improving constituents in amounts lower than those present in crude oil. Studies carried out at our laboratory resulted in the preparation of a nutritionally superior RBO with a light color, a very low wax content, and proven health benefits in experimental animals (Fig. 1.) The oil was found to be equivalent to physically refined RBO in its nutraceutical content, but with low color units. Further developments may yield an even lighter RBO.

SUPERCRITICAL CARBON DIOXIDE (SC-C02) AND ENZYMATIC PROCESSES

SC-CO, extraction of rice bran has been reported from the Council of Scientific and Industrial Research (CSIR)-NIIST (Thiruvananthapuram).

TABLE 2 - Acidity of oryzanol in rice bran oil (RBO) and its contribution to the free fatty acid (FFA) content of the oil

RBO samples used in the study	Observed FFA (% as oleic acid) (phenolphthalein indicator)	Oryzanol (%)	Real FFA (% as oleic) = FFA - (% oryzanol x 0.425)3
Chemically refined RBO			
1	0.14	0.1436	0.08
2	0.16	0.1841	0.08
Physically refined RBO			
1	0.40	1.1057	-0.07
2	0.47	1.0875	0.01
3.	0.48	1.0664	0.03
4	0.46	1.2072	-0.05
5.	0.49	1.3194	-0.07
6	0.43	0.5567	0.19
7	0.35	0.6024	0.09
8	0.43	0.5996	0.16
9	0.44	0.7260	0.13
10	0.47	0.7529	0.15
11	0.29	0.6070	0.03
12	0.55	1.3902	0.12

"Factor for phenolphthalein indicator. Source: Gopala Krishna et al., 2006.

The phytochemical contents of RBO under optimal conditions were as follows: tocols, 1,500-1,800 ppm; sterols, 15,350-19,120 ppm; and oryzanol, 5,800-11,110 ppm (Balachandran et al., 2008).

Enzymatic (alcalase) treatment of rice bran produced an oil yield of 79% and a protein yield of 68% compared with the amounts originally found in the bran (Hanmoungjai and Niranjan, 2001). RBO processed in this manner had good quality attributes but poor shelf life. Enzymatic processing is an emerging technology and may have commercial value in times to come.

HYPOCHOLESTEROLEMIC EFFECT

Several studies have shown that the effect of RBO on serum cholesterol concentrations is due to the unsaponifiable matter comprising oryzanol, campesterol, and 3-sitosterols. Consequently, it could become an important functional food with cardiovascular health benefits. RBO, which is rich in tocopherols and tocotrienols, may improve oxidative stability. Tocotrienols inhibit HMG [hydroxylmethylglutaric acid]-CoA reductase, resulting in lower total cholesterol level. The hypolipidemic effect of RBO has also been established in human subjects (Sugano and Tsuji. 1997; Most et al, 2005). Thus, RBO could be a suitable edible oil for patients with hyperlipidemia.

BY-PRODUCTS

More than 75% of the rice bran used for oil extraction is converted into defatted rice bran, which contains fiber, protein, residual anti-oxidant components, and minerals, and has a production potential of 24.0 MMT (75% of 31.9 MMT; see Table 1. Phytochemical extracts have been prepared from defatted bran, but the technology for using them in processed foods still needs to be developed. The present availability in India is about 3 MMT, all of which is being used as feed. To be suitable for human food applications, unhealthful factors such as phytic acid, trypsin inhibitor, and a high silica content would have to be removed. Work on preparation of such a type of full-fat rice bran for use as food supplement is in the concluding stages by the author's research team at the CSIR-Central Food Technological Research Institute (CFTRI), Mysore.

As more industries process edible-grade oil from rice bran, large amounts of waste products such as gum sludge, wax sludge, fatty acid distillate/soapstock, and deodorizer distillate (DOD) are accumulating. Pure products (lecithin, wax, squalene, tocot-rienols, phytosterols, and oryzanol) fetch very high prices compared to the prices of sludges/DOD and should be recovered for their health benefits. In India, technologies for value-added products from waste sludges of the industry are available from three CSIR institutions: CSIR-CFTRI, Mysore; CSIR-Indian Institute of Chemical Technology, Hyderabad;CSIR-NIIST, Thiruvananthapuram.

At present, only about 19% of the RBO that could be produced worldwide is being tapped, the top producer, India, produces only about half of what it could. India could produce another 700,000 MT more, but only if the bran produced in remote areas of India could be stabilized against lipase activity for prolonged storage, so that the resulting oil would have a low FFA content. Similarly, other major rice-growing countries such as China, Indonesia, Bangladesh, Vietnam, Myanmar, Thailand, and Philippines have a great potential for production of RBO. Developments that enable RBO to be used in functional foods are needed as a future strategy to make the benefits of this healthful oil available to more people around the globe.

A complete reference list and additional tables can be found in the digital edition of the April 2013 issue of inform. To view them, log in at acocs.org/login, and click the supplements tab to the right of the page.

A.G. Gopala Krishna has been with the CSIR-Central Food Technological Research Institute in Mysore, India, for the last 36 years. He is currently a chief scientist, specializing in lipid chemistry and technology, convenience foods, nutraceuticals, and health foods. He can be contacted at aggk_55@yahoo.com.

(Courtesy : INFORM, April 2013, Vol. 24 (4)

"HAPPY FINDINGS"

New biodiesel production easier and more economical

Michael Logli

BIODIESEL fuels are not new. And the process for mass production, which is quite old, creates unwanted waste products that require additional effort and finances to remove and chemicals that are dangerous to handle. Now a sustainable and affordable process, once out of reach, has come forward, and several companies will use this process to develop and distribute their own biodiesel fuels.

- ***Conventional biofuels production creates unwanted waste products and involves chemicals that can be dangerous to handle.***
- ***Enzymatic processes generate fewer waste products and allow lower grade raw materials to be used.***
- ***Several companies are already building plants that will make these processes a reality.***

Biodiesel can be made in several ways. The most common method involves the use of animal fats or vegetable oils. These contain triglycerides, which react with alcohols to make fatty acid esters. Methanol is usually used, as it is the cheapest available alcohol. A catalyst is then used to speed up the reaction, converting the triglycerides into biodiesel and glycerin. But the catalyst must be removed at the end of the process; if left in the biodiesel, the base catalyst can damage the vehicle engine, and handling the acid catalyst can be dangerous.

The company Novozymes (Franklinton, North Carolina, USA), after more than 10 years of research, has developed an enzymatic process, the BioFAME process, that reduces the waste products from the biodiesel reaction and enables the use of lower-grade raw materials high in free fatty acids. The new enzyme, the Novozymes Callera Trans, replaces the sodium methoxide base catalyst, producing a higher-quality glycerin free of salts.

Piedmont Biofuels also developed an fatty acid esterification process (FAeSTER) alongside Novozymes, which allows producers to use lower grade oils, such as used cooking grease, and recycle the enzyme catalysts. This process eliminates the need for sulfuric acid-catalyzed esterification of free fatty acids. The enzymatic process is overall far more cost effective and safer than the acid chemical process, said Rachel Burton, co-founder and research director of Piedmont.

"The old process is quite good if you have pure materials," said Hans Christian Holm, head of global industry sales for Novozymes. "The new process will not have such drawbacks. We have shown how the BioFAME process can handle more or less all oils and fats while being cost competitive to the old sodium methoxide catalyzed process."

The Novozymes process allows for the safe, environmentally friendly, and, most important for Holm, cost-competitive option. Other processes attempting to be more sustainable are not cost-effective enough to become popular options.

"At the end of the day, you are not going to sell anything by the environmental aspect. You have to compete on cost," Holm said.

Piedmont has begun to build a factory employing the FAeSTER process in Pittsboro, North Carolina, that will be able to produce up to one million gallons of biodiesel each year. Using yellow and brown grease, Burton is confident in being able to fulfill the needs of Piedmont's more than 500 customers in the local North Carolina area.

"We have a wide range of feed stocks. We have the flexibility," Burton said. "We ship it directly to our customers. It is a much different model."

Piedmont is also unique in that it is a B-Certified corporation. The B-Lab certification is proof of adhering to strict standards of social and environmental performance and transparency, and it is the only business in North Carolina with this designation. Piedmont has also been recognized with the BQ9000 certification because of the high quality of its biodiesel. This gives them the ability to work with government agents and distribute biofuels to those markets. It also supports Piedmont's commitment to sustainability in products and production.

Viesel Fuel is also building its own plant implementing the enzymatic process in Stuart, Florida, said process engineer Graham Towerton. The facility should be completed in the first quarter of 2013 and will make 5—10 million gallons a year, distributing mainly to the transportation industry. Viesel will mostly use vegetable oil in its process, but it has looked into using the abundant supply offish oil as another option. Working in Florida also has the advantage of warm weather. Biodiesel can crystallize in colder weather due to its low boiling point, gumming up engines and reducing performance and durability.

"The Florida climate gave us advantages," Towerton said. "We can sell fuel here that might not work in northern climates. We expect to be able to sell all year round."

Viesel's biggest concern is transportation costs. While Viesel must transport its fuel by truck to its customers, it must also clean its biodiesel tankers. The closest facility to clean the trucks is over 200 miles away. This is why Viesel plans to build its own facility for this purpose, as well as encourage other companies to use the facilities, Towerton said. Viesel also plans to use the biodiesel process as a base for self-lubricating oils. These oils, such as engine oil and hydraulic oil, can be used in a variety of applications.

"There are no process limitations. We already got a number of customers looking to purchase all of our volume," Tower-ton said.

Both Burton and Towerton plan to market the technology to other interested companies. Towerton will likely bring the process to Texas, while Burton has already given presentations on the process in other states.

"The technology we drew up ... we intend to market to other folks in the industry," Towerton said.

"We believe that this technology will shift the industry to cleaner, more efficient means of production for today's advanced diesel engines," Burton said.

The process, however, is not a panacea for the industry. The challenge now is proving the process will be efficient and fulfill market needs on an industrial scale, said Michael Haas, research biochemist at the US Department of Agriculture. The US government, according to Haas, wants to increase the production of biodiesel from the current one billion gallons produced annually to four billion annually in the next five to seven years. To meet that goal, sustainable biodiesel processes must meet the quotas while remaining efficient and environmentally friendly.

Haas fears working with used cooking oils and animal fats will not be enough to satisfy this. There is currently no perfect oil solution either. Vegetable oils and animal fats may be recycled in multiple biodiesel production processes, but recovering the enzyme from a viscous solution through ultrafiltration becomes difficult. Haas believes oil isolated from algae may be a solution in the future. Algae are easier to cultivate and grow compared to soybeans and produce more oil per acre, and their by-products can be converted into biobutanol, bioethanol and other forms of fuel and consumer-grade oil. The potential for growth and advancement is there, just as it was before. The key now is finding the solutions.

"Engineers know the engineering solutions that biochemists cannot solve," Haas said. "If we are going to increase production fourfold, we need to pursue more fats."

(Courtesy : INFORM, March 2013, Vol. 24 (3)

At Palsgaard we therefore decided to see if it were possible to successfully create a low-fat

"TRY OUT"

How to successfully manufacture
a low-fat spread with only 10% fat

Anders Molbak Jensen

INSTABILITY problems and insecure production parameters can make low-fat spreads challenging to produce. In this article, a product and applications manager from the Danish emulsifier specialist Palsgaard A/S describes how his company:

- ***created an emulsifier system for 10% low-fat spreads***
- ***stabilized the fat and water phases***
- ***set up optimal processing and storage conditions***

Reducing the fat content in a margarine spread beyond the traditional 40% can help meet the growing consumer demand for spreads with less saturated fat and total fat, while decreasing the total cost of raw materials . Yet, historically, margarine, dairy, and other spread producers have been cautious about developing and producing low-fat spreads due to the problems these products can present during production, such as an increased risk of unstable products and insecure production parameters.

spread with only 10% fat content with the following boundaries:

- 10% fat content
- no hydrogenated oils or fats
- no hydrogenated emulsifiers
- offers the potential to use sustainable palm oil (RSPO certified)
- no allergenic ingredients
- non GMO
- no trans fatty acids (< 1 %)

To do so, we created the recipe shown in Table 1, which we subsequently tested in our large-scale margarine pilot plant to specify the right processing parameters. The following explains how we achieved the desired results.

The emulsion type used in the recipe was water in oil (W/O) as used in other margarine and spread products. In theory, it is difficult to reduce the fat content of a spread to lower than 25.4% if the water droplets have exactly the same size in a W/O emulsion, as shown in Figure 1a. In practice, however, by utilizing the combined benefits of the two emulsifier types unsaturated mono- diglyceride (MAG) and polyglycerol polyriceneolate (PGPR) it is possible to create water droplets with different sizes. By doing so, the emulsion can be much more closely packed as shown in Figure 1b. This is the reason why it is possible to produce 20% - 15% or even 10% low-fat spreads.

INSTABILITY PROBLEMS IN LOW-FAT SPREADS

When creating a low fat spread, it is important that the fat composition contains more liquid oil than similar high-fat products, due to the fact that the oil phase needs to cover a higher amount of water droplets. If the fat phase contains too much solid fat, the smoothness of the product will disappear. Equally, if the emulsion contains too much palm stearin it will tend to become more unstable in 10% low-fat spreads compared to palm oil. The reason is probably more brittleness during and after production.

Figures 2a and 2b demonstrate the build-up of the primary crystal bond structure and how the fat, if it is brittle more or less, squeezes out the water with mechanical treatment. The emulsifiers that are located at the surface between the water- and oil phase cannot avoid this phenomena. Only a combination of the right process parameters and fat composition can solve the problem. Thus, when free water is found, it is not always because of an emulsifier problem.

TABLE 1. Recipe suggestion for a 10% low-fat spread		
Emulsifier	Mono- diglyceride (High Oleic)	0.60%
	PGPR (extra polymerised)	0.40%
	Oil absorber (TAG)	0.70%
Oil blend	RDB palm oil	2.00%
	Rape seed oil	6.26%
	Flavour	0.02%
	Colour Annatto	0.02%
Water phase	Salt	0.60%
	Potassium sorbate	0.20%
	Maltodextrine	1.50%
	Sodium alginate	0.55%
	Water	87.15%
	Adjusted to pH 4.5 with citric acids	
Total content		100%

Figures 2a and 2c show the effect of crystallization, the development of crystals, and the formation of a crystal network. Mechanical treatment will break down the primary crystal bond structure and give a more smooth structure with plasticity mainly based on van der Waals forces (secondary crystal bond structure).

CREATING AN EMULSIFIER SYSTEM FOR 10% LOW-FAT SPREADS

To face the challenge of oil separation and secure the right mouth-feel of the spread, we used two different types of emulsifiers. One was a special unsaturated mono-diglyceride in which the fatty acid composition is mainly based on oleic acids. These unsaturated fatty acids offer better emulsification and emulsion stability for reduced and low fat spreads compared to standard mono-diglycerides. The other emulsifier used in the trials was a polyglycerol polyricineolate (PGPR) based on fatty acids of polymerised castor oil esterified with highly polymerised polyglycerol ester.

PGPR is a co-emulsitier, meaning that you will only obtain the desired effect if it is used in combination with another type of emulsifier. In low-fat spreads PGPR is exceptionally good at coating water droplets and fat crystals, and increasing viscosity in low-fat emulsions.

It was therefore critical in stabilizing the 10% low-fat spread, avoiding fluctuations during the production process, and reducing the amount of rejected product. It is important that the PGPR be neutral in both taste and smell to avoid any off-tastes in the spread.

STABILIZING THE FAT PHASE

Oil absorbers based on non-hydrogenated fractionated vegetable fats (TAG) are especially suited for applications in which we do not want to use hydrogenated products. The oil-absorbing effect is effective in products which contain a high amount of liquid oil, such as the oil phase in low-

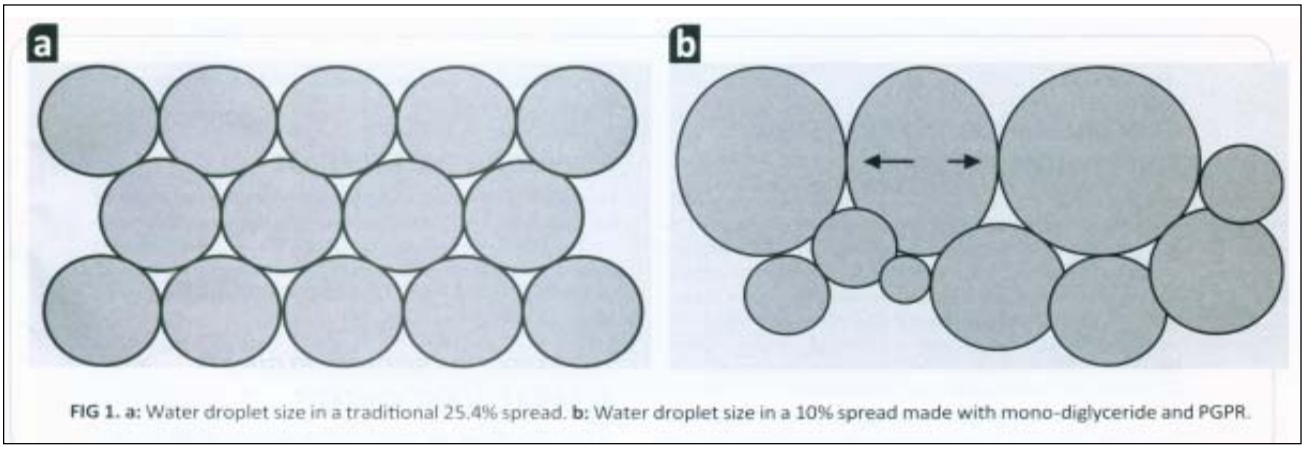

FIG 1. **a:** Water droplet size in a traditional 25.4% spread. **b:** Water droplet size in a 10% spread made with mono-diglyceride and PGPR.

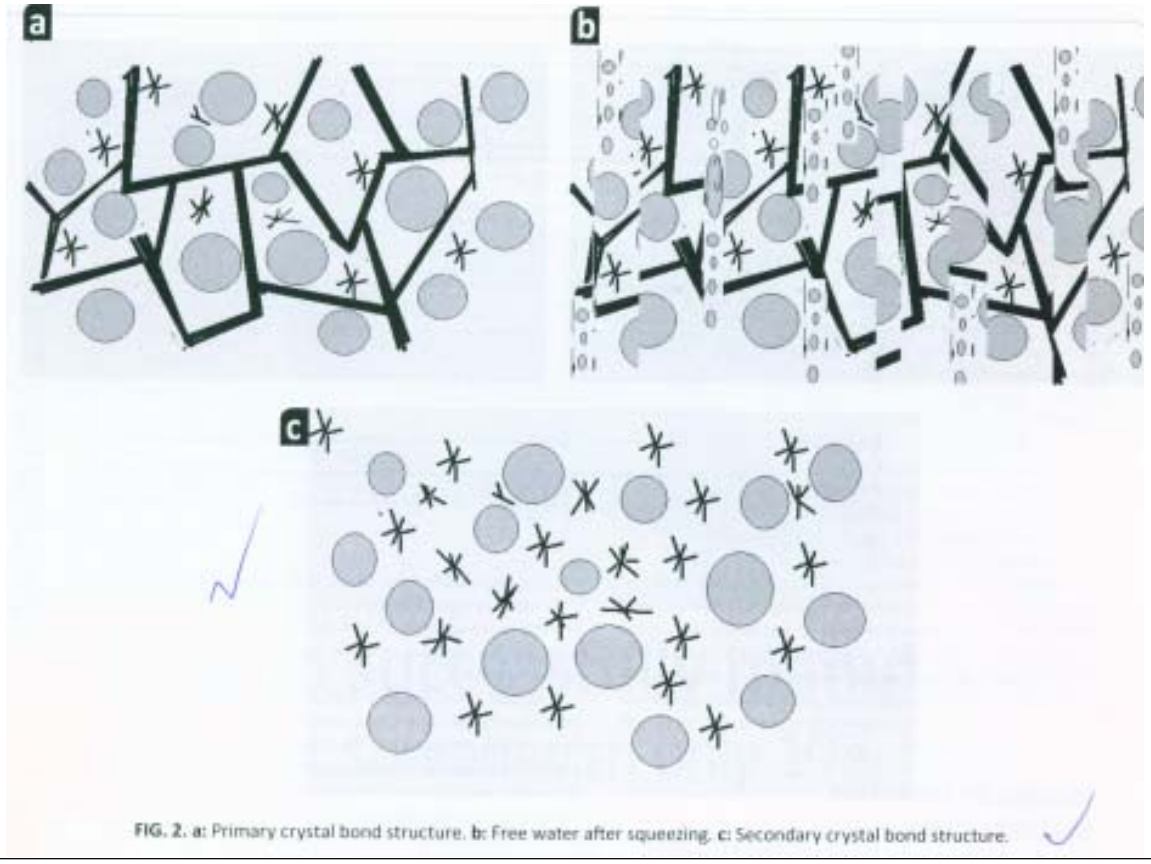

FIG. 2. a: Primary crystal bond structure. b: Free water after squeezing. c: Secondary crystal bond structure.

fat spreads. The oil-absorbing behavior reduces the risk of oiling out.

THE EFFECT OF SODIUM ALGINATE IN 10% LOW-FAT SPREADS

In the water phase, we added sodium alginate, which reacts as a thickener of the water phase. It stabilizes the water phase in the 10% low-fat spread and reduces the risk of squeezing out the water.

Sodium alginate also improves the mouth-feel of very low-fat spreads. The optimal effect is achieved when using 0.55% sodium alginate. At 0.75% sodium alginate the water droplets become too viscous , and the spread starts to become less stable with a higher risk of free water.

HOW TO SET UP THE RIGHT PROCESSING CONDITIONS

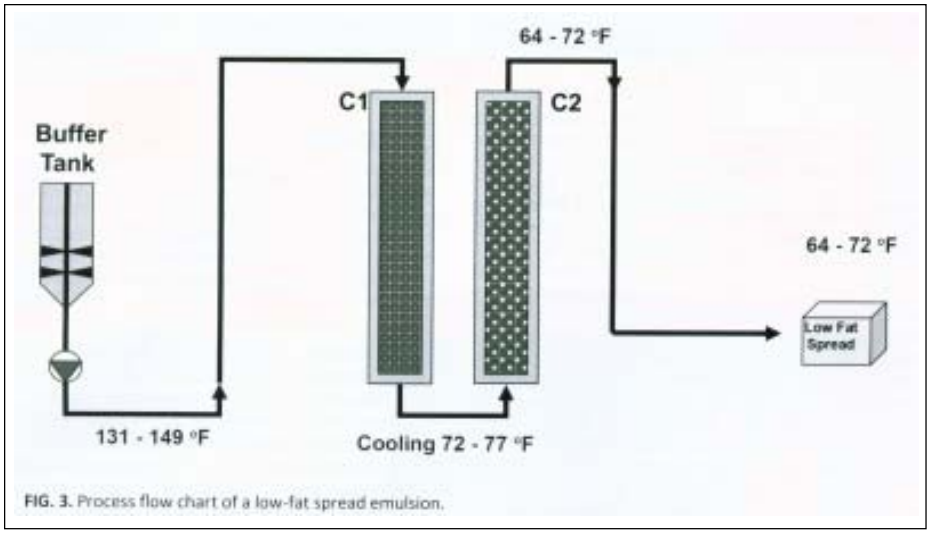

FIG. 3. Process flow chart of a low-fat spread emulsion.

The process ot manufacturing these low-fat spreads is the opposite of what is traditionally used when making a 40% spread.

Therefore, the practical experience from producing 40% low-fat spreads cannot be used in the production of very low-fat spread emulsions. Figure 3 shows the process flow needed to successfully manufacture a 10% low-fat spread.

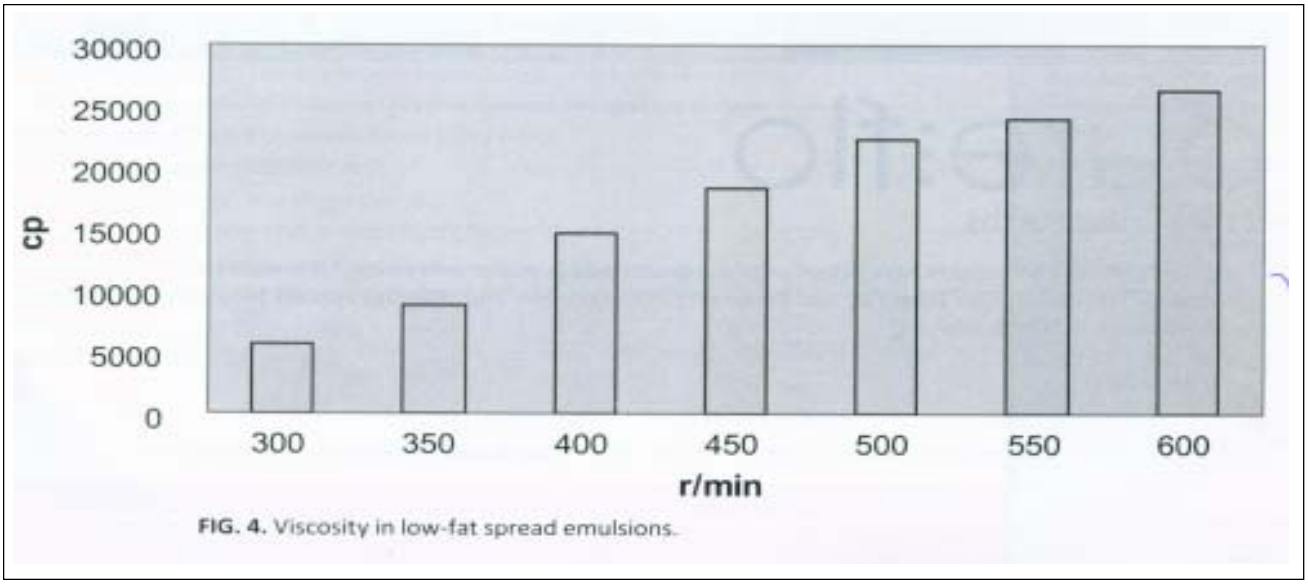

FIG. 4. Viscosity in low-fat spread emulsions.

The water phase needs to be added slowly, but the emulsion itself will have a tendency to build up a lot of viscosity in very low-fat spreads if the mechanical treatment is too intensive. The stirrers that are functioning fine when making 30 -40% low-fat spread emulsions need to be designed for more viscous emulsions otherwise “dead” areas will arise in the emulsion tank. Stirrers function very well in emulsion tanks for the relative high-viscous emulsions. Slow agitation is important to avoid the build-up of too viscous emulsions. Figure 4 shows that double up of agitation in a pre-emulsifying unit can increase the viscosity up to 5 times.

Keeping the temperature between 131 - 149"F in the emulsion and buffer tanks is important for reducing the risk of high viscous emulsions. If this is not heeded the viscous emulsion may become so thick that it is impossible to pump from the tanks. This is also why pin machines are not necessary in the production flow. The production capacity can be high and the packing temperatures do not need to be very low because of the cooling capacity in the water phase.

The crystallization part of the process is important, but in another way compared to high fat margarine products. In low fat spreads the fat crystals do not dominate the structure in the same way as in margarine and butter. The concentrated packing of water droplets produce a W/O emulsion with a more mayonnaise-like structure. In high fat margarines the mouth-feel is affected by the melting crystals and the subsequent phase inversion of the emulsion. Low-fat products and their very strong emulsifier systems reduce the instability effect just because the fat crystals melt down unlike the high-fat products.

STORAGE-THE LAST STEP IN PRODUCTION

In the first days after production the crystallisation and formation of crystal network will continue, thereby affecting the low-fat spread. It is our experience that high storage temperatures help transform the spread to a softer product also after cooling to low temperatures. Contrary, fast cooling directly from production will increase the tendency to brittle and more unstable low-fat spreads. Therefore, the best way to store low fat spreads is at 59°F for 3-5 days before cooling it down to 41°F.

CONCLUSION

As described above, it is possible to create a low-fat margarine spread with only 10% fat and overcome the usual challenges of oil separation and poor mouth-feel, but it must be done with a clear focus on the recipe and on the production parameters. Choosing the right combination of emulsifiers will get you most of the way, and getting your processing parameters right will get you the rest of the way.

(Courtesy : INFORM, March 2013, Vol. 24 (3)

"SURE FIRE"

Aviation biofuel test results in Canada

THE National Research Council (NRC) of Canada flew the first civilian jet powered by 100% unblended biofuel on October 29,2012 (see Inform 24:21, 2013). A Dassault Falcon 20 twin-engine jet flew over Ottawa, Canada, at 30,000 feet (9,000 meters), an altitude normally used by commercial aircraft. A Lockheed T-33 followed the Falcon 20 to collect information on the emissions generated by combusting the biofuel.

A team of experts analyzed the data and announced on January 7 there had been a 50% reduction in aerosol emissions when using biofuel compared to conventional fuel. Furthermore, additional tests performed on a static engine showed a significant reduction in particles (up to 25%) and in black carbon emissions (up to 49%) compared to conventional fuel. These tests also showed a comparable engine performance, but an improvement of 1.5% in fuel consumption during the steady-state operations. The jet s engines required no modification, as the biofuel tested in-flight meets the specifications of petroleum-based fuels (http://tinyurl.com/AviationBiofuel).

(Courtesy : INFORM, March 2013, Vol. 24 (4)

"MAGICIANS"

Takings leaf but of nature's book

AN important advance in the race to develop carbon-neutral renewable energy sources has been achieved.

Scientists with the US Department of Energy (DOE)'s Lawrence Berkeley National Laboratory (Berkeley Lab) have reported the first fully integrated nano-system for artificial photosynthesis. While "artificial leaf is the popular term for such a system, the key to this success was an "artificial forest."

"Similar to the chloroplasts in green plants that carry out photosynthesis, our artificial photosynthetic system is composed of two semiconductor light absorbers, an interfacial layer for charge transport, and spatially separated co-catalysts," explained Peidong Yang, a chemist with Berkeley Lab's Materials Sciences Division, who led this research.

"To facilitate solar water- splitting in our system, we synthesised tree-like nanowire heterostructures, consisting of silicon trunks and titanium oxide branches. Visually, arrays of these nanostructures very much resemble an artificial forest," he said.

Solar technologies are the ideal solutions for carbon-neutral renewable energy - there's enough energy in one hour's worth of global sunlight to meet all human needs for a year. Artificial photosynthesis, in which solar energy is directly converted into chemical fuels, is regarded as one of the most promising of solar technologies. A major challenge for artificial photosynthesis is to produce hydrogen cheaply enough to compete with fossil fuels. Meeting this challenge requires an integrated system that can efficiently absorb sunlight and produce charge — carriers to drive separate water reduction and oxidation half-reactions.

Yang said the reasearchers integrated a nanowire nanoscale heterostructure into a functional system that mimics the integration in chloroplasts,

(Source : DNA, 18-05-2013).

"GREAT SCIENTIST"

Thank Einstein for new exoplanet discovery

A TEAM at Tel Aviv University and the Harvard-Smiihsonian Centre for Astrophysics (CfA) has just discovered an exopianet using a new method that relies on Einstein's special theory of relativity.

"We are looking for very subtle effects. We needed high quality measurements of stellar brightnesses, accurate to a few parts per million," said team member David Latham of the CfA.

"This was only possible because of the exquisite data NASA is collecting with the Kepler spacecraft," added lead author Simchon Faigler of Tel Aviv University, Israel.

The two most prolific techniques for finding exoplanets are radial velocity (looking for wobbling stars) and transits (looking for dimming stars). Although Kepler was designed to find transiting planets, this planet was not identified using the transit method.

Instead, it was discovered using a technique first proposed by Avi Loeb of the CfA and his colleague Scott Gaudi in 2003. The new method looks for three small effects that occur simultaneously as a planet orbits the star. Einstein's "beaming" effect causes the star to brighten as it moves toward us, tugged by the planet, and dim as it moves away.

The brightening results from photons "piling up" in energy, as well as light getting focused in the direction of the star's motion due to relativistic effects.

(Source : DNA, 15-05-2013).

"MIRACLE"

Skin cells complete embryonic journey

Scientists successfully convert human skin cells into embryonic stem cells

A TEAM of scientists has successfully reprogrammed human skin cells to become embryonic stem cells capable of transforming into any other cell type in the body.

It is believed that stem cell therapies hold the promise of replacing cells damaged through injury or illness. Diseases or conditions that might be treated through stem cell therapy include Parkinson's disease, multiple sclerosis, cardiac disease and spinal cord injuries.

The breakthrough was made by scientists at Oregon Health and Science University and the Oregon National Primate Research Centre (ONPRC).

The research, led by Shoukhrat Mitalipov, PhD, a senior scientist at ONPRC, follows previous success in transforming monkey skin cells into embryonic stem cells in 2007.

The technique used by Dr Mitalipov, Dr Paula Amato, MD, and their colleagues in OHSU's Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gyne-cology, is a variation of a commonly used method called somatic cell nuclear transfer, or SCNT.

It involves transplanting the nucleus of one cell, containing an individual's DNA, into an egg cell that has had its genetic material removed. The unfertilised egg cell then develops and eventually produces stem cells.

"A thorough examination of the stem cells derived through this technique demonstrated their ability to convert just like normal embryonic stem cells, into several different cell types, including nerve cells, liver cells and heart cells. Furthermore, because these reprogrammed cells can be generated with nuclear genetic material from a patient, there is no concern of transplant rejection," explained Dr Mitalipov.

"While there is much work to be done in developing safe and effective stem cell treatments, we believe this is a significant step forward in developing the cells that could be used in regenerative medicine," he asserted.

Another noteworthy aspect of this research is that it does not involve the use of fertilised embryos, a topic that has been the source of a significant ethical debate.

This latest research has been published in the journal Cell online and will appear in print June 6.

According to the University of Wisconsin's Stem cell & Regenerative Medicine Centre, Embryonic stem cells are pluripotent, meaning they can become all 220 mature cell types in the human body. They are powerful tools for research on early reproduction and development, causes of birth defects, and miscarriage. They also shed light on the origins of numerous diseases and disorders, such as Parkinson's, ALS, Hun-tington's, Alzheimer's, spinal muscular atrophy, multiple

sclerosis, arthritis, musculoskeletal disease, skin disease, leukaemia and lymphoma.

(Source : DNA, 17-05-2013).

"OF COURSE"

The 'Godmen' win science prize

PHYSICISTS Peter Higgs and Francois Englert and the European Organisation for Nuclear Research will share the 2013 Prince of Asrurias Award for Technical and Scientific Research in recognition of their work establishing the existence of the so-called God particle, the Asturias Foundation said Wednesday.

Working independently, Higgs and Englert - along with the late Robert Brout - formulated in 1964 the existence of a subatomic particle that came to be known as the Higgs boson.

But it was only in 2012 that the European Organization for Nuclear Research, or CERN, was able to confirm the existence of this particle through experiments conducted with the Large Hadron Collider.

"This finding, which has been called the greatest discovery in the history of the understanding of Nature, enables a glimpse at what happened immediately after the Big Bang," the Asturias Foundation said.

News of the award coincided with the 84th birthday of Higgs, a native of Newcastle, England, who taught for 16 years at the University of Edinburgh.

Englert, an 80-year-old Belgian, is affiliated with the Institute for Quantum Studies at Chapman University in California.

"The discovery of the Higgs boson is a prime example of how Europe has led a collective effort to solve one of the deepest mysteries of physics," the Asturias Award jury said Wednesday.

Along with a cash prize of 50,000 euros (about $64,000] and a sculpture by Joan Miro, each award recipient gets a diploma and an insignia bearing the Prince of Asturias Founda-tion's coat of arms.

(Source : DNA, 31-05-2013).

"HONEY BEES INDEED"

In the land of mines, blood and honey

MIRJANA Filipovic is still haunted by the land mine blast that killed her boyfriend and blew off her left leg while on a fishing trip nearly a decade ago. It happened in a field that !i was supposedly demined.

Now, unlikely heroes may be coming to the rescue to prevent simtragedies: sugar-craving honeybees, latian researchers are training them to find unexploded mines littering their countryside in the rest of the Balkans. When Croatians the European Union on July 1, in addition to the beauty of its aquamarine Adriatic sea, deep blue mountain lakes and lush green forests, it will also bring numerous uncleared minefields to the bloc's territory. About 750 square kilometres are still suspected to be filled with mines from the Balkan wars in the 1990s.

Nikola Kezic, an expert on the behaviour of honeybees, sat quietly together with a group of young researchers on a recent day in a large net tent filled with the buzzing insects on a grass field lined with acacia trees. The professor at Zagreb University outlined the idea for the experiment: Bees have a perfect sense of smell that can quickly detect the scent of the explosives. They are being trained to identify their food with the scent of TNT.

"Our basic conclusion is that the bees can clearly detect this target and we are very satisfied," said Kezic, who leads a part of a larger multimillion-euro programme, called "Tiramisu," sponsored by the EU to detect land mines on the continent Several feeding points were set up on the ground around the tent, but only a few have TNT particles in them.

The method of training the bees by authenticating the scent of explosives with the food they eat appears to work: bees gather mainly at the pots containing a sugar solution mixed with TNT, and

not the ones that have a different smell. Kezic said the feeding points containing the TNT traces offer "a sugar solution as a reward, so they can find the food in the middle."

"It is not a problem for a bee to learn the smell of an explosive, which it can then search," Kezic said. "You can train a bee, but training their colony of thousands becomes a problem."

Croatian officials estimate that since the beginning of the Balkan wars in 1991, about 2,500 people have died from land mine explosions. During the four-year war, around 90,000 land mines were placed across the entire country, mostly at random and without any plan or existing maps. Dijana Plestina, the head of the Croatian government's de-mining bureau, said the suspected devices represent a large obstacle for the country's population and industry, including agriculture and tourism. In the nearly two decades since the end of the war, land mines have taken the lives of 316 people, including 66 de-miners, she said.

"While this exists, we are living in a kind of terror, at least for the people who are living in areas suspected to have mines," she said. "And of course, that is unacceptable. We will not be a country in peace until this problem is solved."

It may be a while before the honeybees hit real minefields, Kezic said.

(Source : DNA, 20-05-2013).